Programme Structure

BACHELOR OF TECHNOLOGY

in

Computer Science & Engineering (CSE)
with Specializations

Program Code: SET0101

Department of Computer Science & Engineering

Sharda School of Engineering & Technology

(Batch: 2023 – 2027)

Programme Structure

of

Bachelor of Technology- Computer Science & Engineering

B.Tech (CSE) with Specialization in Artificial Intelligence & Machine Learning

B.Tech (CSE) with Specialization in Artificial Intelligence of Things (AIoT)

B.Tech (CSE) with Specialization in Augmented and Virtual Reality

B.Tech (CSE) with Specialization in Banking & Insurance

B.Tech (CSE) with Specialization in Block chain Technology

B.Tech (CSE) with Specialization in Business Analytics

B.Tech (CSE) with Specialization in Cloud Technology and Virtualization in association with AWS

B.Tech (CSE) with Specialization in Data Science & Analytics

B.Tech (CSE) with Specialization in Cyber Security & Forensics in association with Microsoft

B.Tech (CSE) with Specialization in Full Stack Web Development in association with Xebia Academic Alliance

1. Standard Structure of the Program at University Level

1.1 Vision, Mission and Core Values of the University

Vision of the University

To serve the society by being a global University of higher learning in pursuit of academic excellence, innovation and nurturing entrepreneurship.

Mission of the University

1. **Transformative educational experience**
2. **Enrichment by educational initiatives that encourage global outlook**
3. **Develop research, support disruptive innovations and accelerate entrepreneurship**
4. **Seeking beyond boundaries**

Core Values

- **Integrity**
- **Leadership**
- **Diversity**
- **Community**

Vision of the School

To become a globally acclaimed institution of higher learning in engineering and technology promoting excellence in research, innovation and entrepreneurship

Mission of the School

1. **To impart quality education with strong industry & academic connectivity in the expanding fields of Engineering and Technology in a conductive and enriching learning environment.**
2. **To product technocrats equipped with technical & soft skills and experiential learning required to stay current with the modern tools in emerging technologies to fulfill professional responsibilities and uphold ethical values.**
3. **To inculcate a culture of interdisciplinary research, innovation and entrepreneurship to provide sustainable solutions to meet the growing challenges and societal needs.**
4. **To foster collaborative learning and to play adaptive leadership role in professional career and pursuit of higher education through effective mentoring and counseling.**

Core Values

- **Industry & Academic Connectivity**
- **Experiential learning**
- **Interdisciplinary research**
- **Global**

1.2 Vision and Mission of the Department

Vision of the Department

To be recognized as the fountainhead of excellence in technical knowledge and research in computer science and engineering to attract students and scholars across the globe

Mission of the Department

1. **To strengthen core competency of students to be successful, ethical, effective problem solver in Computer Science & Engineering through analytical learning.**
2. **To promote interdisciplinary research & innovation-based activities in emerging areas of technology globally**
3. **To facilitate and foster the industry-academia collaboration to enhance entrepreneurship skills and acquaintance with corporate culture.**
4. **To inculcate in them a higher degree of social consciousness and moral values towards solving interdisciplinary societal problems using industry-academia collaboration**

Core Values

- **Competency**
- **Global**
- **Entrepreneurship Skills**
- **Interdisciplinary research**

1.3 Programme Educational Objectives (PEO)

1.3.1 Writing Programme Educational Objectives (PEO)

The Program Educational Objectives (PEOs) of UG Program in Computer Science & Engineering are:

PEO-1 The graduates will establish themselves as professionals by solving real-life problems using exploratory and analytical skills acquired in the field of Computer Science and Engineering.

PEO-2 The graduates will provide sustainable solutions to ever changing interdisciplinary global problems through their Research & Innovation capabilities.

PEO-3 The graduates will become employable, successful entrepreneur as an outcome of Industry-Academia collaboration.

PEO-4 The graduates will embrace professional code of ethics while providing solution to multidisciplinary social problems in industrial, entrepreneurial and research environment to demonstrate leadership qualities

1.3.2 Map PEOs with Mission Statements:

DEPARTMENT PEOs / DEPT OF CSE MISSION STATEMENTS	1. The graduates will establish themselves as professionals by solving real-life problems using exploratory and analytical skills acquired in the field of Computer Science and Engineering.	2. The graduates will be able to provide sustainable solutions to ever changing interdisciplinary global problems through their Research & Innovation capabilities.	3. The graduates will become employable, successful entrepreneur and innovator as an outcome of Industry-Academia collaboration.	4. The graduates will be able to embrace professional code of ethics while providing solution to multidisciplinary social problems in industrial, entrepreneurial and research environment to demonstrate leadership qualities.	
1. To strengthen core competency of students to be successful, ethical, effective problem solver in Computer Science & Engineering through analytical learning.	**3**	**3**	**2**	**2**	**10/12**
2. To promote interdisciplinary research & innovation-based activities in emerging areas of technology globally.	**2**	**3**	**2**	**2**	**9/12**
3. To facilitate and foster the industry-academia collaboration to enhance entrepreneurship skills and acquaintance with corporate culture.	**2**	**2**	**3**	**3**	**10/12**
4: To inculcate in them a higher degree of social consciousness and moral values towards solving interdisciplinary societal problems using industry-academia collaboration	**2**	**2**	**2**	**3**	**9/12**
	9/12	**10/12**	**9/12**	**10/12**	**83%**

Correlation levels 1, 2, or 3 as defined below:

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

If there is no correlation, put “-“

1.3.3 Program Outcomes (PO's)

PO1:	**Engineering knowledge:**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2:	**Problem analysis:**	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3:	**Design/development of solutions:**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4:	**Conduct investigations of complex problems:**	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5:	**Modern tool usage:**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6:	**The engineer and society:**	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7:	**Environment and sustainability:**	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8:	**Ethics:**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9:	**Individual and team work:**	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:**	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11:	**Project management and finance:**	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12:	**Life-long learning:**	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1:		Experiment and prepare programming concepts and provide new ideas and innovations towards research and societal issues.
PSO2:		Analyse and develop computer programs in the areas related to algorithms, system software, cloud computing, artificial intelligence & machine learning, bioinformatics, big data analytics, block chain, cyber security and networking for efficient design of computer-based systems of varying complexity.
PSO3:		Apply standard Software Engineering practices and strategies in software project development using open-source programming environment to deliver a quality product for business success.

1.3.4 Mapping of Program Outcome Vs Program Educational Objectives

Mapping	PEO1	PEO2	PEO3	PEO4
PO1	3	3	2	1
PO2	3	3	3	1
PO3	2	2	3	3
PO4	2	2	3	2
PO5	2	3	2	2
PO6	1	2	2	3
PO7	1	1	2	3
PO8	1	1	2	3
PO9	1	2	3	1
PO10	1	1	3	2
PO11	3	2	3	1
PO12	2	3	1	1
PSO1	2	3	1	3
PSO2	3	3	2	2
PSO3	3	3	2	2

1. Slight (Low) ***2. Moderate (Medium)*** ***3. Substantial (High)***

1.3.5 Program Outcome Vs Courses Mapping Table[1]:

Course Code	Course Name	Course Outcome Statement	PO1 Engineering knowledge	PO2 Problem analysis	PO3 Design/development of solutions	PO4 Conduct investigations of complex problems	PO5 Modern tool usage	PO6 The engineer and society	PO7 Environment and sustainability	PO8 Ethics	PO9 Individual and team work	PO10 Communication:	PO11 Project management and finance	PO12 Lifelong learning	PSO1 Familiarity and practical proficiency	PSO2 Understand, analyze and develop	PSO3 Apply standard Software
CSE113	Programming for Problem Solving	CO1	1	2	2						2				1	2	
		CO2	2		3	2	2				1		1		2	2	
		CO3	3		2	1					3					2	
		CO4	1		2	1					1					3	
		CO5	1		1											1	
		CO6	3	3	3	2					2		2		2	3	1
MTH142	Calculus and Abstract Algebra	CO1	3	3	2	2	3	1				1	1	1			
		CO2	3	3	3	2	2	2				1	1	2			
		CO3	3	3	2	2	2	1				1	1	1			
		CO4	3	3	2	2	2	1				1	1	1			
		CO5	3	3	2	2	2	1				1	1	2			
		CO6	3	3	2	3	2	2				1	1	2			
PHY125	Engineering Physics-I	CO1	3	3	2	2	2	1	1	1	2	1	1	1			
		CO2	3	3	2	3	3	2	1	1	1	1	1	1			

[1] Cel value will contain the correlation value of respective course with PO.

		CO3	3	3	2	3	3	2	1	1	1	1	1	1			
		CO4	3	3	3	2	3	2	1	1	1	1	1	1			
		CO5	3	3	3	2	3	2	1	1	1	1	1	1			
		CO6	3	3	3	3	3	2	1	1	1	1	1	1			
CVL103	Environmental Studies	CO1	2	2	3	3	3	3									
		CO2	2	2	2	2	2	3									
		CO3	2	2	3	2	3	3									
		CO4	2	2	3	2	3	3									
		CO5	2	2	2	2	3	3									
		CO6	2	2	3	2	2	3									
ARP101	Communicative English-1	CO1										3		3			
		CO2								2	2	2		3			
		CO3				2				2	2			3			
		CO4		2	2							2	2	3			
		CO5		3	2	2								2			
		CO6		2										3			
CSP113	Programming for Problem Solving Lab	CO1	2		3	2	2				2				3	2	2
		CO2	3		3	2	2				3				3	3	1
		CO3	2		3	1	2				2				2	3	2
		CO4	1		2	1	1				2				2	2	
		CO5	2		3	2	2				3				3	2	2
		CO6	3		3	3	1				2				2	3	2
CSP101	Introduction to Computer Science and Engineering	CO1	3	2										3	3		3
		CO2	3	2										3		3	2
		CO3	3	2										3		2	3
		CO4	3											3		3	2

		CO5	3					2		2				3		3	3
		CO6															
MEP106	Computer Aided Design & Drafting	CO1	2	2	2		3							3	3	3	
		CO2	2	2	2		3							3	3	3	
		CO3	2	2	2		3							3	3	3	
		CO4	2	2	2	2	3				2	2		3	3	3	
		CO5	2	2	2	2	3				2	2		3	3	3	
		CO6	2	2	2	2	3				2	2		3	3	3	
PHY162	Physics Lab	CO1	2	2	2	1	1	1	2	3	3	3	2	3	2		
		CO2	2	2	2	1	1	1	2	3	3	3	2	3	2		
		CO3	2	2	2	1	1	1	2	3	3	3	2	3	2		
		CO4	2	2	2	1	1	1	2	3	3	3	2	3	2		
		CO5	2	2	2	1	1	1	2	3	3	3	2	3	2		
		CO6	2	2	2	1	1	1	2	3	3	3	2	3	2		
Semester II																	
CSE114	Application based Programming in Python	CO1	2	1	1					2				2		1	
		CO2	2	2	2	1				2				2		2	1
		CO3	2	2	1					2				2	1	2	1

		CO4	2	2	2	2	1	2		2				2	1	2	2
		CO5	2	2	2	2	3	2		2				2	2	2	1
		CO6	3	3	2	2	2	2		2				2	2	3	2
MTH145	Probability and Statistics	CO1	3	3	2	2	3	1				1	1	1			
		CO2	3	2	3	2	2	2				1	1	2			
		CO3	3	3	2	2	2	1				1	1	1			
		CO4	3	2	2	2	2	1				1	1	1			
		CO5	3	3	2	2	2	1				1	1	2			
		CO6	3	3	2	3	2	2				1	1	2			
EEE112	Principles of Electrical and Electronics Engineering	CO1	3	3	2	2											
		CO2	1	1	2												
		CO3	2	2	1												
		CO4	2	1	2								1				
		CO5	3	2	1								1				
		CO6	2	2	3	1							1				
HMM111	Human Value & Ethics	CO1	1	1	1	1	2	1	2			2	3	1	1	3	
		CO2	1	3	2	2	1	3	1	1	2		3	3	2	2	1
		CO3		2	2	2		2	2		1		1		1	3	2
		CO4	1		1	2	3				2	3		2			1
		CO5		3		1	2	3	2	1		2	2	1	3	1	
		CO6	2		1			1			1	1				2	3
ARP102	Communicative English -2	CO1										3		3			
		CO2										3		3			
		CO3										3		3			
		CO4										3		3			
		CO5								3		3		3			
		CO6								3		3		3			

CSP105	Design and creativity Lab	CO1	3	3		3					3	3	2	3	2	2	1
		CO2	3	2		3			2		3	3	2	3			1
		CO3	3	2			2				3	3	2	3	2	2	
		CO4	3	3				2			3	3	2	3		2	
		CO5	3	3	2	2	2	2	3	3	3	3	2	3	2	2	
		CO6	3	3		3					3	3	2	3			1
CSP114	Application based Programming in Python	CO1	1	1	1	1				2				2		1	
		CO2	2	2	1	1	2			2				2		1	1
		CO3	2	2	1	1	1	1		2				2	1	2	1
		CO4	2	2	2	2	1	1		2				2	2	2	1
		CO5	2	2	2	2	2	2		2				2	2	2	2
		CO6	3	3	2	2	2	3		2				2	2	2	2
MEP105	Mechanical Workshop	CO1	1					2						2			
		CO2	1				1	2						1	1		1
		CO3	2		1		1	2						2	1		1
		CO4	2		1		2	2						2	1		1
		CO5	2		1		2	2						2	2		1
		CO6	2		1		2	2						2	2		1
EEP112	Principles of Electrical and Electronics Engineering	CO1	3	3	2	2											
		CO2	1	1	2												
		CO3	2	2	1												
		CO4	2	1	2								1				
		CO5	3	2	1								1				
		CO6	2	2	3	1							1				
CSE242	Data Structures	CO1	2		2						2				2	2	
		CO2	1	2	3						1				3	1	2

		CO3	2	3	3	2					2				2	3	
		CO4			2						3			1	2	2	
		CO5	3	2	3	2	1				2				3	2	2
		CO6	2		3	3	2				1				2	3	3
CSP242	Data Structures Lab	CO1	2	2	3						3			2	3	2	2
		CO2	3	2	2	2	2				2				2	3	3
		CO3	3	1	3	3					3			1	3	2	2
		CO4	3	2	3	2					2			2	2	3	2
		CO5	2	2	2										1	2	2
		CO6	3	3	2	3					3				2	3	2
Semester III																	
CSE252	Computer Networks	CO1		2									2	3		3	
		CO2	2		2	2	3						2	3		3	
		CO3	3	2		2		2							2		2
		CO4		2	2											2	2
		CO5	2	2	2	2										2	
		CO6	2			2				2			2			2	
CSE245		CO1	2	3	3	1		3			3			3	3	3	

	Discrete Structures	CO2	2	2	3			2						3	3	2	
		CO3	3	2	3	3	3				2					3	2
		CO4	2	2	3	3	3						3	3	3		3
		CO5	2	2	2	3		3			3		3	3		2	3
		CO6	1	2	1	2	3				3		3		3	3	2
CSE247	Computer Organization and Architecture	CO1	3	1	1			2						2		1	3
		CO2	3	3	3			3						3		2	3
		CO3	3	2	3			2						3		2	3
		CO4	3	2	2			1						3		3	2
		CO5	3	3	3			2						3		2	2
		CO6	3	3	3			2						3		1	2
CSE253	Object Oriented Programming Using Java	CO1					2							2			
		CO2					2										
		CO3	2	3	3		2				3			2	2	3	
		CO4					2										
		CO5					2										
		CO6	3	3	3		2	3	2		3		2	3	3	3	2
CSE254	Principles of Operating System	CO1	3	3	3	3				2	2	1	2	1	3	2	2
		CO2	3	2	3	3				2	2	2	1	1	2	3	2
		CO3	3	3	3	3				1	1	1	3	2	3	2	1
		CO4	2	2	2	2	1			2	3	3	3	1	2	2	2
		CO5	2	2	3					3	3	1	2		3		
		CO6	3	2								2	3		2	2	
CSE255	Introduction of Entrepreneurship	CO1	-	-	-	-	1	-	-	-	2	-	2	3	-	-	-
		CO2	1	1	2	3	3	3	-	-	-	-	-	-	-	-	-
		CO3	-	-	-	-	-	-	-	-	-	3	2	3	-	-	-
		CO4	-	-	-	-	-	-	-	-	-	1	3	1	-	-	-

		CO5	-	-	-	1	-	-	3	-	-	-	-	2	-	-	-
		CO6	-	1	3	2	1	-	-	-	-	-	1	2	-	-	-
ARP207	Logical Skills Building and Soft Skills	CO1		2	3												
		CO2						2		2	3						
		CO3								2	2						
		CO4									2			3			
		CO5										2					
		CO6		2													
CSP252	Computer Networks Lab	CO1		2									2	3		3	
		CO2	2		2	2	3						2	3		3	
		CO3	3	2		2		2							2		2
		CO4		2	2											2	2
		CO5	2	2	2	2										2	
		CO6	2			2				2			2			2	
CSP243	Object Oriented Programming Using Java	CO1					2							2			
		CO2					2										
		CO3	2	3	3		2				3			2	2	3	
		CO4					2										
		CO5					2										
		CO6	3	3	3		2	3	2		3		2	3	3	3	2
CSP244	Principles of Operating System Lab	CO1	3	3	3	3				2	2	1	2	1	3	2	2
		CO2	3	2	3	3				2	2	2	1	1	2	3	2
		CO3	3	3	3	3				1	1	1	3	2	3	2	1
		CO4	2	2	2	2	1			2	3	3	3	1	2	2	2
		CO5	2	2	3					3	3	1	2		3		
		CO6	3	2								2	3		2	2	

CSP254	Project Based Learning (PBL) - 1	CO1	3	3		3					3	3	2	3	2	2	1
		CO2	3	2		3			2		3	3	2	3			1
		CO3	3	2			2				3	3	2	3	2	2	
		CO4	3	3				2			3	3	2	3		2	
		CO5	3	3	2	2	2	2	3	3	3	3	2	3	2	2	
		CO6	3	3		3					3	3	2	3			1
CSP292	Summer Internship-I	CO1	2														
		CO2		3	2		2								2	2	
		CO3	2	2	3						3				1		
		CO4										3					
		CO5						2		3							
		CO6												2	1		
Semester IV																	
BTY223	Introduction to Biology for Engineers	CO1	3	1				1	3					3			
		CO2	3	2				2						3			
		CO3	3	3	3	1	1	3	3	2	1	3		3	1	1	
		CO4	3	2				2	2	3	1	2		3	1		
		CO5	3	1	1	1	3	1	3	2	1	2	1	3	1	1	

		CO6	3	3	1	1	2	3	5	1	1	1		3	1		
CSE249	Data Base Management System	CO1	3					2						3	3	3	
		CO2	2				3	2			2			3	3	3	
		CO3	3	3	3		3	2						2	2	3	
		CO4	3	3	3	3		2		2	3			2			3
		CO5	2	3	2		2	2		2				1		3	
		CO6	3	3	3	3	3	3		3	3	3	2	3			3
CSE251	Theory of Computation	CO1	3	3	3	3	2				3			3	3	2	
		CO2	3		3	3	2				2			2		3	2
		CO3	3	3	3	3					2				3	2	
		CO4	2	2	2		2				3			2			3
		CO5	3	3	3	3	3							3	3	2	2
		CO6	3	2	3	3	3				2			3	3	3	2
HMM305	Management for Engineers	CO1	2	1	2	2	2	2		2	1	3			1	1	2
		CO2	1	1	2	2	1	2	1			2	2	1	1	1	2
		CO3	3	1	1	2	3	2		2			1	2	1	2	2
		CO4		2	2	1		1		1		2	1		1	1	2
		CO5		1	2	2		2	3	1	2			1	2	2	1
		CO6	1	2	1	1	2	2	2		1			1	2	2	2
CSE011	Mathematical Techniques	CO1	3	2											2		
		CO2	2	3	1	1	1		1			1	2	1	1	1	
		CO3	3	1	1	1			1			2	1	1	3	1	
		CO4	2	3	2	1	1		1			1	1	1	2	1	
		CO5	1	1	1	2	2		1			1	2	1	2	1	
		CO6	3	1	3	1	2		2			2	2	3	3	1	
CSE012		CO1	3	3	2	2	1	2	2			2	1	2	3	1	
		CO2	3	3	3	2		1	1			1		2	3	1	

	Introduction to Graph Theory and its Applications	CO3	1	3	1	3	2	2				1		2	2	2	
		CO4	1	3	1	3	1	1				2		1	3	2	
		CO5	2	2	2	3	2	1				1		2	1	2	
		CO6	1	1	2	3	1	2				2		2	1	2	2
OE1	Open Elective – 1	CO1															
		CO2															
		CO3															
		CO4															
		CO5															
		CO6															
ARP208	Quantitative and Qualitative Aptitude Skill Building	CO1								2		3		3			
		CO2										2					
		CO3									2	2					
		CO4										2					
		CO5										2					
		CO6		2	2						2						
CSP249	Data Base Management System Lab	CO1	3				2								2	3	2
		CO2		3	3	3	2				3				2	3	3
		CO3		2	2	2	2				3				2	2	3
		CO4		2	2	2	2				3				2	2	3
		CO5		2	2	2	2				3				2	2	3
		CO6		2	3	2	3				3			2	3	3	3
CSP297	Project Based Learning (PBL) - 2	CO1	3	3		3					3	3	2	3	2	2	1
		CO2	3	2		3			2		3	3	2	3			1
		CO3	3	2			2				3	3	2	3	2	2	
		CO4	3	3				2			3	3	2	3		2	

		CO5	3	3	2	2	2	2	3	3	3	3	2	3	2	2	
		CO6	3	3		3					3	3	2	3			1
Semester V																	
CSE354	Design and Analysis of Algorithm	CO1	2	3	1	2					2				3	2	2
		CO2	2	2	2	2					3				2	3	2
		CO3	2	1	2						1				3	2	
		CO4	1	2	2	3					2				2	2	2
		CO5	3	3	1	3					3				2	1	3
		CO6	2	2	3	2	2				2				3	2	
CSE355	Software Engineering and Testing Methodologies	CO1	1	3	2	-	-	-	2	2	3	-	-				
		CO2	3	2	2	1	1	-	3	3	3	-	-				
		CO3	2	2	2	1	1	2	2	3	3	-	-				
		CO4	3	3	2	1	2	2	2	2	3	-	-				
		CO5	3	3	2	1	2	2	2	2	3	-	-				
		CO6	3	3	2	2	3	2	2	3	3	-	-				
CSE356	Research Methodology	CO1	**3**	**2**	2	2	-	-	-	-	**2**	**2**	2	3			
		CO2	**2**	3	3	3	-	2	-	-	-	-	3	3			
		CO3	2	2	-	**2**	**2**	-	**2**	**2**	-	**2**	2	2			

		CO4	3	3	3	**3**	-	3	-	-	3	-	3	3			
		CO5	**2**	-	3	**2**	3	-	3	**3**	**2**	3	3	2			
		CO6	3	-	-	3	**2**	2	**2**	**2**	2	2	**2**	3			
CSE021	Introduction to Cloud Computing	CO1	2	3	1	2											
		CO2	2	2	2	3											
		CO3	1	3	1	2										2	3
		CO4	3	1	2	2										3	2
		CO5	2	2	3	1										2	2
		CO6	1	3	1	2									2	3	3
CSE023	Android Application Development	CO1					3				2			1			2
		CO2					3				2			1			2
		CO3			2		3				2			1	2		2
		CO4					3				2		2	1			2
		CO5			2	3	3		2		2		2	1			2
		CO6	1	2	3	3	3	3	3		3		3	1	3	3	3
CSE024	Web Technologies	CO1					1									1	
		CO2					3							1		1	
		CO3		1	3		2	1			2				1	2	2
		CO4		1	3		1	1			2				1	2	2
		CO5					2									1	
		CO6	2	3	3	1	3	3	1		3		2	2	1	2	3
OE-2	Open Elective – 2	CO1															
		CO2															
		CO3															
		CO4															
		CO5															
		CO6															

ARP305	Personality Development and Decision making Skills	CO1						2			2			3			
		CO2						2			2			3			
		CO3									2	2		3			
		CO4						2	2		2			3			
		CO5						2	2		2			3			
		CO6		2	2												
CSP350	Design and Analysis of Algorithm Lab	CO1	3	3	2	3	1				2				2	3	3
		CO2	2	3	3	2	2				2				3	2	2
		CO3	3	2	2		3				1				2	1	
		CO4	2	3	3	3	1				3				3	3	1
		CO5	3	2	2	3	2				2				2	3	2
		CO6	2	3	3	1	3				1				3	2	3
CSP354	Project Based Learning (PBL) - 3	CO1	3	3		2		1		1	2		2	1	2	2	3
		CO2	3	2	2	2	2			1	2		2	1	2	1	1
		CO3	3	2	2	2	2	3		1	2		2	1	2	2	
		CO4	3	3	2	2	3			1	2			1	2	2	2
		CO5	3	2			3			1	2			1	2	2	
		CO6		1		1				2	2	3	3	3	1		1
CSP355	Software Engineering and Testing Methodologies	CO1	3	-	2	-	-	-	-	1	2	3	-	3	1	-	2
		CO2	3	3	2	3	3	-	-	1	2	3	2	3	2	-	3
		CO3	3	2	3	3	3	-	-	1	2	3	1	2	2	-	3
		CO4	3	1	-	1	3	2	2	3	3	2	3	2	-	-	3
		CO5	3	1	3	3	3	3	2	3	3	1	3	1	3	-	3
		CO6	2	-	-	1	3	-	1	2	2	2	2	2	3	-	3
CSP023		CO1					3				2			1			2
		CO2					3				2			1			2

	Android Application Development Lab	CO3			2		3				2			1	2		2
		CO4					3				2		2	1			2
		CO5			2	3	3		2		2		2	1			2
		CO6	1	2	3	3	3	3	3		3		3	1	3	3	3
CSP024	Web Technologies Lab	CO1					1				2					1	
		CO2		1	1		3				2			1		1	2
		CO3			1		2	1			2					1	2
		CO4					1	1									
		CO5		1			2				2			1		1	2
		CO6	2	3	3	1	3	3			3		2	2	1	2	3
CSP391	Summer Internship-II	CO1	2	2		3	2		1	1	1				1	2	2
		CO2	1	2	1	2	2		1	1	1				1	2	
		CO3	2		2	2	2			1	3		1	1	1	2	2
		CO4								1		3					
		CO5						2		3							
		CO6												2	2	2	
CSP395	Technical Skill Enhancement Course-1 Simulation Lab	CO1	1		1		2							1	1	2	1
		CO2	1		1		2					2		1	1	2	1
		CO3	1	2	1		2							1	1	2	1
		CO4	1		1		2							1	1	2	1
		CO5	1		1		2							1	1	2	1
		CO6	2	2	3	3	2	2	1		2	3	2	2	2	3	1
ECC301	Community Connect	CO1										2	3	3	3	2	1
		CO2					1		1		2	3	3	3	3		
		CO3	2		2		2		2	2					1		
		CO4			1			3							3		

		CO5									2				1		
		CO6									3	3	3				
Semester VI																	
CSE353	Compiler Design	CO1	3				3				2			3	2	1	
		CO2	2	2	3	3	2							2	3	2	
		CO3	3	3	3										3	2	
		CO4	1	2	3	3	3				3					3	2
		CO5	1	1	2	3	2				3			3	1	2	2
		CO6	2		3	3	2				3			3	3	2	3
CSE472	Artificial Intelligence	CO1	1	2	3	2	2					2		2	3	2	2
		CO2	2	3	3	2	3					2		2	3	3	2
		CO3	3	3	3	3	2	1	1			1	2	3	3	2	3
		CO4	3	3	3	3	2	2	1			2	1	3	3	2	3
		CO5	2	3	3	3	3	2	2	2	3	2	2	2	3	3	2
		CO6	2	3	3	3	3	2	2	2	3	2	2	2	3	3	2
CSE031	Digital Image Processing	CO1	3	3	3	3	1	1	1	1	1	2	1	3	2	3	1
		CO2	3	3	3	3	2	1	1	1	1	2	1	3	2	3	2
		CO3	3	3	3	3	2	1	1	1	1	2	1	3	3	3	2

		CO4	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
		CO5	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
		CO6	3	3	3	3	2	3	3	1	3	2	1	3	3	3	3
CSE032	Cryptography and Network Security	CO1	3	2											3	1	
		CO2	2	3	2	1									3	2	
		CO3	2		2		3								2	2	1
		CO4	2			2		2	2						2	2	
		CO5					2			2	2	2			1		
		CO6										2	2	2	2		2
CSE041	Software Project Management	CO1	3		1		1				3	2	3	2			2
		CO2	2		2		2				3	3	3	3			2
		CO3	2		3		2			1	3	2	3	3			3
		CO4	2		2		2			1	3	2	3	3			3
		CO5	1		3		2	3		1	3	3	3	3			3
		CO6	2		3	3	2	2		1	3	3	3	2			2
CSE042	Software Testing	CO1	2	1								3		2			3
		CO2	3	3	3	2	3	1		1	2	3		2	2		3
		CO3	3	3	3	2	2	2		1	2	3		2	2		3
		CO4	3	3	3	2	3	1		1	2	3		2	2		3
		CO5	3	3	2	2	2	2		1	2	3		2	2		3
		CO6	3	3	3	2	3	2	3	2	3	3	3	3	2		3
CSE051	Wireless Networks	CO1	3		3					1							2
		CO2	3	2	3					1							2
		CO3	3	2	3					1							2
		CO4	3	2	3					1							2
		CO5	3	2	3	2	2			1							3

		CO6	3	2	3	2	2			1							3
CSE052	Risk Management	CO1	3						1					1	2		
		CO2	2	2		3	2			1	2	1	1	1			2
		CO3	2								2			1	1		
		CO4	1		2		3				2	2	2				1
		CO5	2	2		2	1		1		2	1	1				1
		CO6	2	2	2				1		2	1	1	1		1	
CSE053	Advanced Operating System	CO1	3	3	3	3				2	2	1	2	1	3	2	2
		CO2	3	2	3	3				2	2	2	1	1	2	3	2
		CO3	3	3	3	3				1	1	1	3	2	3	2	1
		CO4	2	2	2	2	1			2	3	3	3	1	2	2	2
		CO5	2	2	3					3	3	1	2		3		
		CO6	3	2								2	3		2	2	
OE-3	Open Elective – 3	CO1															
		CO2															
		CO3															
		CO4															
		CO5															
		CO6															
ARP306	Campus to Corporate	CO1						2	2		2	3		3			
		CO2						2	2		2	3		3			
		CO3						2	2		2	3		3			
		CO4						2	2		2	3		3			
		CO5						2	2		2	3		3			
		CO6		2	2												
CSP353		CO1	3				3				2			3	2	1	

	Compiler Design Lab	CO2	2	2	3	3	2							2	3	2	
		CO3	3	3	3										3	2	
		CO4	1	2	3	3	3				3					3	2
		CO5	1	1	2	3	2				3			3	1	2	2
		CO6	2		3	3	2				3			3	3	2	3
CSP396	Technical Skill Enhancement Course-2(Application Development Lab)	CO1	1		1		2							1	1	2	1
		CO2	1		1		2					2		1	1	2	1
		CO3	1	2	1		2							1	1	2	1
		CO4	1		2		2							1	1	2	1
		CO5	2		1		2							1	1	2	1
		CO6	2	2	3	2	2	2	1		2	3	2	2	2	3	1
CSP398	Project Based Learning (PBL) - 4	CO1	3	3		2		1		1	2		2	1	2	2	3
		CO2	3	2	2	2	2			1	2		2	1	2	1	1
		CO3	3	2	2	2	2	3		1	2		2	1	2	2	
		CO4	3	3	2	2	3			1	2			1	2	2	2
		CO5	3	2			3			1	2			1	2	2	
		CO6		1		1				2	2	3	3	3	1		1
CSP472	Artificial Intelligence Lab	CO1	1	2	3	2	2					2		2	3	2	2
		CO2	2	3	3	2	3					2		2	3	3	2
		CO3	3	3	3	3	2	1	1			1	2	3	3	2	3
		CO4	3	3	3	3	2	2	1			2	1	3	3	2	3
		CO5	2	3	3	3	3	2	2	2	3	2	2	2	3	3	2
		CO6	2	3	3	3	3	2	2	2	3	2	2	2	3	3	2
Semester VII																	

CSE062	Mobile Computing	CO1	3	3		2	3					2			3	2	
		CO2	3	3		2	3					2			3	2	
		CO3	3	3		2	3					2			2	3	
		CO4	3	3		2	3					2			3	2	
		CO5	3	3		2	3					2			2	2	
		CO6	3	3		2	3					2			2	2	
CSE063	Quantum Computing	CO1	3	3			2			3				3			3
		CO2	3	3	2												3
		CO3	3	3	2		2				2			2	3		
		CO4	3	3		3	2	3		2						3	
		CO5	3	2	3					3	3					3	
		CO6	3	3		3	3	3	3			3	3		3		
CSE071	Introduction to Internet of Things	CO1	3	1	1			2	1					3	3		
		CO2	2	2	1			1	3					3	3		
		CO3	3	1	1	2		2	1					3	3		
		CO4	3	3	3	3	2	2		3	3	3	3	3	2	2	3
		CO5	3	3	3	3	3	2	3					3	3		
		CO6	2	2	2	2	3	2	3					3	3		
CSE072		CO1	3	3			2			3				3			3
		CO2	3	3	2												3

	Parallel Computing Algorithms	CO3	3	3	2		2				2			2	3		
		CO4	3	3		3	2	3		2						3	
		CO5	3	2	3					3	3					3	
		CO6	3	3		3	3	3	3			3	3		3		
CSE073	3D Printing and Software Tools	CO1	3	3			2			3				3			3
		CO2	3	3	2												3
		CO3	3	3	2		2				2			2	3		
		CO4	3	3		3	2	3		2						3	
		CO5	3	2	3					3	3					3	
		CO6	3	3		3	3	3	3			3	3		3		
OE4	Open Elective – 4	CO1															
		CO2															
		CO3															
		CO4															
		CO5															
		CO6															
CSP496	Summer Internship-III	CO1	2	2		3	2		1	1	1				1	2	2
		CO2	1	2	1	2	2		1	1	1				1	2	
		CO3	2		2	2	2			1	3		1	1	1	2	2
		CO4								1		3					
		CO5						2		3							
		CO6												2	2	2	
CSP497	Capstone – 1	CO1	3	3	3	2	2	2	2	1	2	1	1	2	2	3	3
		CO2	3	3	3	3	2	1	1	1	2	1	1	2	3	3	3
		CO3	3	1	3	3	2	1	1	1	2	1	1	2	3	3	3
		CO4	1	1	2	1	2	3	3	1	2	3	1	2	1	2	3

		CO5	1	2	2	1	2	1	1	1	2	2	1	2	1	2	3
		CO6	2	1	2	1	3			1	2	3	1	2	3	3	3
Semester VIII																	
CSP498	Capstone - 2	CO1	2	1	2	2	3	2	2	2	2	2	2	2	3	3	3
		CO2	2	2	3	2	3	2	2	2	2	2	2	2	11	3	3
		CO3	3	3	3	3	3	2	2	2	2	2	2	1	1	3	3
		CO4	2	2	2	2	3	2	2	2	2	3	2	1	1	2	2
		CO5	1	2	2	1	3	2	2	2	2	3	2	1	1	2	2
		CO6	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
B.Tech-Computer Science & Engineering with specialization in Artificial Intelligence & Machine Learning																	

CSA103	Introduction To AI & ML	CO1	3	3	3	1	2	1	1	1	2	3	1	3	2	3	1
		CO2	3	3	3	1	2	3	3	1	2	3	1	3	2	3	2
		CO3	3	3	3	1	2	3	3	1	3	3	3	3	3	3	3
		CO4	3	3	3	1	2	3	3	1	3	3	3	3	3	3	3
		CO5	3	3	3	1	2	3	3	1	3	3	3	3	3	3	3
		CO6	3	3	3	1	2	3	3	3	3	3	3	3	3	3	3
CSA202	Concept of Machine Learning	CO1	3	3	3	3	3	3	2	1	1	3	1	3	2	2	1
		CO2	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
		CO3	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
		CO4	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
		CO5	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
		CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CAL201	Concept of Machine Learning Lab	CO1	3	3	3	3	3	3	2	1	1	3	1	3	2	2	1
		CO2	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
		CO3	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
		CO4	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
		CO5	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
		CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CSA203	Concepts of Neural Networks	CO1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
		CO2	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
		CO3	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
		CO4	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
		CO5	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
		CO6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CSA301	Soft Computing	CO1	3	3	1	1	1	1	1	1	2	1	1	3	1	3	1

		CO2	3	3	3	3	2	3	2	2	2	2	3	3	3	3	3
		CO3	3	3	3	3	3	3	1	2	2	2	3	3	3	3	3
		CO4	3	3	3	3	3	3	3	2	2	2	3	3	3	3	3
		CO5	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3
		CO6	3	3	3	3	3	1	3	2	3	2	3	3	3	3	3
CSA302	Pattern Recognition	CO1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
		CO2	3	3	3	3	2	3	1	1	3	3	1	3	3	3	3
		CO3	3	3	3	3	2	2	2	1	2	3	1	3	3	3	3
		CO4	3	3	3	3	2	2	2	1	2	3	1	3	3	3	3
		CO5	3	3	3	3	2	3	1	1	2	3	1	3	3	3	3
		CO6	3	3	3	3	3	3	2	2	3	3	3	3	3	3	3
CAL302	Pattern Recognition Lab	CO1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
		CO2	3	3	3	3	2	3	1	1	3	3	1	3	3	3	3
		CO3	3	3	3	3	2	2	2	1	2	3	1	3	3	3	3
		CO4	3	3	3	3	2	2	2	1	2	3	1	3	3	3	3
		CO5	3	3	3	3	2	3	1	1	2	3	1	3	3	3	3
		CO6	3	3	3	3	3	3	2	2	3	3	3	3	3	3	3
CSA303	Deep Learning and Its Applications	CO1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
		CO2	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
		CO3	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
		CO4	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
		CO5	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
		CO6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CAL303	Deep Learning and Its Applications Lab	CO1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
		CO2	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
		CO3	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3

		CO4	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
		CO5	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
		CO6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CSA402	Applications of AIML in healthcare/ ICT/ Computer Networks	CO1	3	3	3	3	3	1	2	3	1	3	1	3	3	3	1
		CO2	3	3	3	3	3	2	2	3	3	3	3	3	3	3	3
		CO3	3	3	3	3	3	2	2	3	2	3	3	3	3	3	3
		CO4	3	3	3	3	3	2	2	3	2	3	3	3	3	3	3
		CO5	3	3	3	3	3	2	2	3	3	3	3	3	3	3	3
		CO6	3	3	3	3	3	2	2	3	3	3	3	3	3	3	3
CSA401	Computer Vision	CO1	3	3	3	3	1	1	1	1	1	2	1	3	2	3	1
		CO2	3	3	3	3	2	1	1	1	1	2	1	3	2	3	2
		CO3	3	3	3	3	2	1	1	1	1	2	1	3	3	3	2
		CO4	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
		CO5	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
		CO6	3	3	3	3	2	3	3	1	3	2	1	3	3	3	3
CAL401	Computer Vision Lab	CO1	3	3	3	3	1	1	1	1	1	2	1	3	2	3	1
		CO2	3	3	3	3	2	1	1	1	1	2	1	3	2	3	2
		CO3	3	3	3	3	2	1	1	1	1	2	1	3	3	3	2
		CO4	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
		CO5	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
		CO6	3	3	3	3	2	3	3	1	3	2	1	3	3	3	3
CSA021	Human Computer Interaction	CO1	3	3	2	2	1	1	1	1	1	2	1	3	2	2	1
		CO2	3	3	3	3	2	1	1	1	1	2	1	3	2	3	2
		CO3	3	3	3	3	2	1	1	1	1	2	1	3	3	3	2
		CO4	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
		CO5	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2

		CO6	3	3	3	3	2	1	1	1	1	2	1	3	3	3	3
CSA022	Introduction to Cloud Computing with Machine learning	CO1	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
		CO2	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
		CO3	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
		CO4	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
		CO5	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
		CO6	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
CSA041	Introduction to Natural Language Processing	CO1	3	3	3	3	3	1	1	1	1	3	1	3	2	3	1
		CO2	3	3	3	3	3	1	1	1	1	3	1	3	3	3	2
		CO3	3	3	3	3	3	2	1	1	1	3	1	3	3	3	1
		CO4	3	3	3	3	3	1	2	1	1	3	1	3	3	3	3
		CO5	3	3	3	3	3	2	2	1	2	3	1	3	3	3	3
		CO6	3	3	3	3	3	3	3	1	3	3	2	3	3	3	3
CSA051	Recommender Systems	CO1	3	3	2	3	2	1	1	1	2	1		3	3	2	2
		CO2	3	3	3	3	3	2	2	1	2	2		3	3	3	2
		CO3	3	3	3	3	3	3	3	1	3	2		3	3	2	2
		CO4	3	3	3	3	3	2	2	1	3	2		3	3	3	2
		CO5	3	3	3	3	3	3	3	1	3	2		3	3	3	2
		CO6	3	3	3	3	3	3	3	1	3	3		3	3	3	3
CSA061	Robotics and Intelligent Systems	CO1	3	3	3	3	3	1	1	1	1	2	3	2	3	3	1
		CO2	3	3	3	3	3	1	2	1	2	2	3	2	3	3	2
		CO3	3	3	3	3	3	2	1	1	2	2	3	3	3	3	3
		CO4	3	3	3	3	3	1	1	1	2	2	3	2	3	3	3
		CO5	3	3	3	3	3	1	1	1	2	2	3	2	3	3	3
		CO6	3	3	3	3	3	2	2	2	3	3	2	2	3	3	3
CSE011		CO1	3	2											2		

	Mathematical Techniques	CO2	2	3	1	1	1		1			1	2	1	1	1	
		CO3	3	1	1	1			1			2	1	1	3	1	
		CO4	2	3	2	1	1		1			1	1	1	2	1	
		CO5	1	1	1	2	2		1			1	2	1	2	1	
		CO6	3	1	3	1	2		2			2	2	3	3	1	
CSE021	Introduction to Cloud Computing	CO1	2	3	1	2											
		CO2	2	2	2	3											
		CO3	1	3	1	2										2	3
		CO4	3	1	2	2										3	2
		CO5	2	2	3	1										2	2
		CO6	1	3	1	2									2	3	3
CSE022	Android Application Development	CO1					3				2			1			2
		CO2					3				2			1			2
		CO3			2		3				2			1	2		2
		CO4					3				2		2	1			2
		CO5			2	3	3		2		2		2	1			2
		CO6	1	2	3	3	3	3	3		3		3	1	3	3	3
CSA031	Digital Image Processing	CO1	3	3	3	3	1	1	1	1	1	2	1	3	2	3	1
		CO2	3	3	3	3	2	1	1	1	1	2	1	3	2	3	2
		CO3	3	3	3	3	2	1	1	1	1	2	1	3	3	3	2
		CO4	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
		CO5	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
		CO6	3	3	3	3	2	3	3	1	3	2	1	3	3	3	3
CSA051	Wireless Networks	CO1	3		3					1							2
		CO2	3	2	3					1							2
		CO3	3	2	3					1							2

		CO4	3	2	3					1							2
		CO5	3	2	3	2	2			1							3
		CO6	3	2	3	2	2			1							3
CSE062	MOBILE COMPUTING	CO1	3	3		2	3					2			3	2	
		CO2	3	3		2	3					2			3	2	
		CO3	3	3		2	3					2			2	3	
		CO4	3	3		2	3					2			3	2	
		CO5	3	3		2	3					2			2	2	
		CO6	3	3		2	3					2			2	2	
0	Basics of Internet of Things and Raspberry Pi	CO1	3	1	1			2	1					3	3		
		CO2	3	1	1	2		2	1					3	3		
		CO3	2	1	1		3	1	1		1	1	2	2	1	1	
		CO4	2	2	2		3	2	2	2	1	1	1	2	3	2	2
		CO5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
		CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2
CSI104	Introduction to IoT	CO1	3	1	1			2	1					3	3		
		CO2	2	2	1			1	3					3	3		
		CO3	3	1	1	2		2	1					3	3		
		CO4	3	2	3	2		1	2					3	3		
		CO5	3	3	3	3	3	2	3					3	3		
		CO6	2	2	2	2	3	2	3					3	3		

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CSI104	Introduction to IoT	CO1	3	1	1	-	-	2	1	-	-	-	-	3	3	-	-
		CO2	2	2	1	-	-	1	3	-	-	-	-	3	3	-	-
		CO3	3	1	1	2	-	2	1	-	-	-	-	3	3	-	-
		CO4	3	2	3	2	-	1	2	-	-	-	-	3	3	-	-
		CO5	3	3	3	3	3	2	3	-	-	-	-	3	3	-	-
		CO6	2	2	2	2	3	2	3	-	-	-	-	3	3	-	-
CSI201	Embedded System	CO1	3	-	-	-	-	1	1	-	-	-	-	3	-	1	-
		CO2	3	2	-	-	3	-	-	-	2	2	1	3	2	2	-
		CO3	3	3	-	2	2	-	2	-	2	2	-	3	2	-	-
		CO4	3	3	3	3	3	2	3	2	3	3	3	3	3	2	3
		CO5	3	-	2	2	-	-	-	-	2	2	-	3	-	-	-
		CO6	3	3	3	3	3	3	3	2	3	3	2	3	3	3	3
CIP201	Embedded System Lab	CO1	3	-	-	1	1	1	1	-	3	1	-	3	1	1	1
		CO2	3	2	2	2	3	-	2	2	2	2	1	3	2	2	2
		CO3	3	3	2	2	2	-	2	2	2	2	3	3	2	-	3
		CO4	3	3	3	3	3	1	3	2	3	3	3	3	3	2	3
		CO5	3	-	2	2	-	-	1	1	2	2	3	3	2	-	-
		CO6	3	3	3	3	3	3	3	2	3	3	2	3	3	3	3
CSI202	IoT Architecture and Programming	CO1	2	-	-	-	-	-	-	-	1	-	-	2	-	2	-
		CO2	2	-	-	-	-	-	-	-	2	-	-	2	2	2	-
		CO3	2	3	2	3	3	-	2	1	2	3	-	2	3	2	-
		CO4	2	-	-	2	2	-	2	-	2	2	-	2	-	2	-

		CO5	2	2	-	-	3	-	-	-	2	3	-	2	-	2	2
		CO6	3	3	3	3	3	2	3	3	3	3	2	2	3	3	3
CIP202	IoT Architecture and Programming Lab	CO1	2	2	1	2	2	2	2	-	2	1	3	3	2	2	-
		CO2	2	2	2	1	2	-	-	-	2	-	2	3	2	2	-
		CO3	2	2	2	1	2	-	-	-	2	-	3	3	2	2	-
		CO4	2	2	2	1	2	-	-	2	2	-	3	3	2	2	-
		CO5	2	2	2	2	2	-	-	2	2	-	3	3	3	3	-
		CO6	2	2	2	2	2	3	2	2	3	1	3	3	3	3	2
CSI301	Programming with SENSEnuts IoT Platform	CO1	2	-	-	1	2	2	-	-	1	1	1	2	2	1	1
		CO2	2	2	2	1	2	2	2	-	1	1	1	2	2	1	1
		CO3	2	2	2	2	3	2	2	-	2	2	2	2	3	2	1
		CO4	2	3	2	2	3	2	2	-	2	2	2	2	3	2	1
		CO5	2	3	3	3	3	2	2	2	2	2	2	2	3	3	1
		CO6	3	3	3	3	3	2	2	3	3	3	3	3	3	3	2
CIP301	Programming with SENSEnuts IoT Platform Lab	CO1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
		CO2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2
		CO3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
		CO4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
		CO5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
		CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2
CSI302	IoT: Sensing & Actuator Devices	CO1	2	1	1	1	1	1	1	1	-	1	-	2	1	-	-
		CO2	2	2	1	1	1	2	2	1	2	2	2	2	2	1	1
		CO3	2	2	1	1	1	2	3	1	2	2	2	2	2	1	1
		CO4	2	2	1	1	1	2	1	1	2	2	2	2	2	1	1
		CO5	2	2	1	1	1	2	1	1	2	2	2	2	2	1	1
		CO6	3	3	3	3	2	3	2	1	3	3	3	3	3	3	2

CIP302	IoT: Sensing & Actuator Devices Lab	CO1	3	2	2	2	3	1	1	-	3	3	3	2	1	-	-
		CO2	3	3	2	2	3	2	2	-	3	3	3	2	2	2	-
		CO3	3	3	2	2	3	2	3	-	3	3	3	2	2	2	-
		CO4	3	3	2	2	3	2	1	-	3	3	3	2	2	2	-
		CO5	3	3	2	2	3	2	1	2	3	3	3	2	2	2	-
		CO6	3	3	3	3	3	3	2	2	3	3	3	3	3	3	2
CSI303	Wireless Technologies for IoT	CO1	3	-	2	-	-	-	-	-	1	2	-	1	-	-	-
		CO2	3	2	-	-	-	-	-	1	1	2	-	1	-	-	-
		CO3	3	2	-	2	-	-	-	2	2	2	2	2	-	-	-
		CO4	3	2	2	-	-	-	-	2	2	2	2	2	-	-	-
		CO5	3	2	-	2	3	-	3	2	3	2	3	3	2	-	-
		CO6	3	3	3	3	3	-	3	3	3	3	3	3	2	3	3
CIP303	Wireless Technologies for IoT Lab	CO1	3	3	-	-	2	-	-	-	2	-	-	3	-	-	-
		CO2	3	3	2	-	3	3	-	-	2	-	-	3	3	2	-
		CO3	3	3	3	2	3	3	-	-	3	-	2	3	3	2	-
		CO4	3	3	3	2	3	3	-	-	3	-	2	3	3	2	-
		CO5	3	3	3	2	3	3	-	-	3	-	3	3	3	3	-
		CO6	3	3	3	3	3	3	-	-	3	-	3	3	3	3	-
CSI401	IoT Security	CO1	3	1	2	1	-	-	-	2	-	-	-	2	-	-	-
		CO2	3	1	1	1	-	-	-	2	-	-	-	2	-	-	-
		CO3	3	2	2	2	2	-	-	2	-	-	-	2	-	-	-
		CO4	3	3	3	3	2	2	-	3	3	3	3	3	2	2	3
		CO5	3	3	3	3	2	2	-	1	2	-	2	3	2	-	-
		CO6	3	3	3	3	3	3	-	2	3	3	3	3	2	3	3
CSI023	Micro-controller	CO1	2	-	-	1	2	2	-	-	1	1	1	2	2	1	1
		CO2	2	2	2	1	2	2	2	-	1	1	1	2	2	1	1

	programming using Arduino	CO3	2	2	2	2	3	2	2	-	2	2	2	2	3	2	1
		CO4	2	3	2	2	3	2	2	-	2	2	2	2	3	2	1
		CO5	2	3	3	3	3	2	2	2	2	2	2	2	3	3	1
		CO6	3	3	3	3	3	2	2	3	3	3	3	3	3	3	2
CIP023	Micro-controller programming using Arduino Lab	CO1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
		CO2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2
		CO3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
		CO4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
		CO5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
		CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2
CSI024	Raspberry Pi and its Programming	CO1	2	1	1	-	3	1	1	-	1	1	2	2	1	1	-
		CO2	2	2	2	-	3	2	2	2	1	1	1	2	3	2	2
		CO3	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
		CO4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
		CO5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
		CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2
CIP024	Raspberry Pi and its Programming Lab	CO1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
		CO2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2
		CO3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
		CO4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
		CO5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
		CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2
CSI021	Sensor-Cloud for Internet of Things	CO1	2	2	-	2	-	1	-	-	1	-	-	2	-	1	-
		CO2	2	2	-	2	-	1	-	-	1	-	-	2	-	1	-
		CO3	2	1	1	2	-	1	-	-	1	1	-	2	-	2	-
		CO4	2	2	1	2	-	1	2	-	2	1	-	3	-	2	-

		CO5	2	2	2	2	-	1	2	-	2	1	2	3	2	2	-
		CO6	3	3	3	2	3	2	2	2	2	2	2	3	3	3	2
CIP021	Sensor-Cloud for Internet of Things Lab	CO1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
		CO2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2
		CO3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
		CO4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
		CO5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
		CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2
CSI022	Wireless Sensor Networks	CO1	2	2	-	2	-	2	-	-	1	-	-	2	-	1	-
		CO2	2	2	-	2	-	2	-	-	1	-	-	2	-	1	-
		CO3	2	1	1	2	-	2	-	-	2	2	-	2	-	2	-
		CO4	2	2	1	2	-	2	2	-	2	2	-	3	-	2	-
		CO5	2	2	3	2	-	2	2	-	3	2	2	3	2	3	-
		CO6	3	3	3	2	3	2	2	2	3	2	2	3	3	3	2
CIP022	Wireless Sensor Networks Lab	CO1	2	1	-	-	2	-	-	-	-	-	-	2	-	-	-
		CO2	3	2	1	1	3	-	2	-	1	1	1	2	1	2	2
		CO3	3	1	2	2	3	1	3	-	2	2	2	2	3	2	2
		CO4	3	2	2	2	2	1	3	-	2	2	2	2	1	2	2
		CO5	3	2	2	2	3	2	3	-	3	3	3	3	2	3	3
		CO6	3	2	3	2	3	2	3	2	3	3	3	3	3	3	3
CSI031	Artificial Intelligence for IoT	CO1	3	-	-	-	-	-	-	2	-	-	-	2	-	-	-
		CO2	3	2	2	2	3	2	-	-	2	2	2	2	2	2	2
		CO3	3	2	2	2	3	2	3	2	2	2	2	2	2	2	-
		CO4	3	3	3	3	3	-	-	-	2	2	-	2	2	2	2
		CO5	3	3	3	3	3	3	3	2	2	2	3	3	2	3	2
		CO6	3	3	3	3	3	3	-	2	3	3	3	3	2	3	3

CIP031	Artificial Intelligence for IoT Lab	CO1	2	2	1	-	3	1	1	-	2	2	2	2	1	1	-
		CO2	3	3	2	2	3	2	2	2	1	1	1	3	3	2	3
		CO3	3	2	2	2	3	2	2	2	3	3	3	3	3	2	3
		CO4	3	3	2	2	3	2	2	2	3	3	3	3	3	2	3
		CO5	3	3	2	3	3	2	2	2	3	3	3	3	3	2	3
		CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CSI032	Data Analytics for IoT	CO1	2	3	-	2	-	-	-	-	-	-	-	2	-	1	-
		CO2	3	-	-	2	2	-	-	-	-	-	2	2	2	1	-
		CO3	3	2	3	2	2	-	-	-	-	2	2	2	2	1	-
		CO4	2	-	-	2	-	-	-	-	-	2	2	2	-	1	-
		CO5	3	3	3	2	2	3	2	-	2	2	2	2	2	2	-
		CO6	3	3	3	2	3	3	2	2	2	2	2	2	3	2	-
CSI033	Image Processing with IoT	CO1	3	-	-	-	2	-	-	2	-	-	-	2	-	2	-
		CO2	3	2	2	2	3	2	-	-	2	2	2	2	2	2	2
		CO3	3	2	2	2	3	2	-	2	2	2	-	2	2	2	-
		CO4	3	3	3	3	3	-	-	-	2	2	-	2	2	2	2
		CO5	3	3	3	3	3	3	-	2	2	2	-	3	2	3	2
		CO6	3	3	3	3	3	3	3	2	3	3	3	3	2	3	3
CIP033	Image Processing with IoT Lab	CO1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
		CO2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2
		CO3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
		CO4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
		CO5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
		CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2
CSI011	Android with IoT	CO1	2	-	-	-	2	-	-	-	-	1	2	2	-	-	-
		CO2	2	-	-	-	2	-	-	-	-	-	2	2	-	-	1

		CO3	2	2	-	2	2	2	3	-	2	2	2	3	-	-	-
		CO4	2	2	-	2	2	-	-	-	2	2	2	3	1	1	3
		CO5	2	2	2	3	2	3	2	2	3	3	2	3	3	3	3
		CO6	2	3	3	3	2	3	2	2	3	3	2	3	3	3	3
CIP011	Android with IoT Lab	CO1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
		CO2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2
		CO3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
		CO4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
		CO5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
		CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2
CSI041	Fog Computing in IoT	CO1	2	2	-	-	-	-	-	-	-	-	-	2	-	-	-
		CO2	3	2	2	2	-	-	1	-	-	-	-	2	-	-	-
		CO3	3	2	2	2	2	-	2	-	2	2	2	3	2	2	-
		CO4	3	2	2	2	-	-	2	-	2	2	2	3	2	2	-
		CO5	3	3	3	2	3	2	2	3	3	3	3	3	2	2	2
		CO6	3	3	3	2	3	3	2	3	3	3	3	3	2	2	3
CSI042	Industrial IoT 4.0	CO1	1	-	-	-	-	1	2	2	-	-	-	2	-	-	-
		CO2	2	2	-	1	-	1	2	2	1	-	-	2	-	-	-
		CO3	2	1	-	1	2	1	2	2	2	1	2	2	1	2	-
		CO4	2	2	1	2	2	1	2	2	2	1	2	2	1	2	-
		CO5	2	2	-	2	2	1	2	2	2	2	2	2	2	3	2
		CO6	2	2	2	2	3	1	2	2	3	2	3	3	2	3	2
CSI051	IoT in Healthcare	CO1	3	2	2	-	2	3	3	2	2	2	2	3	2	2	-
		CO2	3	3	3	2	2	3	3	2	2	3	2	3	2	2	-
		CO3	3	3	3	3	2	3	3	2	3	3	3	3	3	3	-
		CO4	3	3	3	3	2	3	3	2	3	3	3	3	3	3	-

		CO5	3	3	3	3	2	3	3	2	3	3	3	3	3	3	-
		CO6	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3
CSI052	Drones in IoT	CO1	3	2	2	-	3	2	2	2	2	2	-	3	2	2	-
		CO2	3	3	3	2	3	3	3	2	2	3	-	3	2	2	-
		CO3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
		CO4	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
		CO5	3	3	3	3	3	3	3	2	3	3	3	3	3	3	-
		CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CSI061	Industrial IoT: Smart Manufacturing	CO1	2	2	2	2	-	2	2	-	-	1	-	2	-	-	-
		CO2	2	2	2	3	-	2	2	-	-	-	2	2	-	-	-
		CO3	3	2	2	3	3	2	2	2	-	-	-	2	-	-	2
		CO4	3	2	2	3	-	2	2	-	-	2	2	2	-	-	2
		CO5	3	2	3	3	-	2	2	-	2	2	-	2	-	-	-
		CO6	3	3	3	3	3	2	2	3	2	2	2	3	3	2	2
CSI062	IoT Applications	CO1	3	3	2	3	3	3	3	2	3	3	3	3	3	2	2
		CO2	3	3	3	3	3	3	3	2	3	3	3	3	3	2	2
		CO3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
		CO4	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
		CO5	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
		CO6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
CIP062	IoT Applications Lab	CO1	3	3	2	3	3	3	3	2	3	3	3	3	3	2	2
		CO2	3	3	3	3	3	3	3	2	3	3	3	3	3	2	2
		CO3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
		CO4	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
		CO5	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
		CO6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2

B.Tech-Computer Science & Engineering with specialization in Cyber Security & Forensics																	
0	Introduction to Cyber Security & Laws	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
0	Digital Forensics	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
0	Digital forensics Lab	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-

		CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
0	Ethical Hacking	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
0	ETHICAL HACKING LAB	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
0	Security Threats Intelligence and Risk Management	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
CSC302	Cryptography and Network Security	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
CCP302		CO1	3	3	-	-	2	-	-	3	-	-	3	-	-	3	3

		CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	3	3
	Cryptography and Network Security Lab	CO3	3	3	2	-	2	-	-	-	2	-	2	3	-	-	3
		CO4	3	3	-	3	2	3	-	2	-	-	-	-	3	-	3
		CO5	3	2	3	-	-	-	-	3	3	-	-	-	3	-	3
		CO6	3	3	-	3	3	3	3	-	-	3	-	3	-	-	3
0	Intrusion Detection and Prevention System	CO1	3	3	-	-	2	-	-	3	-	-	3	-	-	3	3
		CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	3	3
		CO3	3	3	2	-	2	-	-	-	2	-	2	3	-	-	3
		CO4	3	3	-	3	2	3	-	2	-	-	-	-	3	-	3
		CO5	3	2	3	-	-	-	-	3	3	-	-	-	3	-	3
		CO6	3	3	-	3	3	3	3	-	-	3	-	3	-	-	3
0	Intrusion Detection and Prevention System Lab	CO1	3	3	-	-	2	-	-	3	-	-	3	-	-	3	3
		CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	3	3
		CO3	3	3	2	-	2	-	-	-	2	-	2	3	-	-	3
		CO4	3	3	-	3	2	3	-	2	-	-	-	-	3	-	3
		CO5	3	2	3	-	-	-	-	3	3	-	-	-	3	-	3
		CO6	3	3	-	3	3	3	3	-	-	3	-	3	-	-	3
0	Introduction to IoT and It's Security	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
0	Machine Learning	CO1	3	3	3	3	3	3	2	1	1	3	1	3	2	2	1
		CO2	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
		CO3	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3

		CO4	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
		CO5	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
		CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
0	Machine Learning Lab	CO1	3	3	3	3	3	3	2	3		3	3	1	3	2	3
		CO2	3	3	3	2	2	2	3	2	2	3	2	3	3	2	2
		CO3	3	3	2	3	2	1	2	2	2	3	2	2	2	3	2
		CO4	3	3	3	2	2	3	2	3	2	1	3	2	1	3	2
		CO5	3	3	2	2	1	3	2	1	3	2	1	3	2	1	3
		CO6	3	2	3	2	2	1	2	2	1	2	2	2	1	2	1
0	Open source Tools for Cyber Security & Forensics	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
0	Open source Tools for Cyber Security & Forensics Lab	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
0	Packet Analysis	CO1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
		CO2	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
		CO3	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
		CO4	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
		CO5	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3

		CO6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
0	Packet Analysis Lab	CO1	3	3	3	3	--	--	--	2	2	1	2	1	3	2	2
		CO2	3	2	3	3	--	--	--	2	2	2	1	1	2	3	2
		CO3	3	3	3	3	--	--	--	1	1	1	3	2	3	2	1
		CO4	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
		CO5	2	2	3	-	-	-	-	3	3	1	2	-	3	-	-
		CO6	3	2	-	-	-	-	-	-	-	2	3	-	2	2	-
0	Mobile and Wireless Security	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
0	Exploit Writing	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
CSC-032	Malware Analysis	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
0	Cloud Security	CO1															

		CO2															
		CO3															
		CO4															
		CO5															
		CO6															
0	Penetration Testing	CO1		3	3	-	-	2	-	-	3	-	-	-	3	-	-
		CO2		3	3	2	-	-	-	-	-	-	-	-	-	-	-
		CO3		3	3	2	-	2	-	-	-	2	-	-	2	3	-
		CO4		3	3	-	3	2	3	-	2	-	-	-	-	-	3
		CO5		3	2	3	-	-	-	-	3	3	-	-	-	-	3
		CO6		3	3	-	3	3	3	3	-	-	3	3	-	3	-
0	Penetration Testing Lab	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
CSC-062	Web Application Security	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
CSC-022	Disaster Recovery Management	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-

		CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
0	Digital Water Marking and Steganography	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
0	Information Security and Audit Monitoring	CO1	2	2		-	-	-	-	-	-	-	-	-	2	2	-
		CO2	2	2	2	-	-	-	-	-	-	-	-	-	2	2	-
		CO3	2	-	2	-	2	-	-	-	-	-	-	-	2	2	-
		CO4	2	-	-	2	-	2	2	-	-	-	-	-	2	2	
		CO5	-	-	-	-	2	-	2	2	2		-	-	2	-	-
		CO6	-	-	-	-	-	-	-	-	-	2	2	2	2	-	2
0	Network & Cyber Forensics	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
0	Data Privacy and Protection	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

1.3.5.2 COURSE ARTICULATION MATRIX[2]

Course Code	Course Name	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO 1	PS O2	PSO3
		Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication:	Project management and finance	Life-long learning	Familiarity and practical proficiency	Understand, analyse and develop	Apply standard Software
CSE113	Programming for Problem Solving	1.83	2.50	2.17	1.50	2.00				1.80		1.50		1.67	2.17	1.00
MTH142	Calculus and Abstract Algebra	3.00	3.00	2.17	2.17	2.17	1.33				1.00	1.00	1.50			
PHY125	Engineering Physics-I	3.00	3.00	2.50	2.50	2.83	1.83	1.00	1.00	1.17	1.00	1.00	1.00			
CVL103	Environmental Studies	2.00	2.00	2.67	2.17	2.67	3.00									
ARP101	Communicative English-1		2.33	2.00	2.00				2.00	2.00	2.33	2.00	2.83			
CSP113	Programming for Problem Solving Lab	2.17		2.83	1.83	1.67				2.33				2.50	2.50	1.80
CSP101	Introduction to Computer Science and Engineering	3.00	2.00				2.00		2.00				3.00	3.00	2.75	2.60
MEP106	Computer Aided Design & Drafting	2.00	2.00	2.00	2.00	3.00				2.00	2.00		3.00	3.00	3.00	
PHY162	Physics Lab	2.00	2.00	2.00	1.00	1.00	1.00	2.00	3.00	3.00	3.00	2.00	3.00	2.00		
Semester II																
CSE114	Application based Programming in Python	2.17	2.00	1.67	1.75	2.00	2.00		2.00				2.00	1.50	2.00	1.40
MTH145	Probability and Statistics	3.00	2.67	2.17	2.17	2.17	1.33				1.00	1.00	1.50			
EEE112	Principles of Electrical and Electronics Engineering	2.17	1.83	1.83	1.50							1.00				
CSE242	Data Structures	2.00	2.33	2.67	2.33	1.50				1.83			1.00	2.33	2.17	2.33

[2] Each course outcome (Based on Blooms Taxanomy-CO1, CO2, CO3, CO4, CO5, and CO6) of the course needs to map with PO. This table evolves once faculty has mapped each course outcomes of their respective course with PO's.

HMM111	Human Value & Ethics	1.25	2.25	1.40	1.60	2.00	2.00	1.75	1.00	1.50	2.00	2.25	1.75	1.75	2.20	1.75
ARP102	Communicative English -2								3.00		3.00		3.00			
CSP105	Design and creativity Lab	3.00	2.67	2.00	2.75	2.00	2.00	2.50	3.00	3.00	3.00	2.00	3.00	2.00	2.00	1.00
CSP114	Application based Programming in Python	2.00	2.00	1.50	1.50	1.60	1.75		2.00				2.00	1.75	1.67	1.40
MEP105	Mechanical Workshop	1.67		1.00		1.60	2.00						1.83	1.40		1.00
EEP112	Principles of Electrical and Electronics Engineering	2.17	1.83	1.83	1.50							1.00				
CSP242	Data Structures Lab	2.67	2.00	2.50	2.50	2.00				2.60			1.67	2.17	2.50	2.17
Semester III																
CSE252	Computer Networks	2.25	2.00	2.00	2.00	3.00	2.00		2.00			2.00	3.00	2.00	2.40	2.00
CSE245	Discrete Structures	2.00	2.17	2.50	2.40	3.00	2.67			2.75		3.00	3.00	3.00	2.60	2.50
CSE247	Computer Organization and Architecture	3.00	2.33	2.50			2.00						2.83		1.83	2.50
CSE253	Object Oriented Programming Using Java	2.50	3.00	3.00		2.00	3.00	2.00		3.00		2.00	2.33	2.50	3.00	2.00
CSE254	Principles of Operating System	2.67	2.33	2.80	2.75	1.00			2.00	2.20	1.67	2.33	1.25	2.50	2.20	1.75
CSE255	Introduction of Entrepreneurship															
ARP207	Logical Skills Building and Soft Skills		2.00	3.00			2.00		2.00	2.33	2.00		3.00			
CSP252	Computer Networks Lab	2.25	2.00	2.00	2.00	3.00	2.00		2.00			2.00	3.00	2.00	2.40	2.00
CSP243	Object Oriented Programming Using Java	2.50	3.00	3.00		2.00	3.00	2.00		3.00		2.00	2.33	2.50	3.00	2.00
CSP244	Principles of Operating System Lab	2.67	2.33	2.80	2.75	1.00			2.00	2.20	1.67	2.33	1.25	2.50	2.20	1.75
CSP254	Project Based Learning (PBL) -1	3.00	2.67	2.00	2.75	2.00	2.00	2.50	3.00	3.00	3.00	2.00	3.00	2.00	2.00	1.00
CSP292	Summer Internship-I	2.00	2.50	2.50		2.00	2.00		3.00	3.00	3.00		2.00	1.33	2.00	
Semester IV																
BTY223	Introduction to Biology for Engineers	3.00	2.00	1.67	1.00	2.00	2.00	3.20	2.00	1.00	2.00	1.00	3.00	1.00	1.00	
CSE249	Data Base Management System	2.67	3.00	2.75	3.00	2.75	2.17		2.33	2.67	3.00	2.00	2.33	2.67	3.00	3.00
CSE251	Theory of Computation	2.83	2.60	2.83	3.00	2.40				2.40			2.60	3.00	2.40	2.25
HMM305	Management for Engineers	1.75	1.33	1.67	1.67	2.00	1.83	2.00	1.50	1.33	2.33	1.33	1.25	1.33	1.50	1.83
CSE011	Mathematical Techniques	2.33	1.83	1.60	1.20	1.50		1.20			1.40	1.60	1.40	2.17	1.00	
CSE012	Introduction to Graph Theory and its Applications	1.83	2.50	1.83	2.67	1.40	1.50	1.50			1.50	1.00	1.83	2.17	1.67	2.00
OE1	Open Elective – 1															

ARP208	Quantitative and Qualitative Aptitude Skill Building		**2.00**	**2.00**					**2.00**	**2.00**	**2.20**		**3.00**			
CSP249	Data Base Management System Lab	**3.00**	**2.20**	**2.40**	**2.20**	**2.17**				**3.00**			**2.00**	**2.17**	**2.50**	**2.83**
CSP297	Project Based Learning (PBL) -2	**3.00**	**2.67**	**2.00**	**2.75**	**2.00**	**2.00**	**2.50**	**3.00**	**3.00**	**3.00**	**2.00**	**3.00**	**2.00**	**2.00**	**1.00**
Semester V																
CSE354	Design and Analysis of Algorithm	**2.00**	**2.17**	**1.83**	**2.40**	**2.00**				**2.17**				**2.50**	**2.00**	**2.25**
CSE355	Software Engineering and Testing Methodologies															
CSE356	Research Methodology															
CSE021	Introduction to Cloud Computing	**1.83**	**2.33**	**1.67**	**2.00**									**2.00**	**2.50**	**2.50**
CSE023	Android Application Development	**1.00**	**2.00**	**2.33**	**3.00**	**3.00**	**3.00**	**2.50**		**2.17**		**2.33**	**1.00**	**2.50**	**3.00**	**2.17**
CSE024	Web Technologies	**2.00**	**1.67**	**3.00**	**1.00**	**2.00**	**1.67**	**1.00**		**2.33**		**2.00**	**1.50**	**1.00**	**1.50**	**2.33**
OE-2	Open Elective – 2															
ARP305	Personality Development and Decision making Skills		**2.00**	**2.00**			**2.00**	**2.00**		**2.00**	**2.00**		**3.00**			
CSP350	Design and Analysis of Algorithm Lab	**2.50**	**2.67**	**2.50**	**2.40**	**2.00**				**1.83**				**2.50**	**2.33**	**2.20**
CSP354	Project Based Learning (PBL) -3	**3.00**	**2.17**	**2.00**	**1.80**	**2.50**	**2.00**		**1.17**	**2.00**	**3.00**	**2.25**	**1.33**	**1.83**	**1.80**	**1.75**
CSP355	Software Engineering and Testing Methodologies															
CSP023	Android Application Development Lab	**1.00**	**2.00**	**2.33**	**3.00**	**3.00**	**3.00**	**2.50**		**2.17**		**2.33**	**1.00**	**2.50**	**3.00**	**2.17**
CSP024	Web Technologies Lab	**2.00**	**1.67**	**1.67**	**1.00**	**2.00**	**1.67**			**2.20**		**2.00**	**1.33**	**1.00**	**1.20**	**2.25**
CSP391	Summer Internship-II	**1.67**	**2.00**	**1.50**	**2.33**	**2.00**	**2.00**	**1.00**	**1.40**	**1.67**	**3.00**	**1.00**	**1.50**	**1.25**	**2.00**	**2.00**
CSP395	Technical Skill Enhancement Course-1 Simulation Lab	**1.17**	**2.00**	**1.33**	**3.00**	**2.00**	**2.00**	**1.00**		**2.00**	**2.50**	**2.00**	**1.17**	**1.17**	**2.17**	**1.00**
ECC301	Community Connect															
Semester VI																
CSE353	Compiler Design	**2.00**	**2.00**	**2.80**	**3.00**	**2.40**				**2.75**			**2.75**	**2.40**	**2.00**	**2.33**
CSE472	Artificial Intelligence	**2.17**	**2.83**	**3.00**	**2.67**	**2.50**	**1.75**	**1.50**	**2.00**	**3.00**	**1.83**	**1.75**	**2.33**	**3.00**	**2.50**	**2.33**
CSE031	Digital Image Processing	**3.00**	**3.00**	**3.00**	**3.00**	**1.83**	**1.67**	**1.33**	**1.00**	**1.33**	**2.00**	**1.00**	**3.00**	**2.67**	**3.00**	**2.00**
CSE032	Cryptography and Network Security	**2.25**	**2.50**	**2.00**	**1.50**	**2.50**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.17**	**1.75**	**1.50**
CSE041	Software Project Management	**2.00**		**2.33**	**3.00**	**1.83**	**2.50**		**1.00**	**3.00**	**2.50**	**3.00**	**2.67**			**2.50**
CSE042	Software Testing	**2.83**	**2.67**	**2.80**	**2.00**	**2.60**	**1.60**	**3.00**	**1.20**	**2.20**	**3.00**	**3.00**	**2.17**	**2.00**		**3.00**
CSE051	Wireless Networks	**3.00**	**2.00**	**3.00**	**2.00**	**2.00**			**1.00**							**2.33**

CSE052	Risk Management	**2.00**	**2.00**	**2.00**	**2.50**	**2.00**		**1.00**	**1.00**	**2.00**	**1.25**	**1.25**	**1.00**	**1.50**	**1.00**	**1.33**
CSE053	Advanced Operating System	**2.67**	**2.33**	**2.80**	**2.75**	**1.00**			**2.00**	**2.20**	**1.67**	**2.33**	**1.25**	**2.50**	**2.20**	**1.75**
OE-3	Open Elective – 3															
ARP306	Campus to Corporate		**2.00**	**2.00**			**2.00**	**2.00**		**2.00**	**3.00**		**3.00**			
CSP353	Compiler Design Lab	**2.00**	**2.00**	**2.80**	**3.00**	**2.40**				**2.75**			**2.75**	**2.40**	**2.00**	**2.33**
CSP396	Technical Skill Enhancement Course-2(Application Development Lab)	**1.33**	**2.00**	**1.50**	**2.00**	**2.00**	**2.00**	**1.00**		**2.00**	**2.50**	**2.00**	**1.17**	**1.17**	**2.17**	**1.00**
CSP398	Project Based Learning (PBL) -4	**3.00**	**2.17**	**2.00**	**1.80**	**2.50**	**2.00**		**1.17**	**2.00**	**3.00**	**2.25**	**1.33**	**1.83**	**1.80**	**1.75**
CSP472	Artificial Intelligence Lab	**2.17**	**2.83**	**3.00**	**2.67**	**2.50**	**1.75**	**1.50**	**2.00**	**3.00**	**1.83**	**1.75**	**2.33**	**3.00**	**2.50**	**2.33**
Semester VII																
CSE062	Mobile Computing	**3.00**	**3.00**		**2.00**	**3.00**					**2.00**			**2.50**	**2.17**	
CSE063	Quantum Computing	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
CSE071	Introduction to Internet of Things	**2.67**	**2.00**	**1.83**	**2.50**	**2.67**	**1.83**	**2.20**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.83**	**2.00**	**3.00**
CSE072	Parallel Computing Algorithms	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
CSE073	3D Printing and Software Tools	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
OE4	Open Elective – 4															
CSP496	Summer Internship-III	**1.67**	**2.00**	**1.50**	**2.33**	**2.00**	**2.00**	**1.00**	**1.40**	**1.67**	**3.00**	**1.00**	**1.50**	**1.25**	**2.00**	**2.00**
CSP497	Capstone – 1	**2.17**	**1.83**	**2.50**	**1.83**	**2.17**	**1.60**	**1.60**	**1.00**	**2.00**	**1.83**	**1.00**	**2.00**	**2.17**	**2.67**	**3.00**
Semester VIII																
CSP498	Capstone - 2	**1.83**	**2.00**	**2.33**	**2.00**	**2.83**	**2.00**	**2.00**	**2.00**	**2.00**	**2.33**	**2.00**	**1.50**	**3.17**	**2.50**	**2.50**

B.Tech-Computer Science & Engineering with specialization in Artificial Intelligence & Machine Learning																
CSA103	Introduction To AI & ML	**3.00**	**3.00**	**3.00**	**1.00**	**2.00**	**2.67**	**2.67**	**1.33**	**2.67**	**3.00**	**2.33**	**3.00**	**2.67**	**3.00**	**2.50**
CSA202	Concept of Machine Learning	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.83**	**2.00**	**2.00**	**3.00**	**2.67**	**3.00**	**2.83**	**2.83**	**2.67**
CAL201	Concept of Machine Learning Lab	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.83**	**2.00**	**2.00**	**3.00**	**2.67**	**3.00**	**2.83**	**2.83**	**2.67**
CSA203	Concepts of Neural Networks	**3.00**	**3.00**	**3.00**	**3.00**	**2.83**	**2.33**	**2.33**	**1.17**	**2.33**	**3.00**	**2.67**	**3.00**	**3.00**	**3.00**	**2.67**
CSA301	Soft Computing	**3.00**	**3.00**	**2.67**	**2.67**	**2.50**	**2.33**	**2.17**	**1.83**	**2.33**	**1.83**	**2.67**	**3.00**	**2.67**	**3.00**	**2.67**
CSA302	Pattern Recognition	**3.00**	**3.00**	**3.00**	**3.00**	**2.17**	**2.33**	**1.50**	**1.17**	**2.17**	**3.00**	**1.33**	**3.00**	**3.00**	**3.00**	**2.67**

CAL302	Pattern Recognition Lab	**3.00**	**3.00**	**3.00**	**3.00**	**2.17**	**2.33**	**1.50**	**1.17**	**2.17**	**3.00**	**1.33**	**3.00**	**3.00**	**3.00**	**2.67**
CSA303	Deep Learning and Its Applications	**3.00**	**3.00**	**3.00**	**3.00**	**2.83**	**2.33**	**2.33**	**1.17**	**2.33**	**3.00**	**2.67**	**3.00**	**3.00**	**3.00**	**2.67**
CAL303	Deep Learning and Its Applications Lab	**3.00**	**3.00**	**3.00**	**3.00**	**2.83**	**2.33**	**2.33**	**1.17**	**2.33**	**3.00**	**2.67**	**3.00**	**3.00**	**3.00**	**2.67**
CSA402	Applications of AIML in healthcare/ ICT/ Computer Networks	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**1.83**	**2.00**	**3.00**	**2.33**	**3.00**	**2.67**	**3.00**	**3.00**	**3.00**	**2.67**
CSA401	Computer Vision	**3.00**	**3.00**	**3.00**	**3.00**	**1.83**	**1.67**	**1.33**	**1.00**	**1.33**	**2.00**	**1.00**	**3.00**	**2.67**	**3.00**	**2.00**
CAL401	Computer Vision Lab	**3.00**	**3.00**	**3.00**	**3.00**	**1.83**	**1.67**	**1.33**	**1.00**	**1.33**	**2.00**	**1.00**	**3.00**	**2.67**	**3.00**	**2.00**
CSA021	Human Computer Interaction	**3.00**	**3.00**	**2.83**	**2.83**	**1.83**	**1.33**	**1.00**	**1.00**	**1.00**	**2.00**	**1.00**	**3.00**	**2.67**	**2.83**	**2.00**
CSA022	Introduction to Cloud Computing with Machine learning	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**1.00**	**2.00**	**3.00**	**1.00**	**3.00**	**3.00**	**3.00**	**3.00**
CSA041	Introduction to Natural Language Processing	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**1.67**	**1.67**	**1.00**	**1.50**	**3.00**	**1.17**	**3.00**	**2.83**	**3.00**	**2.17**
CSA051	Recommender Systems	**3.00**	**3.00**	**2.83**	**3.00**	**2.83**	**2.33**	**2.33**	**1.00**	**2.67**	**2.00**		**3.00**	**3.00**	**2.67**	**2.17**
CSA061	Robotics and Intelligent Systems	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**1.33**	**1.33**	**1.17**	**2.00**	**2.17**	**2.83**	**2.17**	**3.00**	**3.00**	**2.50**
CSE011	Mathematical Techniques	**2.33**	**1.83**	**1.60**	**1.20**	**1.50**		**1.20**			**1.40**	**1.60**	**1.40**	**2.17**	**1.00**	
CSE021	Introduction to Cloud Computing	**1.83**	**2.33**	**1.67**	**2.00**									**2.00**	**2.50**	**2.50**
CSE022	Android Application Development	**1.00**	**2.00**	**2.33**	**3.00**	**3.00**	**3.00**	**2.50**		**2.17**		**2.33**	**1.00**	**2.50**	**3.00**	**2.17**
CSA031	Digital Image Processing	**3.00**	**3.00**	**3.00**	**3.00**	**1.83**	**1.67**	**1.33**	**1.00**	**1.40**	**2.00**	**1.00**	**3.00**	**2.67**	**3.00**	**2.00**
CSA051	Wireless Networks	**3.00**	**2.00**	**3.00**	**2.00**	**2.00**			**1.00**							**2.33**
CSE062	MOBILE COMPUTING	**3.00**	**3.00**		**2.00**	**3.00**					**2.00**			**2.50**	**2.17**	
0	Basics of Internet of Things and Raspberry Pi	**2.67**	**1.67**	**1.67**	**2.67**	**3.00**	**2.00**	**1.67**	**2.33**	**2.00**	**2.00**	**2.25**	**2.67**	**2.67**	**2.00**	**2.00**
CSI104	Introduction to IoT	**2.67**	**1.83**	**1.83**	**2.25**	**3.00**	**1.67**	**2.17**					**3.00**	**3.00**		
B.Tech-Computer Science & Engineering with specialization in Internet of Things & Applications																
CSI104	Introduction to IoT	**2.67**	**1.83**	**1.83**	**2.25**	**3.00**	**1.67**	**2.17**					**3.00**	**3.00**		
CSI201	Embedded System	**3.00**	**2.75**	**2.67**	**2.50**	**2.75**	**2.00**	**2.25**	**2.00**	**2.40**	**2.40**	**2.00**	**3.00**	**2.50**	**2.00**	**3.00**
CIP201	Embedded System Lab	**3.00**	**2.75**	**2.40**	**2.17**	**2.40**	**1.67**	**2.00**	**1.80**	**2.50**	**2.17**	**2.40**	**3.00**	**2.17**	**2.00**	**2.40**
CSI202	IoT Architecture and Programming	**2.17**	**2.67**	**2.50**	**2.67**	**2.75**	**2.00**	**2.33**	**2.00**	**2.00**	**2.75**	**2.00**	**2.00**	**2.67**	**2.17**	**2.50**
CIP202	IoT Architecture and Programming Lab	**2.00**	**2.00**	**1.83**	**1.50**	**2.00**	**2.50**	**2.00**	**2.00**	**2.17**	**1.00**	**2.83**	**3.00**	**2.33**	**2.33**	**2.00**
CSI301	Programming with SENSEnuts IoT Platform	**2.17**	**2.60**	**2.40**	**2.00**	**2.67**	**2.00**	**2.00**	**2.50**	**1.83**	**1.83**	**1.83**	**2.17**	**2.67**	**2.00**	**1.17**
CIP301	Programming with SENSEnuts IoT Platform Lab	**2.33**	**2.00**	**2.00**	**2.00**	**3.00**	**2.00**	**2.00**	**2.20**	**2.50**	**2.50**	**2.50**	**2.67**	**2.67**	**2.00**	**2.00**
CSI302	IoT: Sensing & Actuator Devices	**2.17**	**2.00**	**1.33**	**1.33**	**1.17**	**2.00**	**1.67**	**1.00**	**2.20**	**2.00**	**2.20**	**2.17**	**2.00**	**1.40**	**1.20**

CIP302	IoT: Sensing & Actuator Devices Lab	**3.00**	**2.83**	**2.17**	**2.17**	**3.00**	**2.00**	**1.67**	**2.00**	**3.00**	**3.00**	**3.00**	**2.17**	**2.00**	**2.20**	**2.00**
CSI303	Wireless Technologies for IoT	**3.00**	**2.20**	**2.33**	**2.33**	**3.00**		**3.00**	**2.00**	**2.00**	**2.17**	**2.50**	**2.00**	**2.00**	**3.00**	**3.00**
CIP303	Wireless Technologies for IoT Lab	**3.00**	**3.00**	**2.80**	**2.25**	**2.83**	**3.00**			**2.67**		**2.50**	**3.00**	**3.00**	**2.40**	
CSI401	IoT Security	**3.00**	**2.17**	**2.33**	**2.17**	**2.25**	**2.33**		**2.00**	**2.67**	**3.00**	**2.67**	**2.50**	**2.00**	**2.50**	**3.00**
CSI023	Micro-controller programming using Arduino	**2.17**	**2.60**	**2.40**	**2.00**	**2.67**	**2.00**	**2.00**	**2.50**	**1.83**	**1.83**	**1.83**	**2.17**	**2.67**	**2.00**	**1.17**
CIP023	Micro-controller programming using Arduino Lab	**2.33**	**2.00**	**2.00**	**2.00**	**3.00**	**2.00**	**2.00**	**2.20**	**2.50**	**2.50**	**2.50**	**2.67**	**2.67**	**2.00**	**2.00**
CSI024	Raspberry Pi and its Programming	**2.33**	**2.00**	**2.00**	**2.50**	**3.00**	**2.00**	**2.00**	**2.20**	**2.33**	**2.33**	**2.50**	**2.67**	**2.67**	**2.00**	**2.00**
CIP024	Raspberry Pi and its Programming Lab	**2.33**	**2.00**	**2.00**	**2.00**	**3.00**	**2.00**	**2.00**	**2.20**	**2.50**	**2.50**	**2.50**	**2.67**	**2.67**	**2.00**	**2.00**
CSI021	Sensor-Cloud for Internet of Things	**2.17**	**2.00**	**1.75**	**2.00**	**3.00**	**1.17**	**2.00**	**2.00**	**1.50**	**1.25**	**2.00**	**2.50**	**2.50**	**1.83**	**2.00**
CIP021	Sensor-Cloud for Internet of Things Lab	**2.33**	**2.00**	**2.00**	**2.00**	**3.00**	**2.00**	**2.00**	**2.20**	**2.50**	**2.50**	**2.50**	**2.67**	**2.67**	**2.00**	**2.00**
CSI022	Wireless Sensor Networks	**2.17**	**2.00**	**2.00**	**2.00**	**3.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.50**	**2.50**	**2.00**	**2.00**
CIP022	Wireless Sensor Networks Lab	**2.83**	**1.67**	**2.00**	**1.80**	**2.67**	**1.50**	**2.80**	**2.00**	**2.20**	**2.20**	**2.20**	**2.33**	**2.00**	**2.40**	**2.40**
CSI031	Artificial Intelligence for IoT	**3.00**	**2.60**	**2.60**	**2.60**	**3.00**	**2.50**	**3.00**	**2.00**	**2.20**	**2.20**	**2.50**	**2.33**	**2.00**	**2.40**	**2.25**
CIP031	Artificial Intelligence for IoT Lab	**2.83**	**2.67**	**2.00**	**2.40**	**3.00**	**2.00**	**2.00**	**2.20**	**2.50**	**2.50**	**2.50**	**2.83**	**2.67**	**2.00**	**3.00**
CSI032	Data Analytics for IoT	**2.67**	**2.75**	**3.00**	**2.00**	**2.25**	**3.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.25**	**1.33**	
CSI033	Image Processing with IoT	**3.00**	**2.60**	**2.60**	**2.60**	**2.83**	**2.50**	**3.00**	**2.00**	**2.20**	**2.20**	**2.50**	**2.33**	**2.00**	**2.33**	**2.25**
CIP033	Image Processing with IoT Lab	**2.33**	**2.00**	**2.00**	**2.00**	**3.00**	**2.00**	**2.00**	**2.20**	**2.50**	**2.50**	**2.50**	**2.67**	**2.67**	**2.00**	**2.00**
CSI011	Android with IoT	**2.00**	**2.25**	**2.50**	**2.50**	**2.00**	**2.67**	**2.33**	**2.00**	**2.50**	**2.20**	**2.00**	**2.67**	**2.33**	**2.33**	**2.50**
CIP011	Android with IoT Lab	**2.33**	**2.00**	**2.00**	**2.00**	**3.00**	**2.00**	**2.00**	**2.20**	**2.50**	**2.50**	**2.50**	**2.67**	**2.67**	**2.00**	**2.00**
CSI041	Fog Computing in IoT	**2.83**	**2.33**	**2.40**	**2.00**	**2.67**	**2.50**	**1.80**	**3.00**	**2.50**	**2.50**	**2.50**	**2.67**	**2.00**	**2.00**	**2.50**
CSI042	Industrial IoT 4.0	**1.83**	**1.80**	**1.50**	**1.60**	**2.25**	**1.00**	**2.00**	**2.00**	**2.00**	**1.50**	**2.25**	**2.17**	**1.50**	**2.50**	**2.00**
CSI051	IoT in Healthcare	**3.00**	**2.83**	**2.83**	**2.80**	**2.00**	**3.00**	**3.00**	**2.17**	**2.67**	**2.83**	**2.67**	**3.00**	**2.67**	**2.67**	**3.00**
CSI052	Drones in IoT	**3.00**	**2.83**	**2.83**	**2.80**	**3.00**	**2.83**	**2.83**	**2.17**	**2.67**	**2.83**	**3.00**	**3.00**	**2.67**	**2.67**	**2.33**
CSI061	Industrial IoT: Smart Manufacturing	**2.67**	**2.17**	**2.33**	**2.83**	**3.00**	**2.00**	**2.00**	**2.50**	**2.00**	**1.75**	**2.00**	**2.17**	**3.00**	**2.00**	**2.00**
CSI062	IoT Applications	**3.00**	**3.00**	**2.83**	**3.00**	**3.00**	**3.00**	**3.00**	**2.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.67**	**2.00**
CIP062	IoT Applications Lab	**3.00**	**3.00**	**2.83**	**3.00**	**3.00**	**3.00**	**3.00**	**2.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.67**	**2.00**
	B.Tech-Computer Science & Engineering with specialization in Cyber Security & Forensics															
0	Introduction to Cyber Security & Laws	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**

0	Digital Forensics	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
0	Digital forensics Lab	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
0	Ethical Hacking	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
0	ETHICAL HACKING LAB	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
0	Security Threats Intelligence and Risk Management	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
CSC302	Cryptography and Network Security	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
CCP302	Cryptography and Network Security Lab	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**	**3.00**
0	Intrusion Detection and Prevention System	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**	**3.00**
0	Intrusion Detection and Prevention System Lab	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**	**3.00**
0	Introduction to IoT and It's Security	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**

0	Machine Learning	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.83**	**2.00**	**2.00**	**3.00**	**2.67**	**3.00**	**2.83**	**2.83**	**2.67**
0	Machine Learning Lab															
0	Open source Tools for Cyber Security & Forensics	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
0	Open source Tools for Cyber Security & Forensics Lab	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
0	Packet Analysis	**3.00**	**3.00**	**3.00**	**3.00**	**2.83**	**2.33**	**2.33**	**1.17**	**2.33**	**3.00**	**2.67**	**3.00**	**3.00**	**3.00**	**2.67**
0	Packet Analysis Lab	**2.67**	**2.33**	**2.80**	**2.75**	**1.00**			**2.00**	**2.20**	**1.67**	**2.33**	**1.25**	**2.50**	**2.20**	**1.75**
0	Mobile and Wireless Security	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
0	Exploit Writing	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
CSC-032	Malware Analysis	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
0	Cloud Security															
0	Penetration Testing		**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**
0	Penetration Testing Lab	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
CSC-062	Web Application Security	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
CSC-022	Disaster Recovery Management	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
0	Digital Water Marking and Steganography	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
0	Information Security and Audit Monitoring	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**
0	Network & Cyber Forensics	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**

0	Data Privacy and Protection	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

Sharda School of Engineering & Technology							
Department of Computer Science & Engineering							
B.Tech-Computer Science & Engineering							
Batch: 2023 Onwards						**TERM: I**	
S. No.	**Course Code**	**Course**	**Teaching Load**			**Credits**	**Pre-Requisite/Co Requisite**
			L	**T**	**P**		
THEORY SUBJECTS							
1	CSE113	Programming for Problem Solving	3	0	0	3	
2	MTH142	Calculus and Abstract Algebra	3	1	0	4	
3	PHY125	Engineering Physics-I	3	1	0	4	
	OR						
	EEE112	Principles of Electrical and Electronics Engineering	2	1	0	3	
4	CVL103	Environmental Studies	2	0	0	0	
	OR						
	HMM111	Value & Ethics				2	
Practical/Viva-Voce/Jury							
5	ARP101	Communicative English-1	1	0	2	2	
6	CSP113	Programming for Problem Solving Lab	0	0	2	1	
7	CSP101	Introduction to Computer Science and Engineering	0	0	2	1	
8	MEP106	Computer Aided Design & Drafting	0	0	3	1.5	
	OR						
	MEP105	Mechanical Workshop	0	0	3		
9	PHY162	Physics Lab	0	0	2	1	
	OR						
	EEP112	Principles of Electrical and Electronics Engineering					
TOTAL CREDITS						**18.5/19.5**	

Sharda School of Engineering & Technology							
Department of Computer Science & Engineering							
B.Tech-Computer Science & Engineering							
Batch: 2023 Onwards						TERM: II	
S. No.	**Course Code**	**Course**	**Teaching Load**			**Credits**	**Pre-Requisite/Co Requisite**
			L	**T**	**P**		
THEORY SUBJECTS							
1	CSE114	Application based Programming in Python	3	0	0	3	
2	CSE242	Data Structures	3	0	0	3	
3	MTH145	Probability and Statistics	3	1	0	4	
4	PHY125	Engineering Physics-I	3	1	0	4	
	OR						
	EEE112	Principles of Electrical and Electronics Engineering	2	1	0	3	
5	HMM111	Values and Ethics	2	0	0	2	
	OR						
	CVL103	Environmental Studies				0	
Practical/Viva-Voce/Jury							
6	ARP102	Communicative English -2	1	0	2	2	
7	CSP116	Design and creativity Lab	1	0	2	2	
8	CSP242	Data Structures Lab	0	0	2	1	
9	CSP114	Application based Programming in Python	0	0	2	1	
10	MEP105	Mechanical Workshop	0	0	3	1.5	
	OR						
	MEP106	Computer Aided Design & Drafting	0	0	3		
11	PHY162	Physics Lab II	0	0	2	1	
	OR						
	EEP112	Principles of Electrical and Electronics Engineering	0	0	2		
TOTAL CREDITS						**21.5/ 22.5**	

Sharda School of Engineering & Technology							
Department of Computer Science & Engineering							
B.Tech-Computer Science & Engineering							
Batch: 2023 Onwards						TERM: III	
S. No.	**Course Code**	**Course**	**Teaching Load**			**Credits**	**Pre-Requisite/Co Requisite**
			L	**T**	**P**		
THEORY SUBJECTS							
1	BTY223	Introduction to Biology for Engineers	2	0	0	2	
2	CSE245	Discrete Structures	3	1	0	4	
3	CSE247	Computer Organization and Architecture	3	0	0	3	
4	CSE252	Computer Networks	3	0	0	3	
5	CSE253	Object Oriented Programming Using Java	2	0	0	2	
6	CSE254	Principles of Operating System	2	0	0	2	
Practical/Viva-Voce/Jury							
7	ARP207	Logical Skills Building and Soft Skills	1	0	2	2	
8	CSP243	Object Oriented Programming Using Java	0	0	2	1	
9	CSP244	Principles of Operating System Lab	0	0	2	1	
10	CSP252	Computer Networks Lab	0	0	2	1	
11	CSP254	Project Based Learning (PBL) -1	0	0	4	2	
12	CSP292	Summer Internship-I	-	-	-	2	
TOTAL CREDITS						**25**	

Sharda School of Engineering & Technology							
Department of Computer Science & Engineering							
B.Tech-Computer Science & Engineering							
Batch: 2023 Onwards						TERM: IV	
S. No.	**Course Code**	**Course**	**Teaching Load**			**Credits**	**Pre-Requisite/Co Requisite**
			L	**T**	**P**		
THEORY SUBJECTS							
1	CSE249	Data Base Management System	3	0	0	3	
2	CSE251	Theory of Computation	3	1	0	4	Discrete Structures
3	HMM305	Management for Engineers	3	0	0	3	
4	PE-1	Program Elective-1				3	
	CSE011	Mathematical Techniques	3	0	0		
	CSE012	Introduction to Graph Theory and its Applications					
	CSE014/ CSP014	Advanced Java Programming	2	0	2		
5	OE1	Open Elective – 1	2	0	0	2	
Practical/Viva-Voce/Jury							
6	ARP208	Quantitative and Qualitative Aptitude Skill Building	1	0	2	2	
7	IED001	Introduction to Entrepreneurship Development	0	1	2	2	
8	CSP249	Data Base Management System Lab	0	0	2	1	
9	CSP297	Project Based Learning (PBL) -2	0	0	4	2	PBL-1
TOTAL CREDITS						**22**	

Sharda School of Engineering & Technology							
Department of Computer Science & Engineering							
B.Tech-Computer Science & Engineering							
Batch: 2023 Onwards						TERM: V	
S. No.	**Course Code**	**Course**	**Teaching Load**			**Credits**	**Pre-Requisite/Co Requisite**
			L	**T**	**P**		
THEORY SUBJECTS							
1	CSE354	Design and Analysis of Algorithm	3	0	0	3	Data Structure
2	CSE356	Software Engineering and Testing Methodologies	2	0	0	2	
3	PE2	Program Elective-2				3	Operating System(3)
	CSE021	Introduction to Cloud Computing	3	0	0		Object Oriented Programming using Java(Semester 3)
	CSE023/ CSP023	Android Application Development	2	0	2		
	CSE024/ CSP024	Web Technologies					
4	OE-2	Open Elective – 2	2	0	0	2	
Practical/Viva-Voce/Jury							
5	ARP305	Personality Development and Decision making Skills	1	0	2	2	
6	BRM002	Research Methodology	0	1	2	2	
7	CSP350	Design and Analysis of Algorithm Lab	0	0	2	1	
8	CSP354	Project Based Learning (PBL) -3	0	0	4	2	PBL-2
9	CSP355	Software Engineering and Testing Methodologies	0	0	2	1	Data Structure Lab
10	CSP391	Summer Internship-II	-	-	-	2	Operating system, DBMS
11	CSP395	Technical Skill Enhancement Course-1 Simulation Lab	0	0	2	1	
12	ECC301	Community Connect	-	-	-	2	Summer Internship-I
TOTAL CREDITS						**23**	
Sharda School of Engineering & Technology							

Department of Computer Science & Engineering							
B.Tech-Computer Science & Engineering							
Batch: 2023 Onwards							TERM: VI
S. No.	**Course Code**	**Course**	**Teaching Load**			**Credits**	**Pre-Requisite/Co Requisite**
			L	**T**	**P**		
THEORY SUBJECTS							
1	CSE353	Compiler Design	3	0	0	3	
2	CSE472	Artificial Intelligence	3	0	0	3	
3	PE3	Program Elective-3	3	0	0	3	
	CSE031	Digital Image Processing					
	CSE032	Cryptography and Network Security					
4	PE4	Program Elective-4	3	0	0	3	
	CSE041	Software Project Management					
	CSE042	Software Testing					
5	PE5	Program Elective-5	3	0	0	3	
	CSE051	Wireless Networks					
	CSE052	Risk Management					
	CSE053	Advanced Operating System					
6	OE-3	Open Elective – 3	3	0	0	3	
Practical/Viva-Voce/Jury							
7	ARP306	Campus to Corporate	1	0	2	2	
8	CSP353	Compiler Design Lab	0	0	2	1	Operating system Lab
	CSP472	Artificial Intelligence Lab	0	0	2	1	
9	CSP396	Technical Skill Enhancement Course-2(Application Development Lab)	0	0	2	1	
10	CSP398	Project Based Learning (PBL) -4	0	0	4	2	PBL-3
TOTAL CREDITS						**25**	

Sharda School of Engineering & Technology							
Department of Computer Science & Engineering							
B.Tech-Computer Science & Engineering							
Batch: 2023 Onwards						**TERM: VII**	
S. No.	**Course Code**	**Course**	**Teaching Load**			**Credits**	**Pre-Requisite/Co Requisite**
			L	**T**	**P**		
THEORY SUBJECTS							
1	CSE473	Machine Learning	3	0	0	3	
2		Program Elective-6	3	0	0	3	
	CSE062	Mobile Computing					
	CSE063	Quantum Computing					
3		Program Elective-7	2	0	0	2	
	CSE071	Introduction to Internet of Things					
	CSE072	Parallel Computing Algorithms					
	CSE073	3D Printing and Software Tools					
6	OE4	Open Elective – 4	3	0	0	3	
Practical/Viva-Voce/Jury							
7	CSP473	Machine Learning Lab	0	0	2	1	
8	CSP496	Summer Internship-III	-	-	-	2	PBL-4
9	CSP497	Capstone – 1	-	-	-	2	Summer Internship-II
TOTAL CREDITS						**16**	

Sharda School of Engineering & Technology							
Department of Computer Science & Engineering							
B.Tech-Computer Science & Engineering							
Batch: 2023 Onwards						TERM: VIII	
S. No.	**Course Code**	**Course**	**Teaching Load**			**Credits**	**Pre-Requisite/Co Requisite**
			L	**T**	**P**		
Practical/Viva-Voce/Jury							
1	CSP498	Capstone - 2	-	-	-	8	Major Project - 1
TOTAL CREDITS						**8**	

C. Course Modules

TERM - I

School: SET		**Batch : 2023-27**	
Program: B.Tech		**Current Academic Year: 2023-24**	
Branch: ALL		**Semester:1**	
1	Course Code	**CSE113**	Course Name: Programming for problem solving
2	Course Title	Programming for problem solving	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Core	
5	Course Objective	1. Learn basic programming constructs –data types, decision structures, control structures in C 2. learning logic aptitude programming in c language 3. Developing software in c programming	
6	Course Outcomes	Students will be able to: CO1: **demonstrate** the algorithm, Pseudo-code and flow chart for the given problem. CO2**: develop** better understanding of basic concepts of C programming. CO3: **create** and implement logic using array and function. CO4: **construct** and implement the logic based on the concept of strings and pointers. CO5: **apply** user-defined data types and I/O operations in file. CO6: **design** and develop solutions to real world problems using C.	
7	Course Description	Programming for problem solving gives the Understanding of C programming and implement code from flowchart or algorithm	
8	Outline syllabus		CO Mapping
	Unit 1	**Logic Building**	
	A	Flowchart: Elements, Identifying and understanding input/ output, Branching and iteration in flowchart	CO1,
	B	Algorithm design: Problem solving approach(top down/bottom up approach)	CO1
	C	Pseudo Code : Representation of different construct, writing pseudo-code from algorithm and flowchart	CO1
	Unit 2	**Introduction to C Programming**	
	A	Introduction to C programming language, Data types, Variables, Constants, Identifiers and keywords, Storage classes	CO2, CO6
	B	Operators and expressions, Types of Statements: Assignment, Control, jumping.	CO2, CO6

	C	Control statements: Decisions, Loops, break, continue	CO2, CO6
	Unit 3	**Arrays and Functions**	
	A	Arrays: One dimensional and multi-dimensional arrays: Declaration, Initialization and array manipulation (sorting, searching).	CO3, CO6
	B	Functions: Definition, Declaration/Prototyping and Calling, Types of functions, Parameter passing: Call by value, Call by reference.	CO3, CO6
	C	Passing and Returning Arrays from Functions, Recursive Functions.	CO3, CO6
	Unit 4	**Pre-processors and Pointers**	
	A	Pre-processors: Types, Directives, Pre-processors Operators (#,##,\) , Macros: Types, Use, predefined Macros	CO4, CO6
	B	Pointer: Introduction, declaration of pointer variables, Operations on pointers: Pointer arithmetic, Arrays and pointers, Dynamic memory allocation.	CO4, CO6
	C	String: Introduction, predefined string functions, Manipulation of text data, Command Line Arguments.	CO4, CO6
	Unit 5	**User Defined Data Types and File Handling**	
	A	Structure and Unions: Introduction, Declaration, Difference, Application, Nested structure, self-referential structure, Array of structures, Passing structure in function.	CO5, CO6
	B	Files: Introduction, concept of record, I/O Streaming and Buffering, Types of Files: Indexed file, sequential file and random file,	CO5, CO6
	C	Creating a data file, Opening and closing a data file, Various I/O operations on data files: Storing data or records in file, adding records, Retrieving, and updating Sequential file/random file.	CO5, CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 25% / MTE: 25% / ETE: 50%	
	Text book/s*	Kernighan, Brian, and Dennis Ritchie. *The C Programming Language*	
	Other References	1. B.S. Gottfried - Programming With C - Schaum's Outline Series - Tata McGraw Hill 2nd Edition - 2004. 2. E. Balagurusamy - Programming in ANSI C - Second Edition - Tata McGraw Hill- 1999	

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:** demonstrate the algorithm, Pseudo-code and flow chart for the given problem.	**PO1,PO2,PO3, PO9, PSO1,PSO2**
2.	**CO2:** develop better understanding of basic concepts of C programming. .	**PO1,PO3, PO4, PO5, PO9, PO11,PSO1,PSO2**
3.	**CO3:** : create and implement logic using array and function.	**PO1,PO3,PO4, PO9, PSO2**
4.	**CO4:** construct and implement the logic based on the concept of strings and pointers.	**PO1,PO3,PO4, PO9, PSO2**
5.	**CO5:** apply user-defined data types and I/O operations in file.	**PO1,PO3,PSO2**
6	**CO6:** design and develop solutions to real world problems using C.	**PO1,PO2,PO3,PO4,PO9, PO11,PSO1 PSO2,PSO3**

PO and PSO mapping with level of strength for Course Name Programming for problem solving (Course Code CSE 113)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	1	2	2	_	_	-	_	_	2	_	_	_	1	2	_
CO2	2	_	3	2	2	-	_	_	1	_	1	_	2	2	_
CO3	3	_	2	1	_	_	_	_	3	_	_	_	_	2	_
CO4	1	_	2	1	_	_	_	_	1	_	_	_	_	3	_
CO5	1	_	1	_	_	_	_	_	_	_	_	_	_	1	_
CO6	3	3	3	2	-	-	_	_	2	_	2	_	2	3	1

Average of non-zeros entry in following table (should be auto calculated).

School: SET		Batch : 2023-27	
Program: B.Tech.		**Current Academic Year: 2023-24**	
Branch: CSE		**Semester: I**	
1	Course Code	**MTH 145**	
2	Course Title	**Probability and Statistics**	
3	Credits	4	
4	Contact Hours (L-T-P)	3-1-0	
	Course Status	Compulsory	
5	Course Objective	The objective of this course is to familiarize the students with statistical techniques. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.	
6	Course Outcomes	CO1: Explain the concept of probability and Random Variable. (K2,K3, K4) CO2: Explain the concept of distribution functions, densities and probability distributions; illustrate discrete and continuous probability distributions. (K1, K2, K3, K4) CO3: Describe the concept of moments, skewness and Kurtosis; evaluate correlation and regression – Rank correlation; discuss bivariate distributions and their properties . (K1, K2, K5) CO4: Discuss the basic of Curve fitting by the method of least squares; evaluate straight lines, second degree parabolas and more general curves. (K1, K2, K5) CO5: Describe and use the concepts test of significance: Large sample test for single proportion, difference of proportions; calculate single mean, difference of means, and difference of standard deviations. (K1,K2,K3) CO6: Explain the basic concepts of tests of small samples- Student's T test, Chi-square test for goodness of fit, and evaluate the result. (K2, K4, K5)	
7	Course Description	This course is an introduction to the fundamental of Mathematics. The primary objective of the course is to develop the basic understanding of statistics including measures of central tendency, correlation and regression, statistical methods of data sampling, probability and random variables and various discrete and continuous probability distributions and their properties.	
8	**Outline syllabus :Probability and Statistics**		**CO Mapping**
	Unit 1	**Basic Probability**	
	A	Probability spaces, conditional probability, Bayes' rule.	CO1

	B	Discrete random variables, Independent random variables	CO1
	C	Expectation of Discrete Random Variables, Chebyshev's Inequality	CO1
	Unit 2	**Discrete and Continuous Probability Distributions**	
	A	Discrete Probability distributions: Binomial, Poisson.	CO2
	B	Continuous random variables and their properties, distribution functions and densities.	CO2
	C	Normal, exponential and gamma distribution.	CO2
	Unit 3	**Statistics**	
	A	Moments, skewness and Kurtosis.	CO3
	B	Correlation and regression – Rank correlation.	CO3
	C	Bivariate distributions and their properties.	CO3
	Unit 4	**Applied Statistics**	
	A	Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves.	CO4, CO5
	B	Test of significance: Large sample test for single proportion,	CO4, CO5
	C	Difference of proportions, single mean, difference of means, and difference of standard deviations.	CO4, CO5
	Unit 5	**Testing Hypothesis**	
	A	Test for single mean, difference of means	CO6
	B	test for ratio of variances	CO6
	C	Chi-square test for goodness of fit and independence of attributes	CO6
	Mode of examination	Theory	
	Weightage Distribution	CA / MTE / ETE 25% / 25% / 50%	
	Text book/s*	1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006. 2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint). 3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.	
	Other References	1. W. Feller, An Introduction to Probability Theory and its	

		Applications, Vol. 1, 3rd Ed., Wiley, 1968. 2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.	

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	1	-	-	-	1	1	1
CO2	3	2	3	2	2	2	-	-	-	1	1	2
CO3	3	3	2	2	2	1	-	-	-	1	1	1
CO4	3	2	2	2	2	1	-	-	-	1	1	1
CO5	3	3	2	2	2	1	-	-	-	1	1	2
CO6	3	3	2	3	2	2	-	-	-	1	1	2

PHY125 Engineering Physics-I

School: School of Basic Sciences and Research		**Batch : 2023-27**	
Program: B.TECH .		**Current Academic Year: 2023-24**	
Branch: CSE/EC/EEE		**Semester: I**	
1	Course Code	PHY125	
2	Course Title	Engineering Physics-I	
3	Credits	4	
4	Contact Hours (L-T-P)	3-1-0	
	Course Status	Compulsory	
5	Course Objective	To make students proverbial with the fundamental concepts of Semiconductors materials and electromagnetism and their real-life applications for configuring various electronics devices.	
6	Course Outcomes	After the completion of this course, CO1: Students will learn the fundamental concepts of mobility, conductivity, electrons and holes in an intrinsic semiconductors, Donor and Acceptor impurities (n-type and p-type semiconductor), Fermi levels etc. Students will gain knowledge about the formation of depletion region, barrier potential, Zener diode, Characteristics of Zener diode etc. CO2: Students will have a clear understanding of Coherent sources, interaction of radiation with matter (spontaneous and stimulated emission), Einstein's relation, population inversion and pumping, Ruby LASER, He-Ne Laser and semiconductor Laser. CO3: Students will show that they have learned the basics of fiber optics, Holography and its applications. CO4: Students will be able to understand the significance and applications of Maxwell's equations. CO5: Students will be able to know about the short comings of classical physics and will learn various quantum mechanical principles. CO6: Student will be familiar with the essential concepts of Semiconductors materials technology and their applications in industries.	
7	Course Description	This course provides the basic foundation for understanding electronic semiconductor devices and their applications and limitations. It has introductory elements of various concept of material science. This course is essential for students who desire to specialize their engineering in Computer Sciences, Electronics, and Electronics and Electrical engineering.	
8	Outline Syllabus		CO Mapping
	Unit 1	**Semiconductor Physics**	
	A	Classification of Solids on the basis of energy band, electrons and holes concentration in intrinsic semiconductors, Fermi levels, Mobility, conductivity,	CO1

	B	Donor and Acceptor impurities (n-type and p-type semiconductor), Drift and diffusion current, Hall effect,	CO1
	C	p-n junction, types of p-n junction (step-graded and Linearly-graded junction), formation of depletion region, barrier potential, Zener diode, Avalanche and Zener breakdown.	CO1, CO6
	Unit 2	**Laser Physics and optoelectronic Sources**	
	A	Coherent sources, interaction of radiation with matter (spontaneous and stimulated emission), Einstein's relation,	CO2
	B	population inversion and pumping, active components of laser, optical amplification or gain, threshold condition for laser action, Ruby and He-Ne lasers.	CO2, CO6
	C	Optoelectronic sources: Light emitting diode (construction, basic working principle), semiconductor laser (construction, basic working principle)	CO2, CO6
	Unit 3	**Fiber Optics and Holography**	
	A	Introduction, structure of optical fiber, Light guidance through optical fiber, Acceptance angle and Acceptance cone, Numerical aperture,	CO3
	B	Types of optical fibers, Attenuation and Dispersion in optical fiber, Applications of optical fibers.	CO3, CO6
	C	Basic principle of holography, Recording of holograms, Reconstruction process, Applications of holography.	CO3, CO6
	Unit 4	**Electromagnetism**	
	A	Gauss's theorem and its applications, Electric potential, and potential difference, Biot-Savart law and its application to current carrying circular loop	CO4
	B	Ampere's law and its applications to infinitely long straight wire, and solenoids. Electromagnetic induction; Faraday's law	CO4
	C	Maxwell's equations in free space and dielectric media, Electromagnetic waves.	CO4
	Unit 5	**Quantum Mechanics**	
	A	Inadequacy of classical Physics, Wave particle duality, de-Broglie wavelength,	CO5
	B	Davisson-Germer experiment, Schrodinger wave equation,	CO5, CO6
	C	particle in a 1-dimensional box, harmonic oscillator problem,	CO5, CO6
	Mode of Examination	Theory	
	Weightage Distribution	CA: 30% / MTE: 20% / ETE: 50%	
	Text books	Integrated Electronics- Millman - Halkias, Tata Mc Graw Hill	
	Other References	1. Semiconductor Devices Physics and Technology- S M Sze, John Wiley & Sons 2. Semiconductor physics and devices: basic principles- Donald A. Neamen. 3. Laser and non-linear optics by B.B. laud, New Age Int.	

		4. Semiconductor Devices- Kanaan Kano, Pearson Education. 5. Electronics devices and circuit theory by R.L. Boylestad, Pearson. 6. Introduction to Electrodynamics, David J. Griffiths, Pearson Cambridge University Press 7. Fundamentals of Electricity and Magnetism, D. N. Vasudeva, S. Chand & Co. New Delhi 8. Fundamentals of Physics, Halliday, Resnick and Walker, John Wiley. 9. Concepts of Modern Physics, Beiser Arthur, McGraw-Hill Education	

Mapping of CO Vs Pos:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	1	1	1	2	1	1	1
CO2	3	3	2	3	3	2	1	1	1	1	1	1
CO3	3	3	2	3	3	2	1	1	1	1	1	1
CO4	3	3	3	2	3	2	1	1	1	1	1	1
CO.5	3	3	3	2	3	2	1	1	1	1	1	1
CO6	3	3	3	3	3	2	1	1	1	1	1	1

School: SET		**Batch : 2023-27**
Program: B. Tech		**Current Academic Year: 2023-24**
Branch: All		**Semester: I**
1	Course Code	CVL-103
2	Course Title	Environmental Science
3	Credits	02
4	Contact Hours (L-T-P)	2-0-0
	Course Status	Compulsory
5	Course Objective	1. Enable students to learn the concepts, principles and importance of environmental science 2. Provide students an insight of various causes of natural resource depletion and its conservation 3. Provide knowledge of layers of atmosphere with an insight of role of climatic elements in dispersion of pollutants 4. Provide detailed knowledge of causes, effects and control of different types of environmental pollution, solid waste management and its effect on climate change, global warming and ozone layer depletion 5. Provide and enrich the students about social issues such as R&R, water conservation and sustainability.
6	Course Outcomes	CO1.Understand the scope of environmental science with knowledge about various types of natural resources and its conservation CO2. Study about the structure and composition of atmosphere and factors affecting weather and climate CO3. Study about pollution causes, effects and control and solid waste management CO4. Effect of global warming and ozone layer depletion CO5.Understand sustainable development, resettlement and rehabilitation, impact of population explosion on environment CO6.Understand overall environmental issues and its management
7	Course Description	Environmental Science emphasises on various factors as 1. Importance and scope of environmental science 2. Natural resource conservation 3. Pollution causes, effects and control methods and solid waste management 4. Social issues associated with environment

8	Outline syllabus		CO Mapping
	Unit 1	**General Introduction**	
	A	Definition, principles and scope of environmental science	CO1
	B	Water Resources, Land Resources, Food Resources	CO1
	C	Mineral Resources, Energy Resources, Forest Resources	CO1
	Unit 2	**Atmosphere and meteorological parameters**	

	A	Structure and composition of atmosphere	CO2
	B	Meteorological parameters: Pressure, Temperature, Precipitation, Humidity,	CO2
	C	Radiation, Wind speed and direction, Wind Rose	CO2
	Unit 3	**Environmental Pollution (Cause, effects and control measures)**	
	A	Air, water, Noise and Soil pollution	CO3
	B	Case studies on pollution	CO3
	C	Solid waste management: Causes, effects and control measures of urban and industrial wastes.	CO3
	Unit 4	**Climate Change and its impact**	
	A	Concept of Global Warming and greenhouse effect	CO4
	B	Ozone layer Depletion and its consequences	CO4
	C	Climate change and its effect on ecosystem, Kyoto protocol and IPCC concerns on changing climate	CO4
	Unit 5	**Social Issues and the Environment**	
	A	Concept of sustainable development, Water conservation	CO5
	B	Resettlement and rehabilitation of people; its problems and concerns, Case studies	CO5
	C	Population explosion and its consequences	CO5
	Mode of examination	Theory	
	Weightage Distribution	CA: 25%, MTE: 25%, ETE: 50%	
	Text book/s*	**1.** Joseph, Benny, "Environmental Studies", Tata Mcgraw-Hill. **2.** .Howard S. Peavy, Donald R. Rowe, George Tchobanoglous. Environmental engineering Mc Grav Hill, 1985	
	Other References		

CO↓ PO→	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	3	3	3	3
CO2	2	2	2	2	2	3
CO3	2	2	3	2	3	3
CO4	2	2	3	2	3	3
CO5	2	2	2	2	3	3
CO6	2	2	3	2	2	3

School: SET			
Program: B.Tech			
Branch: All	**Semester: I/II**		
1	Course Code	HMM111 | Course Name	
2	Course Title	Human Values and Ethics	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Compulsory	
5	Course Objective	To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence	
6	Course Outcomes	1. Understand that the technical education without study of human values can generate more problems than solutions. 2. Define the principles and ideals, which help in making the judgement of what is more important. 3. See that 'I' and 'Body' are two realities, and most of their desires are related to 'I' and not body, while their efforts are mostly centered on the fulfilment of the needs of the body assuming that it will meet the needs of 'I' too. 4. Appreciate the importance of harmony in the self, family and the society for mutual fulfilment. 5. Understand the importance of harmony among human beings, other living beings and entire nature for universal equilibrium and mutual co-existence. 6. Know and practice the ethical approach in profession for continuous happiness and sustained prosperity.	
7	Course Description	Human values and embedded in all human beings it is important to sensitize them towards these values that they can use in their life to attain mutual happiness and mutual prosperity. Professional ethics will enlighten them about the value addition that can be done within the framework of ethical behaviour.	
8	Outline syllabus		CO Mapping
	Unit 1	The Need and Process for Value Education	
	A	The need, basic guidelines, content, and process for Value Education	CO1
	B	Concept of 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration; Continuous Happiness and Prosperity- A look at basic Human Aspirations	CO1,CO2
	C	Right understanding, Relationship and Physical Facilities- the basic requirements for fulfilment aspirations of every human being with their correct priority	CO1,CO2
	Unit 2	Understanding Harmony in the Human Being - Harmony in Myself	
	A	Human being as a co-existence of the sentient 'I' and the material 'Body'	CO3

	B	The needs of Self ('I') and 'Body' ; Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)			CO3
	C	The characteristics and activities of 'I' and harmony in 'I' ; Understanding the harmony of I with the Body: Correct appraisal of Physical needs, meaning of Prosperity in detail			CO3
	Unit 3	Harmony in the Family and Society			
	A	Values in human-human relationship; Trust and Respect as the foundational values of relationship			CO4
	B	Understanding the meaning of Trust; Difference between intention and competence; The meaning of Respect; Difference between respect and differentiation; the other salient values in relationship			CO4
	C	Harmony in the society (society being an extension of family; Visualizing a universal harmonious order in society - from family to world family			CO4
	Unit 4	Harmony in the Nature and Existence			
	A	The harmony in the Nature			CO5
	B	Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature			CO5
	C	Understanding Existence as Co-existence of mutually interacting units in all-pervasive space			CO5
	Unit 5	Competence in professional ethics			
	A	Ability to utilize the professional competence for augmenting universal human order			CO6
	B	Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,			CO6
	C	Ability to identify and develop appropriate technologies and management patterns for above production systems.			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	3. R.R Gaur, R Sangal, G P Bagaria, "A foundation course in Human Values and professional Ethics", Excel books, New Delhi			
	Other References	1. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. 2. A.N. Tripathy, 2003, Human Values, New Age International Publishers. 3. PL Dhar, RR Gaur, Science and Humanism, Commonwealth Publishers. Starting out with Python, Tony Gaddis, Pearson			

CO and PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1						3	1	3	1			3					
CO2						2	1	3	2			3					
CO3						3	1	3	2			3					
CO4						3	1	3	2			3					
CO5						3	3	3	3		2	3					
CO6						3	3	3	2		3	3					

School:		SET | SOL | SMFE | SBS-BBA | SBSR | SOE | SAP	
Department		Sharda Skills	
Program:		Communicative English -2	
Branch:		Aptitude Reasoning & Personality	
1	Course Code	ARP - 102	
2	Course Title	Communicative English -2	
3	Credits	2	
4	Contact Hours (L-T-P)	1-0-2	
	Course Status	Core	
5	Course Objective	To Develop LSRW skills through audio-visual language acquirement, creative writing, advanced speech et al and MTI Reduction with the aid of certain tools like texts, movies, long and short essays.	
6	Course Outcomes	After completion of this course, students will be able to: CO1 Acquire Vision, Goals and Strategies through Audio-visual Language Texts CO2 Synthesize complex concepts and present them in creative writing CO3 Develop MTI Reduction/Neutral Accent through Classroom Sessions & Practice CO4 Determine their role in achieving team success through defining strategies for effective communication with different people CO5 Realize their potentials as human beings and conduct themselves properly in the ways of world. CO6 Acquire satisfactory competency in use of Quantitative aptitude and Logical Reasoning	
7	Course Description	The course takes the learnings from the previous semester to an advanced level of language learning and self-comprehension through the introduction of audio-visual aids as language enablers. It also leads learners to an advanced level of writing, reading, listening and speaking abilities, while also reducing the usage of L1 to minimal in order to increase the employability chances.	
8	Outline syllabus – ARP 102		**CO Mapping**
	Unit 1	Acquiring Vision, Goals, Strategies through Audio-visual Language Texts and Creative Writing	

	A	Pursuit of Happiness / Goal Setting & Value Proposition in life,12 Angry Men / Ethics & Principles,The King's Speech / Mission statement in life | strategies & Action Plans in Life			CO1
	B	Story Reconstruction - Positive Thinking,Theme based Story Writing - Positive attitude			CO2
	C	Learning Diary Learning Log – Self-introspection			CO2
	Unit 2	Writing Skills 1 and MTI Reduction/Neutral Accent through Classroom Sessions & Practice			
	A	Precis, Paraphrasing, Essays (Simple essays)			CO2
	B	Vowel, Consonant, sound correction, speech sounds, Monothongs, Dipthongs and Tripthongs, Vowel Sound drills , Consonant Sound drills, Affricates and Fricative Sounds			co3
	C	Speech Sounds | Speech Music| Tone | Volume| Diction |Syntax |Intonation | Syllable Stress			
	Unit 3	Gauging MTI Reduction Effectiveness through Free Speech			
	A	Jam sessions			CO3
	B	Extempore			CO3
	C	Situation-based Role Play			CO3
	Unit 4	Leadership and Management Skills and Universal Human Values			
	A	Innovative Leadership and Design Thinking, Ethics and Integrity			CO4
	B	Love & Compassion, Non-Violence & Truth, Righteousness, Peace			CO5
	C	Service, Renunciation (Sacrifice)			CO5
	Unit 5	Introduction to Quantitative aptitude & Logical Reasoning			
	A	Analytical Reasoning			CO6
	B	Number Systems and its Application in Solving Problem			CO6
	C	Puzzle Solving			CO6
	Mode of examination	CA / VIVA / ESE			
	Weightage Distribution	CA	VIVA	ETE	
		25	25	50	
	Text book/s*	.Wren, P.C.&Martin H. *High English Grammar and Composition*, S.Chand& Company Ltd, New Delhi.			

		• Blum, M. Rosen. *How to Build Better Vocabulary*. London: Bloomsbury Publication • Comfort, Jeremy(et.al). *Speaking Effectively*. Cambridge University Press.	
	Other References	The Luncheon by W.Somerset Maugham - http://mistera.co.nf/files/sm_luncheon.pdf	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1 Acquire Vision, Goals and Strategies through Audio-visual Language Texts.	PO9, PO10, PO11,PO12
2.	CO2 Synthesize complex concepts and present them in creative writing.	PO9, PO10, PO11,PO12
3.	CO3 Develop MTI Reduction/Neutral Accent through Classroom Sessions & Practice.	PO9, PO10, PO11,PO12
4.	CO4 Determine their role in achieving team success through defining strategies for effective communication with different people	PO9, PO10, PO11,PO12
5.	CO5 Realize their potentials as human beings and conduct themselves properly in the ways of world..	PO9, PO10, PO11,PO12
6.	CO6 Acquire satisfactory competency in use of Quantitative aptitude and Logical Reasoning	PO9, PO10, PO11,PO12

PO and PSO mapping with level of strength for Course

Code_ Course Name	CO's	PO 1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC302_ Cryptography and Network Security	CO1	-	-		-	-	-	-	-	1	3	1	2	-	-	-
	CO2	-	-	-	–	-	-	-	-	1	3	1	2	-	-	--
	CO3	-	-	-	-	-	-	-	-	1	3	1	2	-	-	-
	CO4	-	-	-	-	-	–	–	-	1	3	1	2	-	-	-
	CO5	-	-	-		-	-	-		1	3	1	2	-	-	-
	CO6	-	-	-	-	-	-	-	-	1	3	1	2	-	-	--

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO9	PO 10	PO11	PO 12	PSO 1	PSO2	PSO3
ARP - 102	Communicative English - 2									1	3	1	2			

Syllabus: CSP 113: Programming for problem solving Lab

School: SET		**Batch : 2023-27**	
Program: B.Tech.		**Current Academic Year: 2023-24**	
Branch: CSE		**Semester: I**	
1	Course Code	CSP113	
2	Course Title	Programming for problem solving Lab	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	1. Learn basic programming constructs –data types, decision structures, control structures in C 2. learning logic aptitude programming in C language 3. Developing software in c programming	
6	Course Outcomes	Students will be able to: CO1: **Implement** core concept of c Programming CO2: **develop** programs using Array and String CO3: **create** Functions for any problem CO4: **Use** Union and Structure to write any program CO5: **implement** concept of Pointers CO6**: design** a real world problem with the help of c programming	
7	Course Description	Programming for problem solving gives the Understanding of C programming and implement code from flowchart or algorithm	
8	Outline syllabus		CO Mapping
	Unit 1	**Logic Building**	**CO1, CO6**
		Draw flowchart for finding leap year	
		Write a c Program to Add Two Integers	
		Write a program to create a calculator	
	Unit 2	**Introduction to C Programming**	**CO2, CO6**
		Write a c program to convert length meter to cm	
		Write a c program to convert temp	
		Write a c program to swap two numbers	
	Unit 3	**Arrays and Functions**	**CO3, CO6**
		Write a c program to calculate the average using arrays	
		Write a c program to find the largest element of the array	
	Unit 4	**Pre-processors and Pointers**	**CO4, CO6**
		Write a c program to swap two values using pointers	
		Write a c program to find largest number from array using pointers	
	Unit 5	**User Defined Data Types and File Handling**	**CO5, CO6**
		Write a c program to store information of a student using structure	

		Write a c program to store information of a student using union			
	Mode of examination	Practical			
	Weightage Distribution	CA	CE(Viva)	ETE	
		25%	25%	50%	
	Text book/s*	Kernighan, Brian, and Dennis Ritchie. *The C Programming Language*			
	Other References	4. B.S. Gottfried - Programming With C - Schaum's Outline Series - Tata McGraw Hill 2nd Edition - 2004. 5. E. Balagurusamy - Programming in ANSI C - Second Edition - Tata McGraw Hill- 1999			

Course outline

This course implements array and pointer and Recursive applications. The course talks primarily about Array, string, functions, structure & union and Pointers etc.

Course Evaluation	
Attendance	None
Any other	CA judged on the practicals conducted in the lab , weightage may be specified
References	
Text book	Kernighan, Brian, and Dennis Ritchie. *The C Programming Language*
Other References	1. B.S. Gottfried - Programming With C - Schaum's Outline Series - Tata McGraw Hill 2nd Edition - 2004. 2. E. Balagurusamy - Programming in ANSI C - Second Edition - Tata McGraw Hill- 1999
Softwares	Turbo C

PO and PSO mapping with level of strength for Course Name Programming for problem solving Lab **(Course Code CSP113)**

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSP113_ Programming for problem solving Lab	CO1	2	-	3	2	2	-	-	-	2	-	-	-	3	2	2
	CO2	3	-	3	2	2	-	-	-	3	-	-	-	3	3	1
	CO3	2	-	3	1	2	-	-	-	2	-	-	-	2	3	2
	CO4	1	-	2	1	1	-	-	-	2	-	-	-	2	2	-
	CO5	2	-	3	2	2	-	-	-	3	-	-	-	3	2	2
	CO6	3	-	3	3	1	-	-	-	2	-	-	-	2	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSP113	Programming for problem solving Lab	2.17		2.83	1.83	1.67	-	-	-	2.33	-	-	-	2.50	2.50	1.80

Syllabus: CSP 101:Introduction to Computer Science and Engineering

School: SET		**Batch : 2023-27**	
Program:B.Tech		**Current Academic Year: 2023-24**	
Branch: CSE		**Semester:I**	
1	Course Code	CSP101	Course Name
2	Course Title	Introduction to Computer Science and Engineering	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	UG	
5	Course Objective	1. To familiarize the students about the importance of Undergraduate course on Computer Science & Engineering. 2. To discuss recent developments in hardware and software environments. 3. To focus future application areas of Computer Science and Engineering. 4. To discuss various research and development options in Computer Science and Engineering.	
6	Course Outcomes	**The student should be able to:** CO1. Understand the technical aspects of Computer Science & Engineering Course. CO2. Perceive some knowledge about programming in various applications. CO3. Acquire basic understanding about computer networking and related technology. CO4. Enhance some fundamental knowledge of DBMS including application areas. CO5. Understand the current trends in computing in discovering wisdom/knowledge and future prediction. CO6. Implement the course program on AWS cloud.	
7	Course Description	This course focuses application areas of Computer Science and Engineering for students admitted in undergraduate program. The purpose of B. Tech. in Computer Science & Engineering is to be given through this course to students.	

8	Outline syllabus		CO Mapping
	Unit 1	**Hardware aspect of Computer Science & Engineering**	
	A	History of Computing Systems, Computer Basics and Computer Organization.	CO1
	B	Computer Architecture, Introduction to various connecting devices.	
	C	Recent additions – IoT, Robotics and new alternate architectures.	
	Unit 2	**Programming Aspects**	
	A	Basics of Programming, Programming Paradigms, System Software versus Application Software.	CO2
	B	Hard Computing versus Soft Computing, Data Structures and Algorithms.	
	C	Computer Graphics, Multimedia, Computer Vision.	

	Unit 3	**Computer Networking and DBMS**	
	A	Introduction to Networking, Various terminologies, Client Server Technology, Web Technology. Introduction to network security	CO3
	B	Introduction to DBMS, DBMS versus File System, Relational DBMS.	
	C	Big Data Analytics & Scientific Computing	
	Unit 4	**Artificial Intelligence**	
	A	Information Processing and Retrieval, Basics of Artificial Intelligence	CO4
	B	Basics of Pattern Recognition	
	C	Basics of Machine Learning	
	Unit 5	**Cloud Computing: Amazon Web Services**	
	A	Concept of Cloud Computing and Virtualization, Real life applications.	CO5
	B	AWS services:EC2, Lambda,S3,IAM,VPC	
	C	AWS security services, management services	
	Mode of examination	Practical	
	Weightage Distribution	CA: 25% ; CE(Viva): 25% ; ETE: 50%	
	Text book/s*	1. Introduction to Computer, Peter Norton, 7/e, 2017, Tata McGraw Hill Publishing. 2. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter 3. AWS Educate Cloud Practitioners Essentials contents	
	Other References	4. Foundations of Computer Science, B A Forouzan& F Mosharraf, 2/e, 2008, Delmar Learning. 5. https://aws.amazon.com/developer/language/java/ 6. https://aws.amazon.com/developer/	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Understand the technical aspects of Computer Science &Engineering Course.	PO1, PO2, PO12, PSO3
2.	**CO2:**Perceive some knowledge about programming in various applications.	PO1, PO12, PSO1, PSO3
3.	**CO3:** Acquire basic understanding about computer networking and related technology.	PO1, PO2, PO12, PSO2, PSO3
4.	**CO4:**Enhance some fundamental knowledge of DBMS including application areas.	PO1, PO12, PSO2, PSO3
5.	**CO5:** Understand the current trends in computing in discovering wisdom/knowledge and future prediction.	PO1, PO6, PO8, PO12, PSO2, PSO3

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	3	-	3	2
CO3	3	2	-	-	-	-	-	-	-	-	-	3	-	2	3
CO4	3	-	-	-	-	-	-	-	-	-	-	3	-	3	2
CO5	3	-	-	-	-	2	-	2	-	-	-	3	-	3	3

School: SET		Batch : 2023-27	
Program: B.Tech		**Current Academic Year: 2023-24**	
Branch: ALL		**Semester: I**	
1	Course Code	MEP 106	
2	Course Title	Computer Aided Design & Drafting Laboratory	
3	Credits	1.5	
4	Contact Hours (L-T-P)	0-0-3	
	Course Status	Compulsory	
5	Course Objective	The objective of this introductory course is to make students familiar with computer-aided drafting/ design, introduce them about the basic commands, tools and dimension techniques for creation and presentation of various engineering drawing by using AutoCAD software which helps in visualization and problem solving in engineering disciplines.	
6	Course Outcomes	After successful completion of this course the student will be able to CO1: Understand the fundamental features of AutoCAD workspace and user interface. CO2: Apply the fundamental tools such as draw, edit, and view for creating two dimensional engineering drawings in AutoCAD. CO3: Choose advance features to present an engineering drawing in AutoCAD. CO4: Apply text and dimension features in the engineering drawing. CO5: Create different orthographic projections from a pictorial view. CO6: Analyze an engineering drawing and use the software packages for drafting and modeling.	
7	Course Description	This introductory course is offered to students to make them proficient in design, layout, product development, and other careers that require technical drawing. Using the current version of the AutoCAD software, students will learn a variety of drawing techniques and be able to replicate specific drawings in multiple perspectives. The pinnacle of the class is to empower and enable students to create using the software provided. Career opportunities in 3D modeling, manufacturing, and engineering will also be explored. No drafting or computer experience is necessary.	
8	Outline syllabus		CO Mapping
	List of Experiments		
	Experiment 1	Introduction to AutoCAD and its interface	CO1
	Experiment 2	Working with coordinates, Drawing offline, circle, arc, polygon and creating sketches	CO2
	Experiment 3	Editing of drawing by using editing Tools and Power tools	CO2
	Experiment 4	Creating of advanced feature like fillet, chamfer, hatch and using of block	CO3
	Experiment 5	Representing text and dimensioning in AutoCAD	CO4
	Experiment 6	Creating the drawings of mechanical components by using AutoCAD features.	CO2, CO3
	Experiment 7	Creating the electrical circuit drawings in AutoCAD.	CO2
	Experiment 8	Drawing plan and elevation of various buildings in AutoCAD.	CO2, CO4

	Experiment 9	Creating the drawing of renowned constructions such as Taj Mahal in AutoCAD			CO3
	Experiment 10	Creating of orthographic projections from a pictorial views			CO5
	Mode of examination	Practical			
	Weightage Distribution	CA	CE(Viva)	ETE	
		25%	25%	50%	
	Text book/s*	1. Ibrahim Zaid,"CAD/CAM- Theory and Practice", McGraw Hill, International Edition.			
	Software	AutoCAD			

1.3.5.1 COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO106.1	2	2	2	-	3	-	-	-	-	-	-	3	3	3
CO106.2	2	2	2	-	3	-	-	-	-	-	-	3	3	3
CO106.3	2	2	2	-	3	-	-	-	-	-	-	3	3	3
CO106.4	2	2	2	2	3	-	-	-	2	2	-	3	3	3
CO106.5	2	2	2	2	3	-	-	-	2	2	-	3	3	3
CO106.6	2	2	2	2	3	-	-	-	2	2	-	3	3	3

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

School: SET		**Batch : 2023-27**
Program: B.Tech		**Current Academic Year: 2023-24**
Branch: Mechanical Engineering		**Semester: I**
1	Course Code	MEP 105
2	Course Title	**Mechanical Workshop**
3	Credits	1.5
4	Contact Hours (L-T-P)	0-0-3
	Course Status	Compulsory
5	Course Objective	The objective of this course is to make the students, familiar with the modern day manufacturing processes, introduce them to various hand tools and equipment, acclimatize with the measuring devices, and perform basic machine tool operations in various machine tools.
6	Course Outcomes	After successful completion of this course, students will be able to CO1: Apply 5S (Seiri, Seiton, Seiso, Seiketsu and Shitsuke) methodology at workplace. CO2: Select the various hand tools used in the basic mechanical engineering workshop sections-smithy, carpentry, assembling, welding etc. CO3: Choose different measuring devices according to the job CO4: Differentiate between various machine tools and their operation CO5: Classify and select suitable tools for machining processes including turning, facing, thread cutting and tapping, milling, drilling and shaping. CO6: Apply the knowledge for advance manufacturing experiments.
7	Course Description	**Black Smithy Shop:** Simple exercises based on black smithy operations such as upsetting, practice of S -Hook from circular bar using hand forging operations. **Carpentry Shop :** Study of different types of wood , Carpentry Tools, Equipment and different joints, Practice of T joint, cross lap joint, Mortise and Tenon T joint, Bridle T joint **Fitting Shop:** Preparation of Square joint, V joint, half round joint, dovetail jointas per the given specifications, which contains: Sawing, Filing, Grinding, and Practice marking operations. **Sheet Metal Shop:** Study of galvanized Iron (G.I.) Sheet material properties, hand tools and sheet metal machines, and projective geometry, demonstration of different sheet metal operations and practice of development of Tray, cylinder, hopper, funnel etc. **Welding Shop:** Introduction, Study of Tools and welding Equipment (Gas and Arc welding), Selection of welding electrode and current, Bead practice and Practice of Butt Joint, Lap Joint. **Machine Shop:** Study of machine tools in particular Lathe machine (different parts, different operations, study of cutting tools), Demonstration of different operations on Lathe machine, Practice of Facing, Plane Turning, step turning, taper turning, knurling and parting and Study of Quick return mechanism of Shaper. **Foundry Shop:** Introduction to foundry, Patterns, pattern allowances, ingredients of moulding sand and melting furnaces. Foundry tools and their purposes, Demo of mould preparation and Practice – Preparation of mould by using split pattern.

8	Outline syllabus		CO Mapping
	List of Experiments		

	Experiment 1	To make a S shaped hook from a given circular rod using hand forging technique.	CO4
	Experiment 2	To make a dovetail lap joint in Carpentry shop.	CO2,CO3
	Experiment 3	To make a cross-half lap joint in Carpentry shop.	CO2,CO3
	Experiment 4	To make a square fit from the given mild steel pieces in fitting shop.	CO3,CO5
	Experiment 5	To prepare a V-Fit from the given mild steel pieces in fitting shop.	CO3, CO5
	Experiment 6	To make a rectangular tray of specified dimensions in sheet metal shop.	CO2, CO5
	Experiment 7	To make a Lap joint, using the given mild steel pieces using arc welding.	CO3, CO5
	Experiment 8	To perform step turning and taper turning operations on the given work piece	CO5
	Experiment 9	To prepare a sand mold, using the given single piece pattern	CO2
	Experiment 10	To prepare a sand mold, using the given Split-piece pattern.	CO2
	Mode of examination	Practical	
	Weight- age Distribution	CA: 25%, MTE: 25%, ETE: 50%	
	Text book/s*	1. Raghuwanshi B.S., Workshop Technology Vol. I & II, DhanpathRai& Sons. 2. Kannaiah P. and Narayana K.L., Workshop Manual, 2nd Edn, Scitech publishers. 3. John K.C., Mechanical Workshop Practice. 2nd Edn. PHI 2010. 4. JeyapoovanT.andPranitha S., Engineering Practices Lab Manual, 3rd Edn. Vikas Pub.2008.	

Program Outcome Vs Courses Mapping Table:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO105.1	1	-	-	-	-	2	-	-	-	-	-	2	-	-	-
CO105.2	1	-	-	-	1	2	-	-	-	-	-	1	1	-	1
CO105.3	2	-	1	-	1	2	-	-	-	-	-	2	1	-	1
CO105.4	2	-	1	-	2	2	-	-	-	-	-	2	1	-	1
CO105.5	2	-	1	-	2	2	-	-	-	-	-	2	2	-	1
CO105.6	2	-	1	-	2	2	-	-	-	-	-	2	2	-	1
CO105	**2**	**-**	**1**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**1**

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

TERM - II

Syllabus for Application Based Programming in Python

School:		**School of Engineering & Technology**		
Department		**Department of Computer Science & Engineering**		
Program:		**B.Tech.**		
Branch:		**CSE**		
1	Course Code	CSE114		
2	Course Title	Application Based Programming in Python		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Core		
5	Course Objective	Emphasis is placed on procedural programming, algorithm design, and language constructs common to most high-level languages through Python Programming.		
6	Course Outcomes	Upon successful completion of this course, the student will be able to: CO1. Demonstrate program by using decision and repetition structures CO2. Construct programs by using Python lists, tuples and dictionaries CO3. Apply methods and functions to improve readability of programs. CO4. Develop logical problem using object-oriented programming methodology. CO5. Analyze and implement various tools, modules and packages for python. CO6. Design efficient logical solution for any given real life problem by using concise and efficient algorithms		
7	Course Description	Python is a language with a simple syntax, and a powerful set of libraries. It is widely used in many scientific areas for data exploration. This course is an introduction to the Python programming language for students without prior programming experience. We cover data types, control flow, object-oriented programming.		
8	Outline syllabus			CO Mapping
	Unit 1	**Introduction**		CO1
	A	Python Environment, Variables, Data Types, Operators.		
	B	**Conditional Statements:** If, If- else, Nested if-else. **Looping:** For, While, Nested loops.		
	C	**Control Statements:** Break, Continue, And Pass. Comments		
	Unit 2	**List, Tuple and Dictionaries**		CO1, CO2
	A	**Lists and Nested List:** Introduction, Accessing list, Operations, Working with lists, Library Function and Methods with Lists		

	B	Strings: Introduction, Accessing items of a string, Operations, Working, Library Functions and Methods with strings. **Tuple:** Introduction, Accessing tuples, Operations, Working, Library Functions and Methods with Tuples.			
	C	Sets: Introduction, Operations, Working, functions with sets. Difference between set and lists. **Dictionaries :**Introduction, Accessing values in dictionaries, Working with dictionaries, Library Functions			
	Unit 3	**Functions and Exception Handling**			CO3
	A	**Functions:** Defining a function, Calling a function, Types of functions, Function Arguments			
	B	Anonymous functions, Global and local variables			
	C	**Exception Handling**: Definition, Except clause, Try, finally clause, User Defined Exceptions			
	Unit 4	**OOP and File Handling**			CO4
	A	**OOPs concept** : Class and object, Attributes, Abstraction, Encapsulation, Polymorphism and Inheritance			
	B	Static and Final Keyword, Access Modifiers and specifiers, scope of a class			
	C	File Handling: Introduction, File Operations			
	Unit 5	**Application based programming**			CO5,CO6
	A	**Modules& packages :**Importing module, Math module, Random module, creating Modules			
	B	Introduction to Numpy, pandas, Matplotlib			
	C	**Applications: Searching Linear Search, Binary Search. Sorting: Bubble Sort**			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	The Complete Reference Python, Martin C. Brown, McGraw Hill			
	Other References	1. Introduction to computing in problem solving using Python, E Balahurusamy, McGraw Hill 2. Introduction to programming using Python, Y. Daniel Liang, Pearson 3. Mastering Python, Rick Van Hatten, Packet Publishing House 4. Starting out with Python, Tony Gaddis, Pearson			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)

1.	CO1. Demonstrate program by using decision and repetition structures	PO1,PO2,PO3,PO8,PO12,PSO2
2.	CO2. Apply methods and functions to improve readability of programs.	PO1,PO2,PO3,PO4,PO8,PO12,PSO2,PSO3
3.	CO3. Construct programs by using Python lists, tuples and dictionaries	PO1,PO2,PO3,PO8,PO12,PSO1, PSO2,PSO3
4.	CO4. Develop logical problem using object-oriented programming methodology.	PO1,PO2,PO3, PO4,PO5,PO6,PO8, PO12,PSO1,PSO2,PSO3
5.	CO5. Analyze and implement various tools, modules and packages for python	PO1,PO2,PO3, PO4,PO5,PO6, PO8, PO12,PSO1,PSO2,PSO3
6.	CO6. Create efficient logical solution for any given real life problem by using concise and efficient algorithms.	PO1,PO2,PO3, PO4,PO5,PO6, PO8, PO12,PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Application Based Programming in Python (Course Code CSE 114)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE114_Application Based programming in Python	CO1	2	1	1					2				2		1	
	CO2	2	2	2	1				2				2		2	1
	CO3	2	2	1					2				2	1	2	1
	CO4	2	2	2	2	1	2		2				2	1	2	2
	CO5	2	2	2	2	3	2		2				2	2	2	1
	CO6	3	3	2	2	2	2		2				2	2	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE114	Application Based programming in Python	2.1	2	1.7	1.2	1	1	-	2	-	-	-	2	1	2	1.1

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***

3. Addressed to ***Substantial (High=3) extent***

School: SET		**Batch : 2023-27**
Program: B.Tech.		**Current Academic Year: 2023-24**
Branch: CSE		**Semester: II**
1	Course Code	**MTH 145**
2	Course Title	**Probability and Statistics**
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	Compulsory
5	Course Objective	The objective of this course is to familiarize the students with statistical techniques. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.
6	Course Outcomes	CO1: Explain the concept of probability and Random Variable. (K2,K3, K4) CO2: Explain the concept of distribution functions, densities andprobability distributions; illustrate discrete and continuous probability distributions. (K1, K2, K3, K4) CO3: Describe the concept of moments, skewness and Kurtosis; evaluate correlation and regression – Rank correlation; discuss bivariate distributions and their properties . (K1, K2, K5) CO4: Discuss the basic of Curve fitting by the method of least squares; evaluate straight lines, second degree parabolas and more general curves. (K1, K2, K5) CO5: Describe and use the concepts test of significance: Large sample test for single proportion, difference of proportions; calculate single mean, difference of means, and difference of standard deviations. (K1,K2,K3) CO6: Explain the basic concepts of tests of small samples- Student's T test, Chi-square test for goodness of fit, and evaluate the result. (K2, K4, K5)
7	Course Description	This course is an introduction to the fundamental of Mathematics. The primary objective of the course is to develop the basic understanding of statistics including measures of central tendency, correlation and regression, statistical methods of data sampling, probability and random variables and various discrete andcontinuous probability distributions and their properties.

8	**Outline syllabus :Probability and Statistics**		**CO Mapping**
	Unit 1	**Basic Probability**	
	A	Probability spaces, conditional probability, Bayes' rule.	CO1

	B	Discrete random variables, Independent random variables	CO1
	C	Expectation of Discrete Random Variables, Chebyshev's Inequality	CO1
	Unit 2	**Discrete and Continuous Probability Distributions**	
	A	Discrete Probability distributions: Binomial, Poisson.	CO2
	B	Continuous random variables and their properties, distribution functions and densities.	CO2
	C	Normal, exponential and gamma distribution.	CO2
	Unit 3	**Statistics**	
	A	Moments, skewness and Kurtosis.	CO3
	B	Correlation and regression – Rank correlation.	CO3
	C	Bivariate distributions and their properties.	CO3
	Unit 4	**Applied Statistics**	
	A	Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves.	CO4, CO5
	B	Test of significance: Large sample test for single proportion,	CO4, CO5
	C	Difference of proportions, single mean, difference of means, and difference of standard deviations.	CO4, CO5
	Unit 5	**Testing Hypothesis**	
	A	Test for single mean, difference of means	CO6
	B	test for ratio of variances	CO6
	C	Chi-square test for goodness of fit and independence of attributes	CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 25% · MTE: 25% · ETE: 50%	
	Text book/s*	1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006. 2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint). 3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.	
	Other References	3. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968. 4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.	

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	1	-	-	-	1	1	1
CO2	3	2	3	2	2	2	-	-	-	1	1	2
CO3	3	3	2	2	2	1	-	-	-	1	1	1
CO4	3	2	2	2	2	1	-	-	-	1	1	1
CO5	3	3	2	2	2	1	-	-	-	1	1	2
CO6	3	3	2	3	2	2	-	-	-	1	1	2

School: SET	**Batch : 2023-27**	
Program: B.Tech	**Current Academic Year: 2023-24**	
Branch:	**Semester: I/II**	

1	Course Code	EEE112	
2	Course Title	Principles of Electrical and Electronics Engineering	
3	Credits	3	
4	Contact Hrs (L-T-P)	2-1-0	
	Course Status	Compulsory	
5	Course Objective	To provide the students with an introductory concept in the field of electrical and electronics engineering to facilitate better understanding of the devices, techniques and equipments used in engineering applications.	
6	Course Outcomes	CO1: To analyze and solve basic electrical circuits CO3: To understand the working principle of transformer and identify its applications. CO3: To understand the working principle of dc and ac motors and identify the starting methods of single phase induction motor CO4: To apply the basics of diode to describe the working of rectifier circuits such as half and full wave rectifiers CO5: To apply the concepts of basic electronic devices to design various circuits CO6: Apply the basic concepts in Electrical and Electronics Engineering for multi-disciplinary tasks	
7	Course Description	This initial course introduces the concepts and fundamentals of electrical and electronic circuits and devices. Topics include basic circuit analysis, diode and transistor fundamentals and applications. This course also introduces working principle and applications of dc/ac motors and transformers.	
8	Outline syllabus		CO Mapping
	Unit 1	**DC & AC Circuits (6 lectures)**	
	A	Electrical circuit elements (R, L and C), series and parallel circuits, concept of equivalent resistance, Kirchhoff current and voltage laws, star-delta conversion	CO1,CO6
	B	Analysis of simple circuits with dc excitation and Superposition Theorem, Representation of sinusoidal waveforms, peak and rms values, real power, reactive power, apparent power, power factor	CO1,CO6
	C	Introduction to three phase system, relationship between phase voltages and line voltages,	CO1,CO6
	Unit 2	**Transformer(4 lectures)**	
	A	Working principle and construction of transformer, EMF equation	CO2,CO6
	B	Efficiency of transformer, Power and distribution transformer and difference between them	CO2,CO6

	C	Transformer applications in transmission and distribution of electrical power	CO2,CO6,
	Unit 4	**Electrical Motors (6 lectures)**	
	A	Construction, working principle, torque-speed characteristic and applications of dc motor.	CO3,CO6
	B	Construction, working principle and applications of a three-phase induction motor, significance of torque-slip characteristic	CO3,CO6
	C	Working principle starting methods and applications of single phase induction motor	CO3,CO6
	Unit 4	**Semiconductor Diode and Rectifier (5 lectures)**	
	A	PN junction and its biasing	CO4,CO6
	B	Semiconductor diode, ideal versus practical diode , VI characteristics of diode	CO4,CO6
	C	Half wave and full wave rectifiers with and without filters.	CO4,CO6
	Unit 5	**Transistors (5 lectures)**	
	A	Bipolar Junction Transistor (BJT) – Construction, working principle and input-output characteristics	CO5,CO6
	B	BJT as CE amplifier and as a switch	CO5,CO6
	C	Introduction to JFET	CO5,CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 25% ; MTE: 25% ; ETE: 50%	
	Text book/s*	1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010. 2. S. K. Bhattacharya, "Basic Electrical and Electronics Engineering", Pearson Publication. 3. Robert L Boylestad, "Electronic Devices and Circuit Theory" Pearson Education, 2009	
	Other References	1. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.	

Course Articulation Matrix:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	1	-	-	-	-	-	--	-	-	-	-	-	-
CO4	2	1	2	-	-	-	-	-	-	-	1	-	-	-	-
CO5	3	2	1	-	-	-	-	-	-	-	1	-	-	-	-
CO6	2	2	3	1	-	-	-	-	-	-	1	-	-	-	-

School: SET
Batch:2023-2027
Program: B.Tech
Current Academic Year: 2023-2024
Branch: ECE
Semester: I

1	Course Code	EEP112	
2	Course Title	Principles of Electrical and Electronics Engineering Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	To provide the students with an introductory concept in the field of electrical and electronics engineering to facilitate better understanding of the devices, techniques and equipment‟s used in engineering applications.	
6	Course Outcomes	After successful completion of this course the student will be able to:CO1: To configure and analyze any given circuit. CO2: To inspect the working of transformer and calculate its efficiency CO3: To understand the working of dc and ac motors and measure its various operating parameters. CO4: To design rectifier circuits such as half and full wave rectifiers and observe its output waveforms. CO5: To obtain the characteristics of BJT. CO6:Apply the basic concepts in Electrical and Electronics Engineering for multi-disciplinary tasks.	
7	Course Description	This initial course introduces the concepts and fundamentals of electrical and electronic circuits and devices. Topics include basic circuit analysis, diode and transistor fundamentals and applications. This course also introduces working principle and applications of dc/ac motors and transformers.	
8	Outline syllabus		CO Mapping
	Unit 1	**Practical based on DC & AC Circuits**	CO1
		To configure a dc circuit on breadboard, and measure voltage/current across/through each element	CO1
		To verify Kirchhoff‟s Laws	CO1
		To verify Superposition Theorem	CO1
		To find the real power, reactive power, apparent power and power factor of RL & RC load	CO1
	Unit 2	**Practical related to Transformers**	
		To find the efficiency of transformer by obtaining its losses.	CO2,CO6
	Unit 3	**Practical related to Electrical Motors**	
		To study cut-section of DC motor and induction motor.	CO3,CO6
		To start the DC motor and reverse its direction of rotation.	CO3,CO6
		To start an induction motor and reverse its direction of rotation.	CO3,CO6
	Unit 4	**Practical related to Diode and Rectifier**	
		To determine voltage-current characteristic of diode	CO4,CO6
		To assemble and test half wave and full wave rectifier circuits for their input and output waveform	CO4,CO6

	Unit 5	**Practical related to Transistors**		
		To determine input and output characteristics of BJT	CO5, CO6	
		Validation of BJT as a switch	CO5, CO6	
	Mode of examination	Practical		
	Weightage Distribution	CA	CE	ETE 25%	25%	50%		
	Text book/s*	1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, TataMcGraw Hill, 2010- ISBN:9780070146112 2. S. K. Bhattacharya, “Basic Electrical and Electronics Engineering”,Pearson Publication.ISBN: 9789332586505 3. Robert L Boylestad, “Electronic Devices and Circuit Theory” PearsonEducation, 2009 ISBN: 9780131189058		
	Other References	4. V. D. Toro, “Electrical Engineering Fundamentals”, PrenticeHall India, 1989. SBN:9780132471312		

CO , PO & PSO MAPPING:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEP112.1	3	3	3	1	1	-	-	-	-	-	-	-	2	-	-
EEP112.2	2	2	2	-	-	-	-	-	-	-	-	-	-	-	1
EEP112.3	2	1	1	-	-	-	-	-	-	-	-	-	-	-	-
EEP112.4	2	1	3	-	-	-	-	-	-	-	-	-	2	-	-
EEP112.5	2	1	1	-	-	-	-	-	-	-	-	-	2	-	-
EEP112.6	2	2	2	2	2				2		2	-	1	1	-
EEP112	2.1	1.6	2	1	1	-	-	-	1	-	1	-	1.1	1	1

School: SET			
Program: B.Tech			
Branch: All		**Semester: I/II**	
1	Course Code	HMM111	Course Name
2	Course Title	Human Values and Ethics	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Compulsory	
5	Course Objective	To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence	
6	Course Outcomes	7. Understand that the technical education without study of human values can generate more problems than solutions. 8. Define the principles and ideals, which help in making the judgement of what is more important. 9. See that 'I' and 'Body' are two realities, and most of their desires are related to 'I' and not body, while their efforts are mostly centered on the fulfilment of the needs of the body assuming that it will meet the needs of 'I' too. 10. Appreciate the importance of harmony in the self, family and the society for mutual fulfilment. 11. Understand the importance of harmony among human beings, other living beings and entire nature for universal equilibrium and mutual co-existence. 12. Know and practice the ethical approach in profession for continuous happiness and sustained prosperity.	
7	Course Description	Human values and embedded in all human beings it is important to sensitize them towards these values that they can use in their life to attain mutual happiness and mutual prosperity. Professional ethics will enlighten them about the value addition that can be done within the framework of ethical behaviour.	
8	Outline syllabus		CO Mapping
	Unit 1	The Need and Process for Value Education	
	A	The need, basic guidelines, content, and process for Value Education	CO1
	B	Concept of 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration; Continuous Happiness and Prosperity- A look at basic Human Aspirations	CO1,CO2
	C	Right understanding, Relationship and Physical Facilities- the basic requirements for fulfilment aspirations of every human being with their correct priority	CO1,CO2
	Unit 2	Understanding Harmony in the Human Being - Harmony in Myself	
	A	Human being as a co-existence of the sentient 'I' and the material 'Body'	CO3

	B	The needs of Self ('I') and 'Body' ; Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)	CO3
	C	The characteristics and activities of 'I' and harmony in 'I' ; Understanding the harmony of I with the Body: Correct appraisal of Physical needs, meaning of Prosperity in detail	CO3
	Unit 3	Harmony in the Family and Society	
	A	Values in human-human relationship; Trust and Respect as the foundational values of relationship	CO4
	B	Understanding the meaning of Trust; Difference between intention and competence; The meaning of Respect; Difference between respect and differentiation; the other salient values in relationship	CO4
	C	Harmony in the society (society being an extension of family; Visualizing a universal harmonious order in society - from family to world family	CO4
	Unit 4	Harmony in the Nature and Existence	
	A	The harmony in the Nature	CO5
	B	Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature	CO5
	C	Understanding Existence as Co-existence of mutually interacting units in all-pervasive space	CO5
	Unit 5	Competence in professional ethics	
	A	Ability to utilize the professional competence for augmenting universal human order	CO6
	B	Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,	CO6
	C	Ability to identify and develop appropriate technologies and management patterns for above production systems.	CO6
	Mode of examination	Theory	
	Weightage Distribution	CA / MTE / ETE 25% / 25% / 50%	
	Text book/s*	4. R.R Gaur, R Sangal, G P Bagaria, "A foundation course in Human Values and professional Ethics", Excel books, New Delhi	
	Other References	1. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. 2. A.N. Tripathy, 2003, Human Values, New Age International Publishers. 3. PL Dhar, RR Gaur, Science and Humanism, Commonwealth Publishers. Starting out with Python, Tony Gaddis, Pearson	

CO and PO Mapping

1. Course : Environmental Science

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1						3	1	3	1			3					
CO2						2	1	3	2			3					
CO3						3	1	3	2			3					
CO4						3	1	3	2			3					
CO5						3	3	3	3		2	3					
CO6						3	3	3	2		3	3					

School: SET		**Batch : 2023-27**	
Program: B. Tech		**Current Academic Year: 2023-24**	
Branch: All		**Semester: II**	
1	Course Code	CVL-103	
2	Course Title	Environmental Science	
3	Credits	02	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Compulsory	
5	Course Objective	1. Enable students to learn the concepts, principles and importance of environmental science 2. Provide students an insight of various causes of natural resource depletion and its conservation 3. Provide knowledge of layers of atmosphere with an insight of role of climatic elements in dispersion of pollutants 4. Provide detailed knowledge of causes, effects and control of different types of environmental pollution, solid waste management and its effect on climate change, global warming and ozone layer depletion 5. Provide and enrich the students about social issues such as R&R, water conservation and sustainability.	
6	Course Outcomes	CO1.Understand the scope of environmental science with knowledge about various types of natural resources and its conservation CO2. Study about the structure and composition of atmosphere and factors affecting weather and climate CO3. Study about pollution causes, effects and control and solid waste management CO4. Effect of global warming and ozone layer depletion CO5.Understand sustainable development, resettlement and rehabilitation, impact of population explosion on environment CO6.Understand overall environmental issues and its management	
7	Course Description	Environmental Science emphasises on various factors as 5. Importance and scope of environmental science 6. Natural resource conservation 7. Pollution causes, effects and control methods and solid waste management 8. Social issues associated with environment	
8	Outline syllabus		CO Mapping
	Unit 1	**General Introduction**	
	A	Definition, principles and scope of environmental science	CO1
	B	Water Resources, Land Resources, Food Resources	CO1
	C	Mineral Resources, Energy Resources, Forest Resources	CO1
	Unit 2	**Atmosphere and meteorological parameters**	

	A	Structure and composition of atmosphere	CO2
	B	Meteorological parameters: Pressure, Temperature, Precipitation, Humidity,	CO2
	C	Radiation, Wind speed and direction, Wind Rose	CO2
	Unit 3	**Environmental Pollution (Cause, effects and control measures)**	
	A	Air, water, Noise and Soil pollution	CO3
	B	Case studies on pollution	CO3
	C	Solid waste management: Causes, effects and control measures of urban and industrial wastes.	CO3
	Unit 4	**Climate Change and its impact**	
	A	Concept of Global Warming and greenhouse effect	CO4
	B	Ozone layer Depletion and its consequences	CO4
	C	Climate change and its effect on ecosystem, Kyoto protocol and IPCC concerns on changing climate	CO4
	Unit 5	**Social Issues and the Environment**	
	A	Concept of sustainable development, Water conservation	CO5
	B	Resettlement and rehabilitation of people; its problems and concerns, Case studies	CO5
	C	Population explosion and its consequences	CO5
	Mode of examination	Theory	
	Weightage Distribution	CA 25% / MTE 25% / ETE 50%	
	Text book/s*	**3.** Joseph, Benny, "Environmental Studies", Tata Mcgraw-Hill. **4.** .Howard S. Peavy, Donald R. Rowe, George Tchobanoglous. Environmental engineering Mc Grav Hill, 1985	
	Other References		

CO↓ PO→	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	3	3	3	3
CO2	2	2	2	2	2	3
CO3	2	2	3	2	3	3
CO4	2	2	3	2	3	3
CO5	2	2	2	2	3	3
CO6	2	2	3	2	2	3

Syllabus: CSE242, Data Structures

School: SET	**Batch : 2023-27**	
Program: B.Tech.	**Current Academic Year: 2023-24**	
Branch:CSE/IT	**Semester:**II	
1	Course Code	CSE242
2	Course Title	Data Structures
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Core
5	Course Objective	1. Learn the basic concepts of Data Structures and algorithms. 2. Design and Implementation of Various Basic and Advanced Data Structures. 3. Learn the concepts of various searching, Sorting and Hashing Techniques. 4. Choose the appropriate data structures and algorithm design method for a specified application.
6	Course Outcomes	CO1: **Select** appropriate data structures as applied to specified problem definition. CO2: **Choose** the suitable data structures like arrays, linked list, stacks and queues to solve real world problems efficiently. CO3 **Represent** and manipulate data using nonlinear data structures like trees and graphs to design algorithms for various applications. CO4: **Compare** various techniques for searching and sorting. CO5: **Design** and implement an appropriate hashing function for an application CO6: **Formulate** new solutions for programing problems or improve existing code using learned algorithms and data structures
7	Course Description	This course starts with an introduction to data structures with its classification, efficiency of different algorithms, array and pointer based implementations and Recursive applications. As the course progresses the study of Linear and Non-Linear data structures are studied in details. The course talks primarily about Linked list, stacks, queue, Tree structure, Graphs etc. This Course also deals with the concept of searching, sorting and hashing methods.

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Data Structure – Definition, Operations and Applications, Abstract Data Types, Algorithm – Definition, Introduction to Complexity, Big OH notation, Time and Space tradeoffs.	CO1
	B	Dynamic Memory Allocation(Malloc, calloc, realloc, free), Recursion – Definition, Examples- Tower of Hanoi problem, Tail Recursion	CO1
	C	Arrays: Implementation of One Dimensional Arrays, Multidimensional Arrays, Applications of Arrays, Address Calculation, Matrix Operations, Sparse martices	CO1

	Unit 2	**Linked List**			
	A	Concept of Linked List, Garbage Collection, Overflow and Underflow, Array Implementation and Dynamic Implementation of Singly Linked Lists			CO2
	B	Array Implementation and Dynamic Implementation of Doubly Linked List, Circularly Linked List			CO3
	C	Operations on a Linked List- Insertion, Deletion, Traversal, Polynomial Representation and Addition			CO2
	Unit 3	**Stack and Queue**			
	A	Stacks: Definitions, Primitive operations, Application of stacks – Conversion of Infix Expression to Postfix form, Evaluation of Postfix Expressions			CO3
	B	Queues: Definition, Primitive Operations, Implementation of Circular Queues, Priority Queues			CO3
	C	Deques, Application of Queues. Implementation - Linked Stacks, Linked Queues.			CO3
	Unit 4	**Tree and Graphs**			
	A	Trees: Terminologies, Binary tree, Representation, Applications, Binary search Tree – Operations on Binary Search Trees (Traversing, Insertion, deletion etc.), Binary Search Algorithm, AVL Tree			CO4, CO6
	B	Graph: Terminology, Representation, Traversals- Depth First Search, Breadth First Search.			CO4, CO6
	C	Graph Applications – Minimum Spanning Trees – Prim's and Kruskal's Algorithms			CO4, CO6
	Unit 5	**Searching, Sorting and Hashing**			
	A	Implementation and Analysis - Linear search, Binary Search			CO5, CO6
	B	Implementation and Analysis- Bubble Sort, Insertion Sort, Selection Sort, Tree sort			CO5, CO6
	C	Hashing: Concepts and Applications, Hash Functions, Collisions, Methods of Resolving Collisions			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Lipschutz, "Data Structures" Schaum's Outline Series, TMH			
	Other References	1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein "Data Structures Using C and C++" , PHI 2. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication 3. Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with applications", McGraw Hill 4. R. Kruse etal, "Data Structures and Program Design in C", Pearson Education 5. G A V Pai, "Data Structures and Algorithms", TMH			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**Select** appropriate data structures as applied to specified problem definition.	PO1, PO3, PO9, PSO1, PSO2
2.	**Choose** the suitable data structures like arrays, linked list, stacks and queues to solve real world problems efficiently.	PO1, PO2, PO3, PO9, PSO1, PSO2, PSO3
3.	**Represent** and manipulate data using nonlinear data structures like trees and graphs to design algorithms for various applications.	PO1, PO2, PO3, PO4, PO9, PSO1, PSO2
4.	**Compare** various techniques for searching and sorting.	PO3, PO9, PO12, PSO1, PSO2
5.	**Design** and implement an appropriate hashing function for an application	PO1, PO2, PO3, PO4, PO5, PO9, PSO1, PSO2, PSO3
6.	**Formulate** new solutions for programing problems or improve existing code using learned algorithms and data structures	PO1, PO3, PO4, PO5, PO9, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Data Structures (Course Code CSE 242)

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	2	-	2	-	-	-	-	-	2	-	-	-	2	2	-
CO 2	1	2	3	-	-	-	-	-	1	-	-	-	3	1	2
CO 3	2	3	3	2	-	-	-	-	2	-	-	-	2	3	-
CO 4	-	-	2	-	-	-	-	-	3	-	-	1	2	2	-
CO 5	3	2	3	2	1	-	-	-	2	-	--	-	3	2	2
CO 6	2	-	3	3	2	-	-	-	1	-	-	-	2	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO3
CSE242	**Data structures**	2	2.33	2.67	2.33	1.5	-	-	-	1.83	-	-	1	2.33	2.17	2.33

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		SET | SOL | SMFE | SBS-BBA | SBSR | SOE | SAP
Department		Sharda Skills
Program:		Communicative English -2
Branch:		Aptitude Reasoning & Personality
1	Course Code	ARP – 102
2	Course Title	Communicative English -2
3	Credits	2
4	Contact Hours (L-T-P)	1-0-2
	Course Status	Core
5	Course Objective	To Develop LSRW skills through audio-visual language acquirement, creative writing, advanced speech et al and MTI Reduction with the aid of certain tools like texts, movies, long and short essays.
6	Course Outcomes	After completion of this course, students will be able to: CO1 Acquire Vision, Goals and Strategies through Audio-visual Language Texts CO2 Synthesize complex concepts and present them in creative writing CO3 Develop MTI Reduction/Neutral Accent through Classroom Sessions & Practice CO4 Determine their role in achieving team success through defining strategies for effective communication with different people CO5 Realize their potentials as human beings and conduct themselves properly in the ways of world. CO6 Acquire satisfactory competency in use of Quantitative aptitude and Logical Reasoning
7	Course Description	The course takes the learnings from the previous semester to an advanced level of language learning and self-comprehension through the introduction of audio-visual aids as language enablers. It also leads learners to an advanced level of writing, reading, listening and speaking abilities, while also reducing the usage of L1 to minimal in order to increase the employability chances.

8	Outline syllabus – ARP 102		CO Mapping
	Unit 1	Acquiring Vision, Goals, Strategies through Audio-visual Language Texts and Creative Writing	

	A	Pursuit of Happiness / Goal Setting & Value Proposition in life,12 Angry Men / Ethics & Principles,The King's Speech / Mission statement in life | strategies & Action Plans in Life	CO1
	B	Story Reconstruction - Positive Thinking,Theme based Story Writing - Positive attitude	CO2
	C	Learning Diary Learning Log – Self-introspection	CO2
	Unit 2	Writing Skills 1 and MTI Reduction/Neutral Accent through Classroom Sessions & Practice	
	A	Precis, Paraphrasing, Essays (Simple essays)	CO2
	B	Vowel, Consonant, sound correction, speech sounds, Monothongs, Dipthongs and Tripthongs, Vowel Sound drills , Consonant Sound drills, Affricates and Fricative Sounds	co3
	C	Speech Sounds | Speech Music| Tone | Volume| Diction |Syntax |Intonation | Syllable Stress	
	Unit 3	Gauging MTI Reduction Effectiveness through Free Speech	
	A	Jam sessions	CO3
	B	Extempore	CO3
	C	Situation-based Role Play	CO3
	Unit 4	Leadership and Management Skills and Universal Human Values	
	A	Innovative Leadership and Design Thinking, Ethics and Integrity	CO4
	B	Love & Compassion, Non-Violence & Truth, Righteousness, Peace	CO5
	C	Service, Renunciation (Sacrifice)	CO5
	Unit 5	Introduction to Quantitative aptitude & Logical Reasoning	
	A	Analytical Reasoning	CO6
	B	Number Systems and its Application in Solving Problem	CO6
	C	Puzzle Solving	CO6
	Mode of examination	CA / VIVA / ESE	
	Weightage Distribution	CA: 25 | VIVA: 25 | ETE: 50	
	Text book/s*	.Wren, P.C.&Martin H. *High English Grammar and Composition*, S.Chand& Company Ltd, New Delhi.	

		● Blum, M. Rosen. *How to Build Better Vocabulary*. London: Bloomsbury Publication ● Comfort, Jeremy(et.al). *Speaking Effectively*. Cambridge University Press.	
	Other References	The Luncheon by W.Somerset Maugham - http://mistera.co.nf/files/sm_luncheon.pdf	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1 Acquire Vision, Goals and Strategies through Audio-visual Language Texts.	PO9, PO10, PO11,PO12
2.	CO2 Synthesize complex concepts and present them in creative writing.	PO9, PO10, PO11,PO12
3.	CO3 Develop MTI Reduction/Neutral Accent through Classroom Sessions & Practice.	PO9, PO10, PO11,PO12
4.	CO4 Determine their role in achieving team success through defining strategies for effective communication with different people	PO9, PO10, PO11,PO12
5.	CO5 Realize their potentials as human beings and conduct themselves properly in the ways of world..	PO9, PO10, PO11,PO12
6.	CO6 Acquire satisfactory competency in use of Quantitative aptitude and Logical Reasoning	PO9, PO10, PO11,PO12

PO and PSO mapping with level of strength for Course

Code_ Course Name	CO 's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ARP102	CO1	-	-		-	-	-	-	-	1	3	1	2	-	-	-
	CO2	-	-	-	–	-	-	-	-	1	3	1	2	-	-	--
	CO3	-	-	-	-	-	-	-	-	1	3	1	2	-	-	-
	CO4	-	-	-	-	-	–	–	-	1	3	1	2	-	-	-
	CO5	-	-	-		-	-	-		1	3	1	2	-	-	-
	CO6	-	-	-	-	-	-	-	-	1	3	1	2	-	-	--

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ARP - 102	Communicative English - 2									1	3	1	2			

Strength of Correlation

1. Addressed to*Slight (Low=1) extent* *2.* Addressed to*Moderate (Medium=2) extent*
3. Addressed to*Substantial (High=3) extent*

School: SET		**Batch : 2023-27**		
Program: B.Tech.		**Current Academic Year: 2023-24**		
Branch: CSE / IT		**Semester: 2nd**		
1	Course Code	**CSP116**	Course Name: Design & Creativity Lab	
2	Course Title	Design & Creativity Lab (DCL)		
3	Credits	2		
4	Contact Hours (L-T-P)	1-0-2		
	Course Status	Compulsory		
5	Course Objective	1. To align student to think out of box and identify a realistic problem or project 2. To understand the significance of problem and its scope 3. To develop skills to frame small project for the defined problem		
6	Course Outcomes	Students will be able to: CO1: Identify and formulate problem statements using systematic approach for real world/proposed problems. CO2: Develop teamwork and problem-solving skills, along with the ability to communicate effectively with others. CO3: Design the problem solution as per the problem statement framed. CO4: Classify and understand project solution and design solution parameters. CO5: Fabricate the solution by using C programming/other known programming. CO6: Develop future work areas from the project outcome.		
7	Course Description	In DCL, the students will learn the fundamentals of defining the problem, formulating the problem statement, identifying the required skills for developing the solution based on a given problem identified based on the understanding of the programming language studied in the previous semester or known.		
8	Outline syllabus			CO Mapping
	Unit 1	Problem Definition, Formation of Teamwork and problem solving, and Project Assignment.		CO1, CO2
	Unit 2	Develop the ability to communicate effectively and identify proposed problems.		CO2, CO3
	Unit 3	Design proposed solution for identified problem statement.		CO3
	Unit 4	Develop a solution set and obtain the appropriate results for defined parameters.		CO3, CO4
	Unit 5	Demonstrate and execute projects with the team. Determine future work based on the final outcome.		CO4, CO5, CO6
		The report *should include Abstract, Hardware / Software Requirement, Problem Statement, Design/Algorithm, Solution Detail. Reports. References if any.*		

		The presentation, report, work done during the term supported by the documentation, forms the basis of assessment.			
	Mode of examination	Practical /Viva			
	Weight age Distribution	CA	CE (VIVA)	ETE	
		25%	25%	50%	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO)
1.	CO1: Identify and formulate problem statements using systematic approach for real world/proposed problems.	PO1, PO2, PO4, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
2.	CO2: Develop teamwork and problem-solving skills, along with the ability to communicate effectively with others.	PO1, PO2, PO4, PO7, PO9, PO10, PO11, PO12 ,PSO3
3.	CO3: Design the problem solution as per the problem statement framed.	PO1, PO2, PO5, PO9, PO10, PO11, PO12, PSO1,PSO2
4.	CO4: Classify and understand project solution and design solution parameters.	PO1, PO2, PO6, PO9, PO10, PO11, PO12,PSO2
5.	CO5: Fabricate the solution by using C programming/other known programming.	PO1, PO2, PO3, PO4,PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12 PSO1,PSO2, PSO3
6.	CO6: Develop future work areas from the project outcome.	PO1, PO2, PO4, PO9, PO10, PO11, PO12,PSO3

PO and PSO mapping with level of strength for Course Name Design & Creativity Lab **(Course Code CSP116)**

CO/PO Mapping (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Low															
Cos	Programme Outcomes(POs)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	-	3	-	-	-	-	3	3	2	3	2	2	1
CO2	3	2	-	3	-	-	2	-	3	3	2	3			1
CO3	3	2	-	-	2	-	-	-	3	3	2	3	2	2	
CO4	3	3	-	-	-	2	-	-	3	3	2	3		2	
CO5	3	3	2	2	2	2	3	3	3	3	2	3	2	2	
CO6	3	3	-	3	-	-	-	-	3	3	2	3			1
AvgPO attained	3	2.7	0.34	1.84	0.67	0.67	0.84	0.5	3	3	2	3	1	1.4	0.5

School: SET		**Batch : 2023-27**	
Program: B.Tech.		**Current Academic Year: 2023-24**	
Branch: CSE / IT		**Semester: 2nd**	
1	Course Code	**CSP116**	Course Name: Design & Creativity Lab
2	Course Title	Design & Creativity Lab (DCL)	
3	Credits	2	
4	Contact Hours (L-T-P)	1-0-2	
	Course Status	Compulsory	
5	Course Objective	1.To align student to think out of box and identify a realistic problem or project 2.To understand the significance of problem and its scope 3.To develop skills to frame small project for the defined problem	
6	Course Outcomes	Students will be able to: CO1: Identify and formulate problem statements using systematic approach for real world/proposed problems. CO2: Develop teamwork and problem-solving skills, along with the ability to communicate effectively with others. CO3: Design the problem solution as per the problem statement framed. CO4: Classify and understand project solution and design solution parameters. CO5: Fabricate the solution by using C programming/other known programming. CO6: Develop future work areas from the project outcome.	
7	Course Description	In DCL, the students will learn the fundamentals of defining the problem, formulating the problem statement, identifying the required skills for developing the solution based on a given problem identified based on the understanding of the programming language studied in the previous semester or known.	
8	Outline syllabus		CO Mapping
	Unit 1	Problem Definition, Formation of Teamwork and problem solving, and Project Assignment.	CO1, CO2
	Unit 2	Develop the ability to communicate effectively and identify proposed problems.	CO2, CO3
	Unit 3	Design proposed solution for identified problem statement.	CO3
	Unit 4	Develop a solution set and obtain the appropriate results for defined parameters.	CO3, CO4
	Unit 5	Demonstrate and execute projects with the team. Determine future work based on the final outcome.	CO4, CO5, CO6
		The report *should include Abstract, Hardware / Software Requirement, Problem Statement, Design/Algorithm, Solution Detail. Reports.* *References if any.*	

		The presentation, report, work done during the term supported by the documentation, forms the basis of assessment.			
	Mode of examination	Practical /Viva			
	Weight age Distribution	CA	CE (VIVA)	ETE	
		25%	25%	50%	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO)
1.	CO1: Identify and formulate problem statements using systematic approach for real world/proposed problems.	PO1, PO2, PO4, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
2.	CO2: Develop teamwork and problem-solving skills, along with the ability to communicate effectively with others.	PO1, PO2, PO4, PO7, PO9, PO10, PO11, PO12 ,PSO3
3.	CO3: Design the problem solution as per the problem statement framed.	PO1, PO2, PO5, PO9, PO10, PO11, PO12, PSO1,PSO2
4.	CO4: Classify and understand project solution and design solution parameters.	PO1, PO2, PO6, PO9, PO10, PO11, PO12,PSO2
5.	CO5: Fabricate the solution by using C programming/other known programming.	PO1, PO2, PO3, PO4,PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12 PSO1,PSO2, PSO3
6.	CO6: Develop future work areas from the project outcome.	PO1, PO2, PO4, PO9, PO10, PO11, PO12,PSO3

PO and PSO mapping with level of strength for Course Name Design & Creativity Lab **(Course Code CSP116)**

CO/PO Mapping (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Low															
Cos	Programme Outcomes(POs)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	-	3	-	-	-	-	3	3	2	3	2	2	1
CO2	3	2	-	3	-	-	2	-	3	3	2	3			1
CO3	3	2	-	-	2	-	-	-	3	3	2	3	2	2	
CO4	3	3	-	-	-	2	-	-	3	3	2	3		2	
CO5	3	3	2	2	2	2	3	3	3	3	2	3	2	2	
CO6	3	3	-	3	-	-	-	-	3	3	2	3			1
AvgPO attained	3	2.7	0.34	1.84	0.67	0.67	0.84	0.5	3	3	2	3	1	1.4	0.5

Syllabus: CSP 114: Application based programming in Python Lab

School:		**School of Engineering & Technology**	
Department		**Department of Computer Science & Engineering**	
Program:		**B.Tech.**	
Branch:		**CSE**	
1	Course Code	CSP114	
2	Course Title	Application Based Programming in Python Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	Emphasis is placed on procedural programming, algorithm design, and language constructs common to most high level languages through Python Programming.	
6	Course Outcomes	Upon successful completion of this course, the student will be able to: CO1: Develop program based on procedural statements like assignments, conditional statements and loops. CO2: Compare and implement different data types of python. CO3: Create programs by using function and function call. CO4: Formulate clear and accurate logical solution by using OOPS CO5: Apply different modules, packages available in python. CO6: Design real life situational problems and think creatively about solutions of them.	
7	Course Description	Python is a language with a simple syntax, and a powerful set of libraries. It is widely used in many scientific areas for data exploration. This course is an introduction to the Python programming language for students without prior programming experience. We cover data types, control flow, object-oriented programming.	
8	Outline syllabus		CO Mapping
	Unit 1	**Practical based on conditional statements and control structures**	
		1. Program to implement all conditional statements 2. Program to implement different control structures	CO1,C06
	Unit 2	**Practical related to List, Tuples and dictionaries**	
		1. Program to implement operations on lists 2. Program to implement operations on Dictionary **3.** Program to implement operations on Tuple	CO2,CO6
	Unit 3	**Practical related to Functions and Exception Handling**	

		1. Program to implement Exception Handling **2.** Program to use different functions	CO3,CO6
	Unit 4	**Practical related to Object Oriented Programming**	
		1. Program to use object oriented concepts like inheritance, overloading polymorphism etc. 2.Program for file handling	CO4,CO6
	Unit 5	**Practical related to Modules and Applications**	
		1.Program to use modules and package 2.Program to implement searching and sorting	CO5,CO6
	Mode of examination	Practical/Viva	
	Weightage Distribution	CA / 25% — CE(Viva) / 25% — ETE / 50%	
	Text book/s*	2. The Complete Reference Python, Martin C. Brown, McGraw Hill	
	Other References	5. Introduction to computing in problem solving using Python, E Balagurusamy, McGraw Hill 6. Introduction to programming using Python, Y. Daniel Liang, Pearson 7. Mastering Python, Rick Van Hatten, Packet Publishing House 8. Starting out with Python, Tony Gaddis, Pearson	

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Develop program based on procedural statements like assignments, conditional statements and loops.	PO1,PO2,PO3,PO4,PO8,PO12,PSO2
2.	CO2: Compare and implement different data types of python.	PO1,PO2,PO3,PO4,PO5,PO8,PO12,PSO2,PSO3
3.	CO3: Create programs by using function and function call.	PO1,PO2,PO3,PO4,PO5,PO6,PO8,PO12, PSO1,PSO2,PSO3
4.	CO4: Formulate clear and accurate logical solution by using OOPS	PO1,PO2,PO3,PO4,PO5,PO6,PO8,PO12, PSO1,PSO2,PSO3
5.	CO5: Apply different modules, packages available in python.	PO1,PO2,PO3,PO4,PO5,PO6,PO8,PO12, PSO1,PSO2,PSO3
6.	CO6: Design real life situational problems and think creatively about solutions of them.	PO1,PO2,PO3,PO4,PO5,PO6,PO8,PO12, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name-Application Based Programming in Python Lab **(Course Code CSP 114)**

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSP114_Application Based programming in Python Lab	**CO1**	1	1	1	1				2				2		1	
	CO2	2	2	1	1	2			2				2		1	1
	CO3	2	2	1	1	1	1		2				2	1	2	1
	CO4	2	2	2	2	1	1		2				2	2	2	1
	CO5	2	2	2	2	2	2		2				2	2	2	2
	CO6	3	3	2	2	2	3		2				2	2	2	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2	PSO3
CSP114	**Application Based programming in Python Lab**	**2**	**2**	**1.5**	**1.5**	**1.3**	**1.2**	**-**	**2**	**-**	**-**	**-**	**2**	**1.2**	**1.7**	**1.2**

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School: SET		Batch : 2023-27	
Program: B.Tech		**Current Academic Year: 2023-24**	
Branch: Mechanical Engineering		**Semester: II**	
1	Course Code	MEP 105	
2	Course Title	**Mechanical Workshop**	
3	Credits	1.5	
4	Contact Hours (L-T-P)	0-0-3	
	Course Status	Compulsory	
5	Course Objective	The objective of this course is to make the students, familiar with the modern day manufacturing processes, introduce them to various hand tools and equipment, acclimatize with the measuring devices, and perform basic machine tool operations in various machine tools.	
6	Course Outcomes	After successful completion of this course, students will be able to CO1: Apply 5S (Seiri, Seiton, Seiso, Seiketsu and Shitsuke) methodology at workplace. CO2: Select the various hand tools used in the basic mechanical engineering workshop sections-smithy, carpentry, assembling, welding etc. CO3: Choose different measuring devices according to the job CO4: Differentiate between various machine tools and their operation CO5: Classify and select suitable tools for machining processes including turning, facing, thread cutting and tapping, milling, drilling and shaping. CO6: Apply the knowledge for advance manufacturing experiments.	
7	Course Description	**Black Smithy Shop:** Simple exercises based on black smithy operations such as upsetting, practice of S -Hook from circular bar using hand forging operations. **Carpentry Shop :** Study of different types of wood , Carpentry Tools, Equipment and different joints, Practice of T joint, cross lap joint, Mortise and Tenon T joint, Bridle T joint **Fitting Shop:** Preparation of Square joint, V joint, half round joint, dovetail jointas per the given specifications, which contains: Sawing, Filing, Grinding, and Practice marking operations. **Sheet Metal Shop:** Study of galvanized Iron (G.I.) Sheet material properties, hand tools and sheet metal machines, and projective geometry, demonstration of different sheet metal operations and practice of development of Tray, cylinder, hopper, funnel etc. **Welding Shop:** Introduction, Study of Tools and welding Equipment (Gas and Arc welding), Selection of welding electrode and current, Bead practice and Practice of Butt Joint, Lap Joint. **Machine Shop:** Study of machine tools in particular Lathe machine (different parts, different operations, study of cutting tools), Demonstration of different operations on Lathe machine, Practice of Facing, Plane Turning, step turning, taper turning, knurling and parting and Study of Quick return mechanism of Shaper. **Foundry Shop:** Introduction to foundry, Patterns, pattern allowances, ingredients of moulding sand and melting furnaces. Foundry tools and their purposes, Demo of mould preparation and Practice – Preparation of mould by using split pattern.	
8	Outline syllabus		CO Mapping
	List of Experiments		

	Experiment 1	To make a S shaped hook from a given circular rod using hand forging technique.	CO4
	Experiment 2	To make a dovetail lap joint in Carpentry shop.	CO2,CO3
	Experiment 3	To make a cross-half lap joint in Carpentry shop.	CO2,CO3
	Experiment 4	To make a square fit from the given mild steel pieces in fitting shop.	CO3,CO5
	Experiment 5	To prepare a V-Fit from the given mild steel pieces in fitting shop.	CO3, CO5
	Experiment 6	To make a rectangular tray of specified dimensions in sheet metal shop.	CO2, CO5
	Experiment 7	To make a Lap joint, using the given mild steel pieces using arc welding.	CO3, CO5
	Experiment 8	To perform step turning and taper turning operations on the given work piece	CO5
	Experiment 9	To prepare a sand mold, using the given single piece pattern	CO2
	Experiment 10	To prepare a sand mold, using the given Split-piece pattern.	CO2
	Mode of examination	Practical	
	Weight- age Distribution	CA / 25%; MTE / 25%; ETE / 50%	
	Text book/s*	1. Raghuwanshi B.S., Workshop Technology Vol. I & II, DhanpathRai& Sons. 2. Kannaiah P. and Narayana K.L., Workshop Manual, 2nd Edn, Scitech publishers. 3. John K.C., Mechanical Workshop Practice. 2nd Edn. PHI 2010. 4. JeyapoovanT.andPranitha S., Engineering Practices Lab Manual, 3rd Edn. Vikas Pub.2008.	

Program Outcome Vs Courses Mapping Table:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO105.1	1	-	-	-	-	2	-	-	-	-	-	2	-	-	-
CO105.2	1	-	-	-	1	2	-	-	-	-	-	1	1	-	1
CO105.3	2	-	1	-	1	2	-	-	-	-	-	2	1	-	1
CO105.4	2	-	1	-	2	2	-	-	-	-	-	2	1	-	1
CO105.5	2	-	1	-	2	2	-	-	-	-	-	2	2	-	1
CO105.6	2	-	1	-	2	2	-	-	-	-	-	2	2	-	1
CO105	**2**	**-**	**1**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**1**

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SET		Batch : 2023-27	
Program: B.Tech		**Current Academic Year: 2023-24**	
Branch: ALL		**Semester: II**	
1	Course Code	MEP 106	
2	Course Title	Computer Aided Design & Drafting Laboratory	
3	Credits	1.5	
4	Contact Hours (L-T-P)	0-0-3	
	Course Status	Compulsory	
5	Course Objective	The objective of this introductory course is to make students familiar with computer-aided drafting/ design, introduce them about the basic commands, tools and dimension techniques for creation and presentation of various engineering drawing by using AutoCAD software which helps in visualization and problem solving in engineering disciplines.	
6	Course Outcomes	After successful completion of this course the student will be able to CO1: Understand the fundamental features of AutoCAD workspace and user interface. CO2: Apply the fundamental tools such as draw, edit, and view for creating two dimensional engineering drawings in AutoCAD. CO3: Choose advance features to present an engineering drawing in AutoCAD. CO4: Apply text and dimension features in the engineering drawing. CO5: Create different orthographic projections from a pictorial view. CO6: Analyze an engineering drawing and use the software packages for drafting and modeling.	
7	Course Description	This introductory course is offered to students to make them proficient in design, layout, product development, and other careers that require technical drawing. Using the current version of the AutoCAD software, students will learn a variety of drawing techniques and be able to replicate specific drawings in multiple perspectives. The pinnacle of the class is to empower and enable students to create using the software provided. Career opportunities in 3D modeling, manufacturing, and engineering will also be explored. No drafting or computer experience is necessary.	
8	Outline syllabus		CO Mapping
	List of Experiments		
	Experiment 1	Introduction to AutoCAD and its interface	CO1
	Experiment 2	Working with coordinates, Drawing offline, circle, arc, polygon and creating sketches	CO2
	Experiment 3	Editing of drawing by using editing Tools and Power tools	CO2
	Experiment 4	Creating of advanced feature like fillet, chamfer, hatch and using of block	CO3
	Experiment 5	Representing text and dimensioning in AutoCAD	CO4
	Experiment 6	Creating the drawings of mechanical components by using AutoCAD features.	CO2, CO3
	Experiment 7	Creating the electrical circuit drawings in AutoCAD.	CO2
	Experiment 8	Drawing plan and elevation of various buildings in AutoCAD.	CO2, CO4
	Experiment 9	Creating the drawing of renowned constructions such as Taj Mahal in AutoCAD	CO3

	Experiment 10	Creating of orthographic projections from a pictorial views			CO5
	Mode of examination	Practical			
	Weightage Distribution	CA	CE(Viva)	ETE	
		25%	25%	50%	
	Text book/s*	1. Ibrahim Zaid,"CAD/CAM- Theory and Practice", McGraw Hill, International Edition.			
	Software	AutoCAD			

1.3.5.1 COURSE ARTICULATION MATRIX

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO10 6.1	2	2	2	-	3	-	-	-	-	-	-	3	3	3
CO10 6.2	2	2	2	-	3	-	-	-	-	-	-	3	3	3
CO10 6.3	2	2	2	-	3	-	-	-	-	-	-	3	3	3
CO10 6.4	2	2	2	2	3	-	-	-	2	2	-	3	3	3
CO10 6.5	2	2	2	2	3	-	-	-	2	2	-	3	3	3
CO10 6.6	2	2	2	2	3	-	-	-	2	2	-	3	3	3

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

Syllabus: CSP 242, Data Structure Lab

School: SET		**Batch : 2023-27**	
Program: B.Tech.		**Current Academic Year: 2023-24**	
Branch: CSE/IT		**Semester: II**	
1	Course Code	CSP242	
2	Course Title	Data Structure Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	1. Learn the basic concepts of Data Structures and algorithms. 2. Design and Implementation of Various Basic and Advanced Data Structures. 3. Learn the concepts of various searching, Sorting and Hashing Techniques. 4. Choose the appropriate data structures and algorithm design method for a specified application.	
6	Course Outcomes	CO1: **Implement** operation like traversing, insertion, deletion, searching etc. on various data structures. CO2 **apply** linear data structure(s) to solve various problems CO3: **develop** the solution of any problem using non linear data structure(s) CO4: **create** a solution of any problem using searching and sorting techniques CO5: **Design** a hash function using any programming language CO6: **Choose** the most appropriate data structure(s) for a given problem	
7	Course Description	This course starts with an introduction to data structures with its classification, efficiency of different algorithms, array and pointer based implementations and Recursive applications. As the course progresses the study of Linear and Non-Linear data structures are studied in details. The course talks primarily about Linked list, stacks, queue, Tree structure, Graphs etc. This Course also deals with the concept of searching, sorting and hashing methods.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	**CO1**
		Program to implement Operation on Array such as Traversing, Insertion & Deletion operation	**CO1**
		Program based on Recursion such as Towers of Hanoi, Fibonacci series etc.	CO1
	Unit 2	**Linked List**	**CO2**
		Program to implement different operation on the following linked list: Singly, Doubly and circular linked list.	CO2

	Unit 3	**Stack & Queue**			**CO3**
		Program to Implement Stack operation using Array and Linked list			**CO3**
		Program to convert infix expression to post fix expression			**CO3**
		Program on Evaluation of Post fix expression			**CO3**
		Program to implement queue operation using array and linked list			**CO3**
		Program to implement circular queue and deque.			**CO3**
	Unit 4	**Tree & Graph**			**CO4, CO6**
		Program to implement binary tree and BST.			**CO4, CO6**
		Program to implement MST and shortest path algorithm.			CO4, CO6
	Unit 5	**Searching, Sorting & Hashing**			**CO5**
		Program on Searching and Hashing			**CO5**
		Program on Sorting.			CO5
	Mode of examination	Practical			
	Weightage Distribution	CA	CE(Viva)	ETE	
		25%	25%	50%	
	Text book/s*	1. Lipschutz, "Data Structures" Schaum's Outline Series, TMH			
	Other References	1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein "Data Structures Using C and C++" , PHI 2. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication 3. Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with applications", McGraw Hill 4. R. Kruse etal, "Data Structures and Program Design in C", Pearson Education 5. G A V Pai, "Data Structures and Algorithms", TMH			

PO and PSO mapping with level of strength for Course Name Data Structures (Course Code CSE 242)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	2	3	_	_	-	_	_	3	_	_	2	3	2	2
CO2	3	2	2	2	2	-	_	_	2	_	-	_	2	3	3
CO3	3	1	3	3	_	_	_	_	3	_	_	1	3	2	2
CO4	3	2	3	2	_	_	_	_	2	_	_	2	2	3	2

CO5	**2**	**2**	**2**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**1**	**2**	**2**
CO6	**3**	**3**	**2**	**3**	**-**	**-**	**_**	**_**	**3**	**_**	**-**	**_**	**2**	**3**	**2**

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CSP 242	**Data structures Lab**	2.67	2	2.5	2.5	2	-	-	-	2.6	-	-	1.7	2.17	2.5	2.2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

TERM - III

School:SET		**Batch : 2023-27**	
Program: B.Tech		**Current Academic Year: 2023-24**	
Branch:CSE		**Semester:III**	
1	Course Code	CSE245	Course Name: Discrete Structures
2	Course Title	Discrete Structures	
3	Credits	4	
4	Contact Hours(L-T-P)	3-1-0	
	Course Status		
5	Course Objective	This course provides a mathematical foundation for subsequent study in Computer Science, as well as developing the skills necessary to solve practical problems.	
6	Course Outcomes (CO)	After the completion of this course, students will be able to: CO-1. ***Apply the*** basic principles of sets and operations in sets**.** CO-2. ***Classify*** logical notation and determine if the argument is or is not valid. CO-3. ***Construct*** and prove models by using algebraic structures. CO-4. ***Analyze*** basic principles of Boolean algebra with mathematical description. CO-5. ***Construct*** Permutations and combinations in counting techniques and applications of Graph Theory. CO-6. ***Compose*** computer programs in a formal mathematical manner.	
7	**Prerequisite**	Concepts of algebra	
8	**Course Contents**		CO-Mapping
	Unit 1	**Introduction to Set Theory, Relations and Functions.**	
	A	Set Theory: Introduction, Combination of sets, Multi sets, ordered pairs, Set Identities.	CO1
	B	Relations: Definition, Operations on relations, Properties of relations, Composite Relations, Equality of relations, Order of relations.	CO1
	C	Functions: Definition, Classification of functions, Operations on functions, Recursively defined functions.	CO1
	Unit 2	**Logics and Mathematical Induction**	
	A	Propositional Logic: Proposition, well-formed formula, Truth tables, Tautology, Satisfiability, Contradiction, Algebra of proposition, Theory of Inference, Natural Deduction.	CO1,CO2
	B	Predicate Logic: First order predicate, well-formed formula of predicate, quantifiers, Inference theory of predicate logic.	CO1,CO2
	C	Natural Numbers: Introduction, Mathematical Induction, Variants of Induction, Induction with Nonzero Base cases.	CO1,CO2
	Unit 3	**Algebraic Structures**	
	A	Definition, Groups, Subgroups and order, Cyclic Groups, Cosets, Lagrange's theorem, Normal Subgroups,	CO3

	B	Homomorphism's, Definition and elementary properties of Rings and Fields, Integers Modulo n.	CO3
	C	Partial order sets: Definition, Partial order sets, Combination of partial order sets, Hasse diagram.	CO3
	Unit 4	**Lattices and Applications**	
	A	Definition, Properties of lattices – Bounded, Complemented, Modular and Complete Lattice, Morphisms of lattices.	CO4
	B	Boolean Algebra: Introduction, Axioms and Theorems of Boolean algebra, Algebraic manipulation of Boolean expressions. Simplification of Boolean Functions, Karnaugh maps, Logic gates, Digital circuits and Boolean algebra. Combinational and sequential Circuits.	CO4
	C	Recurrence Relation & Generating function: Recursive definition of functions, Recursive algorithms, Method of solving recurrences.	CO4
	Unit 5	**Graph Theory and Applications.**	
	A	Trees: Definition, Binary tree, Binary tree traversal, Binary search tree.	CO4,CO5
	B	Graphs: Definition and terminology, Representation of graphs, Multi graphs, Bipartite graphs, Planar graphs, Isomorphism and Homeomorphism of graphs, Euler and Hamiltonian paths, Graph colouring.	CO4,CO5
	C	Combinatory: Introduction, Counting Techniques, Pigeonhole Principle	CO4,CO5
	Mode of examination	Theory	

	Weightage Distribution	CA	MTE	ETE
		25%	25%	50%

	Text book*	1) *1. C. L. Liu, Elements of Discrete Mathematics, second edition 1985, McGraw-Hill Book Company. Reprinted 2000.* 2) Jean Paul Trembley, R Manohar, "Discrete Mathematical Structures with Application to Computer Science", McGraw-Hill. 3) *K. H. Rosen, Discrete Mathematics and applications, fifth edition 2003, Tata McGraw Hill Publishing Company.*
	other references	1) *J .L. Mott, A. Kandel, T.P .Baker, Discrete Mathematics for Computer Scientists and Mathematicians, second edition 1986, Prentice Hall of India.* 2) *W.K. Grassmann and J.P.Trembnlay, Logic and Discrete Mathematics, A Computer Science*

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)

1.	**CO1:** ***Apply the*** basic principles of sets and operations in sets**.**	**PO1,PO2,PO3,PO4,PO6,PO12, PSO1,PSO2**
2.	**CO2:** ***Classify*** logical notation and determine if the argument is or is not valid.	**PO1,PO2,PO3,PO6,PO9,PO12 PSO1,PSO2**
3.	**CO3:** ***Construct*** and prove models by using algebraic structures.	**PO1,PO2,PO3,PO4,PO5,PO9,PSO2 PSO3**
4.	**CO4:** ***Analyze*** basic principles of Boolean algebra with mathematical description.	**PO1,PO2,PO3,PO4,PO5,PO11,PO12 PSO1, PSO3**
5.	**CO5:** ***Construct*** Permutations and combinations in counting techniques and applications of Graph Theory.	**PO1,PO2,PO3,PO4,PO6,PO9,PO11,PO12, PSO2,PSO3**
6	**CO6:** ***Compose*** computer programs in a formal mathematical manner.	**PO1,PO2,PO3, PO4, PO5,PO9,PO11, PSO1,PSO2,PSO3**

PO and PSO mapping with level of strength for Course Name Discrete Structures (Course Code CSE245)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	3	3	1	_	3	_	_	3	_	_	3	3	3	_
CO2	2	2	3	_	_	2	_	_	_	_	_	3	3	2	_
CO3	3	2	3	3	3	_	_	_	2	_	_	_	_	3	2
CO4	2	2	3	3	3	_	_	_	_	_	3	3	3	_	3
CO5	2	2	2	3	_	3	_	_	3	_	3	3	_	2	3
CO6	1	2	1	2	3	_	_	_	3	_	3	_	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE245	DS	2	2.1	2.5	2	1.5	1.3	0	0	1.8	0	1.8	2	2	2.1	1.6

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***

3. Addressed to ***Substantial (High=3) extent***

Syllabus: CSE 247, Computer organization and architecture

School: SET		**Batch : 2023-27**		
Program: B.Tech		**Current Academic Year: 2023-24**		
Branch: CSE/IT		**Semester: III**		
1	Course Code	CSE247	Course Name	
2	Course Title	Computer Organization and Architecture		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Compulsory		
5	Course Objective	To impart an understanding of the internal organization and operations of a computer and to introduce the concepts of processor logic design and control logic design.		
6	Course Outcomes	Upon successful completion of this course, the student will be able to: **CO1:** Identify the basic structure and functional units of a digital computer CO2:Study the architecture of Bus and registers . **CO3:**Study the design of arithmetic and logic unit and implementation of fixed point and floating-point arithmetic operations **CO4:**Understand basic processing unit and organization of simple processor including instruction sets, instruction formats and various addressing modes **CO5:**Study the two types of control unit techniques **CO6:** Describe hierarchical memory systems including cache memories and select appropriate interfacing standards for I/O devices.		
7	Course Description	This course discusses the basic structure of a digital computer and used for understanding the organization of various units such as control unit, Arithmetic and Logical unit and Memory unit and I/O unit in a digital computer.		
8	Outline syllabus			CO Mapping
	Unit 1	**Computer Organization and Design**		
	A	Functional units of digital system and their interconnections, buses, bus architecture, types of buses and bus arbitration. Register bus and memory transfer		CO1
	B	Register transfer Language, Registertransfer, Bus & memory transfer, Logic micro operations, Shift micro operation.		CO1
	C	Adder-Subtractor- Incrementor, Arithmetic unit, Logic unit.		CO1
	Unit 2	**Computer Arithmetic**		
	A	Representation of numbers in 1’s and 2’s complement, Addition and subtractionofsigned numbers.		CO1, CO2
	B	Binary Multiplier, Multiplication: Signed operand multiplication, Booth algorithm		CO1, CO2
	C	Floating point arithmetic representation: addition and subtraction.		CO1, CO2
	Unit 3	**Processor Organization**		
	A	General register organization, stack organization		CO3
	B	Instruction set architecture of a CPU - registers, Instruction types, formats, instruction execution cycle		CO3
	C	Addressing modes, RISC/CISC		CO3
	Unit 4	**Control Unit**		

	A	Introduction to CPU design, Instruction interpretation and execution, Micro-operation and their register transfer language (RTL) specification	CO3, CO4
	B	Hardwired control CPU design	CO3, CO4
	C	Microprogrammed control CPU design	CO3, CO4
	Unit 5	**Memory and I/O**	
	A	RAM/ROM/Flash memory, Designing Memory System using RAM and ROM chips	CO1, CO5
	B	Cache memory: Memory hierarchy, performance Considerations, mapping techniques	CO1, CO5
	C	Input Output: Isolated vs. Memory mapped I/O, Programmed I/O, Interrupt driven I/O, Direct Memory Access	CO1, CO5
	Mode of examination	Theory	
	Weightage Distribution	CA: 25%, MTE: 25%, ETE: 50%	
	Text book/s*	1. M. Morris Mano, Computer System Architecture, Pearson	
	Other References	1. C. Hamacher, Z. Vranesic and S. Zaky, "Computer Organization", McGrawHill, 2002. 2. W. Stallings, "Computer Organization and Architecture - Designing for Performance", Prentice Hall of India, 2002. 3. D. A. Patterson and J. L. Hennessy, "Computer Organization and Design - The Hardware/Software Interface", Morgan Kaufmann,1998. 4. J.P. Hayes, "Computer Architecture and Organization", McGraw-Hill, 1998.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1. Identify the basic structure and functional units of a digital computer.	PO1, PO2, PO3, PO6, PO12, PSO3
2.	CO2:Study the architecture of Bus and registers	PO1, PO2, PO3, PO6, PO12, PSO3
3.	CO3. Study the design of arithmetic and logic unit and implementation of fixedpoint and floating-point arithmetic operations	PO1, PO2, PO3, PO6, PO12, PSO3
4.	CO4. Understand basic processing unit and organization of simple processor including instruction sets, instruction formats and various addressing modes	PO1, PO2, PO3, PO6, PO12, PSO3
5.	CO5. Study the two types of control unit techniques	PO1, PO2, PO3, PO4, PO6, PO12, PSO2, PSO3

6.	CO6. Describe hierarchical memory systems including cache memories and select appropriate interfacing standards for I/O devices	PO1, PO2, PO3, PO6, PO12, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Computer Organization and Architecture **(Course Code CSE 247)**

CSE247	Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	CO1	3	1	1	-	-	2	-	-	-	-	-	2	-	1	3
	CO2	3	3	3	-	-	3	-	-	-	-	-	3	-	2	3
	CO3	3	2	3	-	-	2	-	-	-	-	-	3	-	2	3
	CO4	3	2	2	-	-	1	-	-	-	-	-	3	-	3	2
	CO5	3	3	3	-	-	2	-	-	-	-	-	3	-	2	2
	CO6	3	3	3	-	-	2	-	-	-	-	-	3	-	1	2

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

2.1 Template A1: Syllabus for Theory Courses

School:		**School of Engineering & Technology**	
Department		**Department of Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:			
1	Course Code	CSE253	
2	Course Title	Object Oriented Programming Using Java	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Core /Elective/Open Elective	
5	Course Objective	To learn Java language syntax and semantics and concepts such as classes, objects, inheritance, polymorphism and multithreading.	
6	Course Outcomes	CO1. Define Object oriented programming concepts by identifying classes, objects, members of a class and relationships among them needed for a specific problem. CO2: Illustrate different features of java. CO3: Develop Java programs to solve problems of applications using OOP principles such as abstraction, polymorphism and inheritance. CO4: Categorize runtime errors thrown in the application software or generated runtime by applying the methods of exception handling. CO5. Explain the concept of multithreading. CO6. Design real life application using Java	
7	Course Description	Basic Object Oriented Programming (OOP) concepts including objects, classes, methods, parameter passing, information hiding, inheritance and polymorphism are discussed.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Object Oriented Paradigm**	
	A	Introduction to OOP, Characteristics of OOP, Difference between OOP and procedural languages	CO1, CO2
	B	Byte Code, Architecture of JVM	CO1, CO2
	C	Features of Java, Class Loader Execution Engine, Garbage collection.	CO1, CO2
	Unit 2	**Introduction to Java**	
	A	Classes, Objects ,Constructors, Methods	CO1,CO2
	B	Constants, Variables, Data Types, Operators, Expressions, Decision Making Branching, Loops	CO1, CO2
	C	Arrays	CO1, CO2
	Unit 3	**Polymorphism & String handling**	
	A	Polymorphism, method overloading	CO3
	B	Constructors overloading , Wrapper class ,Type conversion & casting,	CO3
	C	Strings and String handling,	CO3
	Unit 4	**Inheritance**	

	A	Inheritance, Types of inheritance, Overriding methods, use of this and super			CO3,CO6
	B	Constructor call in inheritance, Abstract class , Concept of multiple inheritance in Java			CO3,CO6
	C	Final class, method and variable, Interface, Access Modifiers			CO3,CO6
	Unit 5	**Exception and Multithreading**			
	A	Introduction to Exception Handling, Introduction to try, catch, Finally , throw and throws			CO4,CO6
	B	Checked and Unchecked exceptions, User define exception			CO4,CO6
	C	Introduction to Multithreading, Creating thread using Runnable interface and Thread class, Thread life cycle			CO5,CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1.Schildt H, "The Complete Reference JAVA2", TMH			
	Other References	1. Balagurusamy E, "Programming in JAVA", TMH 2. Professional Java Programming: BrettSpell, WROX Publication			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Define Object oriented programming concepts by identifying classes, objects, members of a class and relationships among them needed for a specific problem.	PO5,PO12
2.	Illustrate different features of java.	PO5
3.	Develop Java programs to solve problems of applications using OOP principles such as abstraction, polymorphism and inheritance.	PO1,PO2,PO3,PO5, PO9,PO12,PSO1,PSO2
4.	Categorize runtime errors thrown in the application software or generated runtime by applying the methods of exception handling and File I/O	PO5
5.	Explain the concept of multithreading.	PO5
6.	Design real life application using Java.	PO1,PO2,PO3,PO5,PO6,PO7,PO9,PO11,PO12,PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Object Oriented Programming Using Java **(Course Code CSE243)**

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	CO1					2							2			
	CO2					2										
	CO3	2	3	3		2				3			2	2	3	
	CO4					2										
	CO5					2										
CSE253_ Object Oriented Programming Using Java	CO6	3	3	3		2	3	2		3		2	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE 253	Object Oriented Programming Using Java	2.5	3	3	0	2	3	2	0	3	0	2	2.3	2.5	3	2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Syllabus: CSE 244, Principles of Operating System

School: SET		**Batch : 2023-27**	
Program: B.Tech		**Current Academic Year: 2023-24**	
Branch: CSE		**Semester: III**	
1	Course Code	**CSE 244**	Course Name: Principles of Operating System
2	Course Title	Principles of Operating System	
3	Credits	4	
4	Contact Hours (L-T-P)	3-0-2	
	Course Status	Core	
5	Course Objective	1. This course introduces the challenges for designing the operating systems. 2. Includes different design principles and algorithms. 3. Evaluation of algorithms proposed. 4. Implementation of algorithms and utilities.	
6	Course Outcomes	Students will be able : **CO1:** To Understand the basic concept of Operating system. **CO2:**Explore process management concepts including scheduling, synchronization, deadlocks **CO3:** To understand and implement algorithms in resource allocation and utilization. **CO4:** To integrate and interpret effectiveness, efficiency of algorithms used for resource management of operating systems. **CO5:** Analyze various memory management and virtual memory techniques **CO6:** To Understand file and disk management and analyzing them	
7	Course Description	This course introduces the design principles of operating systems, resource management, identifying challenges and applying respective algorithms.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Operating System Concepts and functions, Comparison of different Operating system	CO1
	B	Types of Operating Systems (Batch, Multiprogramming ,Multi-Tasking , Multiprocessing, Distributed and Real Time Operating System)	CO1
	C	Operating System Structure(Monolithic, Layered and Microkernel), Operating System Services	CO1
	Unit 2	**Process Synchronization**	
	A	Process Concepts (PCB, Process States , Process Operations, Inter process communication)	CO1, CO2
	B	Critical Section problem & their solutions, Introduction to Semaphores	CO1, CO2
	C	Classical Problems of Synchronization(Producer Consumer Problem, Readers Writer Problem, Dining philosophers problem)	CO1, CO2
	Unit 3	**CPU Scheduling**	

	A	Concept , Types of schedulers(Short term, Long term, Middle term), Dispatcher, Performance Criteria			CO1,CO2
	B	CPU Scheduling Algorithms(FCFS, SJF, Priority, Round Robin, Multilevel Queue, Multilevel feedback Queue)			CO1,CO2,CO3,CO4
	C	Deadlock concepts & Handling Techniques(Avoidance, Prevention and Detection & Recovery)			CO1,CO2,CO3,CO4
	Unit 4	**Memory Management**			
	A	Memory Hierarchy, Memory Management Unit			CO1,CO2,CO3,CO5
	B	Paging, Segmentation			CO1,CO2,CO3,CO5
	C	Virtual memory concept, demand paging, Page replacement algorithms(FCFS, Optimal, LRU)			CO1,CO2,CO3,CO5
	Unit 5	**INPUT-OUTPUT Management**			
	A	Input –Output interface, Modes of data transfer(Programmed, interrupt and DMA)			CO1,CO2,CO3,CO6
	B	Disk structure , Disk scheduling(FCFS,SSTF, SCAN, LOOK,C-SCAN, C-LOOK)			CO1,CO2,CO3,CO4,CO6
	C	File Concept ,File operations, File Directories, Case study of Windows Operating System			CO1,CO2,CO3,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	2. Silberschatz G, *Operating System Concepts*, Wiley			
	Other References	1. W. Stalling, "Operating System", Maxwell Macmillan 2. Tannenbaum A S, *Operating System Design and Implementation*, Prentice Hall India 3. Milenkovic M, *Operating System Concepts*, McGraw Hill			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:** To identify the challenges and apply suitable algorithms for them.	PO1,PO2,PO3,PO4,PSO1
2.	**CO2:** To assess the strengths and weaknesses of the algorithms.	PO1, PO3, PO4, PSO2
3.	**CO3:** To understand and implement algorithms in resource allocation and utilization.	PO1,PO2,PO3,PO4
4.	**CO4:** To integrate and interpret effectiveness, efficiency of algorithms used for resource management of operating systems.	PO9, PO10,PO11, PSO3
5.	**CO5:** Analyze various memory management and virtual memory techniques	PO1,PO2,PO8,PO9,PO10,PSO1
6.	**CO6:** To Understand file and disk management and analyzing them.	PO1,PO2,PO10,PO11,PSO1,PSO2

PO and PSO mapping with level of strength for Course Name Principles of Operating System (Course Code CSE 244)

CSE244	Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	CO 1	3	3	3	3	--	--	--	2	2	1	2	1	3	2	2
	CO 2	3	2	3	3	--	--	--	2	2	2	1	1	2	3	2
	CO 3	3	3	3	3	--	--	--	1	1	1	3	2	3	2	1
	CO 4	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
	Co5	2	2	3	-	-	-	-	3	3	1	2	-	3	-	-
	CO 6	3	2	-	-	-	-	-	-	-	2	3	-	2	2	-

Syllabus: CSE 252, Computer Networks

School: SET		**Batch : 2023-27**		
Program: B.Tech		**Current Academic Year: 2023-24**		
Branch:CSE		**Semester: III**		
1	Course Code	CSE252	Course Name: B. Tech	
2	Course Title	**Computer Networks**		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Compulsory		
5	Course Objective	Provide students with an overview of networking, insight into the issues, challenges and working at all level of reference models. Also practice on applying protocols in network design.		
6	Course Outcomes	Students will be able to: **CO1:**Demonstrate and differentiate working of all layers of the OSI Reference Model and TCP/IP model. **CO2:**Investigate and explore fundamental issues driving network design including error control. **CO3:** Understand and building the skills of IP addressing, subnetting and routing protocols. **CO4:** Discuss the flow control, elements and protocols of transport layer **CO5:** Describe the connection management and application layer protocols. **CO6:** Outline the basic knowledge of the use of cryptography and network security.		
7	Course Description	To familiarize with the basic taxonomy and terminology of computer networking area.		
8	Outline syllabus			CO Mapping
	Unit 1	**Introduction**		
	A	Introduction to computer networks, applications and uses, classification of Networks based on topologies, geographical distribution and communication techniques		CO1, CO2
	B	**Reference models:** OSI model, TCP/IP model , Overview of Connecting devices (Hub, Repeaters, Switches, Bridges, Routers, Gateways)		CO1, CO2
	C	**Transmission Media:** wired , wireless, Multiplexing techniques-FDM, TDM		CO1, CO2
	Unit 2	**Data Link Layer**		
	A	Functions, Framing, Error Control-Error correction codes(Hamming code),Error Detection codes(Parity Bit, CRC)		CO1, CO2
	B	Flow Control- Stop and Wait Protocol, Sliding window –Go back N and Selective repeat(ARQ)		CO1, CO2
	C	MAC- Sub-layer Protocols: ALOHA, CSMA, CSMA/CD protocols, IEEE Standards 802.3, 802.4,802.5		CO1, CO2
	Unit 3	**Network Layer**		
	A	Design issues , IPV4addressing basics and Header format, CIDR, sub-netting and sub-masking		CO1,CO3
	B	Routing, optimality Principle Routing protocols-, Shortest path, flooding, distance vector routing , link state routing		CO1,CO3

	C	Congestion control-Leaky bucket , Token Bucket, jitter control	CO1,CO3,CO4
	Unit 4	**Transport Layer**	
	A	Need of transport layer with its services, Quality of service, connection oriented and connection less	CO1,CO4
	B	Transmission Control Protocol: Segment structure and header format, TCP Connection Management, Flow Control	CO1,CO4,CO5
	C	TCP congestion control, Internet Congestion Control Algorithm, Overview of User Datagram Protocol (UDP)	CO1,CO4,CO5
	Unit 5	**Application Layer**	
	A	Domain Name System (DNS), HTTP, FTP, SMTP	CO1,CO5
	B	Network Security services, cryptography, Symmetric versus Asymmetric cryptographic algorithms- DES, and RSA	CO1,CO5,CO6
	C	Application of Security in Networks: Digital signature	CO1,CO5,CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 25%, MTE: 25%, ETE: 50%	
	Text book/s*	1. Tanenbaum, A.S." Computer Networks", 4th Edition, PHI	
	Other References	1. Forouzan, B.., "Communication Networks", TMH, Latest Edition 2. W. Stallings, "Data and Computer Communication" Macmillan Press	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:**Demonstrate and differentiate working of all layers of the OSI Reference Model and TCP/IP model.	PO2,PO11,PO12,PSO2
2.	**CO2:**Investigate and explore fundamental issues driving network design including error control.	PO1,PO3,PO4,PO5,PO11PO12,PSO2
3.	**CO3:** Understand and building the skills of IP addressing, subnetting and routing protocols.	PO1,PO2,PO4,PO6,PSO1,PSO3
4.	**CO4:** Discuss the flow control, elements and protocols of transport layer	PO2,PO3,PSO2,PSO3
5.	**CO5:** Describe the connection management and application layer protocols.	PO1, PO2,PO3, PO4, PSO2
6.	**CO6:** Outline the basic knowledge of the use of cryptography and network security.	PO1, PO2, PO4,PO8 PO11, PSO2

PO and PSO mapping with level of strength for Course Name Computer Networks (Course Code CSE 252)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	-	-	-	-	-	-	-	-	2	3	-	3	-
CO2	2	-	2	2	3	-	-	-	-	-	2	3		3	-
CO3	3	2	-	2	-	2	-	-	-	-	-	-	2	-	2
CO4	-	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO5	2	2	2	2	-	-	-	-	-	-	-	-	-	2	-
CO6	2	-	-	2	-	-	-	2	-	-	2	-	-	2	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code/ Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Computer Networks	1.5	1.33	1	1.33	0.5	0.33	-	0.33	-	-	1	1	0.33	2	0.67

Strength of Correlation:1. Addressed to ***Slight (Low=1) extent 2.*** Addressed to ***Moderate (Medium=2) extent 3.*** Addressed to ***Substantial (High=3) extent***

School:		School of Engineering & Technology	
Department		Department of Computer Science & Engineering	
Program:		B.Tech	
Branch:			
1	Course Code	CSP-252	
2	Course Title	Computer Networks Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory/Elective	
5	Course Objective	The students will be introduced to the basic concepts and fundamentals of computer networks along with the study of individual layers of reference model.	
6	Course Outcomes	Students will be able to: CO1: Explain the basic concepts of computer network. CO2: Illustrate and differentiate working of all layers of the OSI Reference Model and TCP/IP model CO3: Analyse fundamental issues driving network design including error control, IP addressing, access control, flow and congestion control CO4: Compare working of various routing algorithms CO5: Test various network security algorithms CO6: Examine various cryptographic Algorithms	
7	Course Description	To familiarize with the basic taxonomy and terminology of computer networking area.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction	
	A	Study of Data Communication and Networking. Identify five components of Data communication system.	CO1, CO2
	B	Study of computer network topology and OSI model layered architecture.	CO1, CO2
	C	Study of basic networking commands: IPCONFIG, PING / Tracer and Net stat utilities to debug the network issues.	CO1, CO2
	Unit 2	Data Link Layer	
	A	To connect the computers in Local Area Network	CO1, CO2
	B	Write a C program to implement Character Stuffing and Destuffing	CO1, CO2
	C	Write a C program to Error Detection using Cyclic Redundancy Check Algorithms.	CO1, CO2
	Unit 3	Network Layer	
	A	Write a program to generate Hamming code.	CO1,CO3

	B	Write a C program to determine if the IP address is in Class A, B, C, D, or E.			CO1,CO3
	C	Write a C program to translate dotted decimal IP address into 32 bit address.			CO1,CO3,CO4
	Unit 4	Transport Layer			
	A	Write a program for congestion control using Leaky bucket algorithm.			CO1,CO4
	B	Write a Program to simulate Distance vector routing.			CO1,CO4,CO5
	C	Creating a Network topology using CISCO packet tracer software			CO1,CO4,CO5
	Unit 5	Application Layer			
	A	Write a program to implement DES for encryption.			CO1,CO5
	B	Using RSA algorithm encrypts a text data and decrypts the same.			CO1,CO5,CO6
	C	Open Ended Project			CO1,CO5,CO6
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	CE(Viva)	ETE	
		25%	25%	50%	
	Text book/s*	Tanenbaum, A.S." Computer Networks", 4th Edition, PHI			
	Other References	1. Forouzan, B.., "Communication Networks", TMH, Latest Edition 2. W. Stallings, "Data and Computer Communication" Macmillan Press			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Explain the basic concepts of computer network.	PO2,PO11,PO12,PSO2
2.	CO2: Illustrate and differentiate working of all layers of the OSI Reference Model and TCP/IP model	PO1,PO3,PO4,PO5,PO11PO12,PSO2
3.	CO3: Analyze fundamental issues driving network design including error control, IP addressing, access control, flow and congestion control	PO1,PO2,PO4,PO6,PSO1,PSO3
4.	CO4: Compare working of various routing algorithms	PO2,PO3,PSO2,PSO3
5.	CO5: Test various network security algorithms	PO1, PO2,PO3, PO4, PSO2
6.	CO6: Examine various cryptographic Algorithms	PO1, PO2, PO4,PO8 PO11, PSO2

PO and PSO mapping with level of strength for Course Name Computer Networks Lab (Course Code CSP252)

Computer Networks Lab (Course Code CSP252)		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	CO1		2	-	-	-	-	-	-	-	-	2	3	-	3	-
	CO2	2	-	2	2	3	-	-	-	-	-	2	3		3	-
	CO3	3	2	-	2	-	2	-	-	-	-	-	-	2	-	2
	CO4	-	2	2	-	-	-	-	-	-	-	-	-	-	2	2
	CO5	2	2	2	2	-	-	-	-	-	-	-	-	-	2	-
	CO6	2	-	-	2	-	-	-	2	-	-	2	-	-	2	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code/Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Computer Networks (CSP252)	1.5	1.33	1	1.33	0.5	0.33	-	0.33	-	-	1	1	0.33	2	0.67

Strength of Correlation

1. Addressed to *Slight (Low=1) extent* 2. Addressed to *Moderate (Medium=2) extent*
3. Addressed to *Substantial (High=3) extent*

School:		**School of Engineering & Technology**
Department		**Department of Computer Science & Engineering**
Program:		**B.Tech**
Branch:		**CSE**
1	Course Code	CSP243
2	Course Title	Object Oriented Programming Using Java Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory/Elective
5	Course Objective	To learn Java language syntax and semantics and concepts such as classes, objects, inheritance, polymorphism, packages and multithreading.
6	Course Outcomes	CO1. Define Object oriented programming concepts by identifying classes, objects, members of a class and relationships among them needed for a specific problem. CO2: Illustrate different features of java. CO3: Develop Java programs to solve problems of applications using OOP principles such as abstraction, polymorphism and inheritance. CO4:Categorize runtime errors thrown in the application software or generated runtime by applying the methods of exception handling and File I/O CO5. Explain the concept of multithreading. CO6. Design real life application using Java
7	Course Description	Basic Object Oriented Programming (OOP) concepts including objects, classes, methods, parameter passing, information hiding, inheritance and polymorphism are discussed.

8	Outline syllabus				CO Mapping
	Unit 1	**Introduction to Object Oriented Paradigm**			
		Program related to garbage collection and OOPS			CO1,CO2
	Unit 2	**Introduction to Java**			
		Program to take input from user, decision making and branching			CO1,CO2
	Unit 3	**Polymorphism**			
		Program related to string handling and polymorphism			CO1,CO2
	Unit 4	**Inheritance, package and Interface Inheritance Implementation**			
		Program related to inheritance and interfaces			CO2,CO3,CO6
	Unit 5	**Exception and Multithreading**			
		Program related to exception handling			CO4,CO6
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	CE(Viva)	ETE	
		25%	25%	50%	
	Text book/s*	1.Schildt H, "The Complete Reference JAVA2", TMH			

	Other References	3. Balagurusamy E, “Programming in JAVA”, TMH Professional Java Programming: Brett Spell, WROX Publication	

PO and PSO mapping with level of strength for Course Name Object Oriented Programming Using Java **(Course Code CSP243)**

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	CO1					2							2			
	CO2					2										
	CO3	2	3	3		2				3			2	2	3	
	CO4					2										
	CO5					2										
CSP243_ Object Oriented Programming Using Java Lab	CO6	3	3	3		2	3	2		3		2	3	3	3	2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Syllabus: CSP 244, Principles of Operating System Lab

School: SET		**Batch : 2023-27**	
Program: B.Tech		**Current Academic Year: 2023-24**	
Branch: CSE		**Semester: III**	
1	Course Code	**CSP 244**	
2	Course Title	Principles of operating System Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status		
5	Course Objective	Introduces different type operating systems, functions of operating systems, working in a Unix/Linux and Windows system, writing programs on Process management and file management.	
6	Course Outcomes	CO1: Working with single user multi task and multi-user multi-tasking environment. CO2: Identify and use utilities of Windows & Unix operating systems CO3: Use the resources of operating system i.e. process management and file management CO4: Writing programs on Process creation, multiple process creation, process synchronization, CO5: Writing program on basic file operations CO6: Writing program on file buffering.	
7	Course Description	The course is designed to make the students research/industry ready as operating systems are indispensable for the systems used in industries/research organizations. New operating systems for different gadgets are launched in last few years. So the students will get the design principles operating system in this course.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
		Illustration of Different types of operating system: Single user Multi task, Multi user Multi task	CO1
		Basic Windows features & Unix commands.	CO2
	Unit 2	**Processes**	
		Process basics: Creating processes using fork( ), the parent-child processes PID, PPID, process states: creating orphan, zombie processes.	CO2, CO3, CO4
	Unit 3	**Process Synchronization**	
		Creating multiple processes, Process table, use the command ps with –el, Synchronization of processes by using sleep( ) & wait( ), background process,	CO3, CO4
	Unit 4	**Files**	
		Basic file operations, Programs for File operations, sharing data between processes using files.	CO3, CO4,CO5
	Unit 5	**File Buffering**	

		File descriptor table, system file table, file pointer, buffer accessing block wise, use the functions: fopen( ), fread( ), ftell( ), lseek( ), fflush( ) etc.			CO3, CO4,CO6
	Mode of examination	Practical			
	Weightage Distribution	CA	CE(Viva)	ETE	
		25%	25%	50%	
	Text book/s*	1. Sumitabha Das, “Unix Concepts and Applications”, Tata McGraw Hill.			
	Other References	1. Unix: The complete Reference, Kenneth Rosen et.al., TMH 2. Unix ‘C’ Odessey, Meeta Gandhi et.al. BPB			

Course outline	
This course introduces the features of GUI i.e. Windows operating system as well as the CUI i.e. the commands used in Unix, so that the students will be familiar with both GUI & CUI environment of operating systems. As the course progresses the students will learn to write programs for process management and file operations. Further the students can implement the algorithms studied in theory by writing programs using the above principles and skills.	
Course Evaluation	
Attendance	None
Any other	CA judged on the practical conducted in the lab , weightage may be specified
References	
Text book	1. Sumitabha Das, “Unix Concepts and Applications”, Tata McGraw Hill.
Other References	1. Unix: The complete Reference, Kenneth Rosen et.al., TMH 2. Unix ‘C’ Odessey, Meeta Gandhi et.al. BPB
Software	Windows, Unix / Any Unix family OS i.e. Linux

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Working with single user multi task and multi-user multi-tasking environment.	PO1,PO2,PO3,PO4,PSO1
2.	CO2: Identify and use utilities of Windows & Unix operating systems	PO1, PO3, PO4, PSO2
3.	CO3: Use the resources of operating system i.e. process management and file management	PO1,PO2,PO3,PO4
4.	CO4: Writing programs on Process creation, multiple process creation, process synchronization,	PO9, PO10,PO11, PSO3

5.	CO5: Writing program on basic file operations	PO1,PO2,PO8,PO9,PO10,PSO1
6.	CO6: Writing program on file buffering.	PO1,PO2,PO10,PO11,PSO1,PSO2

PO and PSO mapping with level of strength for Course Name Principles of Operating System (Course Code CSP 244)

CSE244	Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
	CO 1	3	3	3	3	--	--	--	2	2	1	2	1	3	2	2
	CO 2	3	2	3	3	--	--	--	2	2	2	1	1	2	3	2
	CO 3	3	3	3	3	--	--	--	1	1	1	3	2	3	2	1
	CO 4	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
	Co5	2	2	3	-	-	-	-	3	3	1	2	-	3	-	-
	CO 6	3	2	-	-	-	-	-	-	-	2	3	-	2	2	-

School: SET		**Batch : 2023-27**	
Program: B.tech		**Current Academic Year: 2023-24**	
Branch: CSE / IT		**Semester: 3rd**	
1	Course Code	**CSP254**	Course Name: Project Based Learning -1
2	Course Title	Project Based Learning -1	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-4	
	Course Status	Compulsory	
5	Course Objective	1. To align student's skill and interests with a realistic problem or project 2.To understand the significance of problem and its scope 3.Students will make decisions within a framework	
6	Course Outcomes	Students will be able to: CO1: Identify and formulate problem statement with systematic approach. CO2: Develop teamwork and problem-solving skills, along with the ability to communicate effectively with others. CO3: Design the problem solution as per the problem statement framed. CO4: Classify and understand techniques for software verification and validation of project successfully. CO5: Fabricate and implement the solution by using different aspects of programming language. CO6: Develop a glory of the need to engage in life-long learning.	
7	Course Description	In PBL-1, the students will learn how to define the problem for developing projects, identifying the skills required for developing the project based on given a set of specifications and all subjects of that Semester.	

8	Outline syllabus		CO Mapping
	Unit 1	Problem Definition, Team/Group formation and Project Assignment. Finalizing the problem statement, resource requirement, if any.	CO1, CO2
	Unit 2	Develop a work flow or block diagram for the proposed system / software.	CO2,CO3
	Unit 3	Design algorithms for the proposed problem.	CO3
	Unit 4	Implementation of work under the guidance of a faculty member and obtain the appropriate results.	CO3, CO4
	Unit 5	Demonstrate and execute Project with the team. Validate and verify the project modules.	CO4, CO5, CO6
		Report should include Abstract, Hardware / Software Requirement, Problem Statement, Design/Algorithm, Implementation Detail. Validation Reports. References if any.	

		The presentation, report, work done during the term supported by the documentation, forms the basis of assessment.			
	Mode of examination	Practical /Viva			
	Weight age Distribution	CA	CE(Viva)	ETE	
		25%	25%	50%	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO)
1.	CO1: Identify and formulate problem statement with systematic approach.	PO1, PO2, PO4, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
2.	CO2: Develop teamwork and problem-solving skills, along with the ability to communicate effectively with others.	PO1, PO2, PO4, PO7, PO9, PO10, PO11, PO12 ,PSO3
3.	CO3: Design the problem solution as per the problem statement framed.	PO1, PO2, PO5, PO9, PO10, PO11, PO12, PSO1,PSO2
4.	CO4: Classify and understand techniques for software verification and validation of project successfully.	PO1, PO2, PO6, PO9, PO10, PO11, PO12,PSO2
5.	CO5: Fabricate and implement the solution by using different aspects of programming language.	PO1, PO2, PO3, PO4,PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12 PSO1,PSO2, PSO3
6.	CO6: Develop a glory of the need to engage in life-long learning.	PO1, PO2, PO4, PO9, PO10, PO11, PO12,PSO3

PO and PSO mapping with level of strength for Course Name Project Based Learning -1 (Course Code CSP254)

CO/PO Mapping (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Low															
Cos	Programme Outcomes(POs)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	-	3	-	-	-	-	3	3	2	3	2	2	1
CO2	3	2	-	3	-	-	2	-	3	3	2	3			1
CO3	3	2	-	-	2	-	-	-	3	3	2	3	2	2	
CO4	3	3	-	-	-	2	-	-	3	3	2	3		2	
CO5	3	3	2	2	2	2	3	3	3	3	2	3	2	2	
CO6	3	3	-	3	-	-	-	-	3	3	2	3			1
AvgPO attained	3	2.7	0.34	1.84	0.67	0.67	0.84	0.5	3	3	2	3	1	1.4	0.5

School: SET		**Batch : 2023-27**		
Program: B.tech		**Current Academic Year: 2023-24**		
Branch: CSE / IT		**Semester: 3rd**		
1	Course Code	**CSP292**	Course Name: Summer Internship-I	
2	Course Title	Summer Internship-I		
3	Credits	2		
4	Contact Hours (L-T-P)			
	Course Status	Compulsory		
5	Course Objective	This course will expose students to apply theories learned in the classroom and provides current technological developments relevant to the subject area of training. Students will be able to identify the career preferences and professional goals.		
6	Course Outcomes	Students will be able to: CO1: Get familiarize with industry principles and practices. CO2: Identify and analyze an appropriate problem. CO3: Develop teamwork and apply prior acquired knowledge in problem solving. CO4: Demonstrate effective verbal and written communication skills. CO5: Practice engineer's responsibilities, self-understanding, self-discipline and ethical standards. CO6: Identify the career preferences and professional goals.		
7	Course Description	The Internship aims to offer students the opportunity to apply their prior acquired knowledge in problem solving. Students will acquire skills important for time management, discipline, self learning, and effective communication and so on.		
8	Outline syllabus			CO Mapping
	Unit 1	Define objectives and conditions for the internship, ensuring students that it is related to the study path carried out at the University		CO1,CO6
	Unit 2	Problem Definition and identification, Team/Group formation and Project Assignment. Finalizing the problem statement, resource requirement, if any.		CO2,CO6,
	Unit 3	The internship work plan is drawn up by developing team work and applies prior acquired knowledge in problem solving.		CO3,CO6,
	Unit 4	Demonstrate and execute Project with the team. Submission of evaluation form and final report completed by the intern.		CO4,CO6
	Unit 5	Final evaluation form completed by the supervisor at the Host Organization and final presentation before departmental committee.		CO5,CO6
	Mode of examination	Theory		
	Weight age Distribution	CA		CE(Viva)
		25%		25%

	Text book/s* Other References			ETE	
				50%	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO)
1.	CO1: Get familiarize with industry principles and practices.	PO1
2.	CO2: Identify and analyze an appropriate problem.	PO2,PO3,PO5,PSO1,PSO2
3.	CO3: Develop teamwork and apply prior acquired knowledge in problem solving.	PO1,PO2, PO3,PO9,PSO1
4.	CO4: Demonstrate effective verbal and written communication skills.	PO10
5.	CO5: Practice engineer's responsibilities, self-understanding, self-discipline and ethical standards.	PO6,PO8
6.	CO6: Identify the career preferences and professional goals.	PO12,PSO1

PO and PSO mapping with level of strength for Course Name Summer Internship-I

CO/PO Mapping (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Low															
Cos	Programme Outcomes(POs)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	2	-	2	-	-	-	-	-	-	-	2	2	-
CO3	2	2	3	-	-	-	-	-	3	-	-	-	1	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO5	-	-	-	-	-	2	-	3	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-
Avg PO attained	1	0.84	0.84	0	0.34	0.34	0	0.5	0.5	0.5	0	0.34	0.64	0.34	0

TERM - IV

2.1 Template A1: Syllabus for Theory Subjects

School: SET		**Batch : 2023-27**	
Program: B.Tech		**Current Academic Year: 2023-24**	
Branch: Mechanical Engineering		**Semester: IV**	
1	Course Code	HMM305	
2	Course Title	Management for Engineers	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	The objective of this course is to expose the students to understand the basics of Management Foundations. The students will be given a detailed grounding for the theories and cases related to the general management. The aim of the course is to orient the students in theories and practices of Management so as to apply the acquired knowledge in actual business practices. This is a gateway to the real world of management and decision-making.	
6	Course Outcomes	CO1: Define basic principles and concepts related to management in an organization including the functions, different theories of management and roles they play in an organization. CO2: Explain the primary function Planning with its process. Also, how forecasting is done in organizations with various techniques are used. CO3: Use of organizing by studying different types of organization and also using decentralization and span of control in organizations. CO4: Analyse jobs, recruitment process, manpower planning, job rotation, trainings and rewards in various organizations. CO5: Measure motivation and management control concepts to obtain effective controlling in management system in organizations. CO6: Develop proper system in an organization by using all the functions of management.	
7	Course Description	This course gives an overview of engineering management and help to understand the various functions of management used in an organization. The focus of the course is the development of individual skills and team work.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction of Management & Organisation	CO1,CO6
	A	Management-Definition of Management & Organisation	CO1,CO6
	B	Concept, Nature, Scope and Functions of Management, Levels of Management, Management Theories - Taylors principle, Fayol’s Principles, Hawthorne Studies, Systems Approach and Contingency Approach to Management.	CO1,CO6

	C	Mintzberg's Managerial Roles, Skills of Manager, Functions of management			CO1,CO6
	Unit 2	Management Planning Process			CO2,CO6
	A	Planning objectives and characteristics.			CO2,CO6
	B	Hierarchies of planning.			CO2, CO6
	C	The concept and techniques of forecasting.			CO2,CO6
	Unit 3	Organizing			C03,C06
	A	Meaning, Importance and Principles			C03,C06
	B	Departmentalization, Span of Control			CO3,CO6
	C	Types of Organization, Authority, Delegation of Authority			CO3,CO6
	Unit 4	Staffing			CO4,C06
	A	Meaning, Job analysis			CO4,C06
	B	Manpower planning, Recruitment, Transfers and Promotions			CO4, CO6
	C	Appraisals, Management Development, Job Rotation, Training, Rewards and Recognition,			CO4, CO6
	Unit 5	Directing & Controlling			CO5,CO6
	A	Motivation, Co-ordination, Communication,			CO5,CO6
	B	Directing and Management Control, Decision Making,			CO5,CO6
	C	Management by objectives (MBO) the concept and relevance. Objectives and Process of Management Control			CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Principles & practice of Mgmt., L.M. Prasad			
	Other References	1. Management Today, Burton & Thakur 2. Principles & Practices of Mgmt., C.B. Gupta 3. Understanding Management, Richard L.Daft 4. Management, Stoner, Freemand & Gilbert 5. Essential of Management, Koontz O' Donnel			

BTY223 (Introduction to Biology for Engineers)

School: SET		**Batch : 2023-27**
Program: B Tech		**Current Academic Year: 2023-24**
Branch:		**Semester:**
1	Course Code	**BTY223**
2	Course Title	**Introduction to Biology for Engineers**
3	Credits	2
4	Contact Hrs (L-T-P)	2-0-0
	Course Status	**Compulsory**
5	Course Objective	Students will be introduced to the functions and interactions of biological systems from a quantitative perspective. To provide a foundation in biology with engineering of living systems and to apply various tools of traditional engineering fields. To harness potential of living systems for the benefit of human mankind.
6	Course Outcomes	After the successful completion of this course students will be able to: CO1 Analyze the fundamentals of living things, their classification, cell structure and biochemical constituents. CO2: Examine the concept of plant, animal and microbial systems and growth in real life situations. CO3: Discuss bout genetics and the immune system. CO4: Inspect the cause, symptoms, diagnosis and treatment of common diseases. CO5: Elaborate the basic knowledge of biological systems in relevant industries CO6: Appraise the potential of living system for the benefit of environment and human kind and ecosystem.
7	Course Description	Introduction to Biology designed foundation for careers in for basics of biotechnology, or research in all branches of the Engineering sciences.

8	Outline syllabus		CO Mapping
	Unit 1	**INTRODUCTION TO LIFE PROCESSES & BIOTECHNOLOGY**	
	A	Characteristics of living organisms; Cell theory; structure of Prokaryotic and Eukaryotic Cell	CO1, CO6
	B	Introduction to Biotechnology and its interdisciplinary applications	
	C	Introduction to Bioinformatics and biological databases; and their applications in various fields of science	
	Unit 2	**Biomolecules**	
	A	General classification and important functions of carbohydrates and lipids	CO2, CO6

	B	General classification and important functions of proteins			
	C	General classification and important functions of DNA and RNA			
	Unit 3	**Genetics and Immune system**			
	A	Theories of Evolution			CO3, CO6
	B	Mendel's laws of inheritance; human genome project			
	C	Immune system and Immunity; role of immunity in viral diseases: case studies of COVID-19			
	Unit 4	**Human Diseases; Prevention and Cure**			
	A	Genetic diseases and Infectious diseases and role of biotechnology in cure of these diseases			CO4, CO6
	B	AIDS and Diabetes and role of biotechnology in cure of AIDS and diabetes			
	C	Cancer its causes and role of biotechnology in cure of cancer			
	Unit 5	**UNIT V: Biotechnology and its Industrial applications**			
	A	Genetic Engineering: Applications of Recombinant DNA Technology across various fields: medicine, food, agriculture, diagnostics, therapeutics etc.			CO5, CO6
	B	Application of biotechnology in agriculture and waste management: Bioremediation, Biopesticides, Biofertilizers			
	C	Production of recombinant proteins and vaccines; Bioreactors			
	Mode of examination	**Theory**/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Berger, S. et al. *Introduction to Bioengineering*, 2020 edition Oxford University Press (ISBN: 978-0-19-856515-4)			
	Other References	1. Alberts, B. et al. *Essential Cell Biology*, 2018 Garland Publishing, Inc. (ISBN: 081533480X) 4.			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	1	-	-	-	1	3	-	-	3
CO2	3	-	-	1	-	-	-	-	3	-	-	3
CO3	3	3	3	2	3	-	-	-	2	-	-	2
CO4	3	3	3	2	3	-	-	1	-	-	-	2
CO5	3	-	3	1	-	2	2	2	3	-	-	3
CO6	3	3	3	3	3	3	1	2	3	-	-	2
Avg. Wt.	3	1.50	2.00	1.66	1.50	0.83	0.5	1	2.33	0	0	2.50

Syllabus: CSP 249, Database management System

School: SET		**Batch : 2023-27**	
Program: B.Tech		**Current Academic Year: 2023-24**	
Branch: CSE		**Semester: IV**	
1	Course Code	CSE249	Course Name
2	Course Title	**Database Management System**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status		
5	Course Objective	1.Develop the ability to design, 2. Implement and manipulate databases. 3. Introduce students to build data base management systems. 4. Apply DBMS concepts to various examples and real life applications.	
6	Course Outcomes	Students will be able to: **CO1:** Explain the basics concepts of data base. **CO2:** Demonstrate the knowledge of databases to E-R modelling. **CO3:** Ability to design entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries on the respective data. **CO4:** Apply normalization techniques to reduce redundancy from the database. **CO5:** To appraise the basic issues of Transaction processing, Serializability& concurrency control **CO6:** Design & develop database for real life problems	
7	Course Description	This course introduces database design and creation using a DBMS product. Emphasis is on, normalization, data integrity, data modeling, and creation of simple tables, queries, reports, and forms. Upon completion, students should	

		be able to design and implement normalized database structures by creating simple database tables, queries, reports, and forms.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Databases:**	
	A	Introduction of DBMS, Characteristic of DBMS, Data Models, Database languages, Database Administrator, Database Users.	CO1,CO2,CO6
	B	Three Schema architecture of DBMS, Data Models, Hierarchical, Network ,Data independence and database language, DDL, DML, Data Modeling using Entity Relationship Model	
	C	Strong Entity, Weak entity, Specialization and generalization, converting ER Model to relational tables.	
	Unit 2	**Relational Database Language and Interfaces:**	
	A	Relational data model concepts ,Concept of keys, Mapping Constraints	CO3
	B	Null Values, Domain Constraints, Referential Integrity Constraints	
	C	Unary Relational Operations: SELECT and PROJECT Relational Algebra Operations from Set Theory ,Binary Relational Operations: JOIN and DIVISION ,SQL.	
	Unit 3	**Normalization in Design of Databases:**	
	A	Functional Dependency, Different anomalies in designing a Database, loss less join decompositions	CO1, CO4, CO6
	B	Normalization : first second and third normal forms, BoyceCodd normal form, dependency preservation,	
	C	multi-valued dependencies , fourth normal forms, Inclusion dependencies,	
	Unit 4	**Transaction Management:**	
	A	Transaction processing system, schedule and recoverability, Testing of serializability,	

	B	Serializability of schedules, conflict & view serializable schedule	CO5
	C	Recovery from transaction failures, deadlock handling.	
	Unit 5	**Concurrency Control**	
	A	Two-Phase Locking Techniques for Concurrency Control , Concurrency Control Based on Timestamp Ordering	CO5
	B	Multiversion Concurrency Control Techniques ,Validation (Optimistic) Concurrency Control Techniques	
	C	Granularity of Data Items and Multiple Granularity Locking	
	Mode of examination	Theory	
	Weightage Distribution	CA / MTE / ETE	
		25% / 25% / 50%	
	Text book/s*	1. Korth , Silberschatz&Sudarshan, Data base Concepts, Tata McGraw-Hill, Latest Edition	
	Other References	1.Elmasri, Navathe, Fundamentals of Database Systems, Pearson Education Inc. 2.Thomas Connolly, Carolyn Begg, Database Systems: A Practical Approach to design, Implementation and Management, Pearson Education, Third Edition.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Understand the basics concepts of data base.	PO1, PO6, PO12, PSO1,PSO2
2.	Acquire the knowledge of databases to E-R modelling.	PO1 , PO5 , PO6 ,PO9, PO12, PSO1 PSO2
3.	Ability to design entity relationship and convert entity relationship diagrams into	PO1, PO2, PO3, PO5, PO6, PO12 PSO1, PSO2

	RDBMS and formulate SQL queries on the respective data.	
4	Learn the basic concept of normalization & apply them to reduce redundancy from the database .	PO1, PO2, PO3, PO4, PO6 ,PO8 PO9 ,PO12 , PSO3
5	To appraise the basic issues of Transaction processing ,Serializability& concurrency control	PO1, PO2, PO3, PO5, PO6, PO8 PO12 ,PSO2
6	Design & develop database for real life problems	PO1, PO2, PO3, PO4, PO5, PO6 PO8 ,PO9 ,PO10 ,PO11, PO12 PSO3

PO and PSO mapping with level of strength for Course Name Database Management System (Course Code CSE 249)

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	-	2	-	-	-	-	-	3	3	3	-
CO2	2	-	-	-	3	2	-	-	2	-	-	3	3	3	-
CO3	3	3	3	-	3	2	-	-	-	-	-	2	2	3	-
CO4	3	3	3	3	-	2	-	2	3	-	-	2	-	-	3
CO5	2	3	2	-	2	2	-	2	-	-	-	1	-	3	-
CO6	3	3	3	3	3	3	-	3	3	3	2	3	-	-	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code/ Name	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CSE 249/ DBMS	2.67	3	2.75	3	2.75	2.2	-	2.3	2.7	3	2	2.3	2.6	3	3

Strength of Correlation:1. Addressed to ***Slight (Low=1) extent 2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Syllabus for Introduction of Entrepreneurship Development (IED001)

School: SET		**Batch : 2023-27**	
Program: B. Tech		**Current Academic Year: 2023-24**	
Branch: CSE		**Semester:IV**	
1	Course Code	IED001	
2	Course Title	Introduction of Entrepreneurship Development	
3	Credits	2	
4	Contact Hours (L-T-P)	0-1-2	
	Course Status	**CORE**	
5	Course Objective	Entrepreneurship plays an influential role in the economic growth and development of the country. As the world economy is changing so is the dynamism of the business world. The aim of this course is to instil and kindle the spirit of Entrepreneurship amongst students. The idea of this course is to create "job providers rather than job seekers".	
6	Course Outcomes	**After successfully completion of this course students will be able to:** CO1. To understand how start up entrepreneurship is supportive for enhancing business. CO2. Outline different ways of idea generation as innovator. CO3. Identify & utilize various Government policy for Small Scale Enterprises and its impact on Business. CO4. Analyze various financial schemes available to start up their enterprise. CO5. Assess the importance & significance of institutional support at various levels for determining the entrepreneurial climate. CO6. Develop the art of creativity and innovations in managing the entrepreneurial activities effectively.	
7	**Outline syllabus**		**CO Mapping**
	Unit A	**Introduction to Entrepreneurship**	**CO1**
	Unit A Topic 1	Meaning, Definition and concept of Enterprise, Entrepreneurship and Entrepreneurship Development, Evolution of Entrepreneurship	CO1
	Unit A Topic 2	Theories of Entrepreneurship. Characteristics of Entrepreneurship, Concepts of Intrapreneurship, Entrepreneur v/s Intrapreneur, Entrepreneur Vs. Entrepreneurship, Entrepreneur Vs. Manager	CO1
	Unit A Topic 3	Role of Entrepreneurship in Economic Development, Factors affecting Entrepreneurship, Problems of Entrepreneurship	CO1
	Unit B	**Entrepreneurship Journey as Innovator**	**CO2**
	Unit B Topic 1	Idea generation, Feasibility Study and opportunity assessment	CO2
	Unit B Topic 2	Business Plan: meaning, purpose and elements, Execution of Business Plan	CO2
	Unit B Topic 3	Entrepreneurs as problem solvers, Innovations and Entrepreneurial Ventures – Global and Indian,	CO2, CO6
	Unit C	**Setting Up Small Business Enterprises**	**CO3**
	Unit C Topic 1	Identifying the business Opportunity – Business opportunity in various Sectors – Formalities for setting up a small Business Enterprise	CO3

	Unit C Topic 2	Benefits to Small Scale Enterprises: Tax Holiday, Rehabitation Allowance, Investment Allowance,	CO3
	Unit C Topic 3	Government policy for Small Scale Enterprises: New Small Enterprise Policy 1991, Micro Small & Medium Enterprises Development (MSMED) Act 2006	CO3, CO6
	Unit D	**Role of Government in promoting Entrepreneurship**	**CO4**
	Unit D Topic 1	MSME policy in India, Agencies for Policy Formulation and Implementation: District Industries Centres (DIC), Entrepreneurship Development Institute of India (EDII),	CO4, CO6
	Unit D Topic 2	National Institute of Entrepreneurship & Small Business Development (NIESBUD), National Entrepreneurship Development Board (NEDB),	CO4, CO6
	Unit D Topic 3	Financial Support System: long term and short-term financial support, Investment Institutions.	CO4, CO6
	Unit E	**IPM & Institutional support for small businesses in India**	**CO5**
	Unit E Topic 1	Intellectual Property Management, Importance of innovation, patents & trademarks in small businesses,	CO5
	Unit E Topic 2	Introduction to laws relating to IPR in India, Support in areas of entrepreneurship development	CO5
	Unit E Topic 3	Case Studies based on Role of Industry 4.0 in innovations, Case Studies based on IPR & Patents	CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	CA: 25% ; CE (VIVA): 25 ; ESE: 50%	
	Text book/s*	1. Udyamita by Dr. MMP. Akhouri and S.P Mishra, By National Institute for Entrepreneurship and Small Business Development (NIESBUD), NSIC-PATC Campus, Okhla 2. Entrepreneurial Development by Dr S S Khanka, S Chand & Company Ltd 3. Entrepreneurship Development & Small Business Enterprises by Poornima M Charantimath, Pearson. 4. Lall & Sahai: Entreprenurship (Excel Books 2 edition) Couger, C- Creativity and Innovation (IPP, 1999) 5. Kakkar D N - Enterpreneurship Development (Wiley Dreamtech)	

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1. To understand how start up entrepreneurship is supportive for enhancing business.	PO5, PO9, PO11, PO12
2.	CO2. Outline different ways of idea generation as innovator.	PO1, PO2, PO3, PO4, PO5, PO6
3.	CO3. Identify & utilize various Government policy for Small Scale Enterprises and its impact on Business.	PO10, PO11, PO12
4.	CO4. Analyze various financial schemes available to start up their enterprise.	PO10, PO11, PO12
5.	CO5. Assess the importance & significance of institutional support at various levels for determining the entrepreneurial climate.	PO4, PO7, PO12

6.	CO6. Develop the art of creativity and innovations in managing the entrepreneurial activities effectively.	PO2, PO3, PO4, PO5, PO11, PO12

PO and PSO mapping with level of strength for Course Name Introduction of Entrepreneurship Development (Course Code IED001)

Course Code_ Course Name	**CO's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
IED001_ Introduction of Entrepreneurship Development	CO1	-	-	-	-	1	-	-	-	2	-	2	3	-	-	-
	CO2	1	1	2	3	3	3	-	-	-	-	-	-	-	-	-
	CO3	-	-	-	-	-	-	-	-	-	3	2	3	-	-	-
	CO4	-	-	-	-	-	-	-	-	-	1	3	1	-	-	-
	CO5	-	-	-	1	-	-	3	-	-	-	-	2	-	-	-
	CO6	-	1	3	2	1	-	-	-	-	-	1	2	-	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO11**	**PSO2**	**PSO3**
IED001	Introduction of Entrepreneurship Development	1	1	2.5	2	1.67	3	3	0	2	2	2	2.2	0	0	0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Syllabus: CSE 251, Theory of Computation

School: SET		**Batch : 2023-27**		
Program: B.Tech		**Current Academic Year: 2023-24**		
Branch:CSE		**Semester:IV**		
1	Course Code	CSE-251	Course Name: Theory of Computation	
2	Course Title	Theory of Computation		
3	Credits	4		
4	Contact Hours (L-T-P)	3-1-0		
	Course Status			
5	Course Objective	The goal of this course is to provide students with an understanding of basic concepts in the theory of computation.		
6	Course Outcomes	Students will be able to: **CO1: Formulate** the concept of Automata and related terminology. **CO2: Design** DFA and NDFA and conversion from NDFA to DFA. **CO3: Construct** finite automata without output and with output. **CO4:Implement** regular expression and grammar corresponding to DFA and vice-versa **CO5: Design** Push down Automata from Context Free Language or Grammar and vice-versa. **CO6: Design** Turing Machine for computational problems, Develop a clear understanding of un-decidability.		
7	Course Description	The course introduces some fundamental concepts in automata theory and formal languages including grammar, finite automaton, regular expression, formal language, pushdown automaton, and Turing machine. Not only do they form basic models of computation, they are also the foundation of many branches of computer science, e.g. compilers, software engineering, concurrent systems, etc. The properties of these models will be studied and various rigorous techniques for analyzing and comparing them will be discussed, by using both formalism and examples.		
8	Outline syllabus			CO Mapping
	Unit 1	**Finite Automata**		
	A	Introduction to languages, Kleene closures, Finite Automata (FA), Transition graph, Nondeterministic finite Automata (NFA), Deterministic finite Automata (DFA).		CO1, CO2
	B	Equivalence of NDFA and DFA, Construction of DFA from NFA and optimization of Finite Automata.		CO1, CO2
	C	Applications and Limitation of FA. (FAT tool).		CO1, CO2
	Unit 2	**Regular Expression and Finite Automata**		
	A	Regular Expression, Finite Automata with null move, Regular Expression to Finite Automata.		CO1, CO2,CO4
	B	Arden Theorem, Pumping Lemma for regular expressions.		CO1, CO2,CO4
	C	FA with output: Moore machine, Mealy machine and Equivalence.		CO1, CO2,CO3
	Unit 3	**REGULAR & CONTEXT FREE LANGUAGE**		
	A	Defining grammar, Chomsky hierarchy of Languages and Grammar. Ambiguous to Unambiguous CFG.		CO4
	B	Simplification of CFGs.		CO4
	C	Normal forms for CFGs, Pumping lemma for CFLs.		CO4

	Unit 4	**PUSH DOWN AUTOMATA**			
	A	Description and definition of PDA and Non-Deterministic PDA, Working of PDA.			CO5
	B	Acceptance of a string by PDA with final state and with Null store. Two stack PDA.			CO5
	C	Conversion of PDA into CFG, Conversion of CFG into PDA.			CO5
	Unit 5	**TURING MACHINE**			
	A	Turing machines (TM): Basic model, definition and representation, Language acceptance by TM.			CO6
	B	Turing machine as a computational machine, Halting problem of TM, Universal TM (Visual Turing machine).			CO6
	C	Modifications in TM, Undecidability of Post correspondence problem, Church's Thesis, Godel Numbering.			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science(Automata, Languages and Computation)", PHI			
	Other References	1.Peter Linz, "Formal Languages and Auomata", Narosa Publishing House 2.Hopcroft, Ullman, "Introduction to Automata Theory, Language and Computation", Narosa Publishing House			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:** Formulate the concept of Automata and related terminology.	PO1,PO2,PO3,PO4,PO5, PO9,PO12,PSO1,PSO2
2.	**CO2:** Design DFA and NDFA and conversion from NDFA to DFA.	PO1, PO3, PO4, PO5, PO9, PO12 PSO2, PSO3
3.	**CO3:** Construct finite automata without output and with output.	PO1,PO2,PO3,PO4, PO9,PSO1,PSO2
4.	**CO4:** Implement regular expression and grammar corresponding to DFA and vice-versa	PO1,PO2,PO3, PO5,PO9, PO12 PSO3
5	**CO5:** Design Push down Automata from Context Free Language or Grammar and vice-versa .	PO1,PO2,PO3,PO4, PO5, PO9, PO12,PSO1,PSO2,PSO3
6	**CO6:** Design Turing Machine for computational problems,Develop a clear understanding of un-decidability.	PO1,PO2,PO3,PO4,PO5PO9, PO12, PSO1, PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Theory of Computation **(Course Code CSE251)**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	2	--	--	--	3	--	--	3	3	2	--
CO 2	3	--	3	3	2	--	--	--	2	--	--	2	--	3	2
CO 3	3	3	3	3	--	--	--	--	2	--	--	--	3	2	--
CO 4	2	2	2	--	2	--	--	--	3	--	--	2	--	--	3
CO 5	3	3	3	3	3	--	--	--	--	--	--	3	3	2	2
CO 6	3	2	3	3	3	--	--	--	2	--	--	3	3	3	2

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE251	TOC	2.8	2.1	2.8	2.5	2	0	0	0	2	0	0	2.1	2	2	1.5

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School: SET		**Batch: 2023-27**	
Department		**Department of Computer Science & Engineering**	
Program: B.Tech		**Current Academic Year: 2023-24**	
Branch:CSE		**Semester:IV**	
1	Course Code	CSE 011	
2	Course Title	Mathematical Techniques	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Elective-I	
5	Course Objective	The objective of the course is to teach students the mathematical & statistical techniques that provide sound basis for research and application development in Computer Science.	
6	Course Outcomes	By the end of the course, students will be able to: CO1: Identify and analyze computational errors in numerical computation and series approximation. CO2: Make use of various Numerical techniques for interpolation. CO3: Recall probability concepts and statistical terms to apply in various random situations CO4: Identify various distributions for suitable scenario CO5: Make use of various techniques for hypothesis testing CO6: Apply mathematical and statistical methods in their research and application development	
7	Course Description	In this subject, the fundamental concepts and principles of Mathematical & Statistical Techniques together with the challenging issues in Computer Science software development will be introduced. Discussion on various topics related to mathematics and Computer Science will also be conducted.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction, Computational Errors and their Analysis**	
	A	Accuracy of numbers, Errors and a general error formula, Errors in Numerical Computations.	CO1, CO6
	B	Errors in a Series Approximation.	CO1, CO6
	C	Precisions	CO1, CO6
	Unit 2	**Numerical Techniques**	
	A	LU decomposition for systems of linear equations;	CO2, CO6
	B	numerical solutions of non-linear algebraic equations by Secant, Bisection and Newton-Raphson Methods;	CO2, CO6
	C	Numerical integration by trapezoidal and Simpson's rules.	CO2, CO6
	Unit 3	**Probability**	
	A	Probability: Conditional Probability;	CO3,CO6
	B	Mean, Median, Mode and Standard Deviation;.	CO3,CO6
	C	Random Variables; Distributions;	CO3,CO6
	Unit 4	**Permutation**	
	A	uniform, normal, exponential	CO4,CO6
	B	Poisson, Binomial distribution	CO4,CO6
	C	Permutations; Combinations; Counting; Summation;	CO4,CO6
	Unit 5	**Hypothesis testing**	
	A	Generating functions; recurrence relations;	CO5,CO6
	B	Techniques for statistical quality control,	CO5,CO6
	C	Testing of hypotheses.	CO5,CO6

	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	M. Goyal, "Computer Based Numerical & Statistical Techniques", Infinity Science Press, LLC, MA, USA.			
	Other References	1. Matheus Grasselli and Dimitry Pelinovsky, "Numerical Mathematics", Jones and Bartlet Publishers, USA. 2. Lars Elden, "Mattrix Methods in Data Mining and Pattern Recognition", SIAM (Society for Industrial and Applied Mathematics), USA. Internet as a resource for references.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Identify and analyze computational errors in numerical computation and series approximation.	PO1, PO2, PSO1
2.	CO2: Make use of various Numerical techniques for interpolation.	PO1, PO2, PO3, PO7, PO10, PO11, PO12, PSO1, PSO2
3.	CO3: Recall probability concepts and statistical terms to apply in various random situations	PO1, PO2, PO3, PO4, PO7, PO10, PO11, PO12, PSO1,PSO2
4.	CO4: Identify various distributions for suitable scenario	PO1, PO2, PO3, PO4, PO5, PO7, PO10, PO11, PO12, PSO1, PSO2
5.	CO5: Make use of various techniques for hypothesis testing	PO1, PO2, PO3, PO4, PO5, PO7, PO10, PO11, PO12, PSO1, PSO2
6.	CO6: Apply mathematical and statistical methods in their research and application development	PO1, PO2, PO3, PO4, PO5, PO7, PO10, PO11, PO12, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name Mathematical techniques (Course Code CSE011)

Course	Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO 1	PSO2	PSO3
Mathematical techniques (CSE011)	CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
	CO2	2	3	1	1	1	-	1	-	-	1	2	1	1	1	-
	CO3	3	1	1	1	-	-	1	-	-	2	1	1	3	1	-
	CO4	2	3	2	1	1	-	1	-	-	1	1	1	2	1	-
	CO5	1	1	1	2	2	-	1	-	-	1	2	1	2	1	-
	CO6	3	1	3	1	2	-	2	-	-	2	2	3	3	1	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE011	Mathematical techniques	2.3	1.8	1.3	1	1	0	1	0	0	1.1	1.3	1.1	2.1	.8	0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School: SET		**Batch : 2023-27**	
Program: B.Tech		**Current Academic Year: 2023-24**	
Branch:CS/IT		Semester:IV	
1	Course Code	CSE012	Course Name: Introduction to Graph Theory and its Application
2	Course Title	Introduction to Graph Theory and its Application	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Elective-I	
5	Course Objective	The objective of the course is to teach students the basic graph theory concepts and their applications in computer science.	
6	Course Outcomes	After successful completion of the course students will be able to CO1: demonstrate some of the most important notions and types of graph theory and develop their skill in solving basic applications and understanding societal needs. CO2: interpret the fundamentals of graphs and trees and to apply these as computer science applications such as to find a minimal spanning tree for a given weighted graph etc. CO3: Discover the advanced properties and concepts of graphs such as cut-sets and circuits in graphs, planarity of graphs etc in addition to their application in the real-world. CO4: Examine a graph using matrices to communicate their application in the real world. CO5: Develop efficient graph-theoretic algorithms (mathematically) to explore the applications of coloring problems of graph theory. CO6: Relating the concepts to prepare grounds for project work and research interests.	
7	Course Description	This course is to teach students the basic graph theory concepts and their applications in computer science.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction	
	A	Basic terminologies and concepts of Graph Theory, Fundamental types of graphs, Applications in various areas	CO1
	B	Properties of graphs, theorems based on different types of graph and various operations on graphs	CO1,CO2
	C	Special types of graphs (Hamiltonian, Euler), Travelling salesman problem	CO1, CO6
	Unit 2	TREES	
	A	Fundamentals of trees and their types, Binary trees and their properties, importance of binary trees in data structure (searching algorithms)	CO2
	B	fundamental circuits, spanning trees, algorithms to find spanning trees in a weighted graph (Kruskal& Prim)	CO2
	C	Applications: Representation of the algebraic expressions as ordered binary trees, Huffman procedure for construction of an optimal tree for a given set of weights.	CO2, CO6
	Unit 3	CUT SETS	
	A	a cut-set of a connected graph, the fundamental circuit ,Properties of circuits & cut–sets, Concept of connectivity and separability	CO1, CO3

	B	Concept of Planar graphs with introduction to Kuratowski's non-planar graphs, Proof of Euler's formula			CO3
	C	Detection of planarity , geometric duals of graph, thickness & Crossings, network flow			CO3, CO6
	Unit 4	Coloring and Covering			
	A	Concept of proper coloring of vertices of a graph, chromatic number , Chromatic partitioning			CO5, CO6
	B	Chromatic polynomial, finding chromatic polynomial of a given graph			CO5, CO6
	C	Matching, Covering, Five color problem and its proof			CO5, CO6
	Unit 5	Matrix Representation of Graphs& Applications			
	A	Incidence matrix, sub matrices of A(G), circuit matrix, fundamental circuit matrix and Rank of B			CO3, CO4
	B	Cut set matrix , fundamental cut set matrix, path matrix, Adjacency matrix			CO4
	C	Finding Rank of different matrices, Relationship among A_f, B_f, andC_f			CO3, CO4
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Deo, N, *Graphtheory with applications to Engineering and Computer Science*, Prentice Hall India			
	Other References	1. Wilson R J, *Introduction to Graph Theory*, PearsonEducation 2. Harary, F, *Graph Theory*, Narosa 3. Bondy& Murthy, *Graph theory and application*. Addison Wesley			

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: : demonstrate some of the most important notions and types of graph theory and develop their skill in solving basic applications understanding societal needs.	PO1, PO2, PO6, PO7, PO10, PO11, PO12, PSO1
2.	CO2: interpret the fundamentals of graphs and trees and to apply these as computer science applications such as to find a minimal spanning tree for a given weighted graph etc.	PO1, PO2, PO3, PO4, PO6, PO7, PO10, PO12, PSO1
3.	CO3: Discover the advanced properties and concepts of graphs such as cut-sets and circuits in graph, planarity of graphs etc in addition to their application in real-world.	PO2, PO4, PO5,PO6, PO10, PO12, PSO2
4.	CO4: Examine a graph using matrices to communicate their application in real world.	PO2, PO4, PO10,PSO1, PSO2,
5.	CO5: Develop efficient graph-theoretic algorithms (mathematically) to explore the applications of coloring problem of graph theory.	PO1, PO2, PO4, PO5, PO6, PO10, PO12, PSO2
6	CO6: Relating the concepts to prepare grounds for project work and research interests.	PO4, PO6,PO12,PO10, PSO2, PSO3.

PO and PSO mapping with level of strength for Course Name: Introduction to Graph Theory and its Application (CSE 012)

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	1	2	2	-	-	2	1	2	3	1	-
CO2	3	3	3	2	-	1	1	-	-	1	-	2	3	1	-
CO3	1	3	1	3	2	2	-	-	-	1	-	2	2	2	-
CO4	1	3	1	3	1	1	-	-	-	2	-	1	3	2	-
CO5	2	2	2	3	2	1	-	-	-	1	-	2	1	2	-
Co6	1	1	2	3	1	2	-	-	-	2	-	2	1	2	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE012	Introduction to Graph Theory and its Application	1.83	2.83	1.83	2.67	1.17	1.5	0.5	-	-	1.5	0.17	1.83	2.17	1.67	0.33

Strength of Correlation

1. Addressed to *Slight (Low=1) extent* *2.* Addressed to *Moderate (Medium=2) extent*
3. Addressed to *Substantial (High=3) extent*

Syllabus: CSP 249, Database management System Lab

School: SET		**Batch : 2023-27**	
Program: B.Tech		**Current Academic Year: 2023-24**	
Branch:CSE		**Semester: IV**	
1	Course Code	CSP249	
2	Course Title	Database Management System Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	• To Develop efficient SQL programs to access Oracle databases • Build database using Data Definition Language Statements • Perform operations using Data Manipulation Language statements like Insert, Update and Delete	
6	Course Outcomes	By the end of this course you will be able to: CO1: Understand the concept of SQL commands in DBMS CO2: Create SQL SELECT statements that retrieve any required data CO3: Perform operations using Data Manipulation Language statements like Insert, Update and Delete CO4: Manipulate your data to modify and summaries your results for reporting CO5: Apply Grouping Clauses on various tuples & relations of database CO6: Develop project based on various SQL commands.	
7	Course Description	An introduction to the design and creation of relational databases. Create database-level applications and tuning robust business applications. Lab sessions reinforce the learning objectives and provide participants the opportunity to gain practical hands-on experience.	
8	Outline syllabus		CO Mapping
	Unit 1	**Practical based Data types**	
		Classification SQL, Data types of SQL/Oracle	CO1,CO2
	Unit 2	**Practical based on DDL commands**	
		Create table, Alter table and drop table	CO2,CO3
	Unit 3	**DML commands and Aggregate functions**	
		Introduction about the INSERT, SELECT, UPDATE & DELETE commands.	CO3,CO4
	Unit 4	**Practical based on Grouping Clauses GROUP BY ORDER BY & GROUP BY HAVING**	
		Briefly explain Group by, order by ,having clauses with examples. Aggregate function: sum, avg, count, max, min	CO5
	Unit 5	**Practical based on Sub- queries, JOINS**	

		Related example of Sub- queries, Joins and related examples,Views,Trigger			CO5,CO6
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	CE(Viva)	ETE	
		25%	25%	50%	
	Text book/s*	1. Korth ,Silberschatz& Sudarshan, Data base Concepts, Tata McGraw-Hill			
	Other References	1. Elmasri, Navathe, Fundamentals of Database Systems, Pearson Education Inc. 2. *Thomas Connolly, Carolyn Begg, Database Systems: A Practical Approach to design, Implementation and Management, Pearson Education, Latest Edition.* 3. Jeffrey D. Ullman, Jennifer Windon, A first course in Database Systems, Pearson Education.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Understand the concept of SQL commands in DBMS.	PO1,PO5, PSO1 ,PSO2
2.	CO2: Create SQL SELECT statements that retrieve any required data.	PO2, PO3, PO4, PO5, PO9,PSO1, ,PSO3
3.	CO3: Perform operations using Data Manipulation Language statements like Insert, Update and Delete.	PO2, PO3, PO4, PO5, PO9,PSO1, ,PSO3
4.	CO4: Manipulate your data to modify and summaries your results for reporting.	PO2, PO3, PO4, PO5, PO9,PSO1, ,PSO3
5	CO5: Apply Grouping Clauses on various tuples & relations of database	PO2, PO3, PO4, PO5, PO9,PSO1, ,PSO3
6	CO6: Develop project based on various SQL commands.	PO2, PO3, PO4, PO5, PO9, PO12,PSO1, PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Principles of Database Management System lab (Course Code CSP 249)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	-	-	-	-	-	-	-	2	3	2
CO2	-	3	3	3	2	-	-	-	3	-	-	-	2	3	3
CO3	-	2	2	2	2	-	-	-	3	-	-	-	2	2	3
CO4	-	2	2	2	2	-	-	-	3	-	-	-	2	2	3
CO5	-	2	2	2	2	-	-	-	3	-	-	-	2	2	3
CO6	-	2	3	2	3	-	-	-	3	-	-	2	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code/ Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO 3
CSP249 / DBMS lab	3	2.2	2.4	2.2	2.2	-	-	-	3	-	-	2	2.2	2.5	2.8

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

.School: SET		**Batch : 2023-27**	
Program: B.tech		**Current Academic Year: 2023-24**	
Branch: CSE / IT		**Semester: 4th**	
1	Course Code	**CSP297**	Course Name: Project Based Learning -2
2	Course Title	Project Based Learning -2	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-4	
	Course Status	Compulsory	
5	Course Objective	1. To align student's skill and interests with a realistic problem or project 2.To understand the significance of problem and its scope 3.Students will make decisions within a framework	
6	Course Outcomes	Students will be able to: CO1: Identify and formulate problem statement with systematic approach. CO2: Develop teamwork and problem-solving skills, along with the ability to communicate effectively with others. CO3: Design the problem solution as per the problem statement framed. CO4: Explain the characteristics, architecture of database approach, describe the components of the project. CO5: Fabricate and implement the solution by using different object oriented concepts like encapsulation, polymorphism etc. CO6: Develop a glory of the need to engage in life-long learning.	
7	Course Description	In PBL-1, the students will learn how to define the problem for developing projects, identifying the skills required for developing the project based on given a set of specifications and all subjects of that Semester.	

8	Outline syllabus		CO Mapping
	Unit 1	Problem Definition, Team/Group formation and Project Assignment. Finalizing the problem statement, resource requirement, if any.	CO1, CO2
	Unit 2	Develop a work flow or block diagram for the proposed system / software.	CO2,CO3
	Unit 3	Design algorithms for the proposed problem.	CO3
	Unit 4	Implementation of work under the guidance of a faculty member and obtain the appropriate results.	CO3, CO4
	Unit 5	Demonstrate and execute Project with the team. Validate and verify the project modules.	CO4, CO5, CO6
		Report should include Abstract, Hardware / Software Requirement, Problem Statement, Design/Algorithm, Implementation Detail. Validation Reports. References if any.	

		The presentation, report, work done during the term supported by the documentation, forms the basis of assessment.			
	Mode of examination	Practical /Viva			
	Weight age Distribution	CA	CE(Viva)	ETE	
		25%	25%	50%	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO)
1.	CO1: Identify and formulate problem statement with systematic approach.	PO1, PO2, PO4, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
2.	CO2: Develop teamwork and problem-solving skills, along with the ability to communicate effectively with others.	PO1, PO2, PO4, PO7, PO9, PO10, PO11, PO12 ,PSO3
3.	CO3: Design the problem solution as per the problem statement framed.	PO1, PO2, PO5, PO9, PO10, PO11, PO12, PSO1,PSO2
4.	CO4: Explain the characteristics, architecture of database approach, describe the components of the project.	PO1, PO2, PO6, PO9, PO10, PO11, PO12,PSO2
5.	CO5: Fabricate and implement the solution by using different object oriented concepts like encapsulation, polymorphism etc.	PO1, PO2, PO3, PO4,PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12 PSO1,PSO2, PSO3
6.	CO6: Develop a glory of the need to engage in life-long learning.	PO1, PO2, PO4, PO9, PO10, PO11, PO12,PSO3

PO and PSO mapping with level of strength for Course Name Project Based Learning -1 (Course Code CSP297)

CO/PO Mapping (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Low															
Cos	Programme Outcomes(POs)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	-	3	-	-	-	-	3	3	2	3	2	2	1
CO2	3	2	-	3	-	-	2	-	3	3	2	3			1
CO3	3	2	-	-	2	-	-	-	3	3	2	3	2	2	
CO4	3	3	-	-	-	2	-	-	3	3	2	3		2	
CO5	3	3	2	2	2	2	3	3	3	3	2	3	2	2	
CO6	3	3	-	3	-	-	-	-	3	3	2	3			1
Avg PO attained	3	2.7	0.3	1.8	0.7	0.7	0.8	0.5	3	3	2	3	1	1.3	0.5

TERM - V

School:		**School of Engineering & Technology**		
Department		**Department of Computer Science & Engineering**		
Program:		**B. Tech.**		
Branch:		**Computer Science and Engineering**		
1	Course Code	CSE021		
2	Course Title	Introduction to Cloud Computing		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core		
5	Course Objective	This introductory course on Cloud computing will teach both the fundamental concepts of how and why Cloud systems works, as well as Cloud technologies that manifest these concepts.		
6	Course Outcomes	At the end of the course, students will have achieved the following learning objectives. CO1. Define the basics of cloud and recall the computer Science concepts which are helpful in understanding on demand service architecture. CO2. Classify and describe the architecture and taxonomy of parallel and distributed computing, including shared and distributed memory, and data and task parallel computing. CO3. Apply the PAAS and SAAS to manage the workflow and use of cloud in scientific application. CO4. Categorize and Characterize between Infrastructure services, deployment models, and governance in cloud computing. Examine the design of task and data parallel distributed algorithms for Clouds and use them to construct Cloud applications. CO5. Evaluate the importance of cloud using monitoring and management of services for performance improvement of HPC and to follow the Governance and Compliances.		

		CO6. Elaborate the design concept and formulate to build the solution using cloud service providers as AWS, MS Azure, Google Cloud.Demonstrate the use of Map-Reduce, Vertex-Centric and Continuous Dataflow programming models.	
7	Course Description	This course is an introductory course for cloud computing concepts and helps in understanding the core functionalities, algorithms, models and workflows in cloud environment. In this course Students will get demonstrations of real-time cloud services for better exposure and research understanding.	
8	Outline syllabus		CO Mapping
	Unit 1	**FOUNDATIONS**	
	A	**Introduction to compute** Types of Computing, Grid computing, distributed computing, Client-server computing, Three Tier Architecture, use of Sockets and Remote Procedure Call, working of RMI and CORBA, Web services, Web Sockets, Message Queues and Message Brokers.	CO1
	B	**Introduction to Cloud Computing** Cloud Computing definition, Roots of Cloud Computing, Layers and Types of Clouds, Desired Features of a Cloud, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Challenges and Risks	CO1
	C	**Migrating and Integrating into Cloud** Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud, Enriching the 'Integration as a Service' Paradigm for the Cloud Era, Evolution and Challenges of SaaS Paradigm, Integration Scenarios, The Integration Methodologies	CO1
	Unit 2	**ENTERPRISE CLOUD COMPUTING AND IAAS**	
	A	**The Enterprise Cloud Computing Paradigm** Issues for Enterprise Applications on the Cloud, Transition Challenges, Enterprise Cloud Technology and Market Evolution, Business Drivers Toward a Marketplace for Enterprise Cloud Computing, The Cloud Supply Chain	CO1,CO2
	B	**Virtual Machines Provisioning and Migration Services** Introduction to Virtual Machines,The Anatomy of Cloud Infrastructures, VM Provisioning and Manageability, Virtual	CO1,CO2

		Machine Migration Services, Management of Virtual Machines for Cloud Infrastructures,, Distributed Management of Virtual Infrastructures, Scheduling Techniques	
	C	**Enhancing Cloud Computing Environments Using a Cluster as a Service** Introduction and Related Work, RVWS Design, Cluster as a Service: The Logical Design, Secure Distributed Data Storage in Cloud Computing, Cloud Storage, Technologies for Data Security in Cloud Computing	CO1,CO2
	Unit 3	**PLATFORM AND SOFTWARE AS A SERVICE**	
	A	**Aneka and Comet Cloud** Aneka—Integration of Private and Public Clouds, Technologies and Tools for Cloud Computing, Aneka Cloud Platform, Comet Cloud: An Autonomic Cloud Engine, Introduction of Comet Cloud (Architecture, Autonomic Behavior, Applications overview)	CO1,CO3
	B	**Business Solutions and Workflow** Cloud-Based Solutions for Business Applications (Introduction of Enterprises Demand and Cloud Computing, Dynamic ICT Services), Workflow Engine for Clouds, Workflow Management Systems, Architecture of Workflow Management Systems	CO1,CO3, CO6
	C	**Scientific Applications and Map Reduce Model** Scientific Application for Cloud Environments, Classification of Scientific Applications and Services in the Cloud, SAGA-based Scientific Applications, Map Reduce Programming Model, Map Reduce Impacts and Research Directions	CO1,CO3, CO6
	Unit 4	**MONITORING, MANAGEMENT & GOVERNANCE**	
	A	**SLA Management in Cloud Computing** Introduction of typical Use Cases, Model for Federated Cloud Computing, Security Considerations, SLA Management in Cloud Computing: A Service Provider's Perspective, Types of SLA, Life Cycle of SLA, Automated Policy-based Management	CO1,CO4
	B	**Performance Predictions for HPC on Clouds** Introduction and Background of Grid and Cloud, HPC in the Cloud: Performance-related Issues, Game Hosting on Cloud	CO1,CO4

		Resources, Building Content Delivery Networks Using Clouds, Resource Cloud Mashups			
	C	**Security and Governance** Basic Concept of Organizational Readiness, Drivers for Changes: Common Change Management Models, Security and Risk in the Cloud, Cloud Computing and Identity, Content Level Security—Pros and Cons, Legal Issues in Cloud Computing(PCI DSS), Data Privacy and Security Issues			CO1,CO4
	Unit 5	**AWS, MS AZURE AND GOOGLE CLOUD**			
	A	AWS Services:EC2, IAM, S3, Lambda, EBS, CDN, Cloud Watch,			CO1,CO5, CO6
	B	MS Azure Services: Azure VM , SQL Server on Virtual Machines, Azure SQL Database, Azure Active Directory, Azure Backup			CO1,CO5, Co6
	C	Google Cloud: Compute Engine, Migrate for Compute Engine, Cloud Functions, Gsuite Admin,Cloud Lab Balancing ,Cloud Storage			CO1,CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	CLOUD COMPUTING Principles and Paradigms, Edited by Raj Kumar Buyya, Jam Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter			
	Other References				

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Define the basics of cloud and recall the computer Science concepts which are helpful in understanding on demand service architecture. Classify and describe the architecture and taxonomy of parallel and distributed computing, including shared and distributed memory, and data and task parallel computing.	PO1,PO2,PO3,PO4
2.	Define the basics of cloud and recall the computer	PO1,PO2,PO3,PO4
3.	Apply the PAAS and SAAS to manage the workflow and use of cloud in scientific application.	PO1,PO2,PO3,PO4,PSO2 ,PSO3
4.	Categorize and Characterize between Infrastructure services, deployment models, and governance in cloud computing. Examine the design of task and data parallel distributed algorithms for Clouds and use them to construct Cloud applications.	PO1,PO2,PO3,PO4,PSO2 ,PSO3
5.	Evaluate the importance of cloud using monitoring and management of services for performance improvement of HPC and to follow the Governance and Compliances	PO1,PO2,PO3,PO4,PSO2 ,PSO3
6.	Elaborate the design concept and formulate to build the solution using cloud service providers as AWS, MS Azure, Google Cloud.Demonstrate the use of Map-Reduce, Vertex-Centric and Continuous Dataflow programming models.	PO1,PO2,PO3,PO4,PSO1 ,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Introduction to Cloud Computing **(Course Code CSE021)**

Course Code_ Course Name	**CO's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
Introduction to Cloud Computing **(Course Code CSE021)**	**CO1**	2	3	1	2											
	CO2	2	2	2	3											
	CO3	1	3	1	2										2	3
	CO4	3	1	2	2										3	2
	CO5	2	2	3	1										2	2
	CO6	1	3	1	2									2	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
		1.83	2.33	1.66	2									.33	1.66	1.67

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

2.1 Template A1: Syllabus for Theory Courses (SAMPLE)

School:		**School of Engineering & Technology**			
Department		**Department of Computer Science & Engineering**			
Program:		**B.Tech**			
Branch:		**Computer Science and Engineering**			
1	Course Code	CSE023			
2	Course Title	Android Application Development			
3	Credits	2			
4	Contact Hours (L-T-P)	2-0-0			
	Course Status	Core /Elective/Open Elective			
5	Course Objective	1. Basics of Android OS 2. Develop Basic and advance Android Apps			
6	Course Outcomes	CO1: Define anatomy of an android application. CO2: Compare different components of Android Application CO3: Develop various android applications related to layouts and rich uses interactive interfaces. CO4:Analyze essential android programming concept CO5: Access and work with databases under an android operating system. CO6: Develop Basic and advance android app development for android devices.			
7	Course Description	This android development course will help students to Understand the basis of Android Platform and its lifecycle. This will help them to implement simple GUI applications, use built-in components and work with database to store the data.			

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction and Architecture of Android**	
	A	History of Android, Features of Android, Open Handset Alliance (OHA) , Advantages of Android	CO1
	B	Android Directory Structure, Architecture of Android.	CO1
	C	Structure of Manifest files,	CO1
	Unit 2	**Components of Android**	
	A	Activity, Activity life cycle	CO1,CO2
	B	Services, service life cycle	CO1,CO2
	C	Content Provider, Broadcast receivers	CO1,CO2
	Unit 3	**User Interfaces**	
	A	Layouts-Linear layout, Relative layout, Constraint layout, Table layout	CO3

	B	Input Controls – Text input, Checkboxes, Radio buttons, Button, Spinner, Toggle buttons	CO3
	C	Dialog, date picker, Time picker	CO3
	Unit 4	**Intent & Notification**	
	A	Intents, Intent Filter	CO4, CO6
	B	Implicit intent, Explicit Intent	CO4, CO6
	C	Notification	CO4, CO6
	Unit 5	**Working with SQL Lite**	
	A	Introduction to SQLite database, Steps for connecting application with database.	CO5,CO6
	B	Fetch and update data in database from application,	CO5,CO6
	C	Cursor and content value, opening and closing database	CO5,CO6
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	CA 25% | MTE 25% | ETE 50%	
	Text book/s*	1. Anubhav Pradhan and Anil V. Deshpande, Composing Mobile Apps: Learn, Explore, Apply Using Android, 1st Edition, Wiley India.	
	Other References	1. Wei-Meng Lee , Beginning Android 4 Application Development. 2. Neil Smyth ,Android Studio Development essentials-Android 6	

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Demonstrate and understanding anatomy of an android application.	PO5,PO9,PO12,PSO3
2.	CO2: Develop various android applications related to layouts and rich uses interactive interfaces.	PO5,PO9,PO12,PSO3
3.	CO3:Apply essential android programming concept	PO3,PO5,PO9,PO12,PSO1,PSO3
4.	CO4: Distinguish and	PO5,PO9,PO11,PO12,PSO3

	compare different components of Android	
5.	CO5: Access and work with databases under an android operating system.	PO3,PO4,PO5,PO7,PO9,PO11,PO12,PSO3
6.	CO6: Develop Basic and advance android app development for android devices	PO1,PO2,PO3,PO4,PO5,PO7,PO9,PO11,PO12,PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Android Application Development **(Course Code** CSE023**)**

Course Code_ Course Name	**CO's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CSE023_ Android Application Development	**CO1**					**3**				**2**			**1**			**2**
	CO2					**3**				**2**			**1**			**2**
	CO3			**2**		**3**				**2**			**1**	**2**		**2**
	CO4					**3**				**2**		**2**	**1**			**2**
	CO5			**2**	**3**	**3**		**2**		**2**		**2**	**1**			**2**
	CO6	**1**	**2**	**3**	**3**	**3**	**3**	**3**		**3**		**3**	**1**	**3**	**3**	**3**

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CSE023	**Android Application Development**	**1**	**2**	**2.3**	**3**	**3**	**3**	**2.5**	**0**	**2.2**	**0**	**2.3**	**1**	**2.5**	**3**	**2.2**

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

2.1 Template A1: Syllabus for Theory Courses

School:		**School of Engineering & Technology**		
Department		**Department of Computer Science & Engineering**		
Program:		**B-Tech**		
Branch:		**Computer Science and Engineering**		
1	Course Code			
2	Course Title	Web Technologies		
3	Credits	2		
4	Contact Hours (L-T-P)	2-0-0		
	Course Status	Core /Elective/Open Elective		
5	Course Objective	The objective of this course is to provide a foundation of technologies and technical skills in web development. Based upon the development of a web, this course provides an insight of computer and networking technologies, and hands on experience in web programming.		
6	Course Outcomes	CO1: Define the basic concept of HTML CO2: Illustrate the basics of PHP CO3:Develop interactive web pages using HTML5 and CSS3 CO4: Design web pages/site having validation on user data access. CO5:Compare relationship of HTML,Javascript and PHP CO6:Develop web site for business and organization or for individual		
7	Course Description	The purpose of this course is to give students the basic understanding of Web pages and technologies to be used for designing web sites.		
8	Outline syllabus		CO Mapping	
	Unit 1	**HTML & HTML 5**		
	A	HTML basic tags, various links implementation, image ,image map, table formatting, Lists, form design.	CO1	
	B	Page layout design using frame, div and span tag, iframe	CO1	
	C	HTML5: New elements, canvas, offline webpage, HTML Media: video, audio	CO1,CO3	
	Unit 2	**CSS &CSS3**		
	A	Introduction, syntax, selector: class and id, text formatting, margin, align, pseudo-class, pseudo-element	CO3	
	B	Positioning, background formatting, Navigation bar, and image gallery.	CO3	
	C	CSS3: Introduction, colors, text formatting, fonts formatting, Background formatting, 2D transform, animation	CO3	
	Unit 3	**Java script**		

	A	Introduction, syntax, comment, statement, variable, operators			CO4,CO5
	B	Conditional statements, looping statements, Functions			CO4,CO5
	C	Object, events, Accessing form elements, validating form elements,popup windows.			CO4,CO5
	Unit 4	**PHP Basics**			
	A	Introduction to PHP, syntax, variables, operators			CO2,CO5
	B	Conditional statement, iterative statements,Functions			CO2,CO5
	C	Array: single, multi dimensional, numeric array, associative array			CO2,CO5
	Unit 5	**File Handling in PHP**			
	A	File Operation: Reading & writing data on web page from file, deleting file, renaming file			CO5,CO6
	B	Session Management: introduction, creation, destroying and login session management			CO5,CO6
	C	PHP Database Connectivity, Retrieving records, retrieving fields from record			CO5,CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Ivan Bayross,"HTML,DHTML, JavaScript, Perl & CGI", BPB Publication 2. Schildt H, "The Complete Reference JAVA2", TMH 3. Schildt H, "The Complete Reference J2EE", TMH			
	Other References	1. Rick Delorme," Programming in HTML5 with JavaScript and CSS3", Microsoft			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Define the basic concept of HTML	PO5,PSO2
2.	Illustrate the basics of Extensible markup language.	PO5,PSO2,PO12
3.	Develop interactive web pages using HTML5 and CSS3	PO2,PO3,PO5,PO6,PO9, PSO1,PSO2,PSO3
4.	Design web pages/site having validation on user data access.	PO2,PO3,PO5,PO6,PO9, PSO1,PSO2,PSO3
5.	Compare relationship of HTML,Javascript and PHP	PO5,PSO2

6.	Develop web site for business and organization or for individual	PO1, PO2,PO3,PO4,PO5,PO6, PO7,PO9,PO11,PO12,PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Web Technologies **(Course Code CSE352)**

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
	CO 1					1									1	
	CO 2					3							1		1	
	CO 3		1	3		2	1			2				1	2	2
	CO 4		1	3		1	1			2				1	2	2
	CO 5					2									1	
CSE352_ Web Technologies	**CO 6**	2	3	3	1	3	3	1		3		2	2	1	2	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Cse 352	**Web Technologies**	2	1.6	2.3	1	2	1.6	1	0	2.2	0	2.3	1.5	1	1.5	2.2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Syllabus: Design and Analysis of Algorithm lab

School:		**Batch : 2023-27**
Program:		**Current Academic Year: 2023-24**
Branch:		**Semester:V**
1	Course Code	CSP 350
2	Course Title	**Design and Analysis of Algorithm lab**
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory/Elective
5	Course Objective	Objective of this course is to 1. Reinforce basic design concepts (e.g., pseudocode, specifications, top-down design) 2. Knowledge of algorithm design strategies 3. Familiarity with an assortment of important algorithms. 4. Enable students to analyze time and space complexity
6	Course Outcomes (same as theory course)	Students will be able to: **CO1: calculate** time complexity of searching algorithm **CO2**: **Write** program based on dynamic programming. **CO3: apply** greedy algorithm to any problem **CO4: develop** program based on advanced data structure CO5: **design** a program based on different string matching algorithm CO6**: implement** real world problem based on greedy and dynamic algorithm
7	Course Description	This course introduces concepts related to the design and analysis of algorithms. Specifically, it discusses recurrence relations, and illustrates their role in asymptotic and probabilistic analysis of algorithms. It covers in detail greedy strategies divide and conquer techniques, dynamic programming and max flow - min cut theory for designing algorithms, and illustrates them using a number of well-known problems and applications.

8	Outline syllabus		CO Mapping
	Unit 1	**Practical based on Searching and sorting**	
		1. WAP to demonstrate the concept of Linear and Binary Search 2. WAP to implement Merge sort 3. WAP to implement Quick Sort	CO1
	Unit 2	**Practical based on Dynamic Programming**	
		1. WAP to implement Matrix Chain Multiplication problem 2. WAP to demonstrate the concept of Longest Common Subsequence(LCS) 3. WAP to demonstrate concept of 0 – 1 Knapsack Problem	CO2, CO6
	Unit 3	**Practical based on Greedy Programming**	

		1. WAP to demonstrate concept of Minimum Spanning Tree(Prim's Algorithm) 2. WAP to demonstrate concept of Fractional Knapsack Problem 3. WAP to implement single source shortest problem using Dijkstra's Algorithm			CO3, CO6
	Unit 4	**Practical based on Advance concepts**			
		WAP to demonstrate concept of Red Black Tree insertion and Deletion			CO4
	Unit 5	**Practical based on String Matching**			
		1. WAP to demonstrate the concept of Naïve String matching algorithm. 2. WAP to demonstrate the concept of Robin Karp Algorithm.			CO5
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	CE(Viva)	ETE	
		25%	25%	50%	
	Text book/s*	-			
	Other References				

PO and PSO mapping with level of strength for Course Name Design and Analysis of Algorithms Lab. Course Code CSP 350)

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	3	1	--	--	-	2	-	-	-	2	3	3
CO 2	2	3	3	2	2	--	--	-	2	-	-	-	3	2	2
CO 3	3	2	2	-	3	--	--	-	1	-	-	-	2	1	-
CO 4	2	3	3	3	1	--	--	-	3	-	-	-	3	3	1
CO 5	3	2	2	3	2	-	-	-	2	-	-	-	2	3	2
CO 6	2	3	3	1	3	-	-	--	1	-	-	-	3	2	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CSP 350	**Design and Analysis of Algorithms Lab**	2.5	2.7	2.5	2.4	2	-	-	-	1.8	-	-	-	2.5	2.3	2.2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Branch: CSE / IT		Semester: 5th	
1	Course Code	**CSP354**	Course Name: Project Based Learning -3
2	Course Title	Project Based Learning -3	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-4	
	Course Status	Compulsory	
5	Course Objective	1. To align student's skill and interests with a realistic problem or project. 2.To understand the significance of problem and its scope. 3.Students will make decisions within a framework.	
6	Course Outcomes	Students will be able to: CO1: Identify and formulate problem statement. CO2: Design relational database schema. CO3: Develop the solution by using different aspects of programming language. CO4: Classify and understand various test techniques for verification and validation of project. CO5: Analyze and make use of modern for solving real word problems. CO6: Develop teamwork and need to engage in life-long learning, along with the ability to communicate effectively with others.	
7	Course Description	In PBL-3, the students will learn how to define the problem for developing projects, and Design applicable solutions in one or more application domains using software engineering approaches that integrate ethical, social, legal and economic concerns.	

8	Outline syllabus		CO Mapping
	Unit 1	Problem Definition and identification, Team/Group formation and Project Assignment. Finalizing the problem statement, resource requirement, if any.	CO1,CO4
	Unit 2	Use of the relational algebra operations from mathematical set theory (union, intersection, difference, and Cartesian product) and the relational algebra operations developed specifically for relational databases (select (restrict), project, join, and division)..	CO2,CO6
	Unit 3	Design; implement project work in any programming language.	CO3
	Unit 4	Use of various test tools and techniques for software verification and validation of project	CO4,CO5
	Unit 5	Demonstrate and execute Project with the team.	CO6
		Report should include Abstract, Hardware / Software Requirement, Problem Statement, Design/Algorithm, ER diagrams, Use Case Diagrams, State Diagrams, Sequence Diagrams, Communication Diagrams, and Activity Diagrams, Implementation Detail. Validation Reports.	

		References, Test cases if any. The presentation, report, work done during the term supported by the documentation, forms the basis of assessment.			
	Mode of examination	Practical /Viva			
	Weight age Distribution				
		CA	CE(Viva)	ETE	
		25%	25%	50%	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO)
1.	CO1: Identify and formulate problem statement.	PO1, PO2, PO4,PO6, PO8,PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
2.	CO2: Design relational database schema.	PO1, PO2, PO3,PO4,PO5, PO7, PO8, PO9, PO11, PO12 , PSO1,PSO2,PSO3
3.	CO3: Develop the solution by using different aspects of programming language.	PO1, PO2, PO3,PO4,PO5, PO6, PO8, PO9, PO11, PO12, PSO1,PSO2
4.	CO4: Classify and understand various test techniques for verification and validation of project.	PO1, PO2, PO3,PO4,PO5, PO8,PO9, PO10, PO11, PO12 ,PSO1,PSO2,PSO3
5.	CO5: Analyze and make use of modern for solving real word problems.	PO1, PO2, PO5, PO6, PO7, PO8, PO9, PO12 PSO1,PSO2
6.	CO6: Develop teamwork and need to engage in life-long learning, along with the ability to communicate effectively with others.	PO2, PO4, PO8,PO9, PO10, PO11, PO12,PSO1,PSO3

PO and PSO mapping with level of strength for Course Name Project Based Learning -3 (Course Code CSP354)

CO/PO Mapping (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Low															
Cos	Programme Outcomes(POs)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	-	2	-	1	-	1	2	-	2	1	2	2	3
CO2	3	2	2	2	2	-	-	1	2	-	2	1	2	1	1
CO3	3	2	2	2	2	3	-	1	2	-	2	1	2	2	-
CO4	3	3	2	2	3	-	-	1	2	-	-	1	2	2	2
CO5	3	2	-	-	3	-	-	1	2	-	-	1	2	2	-
CO6		1	-	1	-	-	-	2	2	3	3	3	1	-	1
Avg PO attained	3	2.2	1	1.5	1.7	0.7	0	1.2	2	1	2	1	2	1.5	1.2

Syllabus: CSP 391, Summer Internship-II

School: SET		**Batch: 2023-27**	
Program:B.Tech		**Current Academic Year: 2023-24**	
Branch: CSE		**Semester-v**	
1	Course Code	CSP391	Course Name: **Summer Internship-II**
2	Course Title	**Summer Internship-II**	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	UG	
5	Course Objective	1. Experience the activities and functions of business professionals. 2. Develop and refine oral and written communication skills. 3. Identify areas for future knowledge and skill development.	
6	Course Outcomes	Students will be able to: CO1. Integrate the concepts and strategies of academic study in a real time environment. CO2. Identify, formulate and model problems and find engineering solution based on a systems approach. CO3. Develop teamwork and apply prior acquired knowledge in problem solving. CO4. Develop communication, interpersonal and other critical skills required for career growth. CO5. Practice engineer's responsibilities, self-understanding, self-discipline and ethical standards. CO6. Explore career alternatives prior to graduation.	
7	Course Description	An internship experience provides the student with an opportunity to explore career interests while applying knowledge and skills learned in the classroom in a work setting. The experience also helps students gain a clearer sense of what they still need to learn and provides an opportunity to build professional networks.	

8	Outline syllabus				CO Mapping
	Unit 1	Define objectives and conditions for the internship, ensuring students that it is related to the study path carried out at the University			**CO1,CO2**
	Unit 2	Problem Definition and identification, Team/Group formation and Project Assignment. Finalizing the problem statement, resource requirement, if any.			**CO2**
	Unit 3	The internship work plan is drawn up by developing team work and applies prior acquired knowledge in problem solving.			**CO3**
	Unit 4	Demonstrate and execute Project with the team. Submission of evaluation form and final report completed by the intern.			**CO4**
	Unit 5	Final evaluation form completed by the supervisor at the Host Organization and final presentation before departmental committee.			**CO5,CO6**
	Mode of examination	Practical			
	Weightage Distribution	CA	CE(Viva)	ETE	
		25%	25%	50%	

	Text book/s*	NA
	Other References	NA

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO)
1.	CO1. Integrate the concepts and strategies of academic study in a real time environment.	PO1,PO2,PO4,PO5,PO7, PO8,PO9,PSO1,PSO2,PSO3
2.	CO2. Identify, formulate and model problems and find engineering solution based on a systems approach.	PO1,PO2,PO3, PO4,PO5,PO7, PO8,PO9, PSO1,PSO2
3.	CO3. Develop teamwork and apply prior acquired knowledge in problem solving.	PO1,PO3,PO4,PO5, PO8,PO9,PO11, PO12, PSO1,PSO2,PSO3
4.	CO4. Develop communication, interpersonal and other critical skills required for career growth.	PO8,PO10
5.	CO5. Practice engineer's responsibilities, self-understanding, self-discipline and ethical standards.	PO6,PO8
6.	CO6. Explore career alternatives prior to graduation.	PO12,PSO1,PSO2

PO and PSO mapping with level of strength for Course Name Summer Internship-II (CSP391)

CO/PO Mapping (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Low															
Cos	Programme Outcomes(POs)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	2	-	3	2	-	1	1	1	-	-	-	1	2	2
CO2	1	2	1	2	2	-	1	1	1	-	-	-	1	2	-
CO3	2	-	2	2	2	-	-	1	3	-	1	1	1	2	2
CO4	-	-	-	-	-	-	-	1	-	3	-	-	-	-	-
CO5	-	-	-	-	-	2	-	3	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	2	2	2	-
Avg PO attained	1	0.7	0.5	1.2	1	0.3	0.3	1.2	1	1	0	1	1	1.3	0.7

Technical Skill Enhancement Course-1 (Simulation Lab)

School: SET		**Batch : 2023-27**	
Program: B.TECH		**Current Academic Year: 2023-24**	
Branch:CSE		**Semester: V**	
1	Course Code	CSP 395	Technical Skill Enhancement Course-1 (Simulation Lab)
2	Course Title	Simulation Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Lab	
5	Course Objective	The objective of this course is to provide the basic programming concepts of MATLAB such as – functions, arrays, loops, conditional statements, procedures.It alsoexpose students with visual representations of a model and its results.	
6	Course Outcomes	Students will be able to: **CO1:**Use basic fundamentals to write simple Matlab programs. **CO2:** Plot graphs in Matlab and use procedural functions. **CO3**: Writing Matlab programs with logic and flow control. **CO4:**Manipulate and work with text files. **CO5**:Make use of graphical user interfaces in MATLAB. **CO6**: Apply MATLAB Programming to solve real life problem	
7	Course Description	This course introduces the concepts of MATLAB programming, Modelling and simulation to identify the problems, and choose the relevant models and algorithms to apply. Matlab is used for scientific applications involving images, sound, and other signals.	
8	Outline syllabus		CO Mapping
	UNIT-1	**Introduction to MATLAB**	CO1,CO6
	A	Programming Environment: MATLAB Windows, A First Program	
	B	Expressions, Constants, Variables and assignment statement	
	C	Arrays	
	UNIT-2	**Graph Plots&Procedures and Functions**	CO2,CO6
	A	Basic plotting, Built in functions, Generating waveforms, Sound replay, load and save	
	B	Procedures and Functions: Arguments and return values, M-files	
	C	Formatted console input-output, String handling	
	UNIT-3	**Control Statements**	CO3,CO6
	A	Conditional statements: If, Else, Else-if	
	B	Repetition statements: While	
	C	Repetition statements: for loop	

	UNIT-4	**Manipulating Text**			CO4,CO6
	A	Writing to a text file, Reading from a text file			
	B	Randomising and sorting a list			
	C	Searching a list			
	UNIT-5	**GUI Interface**			CO5,CO6
	A	Attaching buttons to actions			
	B	Getting Input, Setting Output			
	C	Develop MATALB Application			
	Mode of examination				
	Weightage Distribution	Project on Simulation based	CE(Viva)	ETE	
		25%	25%	50%	
	Text book/s*				
	Other References	1.			

CO and PO Mapping

Mapping between Cos and Pos, PSO's		
Sl. No.	**Course Outcomes (COs)**	**Mapped Program Outcomes and PSO's**
1	**CO1:**Use basic fundamentals to write simple Matlab programs.	**PO1,PO3,PO5,PO12,PSO1,PSO2,PSO3**
2	**CO2:** Plot graphs in Matlab and use procedural functions.	**PO1,PO3,PO5,PO10,PO12,PSO1,PSO2,PSO3**
3	**CO3**: Writing Matlab programs with logic and flow control.	**PO1,PO2,PO3,PO5,PO12,PSO1,PSO2,PSO3**
4	**CO4:**Manipulate and work with text files.	**PO1,PO3,PO5,PO12,PSO1,PSO2,PSO3**
5	**CO5**:Make use of graphical user interfaces in MATLAB.	**PO1,PO3,PO5,PO12,PSO1,PSO2,PSO3**
6	**CO6**: Apply MATLAB Programming to solve real life problem	**PO1,PO2,PO3,PO4,PO5,PO6,PO7,PO8,PO9,PO10,PO11,PO12,PSO1,PSO2,PSO3**

PO and PSO mapping with level of strength for Course Name: Technical Skill Enhancement Course-1 CSP 395)

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO1 1	PO 12	PSO 1	PSO2	PSO3
CO1	1	-	1	-	2	-	-	-	-	-	-	1	1	2	1
CO2	1	-	1	-	2	-	-	-	-	2	-	1	1	2	1
CO3	1	2	1	-	2	-	-	-	-	-	-	1	1	2	1
CO4	1	-	1	-	2	-	-	-	-	-	-	1	1	2	1
CO5	1	-	1	-	2	-	-	-	-	-	-	1	1	2	1
CO6	2	2	3	3	2	2	1	-	2	3	2	2	2	3	1
Avg PO attained	1	0.7	1.3	0.5	2	0.3	0.2	0	0	1	0	1	1	2.2	1

TERM - VI

Syllabus: CSE 353, Compiler Design

School: SET		**Batch : 2023-27**	
Program: B.Tech		**Current Academic Year: 2023-24**	
Branch:CSE		**Semester: VI**	
1	Course Code	**CSE353**	Course Name: Compiler Design
2	Course Title	**Compiler Design**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Core	
5	Course Objective	1. To provide students with an overview of the issues that arise in Compiler construction as well as to throw light upon the significant theoretical developments and tools that are deep rooted into computer science. 2. To introduce the major phases of Compiler construction and also its theoretical aspects including regular expressions, context-free grammars, Finite Automata etc.	
6	Course Outcomes	After the successful completion of this course, students will be able to : **CO 1:Explain** the concepts and different phases of compilation with compile time error handling **CO 2:Represent** language tokens using regular expressions, context free grammar and finite automata and design lexical analyzer for a language **CO 3:Compare** top down with bottom up parsers, and develop appropriate parser to produce parse tree representation of the input **CO 4: Design** syntax directed translation schemes for a given context free grammar. **CO 5:Generate** intermediate code for statements in high level language, Benefits and limitations of automatic memory management. **CO 6:Apply** optimization techniques to intermediate code and generate machine code for high level language program	
7	Course Description	To provide students with an overview of the issues that arise in Compiler construction as well as to throw light upon the significant theoretical developments and tools that are deep rooted into computer science.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction	
	A	Introduction to Compiler, Phases and passes, Bootstrapping, Cross-Compiler	CO1, CO2

	B	Finite state machines and regular expressions and their applications to lexical analysis			CO1, CO2
	C	lexical-analyzer generator, Lexical Phase errors			CO1, CO2
	Unit 2	**Parsing Techniques**			
	A	The syntactic specification of programming languages: Context free grammars, derivation and parse trees.			CO2, CO3
	B	Basic Parsing Techniques: Parsers, Shift reduce parsing, operator precedence parsing, top down parsing, predictive parsers. Automatic Construction of efficient Parsers: LR parsers, the canonical Collection of LR(0) items, constructing SLR parsing tables			CO2, CO3
	C	Constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars. Syntactic phase errors and semantic errors.			CO2, CO3
	Unit 3	**Syntax Directed Translations And Intermediate Code Generation**			
	A	Syntax directed definition, Construction of syntax trees, syntax directed translation scheme			CO4,CO5
	B	Variants of Syntax Trees, Three Address Codes			CO4,CO5
	C	Translation of Expression, Type Checking and control flow.			CO4,CO5
	Unit 4	**Symbol table**			
	A	Data structure for symbols tables, representing scope information.			CO5
	B	Run-Time Administration: Implementation of simple stack allocation scheme			CO5
	C	Run Time Storage Management			CO5
	Unit 5	**Code Generation And Optimization**			
	A	Sources of Optimization of basic blocks and flow graphs			CO4,CO6
	B	Basic Blocks, Flow graphs, DAG			CO4,CO6
	C	Global Data Flow Analysis			CO4,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. 1.Aho, Sethi, Ulman, compilers Principles, Techniques, and Tools, Pearson Education, 2003			
	Other References	1. Lauden, Principles of Compiler Construction. 2. D. M. *Dhamdhere Compiler* Construction--Principles and Practice, Macmillan India,			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO 1:Explain** the concepts and different phases of compilation with compile time error handling	PO1,PO5,PO6,PO9,PO12,PSO1,PSO2
2.	**CO 2:Represent** language tokens using regular expressions, context free grammar and finite automata and design lexical analyzer for a language	PO1,PO2,PO3, PO4,PO5, PO12, PSO1, PSO2
3.	**CO 3:Compare** top down with bottom up parsers, and develop appropriate parser to produce parse tree representation of the input	PO1,PO2,PO3,PSO1,PSO2
4.	**CO 4: Design** syntax directed translation schemes for a given context free grammar.	PO1,PO2,PO3, PO4,PO5,PO9, PSO2,PSO3
5.	**CO 5:Generate** intermediate code for statements in high level language, Benefits and limitations of automatic memory management.	PO1,PO2,PO3, PO4,PO5,PO9,PO12,PSO1,PSO2,PSO3
6.	**CO6:Apply** optimization techniques to intermediate code and generate machine code for high level language program	PO1, PO3,PO4, PO4,PO5,PO9,PO12 PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Compiler Design (Course Code CSE 353)

Cos	PO1	PO 2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO1 0	PO 11	PO1 2	PS O1	PSO2	PSO3
CO1	3	--	--	--	3	--	--	--	2	--	--	3	2	1	--
CO2	2	2	3	3	2	--	--	--	--	--	--	2	3	2	--
CO3	3	3	3	--	--	--	--	--	--	--	--	--	3	2	--
CO4	1	2	3	3	3	--	--	--	3	--	--	--	--	3	2
CO5	1	1	2	3	2	--	--	--	3	--	--	3	1	2	2
CO6	2	--	3	3	2	--	--	--	3	--	--	3	3	2	3

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE353	Compiler Design	2	1.3	2.3	2	2	0	0-	0	1.8	0	0	2	2	2	1.2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

2.1 Template A1: Syllabus for Theory Courses (SAMPLE)

School:		School of Engineering & Technology		
Department		Department of Computer Science & Engineering		
Program:		B.Tech		
Branch:		CSE		
1	Course Code	CSE063		
2	Course Title	Quantum Computing		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	2
	Course Status	Core /Elective/Open Elective		
5	Course Objective	Fundamentals of quantum information processing, including quantum computation, quantum cryptography, and quantum information theory. Topics include: the quantum circuit model, qubits, unitary operators, measurement, entanglement, quantum algorithms for factoring and search, quantum cryptographic key distribution, error-correction and fault-tolerance, information capacity of quantum channels, complexity of quantum computation.		
6	Course Outcomes (must be 6 COs, following verbs given in Bloom's Taxonomy)	CO1: Analyze the behavior of basic quantum algorithms CO2: Demonstrate simple quantum algorithms CO3: Simulate a simple quantum error-correcting code CO4: Prove basic facts about quantum information channels CO5: Explain quantum computing and quantum protocols CO6: Illustrate information channels in the quantum circuit model.		
7	Course Description	This course teaches the fundamentals of quantum information processing, including quantum computation, quantum cryptography, and quantum information theory.		
8	Outline syllabus		CO Mapping	
	Unit 1	Introduction		
	A	Computers and the Strong Church–Turing Thesis, Circuit Model of Computation		
	B	A Linear Algebra Formulation of the Circuit Model, Reversible Computation	CO1	
	C	Quantum Physics and Computation	CO1, CO2	
	Unit 2	LINEAR ALGEBRA AND THE DIRAC NOTATION	CO1, CO2,CO4	
	A	The Dirac Notation and Hilbert Spaces, Dual Vectors, Operators		

	B	The Spectral Theorem, Functions of Operators			
	C	Tensor Products, The Schmidt Decomposition Theorem			CO1, CO2
	Unit 3	A QUANTUM MODEL OF COMPUTATION			CO1, CO2
	A	The Quantum Circuit Model, Quantum Gates			CO1, CO2,CO5,CO6
	B	Universal Sets of Quantum Gates, Efficiency of Approximating Unitary Transformations			
	C	Implementing Measurements with Quantum Circuits			
	Unit 4	INTRODUCTORY QUANTUM ALGORITHMS			CO1,CO2,CO3
	A	Probabilistic Versus Quantum Algorithms, Phase Kick-Back			CO1,CO2,CO3
	B	The Deutsch Algorithm, The Deutsch–Jozsa Algorithm			CO1,CO2,CO3
	C	Simon's Algorithm			
	Unit 5				
	A	Tools for Analysing Probabilistic Algorithms			CO2,CO3,CO4
	B	Solving the Discrete Logarithm Problem When the Order of a Is Composite			CO3,CO4
	C	Computing Schmidt Decompositions			CO2, CO4,CO5
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	"An Introduction to Quantum Computing", Phillip Kaye Raymond Laflamme, Michele Mosca			
	Other References				

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Analyze the behavior of basic quantum algorithms	
2.	CO2: Demonstrate simple quantum algorithms	PO1, PO2, PO5, PO8, PO12, PSO3
3.	CO3: Simulate a simple quantum error-correcting code	PO1, PO2, PO3, PSO3
4.	CO4: Prove basic facts about quantum information channels	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
5.	CO5: Explain quantum computing and quantum protocols	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
6.	CO6: Illustrate information channels in the quantum circuit model	PO1, PO2, PO3, PO8, PO9, PSO2,

PO and PSO mapping with level of strength for Course Name Quantum Computing (Course Code CSE063)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Quantum Computing	CO 1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO 2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO 3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO 4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO 5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO 6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	Quantum Computing	3	2.7	1.1	1	1.5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Strength of Correlation

1. Addressed to *Slight (Low=1) extent* 2. Addressed to *Moderate (Medium=2) extent*
3. Addressed to *Substantial (High=3) extent*

School:		**School of Engineering & Technology**		
Department		**Department of Computer Science & Engineering**		
Program:		**B. Tech**		
Branch:				
1	Course Code	CSE032		
2	Course Title	Cryptography and Network Security		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Core		
5	Course Objective	The objective of this course is to provide an intention to explain basic concepts and algorithms of symmetric &asymmetric key cryptography, including encryption/decryption and key exchange with the application of cryptography and technique.		
6	Course Outcomes	On successful completion of this module students will be able to: CO1: Identify the basic concepts of computer security, algorithms of symmetric Key cryptography, including encryption/decryption. CO2: Apply the tools and methodologies used to perform mathematic concepts behind the cryptographic algorithms.. CO3: Explain the tools and methodologies used to perform Security analysis. CO4: Interpret use of cryptographic data integrity algorithms and user authentication protocols CO5: Examine security at application layer, transport layer and network layer. CO6: Compare various algorithm of cryptography used for Network Security.		
7	Course Description	This course will provide a deterministic approach of both the principles and practice of cryptography & network security. It covers the basic issues to be addressed by a network security capability, and explored by providing a tutorial and survey of cryptography and network security technology.		
8	Outline syllabus			CO Mapping
	Unit 1	**Introduction& symmetric Key Cryptography**		
	A	Computer Security Concepts- OSI security Architecture, Security attacks, Services, mechanism, model of network security		CO1
	B	Classical encryption techniques- Substitution Cipher(Mono-alphabetic, Poly-alphabetic), Transposition cipher, Stegnography		CO1
	C	Block Cipher- Encryption Principles, DES and its variants, strength of DES		CO1
	Unit 2	**Mathematics of Cryptography**		
	A	Eucledian, Extended Eucledian Algorithm, EuilersTotient Function , Ferment little Theorem, Eulers theorem		CO2

	B	Primality Testing-Miller Rabin test, Chinese Remainder Theorem			CO2, CO6
	C	Exponential- square and multiply method, Discrete Logarithm			CO2, CO6
	Unit 3	**Asymmetric Cryptography & Key Exchange**			
	A	Public Key cryptography-RSA, Cryptanalysis of RSA			CO3
	B	Elgamal cryptography, Elliptic Curve cryptography			CO3, CO6
	C	Key Management and distribution : KDC, Diffie Hellman Key Exchange			CO3, CO6
	Unit 4	**Digital signatures**			
	A	User Authentication protocol- Kerberos			CO4
	B	Digital Signature –RSA, Elgamal, DSS			CO4
	C	Data integrity algorithms-Hash Functions, MD5, SHA-512			CO4
	Unit 5	**Security**			
	A	Security at Application layer-Email Architecture, S/MIME, PGP-Scenarios, key rings			CO5
	B	Security at Transport layer-SSL(Services, Protocols)			CO5
	C	Security at Network layer-IPSec(Modes, Security Protocols-AH, ESP, Services provided by IPSEC)			CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Atul Kahate , "Network Security ", Wiley India Pvt Ltd, 2010. 2. Michael T. Simpson, "Hands-on Cryptography & Network Security & Network Defense", Course Technology, 2010. 3. Rajat Khare, "Network Seuciryt and Cryptography & Network Security ", Luniver Press, 2006.			
	Other References	1. Bruce Schneier, "Applied Cryptography", John Wiley & Sons Inc, 2001. 2. Behrouz A. Forouzan, "Cryptography And Network Security"-McGraw Hill 1. Internet as a resource for reference.			

<u>CO and PO Mapping</u>

S. No.	*Course Outcome*	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Identifybasic concepts of computer security, algorithms of symmetric Key cryptography, including encryption/decryption.	PO1, PO2, PSO1. PSO2
2.	CO2: Apply the tools and methodologies used to perform mathematic concepts behind the cryptographic algorithms..	PO1,PO2,PO3, PO4, PSO1,PSO2
3.	CO3: Explain the tools and methodologies used to perform Security analysis.	PO1, PO3, PO5, PSO1, PSO2
4.	CO4: Analyze and use cryptographic data integrity algorithms and user authentication protocols	PO1, PO4, PO6, PO7, PSO1,PSO2

5.	CO5. Examine security at application layer, transport layer and network layer.	PO5,PO7, PO8, PO9, PSO1,PSO2
6.	CO6: Compare various algorithm of cryptography used for Network Security.	PO10,PO11,PO12,PSO1,PSO3

PO and PSO mapping with level of strength for Course Name Cryptography and Network Security **(Course Code CSE032)**

Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSE032_Cryptography and Network Security	CO1	3	2		-	-	-	-	-	-	-	-	-	3	1	-
	CO2	2	3	2	1	-	-	-	-	-	-	-	-	2	3	-
	CO3	2	-	2	-	3	-	-	-	-	-	-	-	2	2	1
	CO4	2	-	-	2	-	2	2	-	-	-	-	-	2	2	
	CO5	-	-	-	-	2	-	2	2	2		-	-	1	-	-
	CO6	-	-	-	-	-	-	-	-	-	2	2	2	2	-	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSE032	Cryptography and Network Security y and Network Security	**2.5**	**2.5**	**2**	**1.5**	**2.5**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**1.5**

Strength of Correlation

1. Addressed to***Slight (Low=1) extent*** ***2.*** Addressed to***Moderate (Medium=2) extent***
3. Addressed to***Substantial (High=3) extent***

Syllabus: CSE041 SOFTWARE PROJECT MANAGEMENT

School:		**School of Engineering & Technology**		
Department		**Department of Computer Science & Engineering**		
Program:		**B.Tech**		
Branch:		**Computer Science and Engineering**		
1	Course Code	CSE041		
2	Course Title	SOFTWARE PROJECT MANAGEMENT		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core /Elective/Open Elective		
5	Course Objective	To provide fundamental skills of software Project management emphasizing on issues & hurdles associated with delivering successful projects. Apply project management concepts through working in a group as team leader or active team member on an IT project.		
6	Course Outcomes (6)	After successful completion of this course students should be able to: CO1: Define the Project Management principles while developing software. CO2: Explain different project scheduling techniques. CO3: Apply vario-+us project monitoring,control and review techniques CO4: Categorize various activities and estimate the risks involved in various project activities. CO5: Assess project quality and issues related to contract management. CO6: Discuss the impact of project planning on the performance of the organizations		
7	Course Description	This course is aimed at introducing the primary important concepts of project management related to managing software development projects. Students will also get familiar with the different activities involved in Software Project Management. Further, they will also come to know how to successfully plan and implement a software project management activity, and to complete a specific project in time with the available budget.		

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Software Project Planning**	
	A	Fundamentals of Software Project Management (SPM), Need Identification, Vision and Scope Document, Project Management Cycle, SPM Objectives	CO1
	B	SPM Framework, Software Project Planning, Planning Objectives, Project Plan, Types of Project Plan, Structure of a Software Project Management Plan	CO1
	C	Software Project Estimation, Estimation Methods, Estimation Models, Decision Process	CO1
	Unit 2	**Project Organization and Scheduling Project Elements**	
	A	Work Breakdown Structure (WBS), Types of WBS, Functions, Activities and Tasks, Project Life Cycle and Product Life Cycle	CO2

	B	Ways to Organize Personnel, Project Schedule, Scheduling Objectives, Building the Project Schedule, Scheduling Terminology and Techniques	CO2
	C	Network Diagrams: PERT, CPM, Bar Charts: Milestone Charts, Gantt Charts	CO2
	Unit 3	**Project Monitoring and Control**	
A	Dimensions of Project Monitoring & Control, Earned Value Analysis	CO3, CO6	
B	Earned Value Indicators: Budgeted Cost for Work Scheduled (BCWS), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI)	CO3	
C	Software Reviews, Types of Review: Inspections, Desk checks, Walkthroughs, Code Reviews	CO3	
	Unit 4	**Project Management Tools**	
	A	Software Configuration Items and Tasks, Baselines, Plan for Change, Change Control, Change Requests Management, Version Control	CO4
	B	Risk Management: Risks and Risk Types, Risk Breakdown Structure (RBS), Risk Management Process: Risk Identification, Risk Analysis, Risk Planning, Risk Monitoring	CO4, CO6
	C	Cost Benefit Analysis, Software Project Management Tools: CASE Tools, MS-Project	CO4, CO6
	Unit 5	**Software Quality and Staffing in Project Management**	
	A	Concept of Software Quality, Software Quality Attributes, Software Quality Metrics and Indicators, The SEI Capability Maturity Model (CMM)	CO5, CO6
	B	SQA Activities, Formal SQA Approaches: Proof of Correctness, Statistical Quality Assurance, Product versus process quality management,	CO5
	C	Introduction, types of contract, stages in contract, placement, typical terms of a contract, contract management, acceptance	CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva	

	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	

	Text book/s*	1. Cottrell M. and Hughes B., "Software Project Management", 5th Edition, The McGraw-Hill Companies. 2. Walker Royce: ―Software Project Management- Addison-Wesley, 1998	
	Other References	1. Pankaj Jalote, "Software Project Management in practice", 1st Edition, Pearson Education, 2005. 2. Kathy Schwalbe, "Information Technology Project Management" International Student Ed. THOMSON Course Technology	

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the Project Management principles while developing software.	PO1,PO3,PO5,PO9,PO10, PO11,PO12,PSO3
2.	CO2: Explain different project scheduling techniques.	PO1,PO3,PO5,PO9,PO10, PO11,PO12,PSO3
3.	CO3: Apply various project monitoring, control and review techniques	PO1,PO3,PO5,PO8,PO9, PO10,PO11,PO12,PSO3
4.	CO4: Categorize various activities and estimate the risks involved in various project activities.	PO1,PO3,PO5,PO8,PO9, PO10,PO11,PO12,PSO3
5.	CO5: Assess project quality and issues related to contract management.	PO1,PO3,PO5,PO6,PO8,PO9, PO10,PO11,PO12,PSO3
6.	CO6: Discuss the impact of project planning on the performance of the organizations	PO1,PO3,PO4,PO5,PO6,PO8,PO9, PO10,PO11,PO12,PSO3

PO and PSO mapping with level of strength for Software Project management (Course code CSE 041)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE041_ Software Project Manageme nt	CO1	3	-	1	-	1	-	-	-	3	2	3	2	-	-	2
	CO2	2	-	2	-	2	-	-	-	3	3	3	3	-	-	2
	CO3	2	-	3	-	2	-	-	1	3	2	3	3	-	-	3
	CO4	2	-	2	-	2	-	-	1	3	2	3	3	-	-	3
	CO5	1	-	3	-	2	3	-	1	3	3	3	3	-	-	3
	CO6	2	-	3	3	2	2	-	1	3	3	3	2	-	-	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE041	Software Project Managem ent	2	-	2.3	3	1.8	2.5	-	1	3	2.5	3	2.6	-	-	2.5

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

CSE042 SOFTWARE TESTING

School:		**SET**		
Program:		**B.Tech**		
Branch:		**CSE**		
1	Course Code	CSE042		
2	Course Title	SOFTWARE TESTING		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core /Elective/Open Elective (Drop Down)		
5	Course Objective	The primary objective of this course is to introduce and instruct software testing and Quality assurance concepts, strategies, and techniques in order to develop a total understanding of the testing process and how it impacts the software project.		
6	Course Outcomes (5-6)	On successful completion of this module students will be able to CO1: Define Basic concepts of Testing and Debugging CO2: Make use of Control flow graph to perform white box testing CO3: Apply Data flow and integration testing to develop feasible software CO4: Classify techniques of Functional testing and design test cases CO5: Evaluate the software quality using Reviews, maturity models and ISO standards. CO6: Adapt software testing methods and modern software testing tools for their testing projects.		
7	Course Description	This course will examine fundamental software testing and related program analysis techniques. In particular, the important phases of testing will be reviewed, emphasizing the significance of each phase when testing different types of software. The course will also include concepts such as test generation, test oracles, test coverage, regression testing, mutation testing, program analysis (e.g., program-flow and data-flow analysis), and test prioritization.		

8	Outline syllabus		CO Mapping
	Unit 1	Introduction	
	A	Human and errors, Testing Objectives, Principles of Testing, Behaviour and Correctness, verification and validation, Debugging and its techniques	CO1
	B	Software metrics, Software Testing Life Cycle, Testing activities , Test Levels,	CO1
	C	Testing exit criteria, Bug defect life cycle, White Box and Black Box Testing, test planning and design	CO1
	Unit 2	Unit and Control Flow Testing	
	A	Concept of Unit Testing, Static Unit Testing, Defect Prevention, Dynamic Unit Testing, Mutation Testing	CO2,CO6
	B	Control Flow Testing: Overview of Control Flow Testing, Control Flow Graph, Paths in a Control Flow Graph	CO2,CO6

	C	Cyclomatic complexity, Path Selection Criteria, Generating test input	CO2,CO6
	Unit 3	Data Flow & Performance testing	
	A	Data Flow Anomaly, Overview of Dynamic Data Flow Testing, Data Flow Graph, Data Flow Terms	CO3,CO6
	B	Data Flow Testing Criteria, Comparison of Data Flow Test Selection Criteria, Feasible Paths and Test Selection Criteria	CO3,CO6
	C	Integration Testing: Introduction, Integration Techniques, Regression testing, Performance testing: Stress, Load, Volume, Soak and Spike, Overview of performance tools: Jmeter, Loadrunner, WebLoad	CO3,CO6
	Unit 4	Functional Testing	
	A	Equivalence Class Partitioning, Boundary Value Analysis, Decision Tables, Random Testing: Monkeys & Gorillas, Error Guessing	CO4,CO6
	B	Test case designing – Test cases, Test case format, Test case designing, Acceptance testing and criteria	CO4,CO6
	C	Automation testing**:** Need for automation, categorization of Testing tools, Selection of testing tools, Guidelines for automated testing, Overview of commercial testing tools	CO4,CO6
	Unit 5	**Reviews and Quality Control**	
	A	Testing maturity model, Test metrics and measurements – project, progress and productivity metrics – Status Meetings – Reports and Control Issues – Criteria for Test Completion	CO5,CO6
	B	Types of reviews – Developing a review program – Components of Review Plans– Reporting Review Results	CO5,CO6
	C	Five Views of Software Quality, McCall's Quality Factors and Criteria, ISO 9000:2000 Software Quality Standard, evaluating software quality	CO5,CO6
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	CA: 25%; MTE: 25%; ETE: 50%	
	Text book/s*	1. Sagar Naik & Piyu Tripathy, "Software Testing and Quality Assurance: Theory and Practice", Wiley.	
	Other References	1. Naresh Chauhan, "Software Testing : Principles and practices", Oxford university press 2. Boris Beizer, "Software Testing Techniques", Dreamtech Press 3. K.K. Aggrawal and Yogesh Singh, " Software Engineering" New Age International Publication	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define Basic concepts of Testing and Debugging	PO1,PO2,PO10,PO12,PSO3
2.	CO2: Make use of Control flow graph to perform white box testing	PO1,PO2,PO3,PO4,PO5,PO6, PO8,PO9,PO10,PO12,PSO1,PSO3
3.	CO3: Apply Data flow and integration testing to develop feasible software	PO1,PO2,PO3,PO4,PO5,PO6, PO8,PO9,PO10,PO12,PSO1,PSO3
4.	CO4: Classify techniques of Functional testing and design test cases	PO1,PO2,PO3,PO4,PO5,PO6, PO8,PO9,PO10,PO12,PSO1,PSO3
5.	CO5: Evaluate the software quality using Reviews, maturity models and ISO standards.	PO1,PO2,PO3,PO4,PO5,PO6, PO8,PO9,PO10,PO12,PSO1,PSO3
	CO6: Adapt software testing methods and modern software testing tools for their testing projects.	PO1,PO2,PO3,PO4,PO5,PO6,PO7, PO8,PO9,PO10,PO11,PO12,PSO1,PSO3

PO and PSO mapping with level of strength for Software Testing (CSE 042)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CSE042_ Software Testing	CO1	2	1	-	-	-	-	-	-	-	3	-	2	-	-	3
	CO2	3	3	3	2	3	1	-	1	2	3	-	2	2	-	3
	CO3	3	3	3	2	2	2	-	1	2	3	-	2	2	-	3
	CO4	3	3	3	2	3	1	-	1	2	3	-	2	2	-	3
	CO5	3	3	2	2	2	2	-	1	2	3	-	2	2	-	3
	CO6	3	3	3	2	3	2	3	2	3	3	3	3	2	-	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE042	Software Testing	2.8	2.6	2.8	2	2.6	1.6	3	1.2	2.2	3	3	2.1	2	-	3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

1	Course Code	**CSE051**	
2	Course Title	**Wireless Networks**	
3	Credits	3	
4	Contact Hours	**3-0-0**	
5	Course Objective	The objective of this course is to provide fundamental knowledge about Wireless networks, protocol stack and standards, understand and analyze the network layer solutions for Wireless networks, and make student aware of 4G Services.	
6	Course Outcomes	After successful completion of this course students should be able to: CO1. Enumerate, identify the foundation, and describe properties and capabilities of commonly used wireless technologies CO2. Identify and describe the infrastructure and requirements of Mobile IP and Mobile IPv6 CO3.Illustrate the issues and solutions of various layers of mobile networks, namely MAC layer, Network Layer & Transport Layer CO4. Demonstrate the typical mobile networking infrastructure through a popular GSM protocol CO5. Identify and describe the structure of current 4G cellular networks. CO6.Compare applications of 4G technologies.	
7	**Course Description**	The course will describe concepts, technology and applications of wireless networking as used in current and next-generation wireless networks. In addition, the course addresses the fundamentals of wireless communications and provides an overview of existing and emerging wireless communication networks.	
8	**Course Contents**		
	Unit A	**WIRELESS LAN**	**CO Mapping**
	Unit A Topic 1	Introduction-WLAN technologies: Infrared, UHF narrowband, spread spectrum -IEEE802.11: System architecture, protocol architecture,	CO1
	Unit A Topic 2	Physical layer, MAC layer, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2	CO1
	Unit A Topic 3	Bluetooth: Architecture, Radio Layer, Baseband layer, Link manager Protocol, security - IEEE802.16-WIMAX: Physical layer, MAC, Spectrum allocation for WIMAX	CO1
	Unit B	**MOBILE NETWORK LAYER**	
	Unit B Topic 1	Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation,	CO1, CO2
	Unit B Topic 2	IPV6-Network layer in the internet Mobile IP session initiation protocol	CO1, CO2
	Unit B Topic 3	Mobile ad-hoc network: Routing Destination Sequence distance vector, Dynamic source routing.	CO1, CO2
	Unit C	**MOBILE TRANSPORT LAYER**	
	Unit C Topic 1	TCP enhancements for wireless protocols - Traditional TCP: Congestion control, fast retransmit/fast recovery, Implications of mobility	CO3
	Unit C Topic 2	Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP, Time out freezing	CO3
	Unit C Topic 3	Selective retransmission, Transaction oriented TCP - TCP over 3G wireless networks.	CO3
	Unit D	**WIRELESS WIDE AREA NETWORK**	

	Unit D Topic 1	Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture	CO3, CO4
	Unit D Topic 2	3G-MSC, 3G-SGSN, 3G-GGSN, SMS-GMSC/SMS-IWMSC, Firewall,	CO3, CO4
	Unit D Topic 3	DNS/DHCP-High speed Downlink packet access (HSDPA)- LTE network architecture and protocol.	CO3, CO4
	Unit E	**4G NETWORKS**	
	Unit E Topic 1	Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies	CO5, CO6
	Unit E Topic 2	Multicarrier Modulation, Smart antenna techniques, OFDM-MIMO systems,	CO5, CO6
	Unit E Topic 3	Adaptive Modulation and coding with time slot scheduler, Cognitive Radio.	CO5, CO6
	Reading Content		
	Text book*	1. Jochen Schiller, Mobile Communications, Second Edition, Pearson Education 2012.(Unit I,II,III)	
	other references	1. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband", Second Edition, Academic Press, 2008. 2.Anurag Kumar, D.Manjunath, Joy kuri, "Wireless Networking", First Edition, Elsevier 2011. 3.Simon Haykin , Michael Moher, David Koilpillai, "Modern Wireless Communications", First Edition, Pearson Education 2013	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Enumerate, identify the foundation, and describe properties and capabilities of commonly used wireless technologies	PO1,PO3,PO8 PSO3
2.	CO2. Identify and describe the infrastructure and requirements of Mobile IP and Mobile IPv6	PO1,PO2,PO3,PO8 PSO3
3.	CO3.Illustrate the issues and solutions of various layers of mobile networks, namely MAC layer, Network Layer & Transport Layer	PO1,PO2,PO3,PO8 PSO3
4.	CO4. Demonstrate the typical mobile networking infrastructure through a popular GSM protocol	PO1,PO2,PO3,PO8 PSO3
5	CO5. Identify and describe the structure of current 4G cellular networks.	PO1,PO2,PO3,PO4,PO5,PO8 PSO3
6.	CO6.Compare applications of 4G technologies.	PO1,PO2,PO3,PO4,PO5,PO8 PSO3

PO and PSO mapping with level of strength for Course Name Wireless Networks (CSE051)

	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
	CO1	3	-	3	-	-	-	-	1	-	-	-	-	-	-	2
	CO2	3	2	3	-	-	-	-	1	-	-	-	-	-	-	2
	CO3	3	2	3	-	-	-	-	1	-	-	-	-	-	-	2
	CO4	3	2	3	-	-	-	-	1	-	-	-	-	-	-	2
	CO5	3	2	3	2	2	-	-	1	-	-	-	-	-	-	3
	CO6	3	2	3	2	2	-	-	1	-	-	-	-	-	-	3
	Avg.	3	1.6	3	0.6	0.6	-	-	1	-	-	-	-	-	-	2.3

School:		**School of Engineering & Technology**		
Department		**Department of Computer Science & Engineering**		
Program:		**B. tech**		
Branch: CSE		**Semester: 6**		
1	Course Code	CSE052		
2	Course Title	**Risk Management**		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Core /Elective/Open Elective		
5	Course Objective	The objective of this course is to provide an insight to fundamentals of risk management in which business and society make an assessment of, control, regulation of risk management and transfer risk.		
6	Course Outcomes	On successful completion of this module students will be able to: CO1: define the basic concept of risk, types, uncertainty, managing, evaluation and prediction of risk. CO2: illustrate the key stages, component, framework, standards, architecture, strategy policies, and protocols process of the risk management. CO3: identify various risk, score them, control and opportunity risk CO4: apply approach/technique of risk assessment for strategy, projects and operations, and make use of risk matrix CO5: analyze uncertainty and risk in projects and apply measurement CO6: Explain, compare and apply risk management concept and techniques in projects to the success of the organization.		
7	Course Description	This course is to provide students with the concepts and fundamentals of risk management, a study of risk assessment and management techniques, methods, and models used in industry to minimize, control and communicate risks.		
8	Outline syllabus			CO Mapping
	Unit 1	**Introduction**		
	A	The Concept of Risk, Risk and Uncertainty: Distinction, Classification of Risks		CO1, CO6
	B	Managing Risk, Sources and Measurement of Risk		CO1, CO6
	C	Risk Evaluation and Prediction, Types of Risk		CO1, CO6
	Unit 2	**Principles and aims of risk management**		
	A	Principles of risk management, Importance of risk management, Risk management activities, Perspectives of risk management		CO2, CO6

	B	Scope of risk management standards:- Risk management process, Risk management framework	CO2, CO6
	C	Risk architecture, strategy Policies and protocols	CO2, CO6
	Unit 3	**Risk classification Systems**	
	A	Shor, Medium and long term Risk	CO3, CO6
	B	FIRM risk scorecard, PESTLE risk classification system	CO3, CO6
	C	Hazard, control and opportunity risk	CO3, CO6
	Unit 4	**Risk Assessment**	
	A	Importance of risk assessment, Approaches to risk assessment, risk assessment techniques	CO4, CO6
	B	Risk Matrix, Risk Perception, Risk appetite	CO4, CO6
	C	Application of risk matrix, inherent and current level of risk, 4T's of risk response	CO4, CO6
	Unit 5	**Risk Management**	
	A	Importance of risk appetite – Risk tolerance, treatment, termination	CO5, CO6
	B	Introduction to Project Risk Management, uncertainty in projects , project lifecycle, Project risk analysis and management	CO5, CO6
	C	Operational risk management- definition, measurement, difficulties of measurement	CO5, CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 25% / MTE: 25% / ETE: 50%	
	Text book/s*	1. Paul Hopkin,"Fundamental of Risk Management-Understanding evaluating and implementing effective risk management", KoganPage London Philadelphia New Delhi.	
	Other References	1. Internet	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: define the basic concept of risk, types, uncertainty, managing, evaluation and prediction of risk.	PO1, PO2, PO7, P12, PSO1
2.	CO2: illustrate the key stages, component, framework, standards, architecture, strategy policies, and protocols process of the risk management.	PO1, PO4, PO5, PO8, PO9, PO10, PO11, PO12 PSO3
3.	CO3: identify various risk, score them, control and opportunity risk	PO1, PO2, PO4, PO9, P12, PSO1

4.	CO4: apply approach/technique of risk assessment for strategy, projects and operations, and make use of risk matrix	PO1, PO3, PO5, PO6, PO9, P11, PSO3
5.	CO5: analyze uncertainty and risk in projects and apply measurement	PO1, PO2, PO4, PO5, PO7, PO9, PSO3
6.	CO6: explain, compare and apply risk management concept and techniques in projects to the success of the organization.	PO1, PO3, PO5, PO7, PO9, P11, P12, PSO2

PO and PSO mapping with level of strength for Course Name Risk Management (Course Code CSE052)

	Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSE052 _ Risk Management	CO1	3	-	-	-	-	-	1	-	-	-	-	1	2	-	-
	CO2	2	2	-	3	2	-	-	1	2	1	1	1	-	-	2
	CO3	2	-	-	-	-	-	-	-	2	-	-	1	1	-	-
	CO4	1	-	2	-	3	-	-	-	2	2	2	-	-	-	1
	CO5	2	2	-	2	1	-	1	-	2	1	1	-	-	-	1
	CO6	2	2	2	-	-	-	1	-	2	1	1	1	-	1	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE052	Risk Manage ment	2	2	2	2.5	2	-	1	1	2	1.25	1.25	1	1.5	1	1.33

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Syllabus: CSE 053, Advanced Operating System

School: SET		**Batch : 2023-27**	
Program: B.Tech		**Current Academic Year: 2023-24**	
Branch: CSE		**Semester: VI**	
1	Course Code	**CSE053**	Course Name: Advanced Operating System
2	Course Title	Principles of Operating System	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Core	
5	Course Objective	1. This course introduces the challenges for designing the operating systems. 2. Includes different design principles and algorithms. 3. Evaluation of algorithms proposed. 4. Implementation of algorithms and utilities.	
6	Course Outcomes	Students will be able : **CO1** Discuss the various synchronization, scheduling and memory management issues **CO2** Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system **CO3** Discuss the various resource management techniques for distributed systems **CO4** Identify the different features of real time and mobile operating systems **CO5** Install and use available open source kernel **CO6** Modify existing open source kernels in terms of functionality or features used	
7	Course Description	This course covers general issues of design and implementation of advanced modern operating systems. The focus is on issues that are critical to the applications of distributed systems and computer networks, which include inter process communication, distributed processing, sharing and replication of data and files.	
8	Outline syllabus		CO Mapping
	Unit 1	**FUNDAMENTALS OF OPERATING SYSTEMS**	
	A	Overview – Synchronization Mechanisms – Processes and Threads - Process Scheduling	CO1
	B	Deadlocks: Detection, Prevention and Recovery	CO1
	C	Models of Resources – Memory Management Techniques.	CO1
	Unit 2	**DISTRIBUTED OPERATING SYSTEMS**	
	A	Issues in Distributed Operating System – Architecture – Communication Primitives –	CO1, CO2
	B	Lamport’s Logical clocks – Causal Ordering of Messages	CO1, CO2

	C	Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms – Agreement Protocols.	CO1, CO2
	Unit 3	**DISTRIBUTED RESOURCE MANAGEMENT**	
	A	Distributed File Systems – Design Issues - Distributed Shared Memory – Algorithms for – Implementing Distributed Shared memory	CO1,CO2
	B	Issues in Load Distributing – Scheduling Algorithms – Synchronous and Asynchronous Check Pointing and Recovery	CO1,CO2,CO3,CO4
	C	Fault Tolerance – Two-Phase Commit Protocol – Non-blocking Commit Protocol – Security and Protection.	CO1,CO2,CO3,CO4
	Unit 4	**REAL TIME AND MOBILE OPERATING SYSTEMS**	
	A	Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems	CO1,CO2,CO3,CO5
	B	Real Time Task Scheduling - Handling Resource Sharing	CO1,CO2,CO3,CO5
	C	Mobile Operating Systems –Micro Kernel Design - Client Server Resource Access – Processes and Threads - Memory Management - File system.	CO1,CO2,CO3,CO5
	Unit 5	**CASE STUDIES**	
	A	linux System: Design Principles - Kernel Modules - Process Management Scheduling -	CO1,CO2,CO3,CO6
	B	Memory Management - Input-Output Management - File System	CO1,CO2,CO3,CO4,CO6
	C	Inter-process Communication. iOS and Android: Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.	CO1,CO2,CO3,CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 25%	MTE: 25%	ETE: 50%	
	Text book/s*	Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, “Operating System Concepts”, Seventh Edition, John Wiley & Sons, 2004.	
	Other References	1. Mukesh Singhal and Niranjan G. Shivaratri, “Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems”, Tata	

		McGraw-Hill, 2001. 2. Daniel P Bovet and Marco Cesati, “Understanding the Linux kernel”, 3rd edition, O’Reilly, 2005. 3. Rajib Mall, “Real-Time Systems: Theory and Practice”, Pearson Education India, 2006.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1** Discuss the various synchronization, scheduling and memory management issues	PO1,PO2,PO3,PO4,PSO1
2.	**CO2** Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system	PO1, PO3, PO4, PSO2
3.	**CO3** Discuss the various resource management techniques for distributed systems	PO1,PO2,PO3,PO4
4.	**CO4** Identify the different features of real time and mobile operating systems	PO9, PO10,PO11, PSO3
5.	**CO5** Install and use available open source kernel	PO1,PO2,PO8,PO9,PO10,PSO1
6.	**CO6** Modify existing open source kernels in terms of functionality or features used	PO1,PO2,PO10,PO11,PSO1,PSO2

PO and PSO mapping with level of strength for Course Name Principles of Operating System (Course Code CSE 053)

CSE053	Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	CO1	3	3	3	3	--	--	--	2	2	1	2	1	3	2	2
	CO2	3	2	3	3	--	--	--	2	2	2	1	1	2	3	2
	CO3	3	3	3	3	--	--	--	1	1	1	3	2	3	2	1
	CO4	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
	Co5	2	2	3	-	-	-	-	3	3	1	2	-	3	-	-
	CO6	3	2	-	-	-	-	-	-	-	2	3	-	2	2	-

CSP472: Artificial Intelligence Lab

School:		**School of Engineering & Technology**
Department		**Department of Computer Science & Engineering**
Program:		**B-TECH**
Branch:		**Computer Science and Engineering**
1	Course Code	CSP472
2	Course Title	**Artificial Intelligence Lab**
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	The objective of the course is to introduce basic fundamental concepts in Artificial Intelligence (AI), with a practical approach in understanding them. To visualize the scope of AI and its role in futuristic development. • To develop a sense of appreciation for traditional AI Programming • To use classical AI problems to understand cognitive process. • To have an overview of the various processes involved in Machine Learning • To develop a working model of real life problem base on Artificial Agent.
6	Course Outcomes	After the completion of this course, students will be able to: CO-1. ***Relate*** the goals of Artificial Intelligence and AI and non-AI solution. CO-2. ***Analyze and*** various AI uninformed and informed search algorithms. CO-3. ***Extend*** knowledge representation, reasoning, and theorem proving techniques to real-world problems CO-4. ***Make use of:*** Machine learning algorithms in various application domains of AI. CO-5. ***Select*** Artificial Intelligent based applications. CO-6. ***Develop*** independent (or in a small group) research and communicate it effectively.
7	Course Description	In this course students will learn basic introduction of Artificial Intelligence, problem solving agents, reasoning, learning and applications of artificial intelligence.

8	Outline syllabus		CO Mapping
	Unit 1	**Practical based on goal based problems**	**CO1**
		Sub unit - a, b and c detailed in Instructional Plan	
	Unit 2	**Practical related to uninformed search algorithm.**	**CO1,CO2**
		Sub unit - a, b and c detailed in Instructional Plan	
	Unit 3	**Practical related to informed search algorithm.**	**CO3**
		Sub unit - a, b and c detailed in Instructional Plan	
	Unit 4	**Practical related to knowledge representations and logical reasoning**	**CO4**
		Sub unit - a, b and c detailed in Instructional Plan	

<table>
<tr><td></td><td>Unit 5</td><td colspan="3">Practical related to machine learning algorithms</td><td>CO5,CO6</td></tr>
<tr><td></td><td></td><td colspan="3">Sub unit - a, b and c detailed in Instructional Plan</td><td></td></tr>
<tr><td></td><td>Mode of examination</td><td colspan="3">Practical/Viva</td><td></td></tr>
<tr><td rowspan="2"></td><td rowspan="2">Weightage Distribution</td><td>CA</td><td>CE(Viva)</td><td>ETE</td><td></td></tr>
<tr><td>25%</td><td>25%</td><td>50%</td><td></td></tr>
<tr><td></td><td>Text book/s*</td><td colspan="3">1. Rich E& Knight K, Artificial Intelligence, Tata McGraw Hill, Edition 3.</td><td></td></tr>
<tr><td></td><td>Other References</td><td colspan="3">1. Russell S &Norvig P, Artificial Intelligence: A Modern Approach, Prentice Hall.
2. Dan W. Patterson, Artificial Intelligence & Expert Systems, Pearson Education with Prentice Hall India. Indian Edition.</td><td></td></tr>
</table>

Course Outcomes:

Sl. No.	Course Outcome (CO)	
CO-1:	***Relate*** the goals of Artificial Intelligence and AI and non-AI solution.	PO3, PO4, PO5, PO10, PSO1, PSO2, PSO3
CO-2:	***Analyze and*** various AI uninformed and informed search algorithms.	PO1, PO2, PO3, PO4, PO5, PO10, PSO1, PSO2, PSO3
CO-3:	***Extend*** knowledge representation, reasoning, and theorem proving techniques to real-world problems	PO1, PO2, PO3, PO4, PO5, PO12, PSO1, PSO2, PSO3
CO-4:	***Make use of:*** Machine learning algorithms in various application domains of AI.	PO1, PO2, PO3, PO4, PO5, PO12, PSO1, PSO2, PSO3
CO-5:	***Select*** Artificial Intelligent based applications.	PO1, PO2, PO3, PO4, PO5, PO9, PO10 PO12, PSO1, PSO2, PSO3
CO-6:	***Develop*** independent (or in a small group) research and communicate it effectively.	PO1, PO2, PO3, PO4, PO5, PO9, PO10 PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Artificial Intelligence Lab (Course Code CSP472)

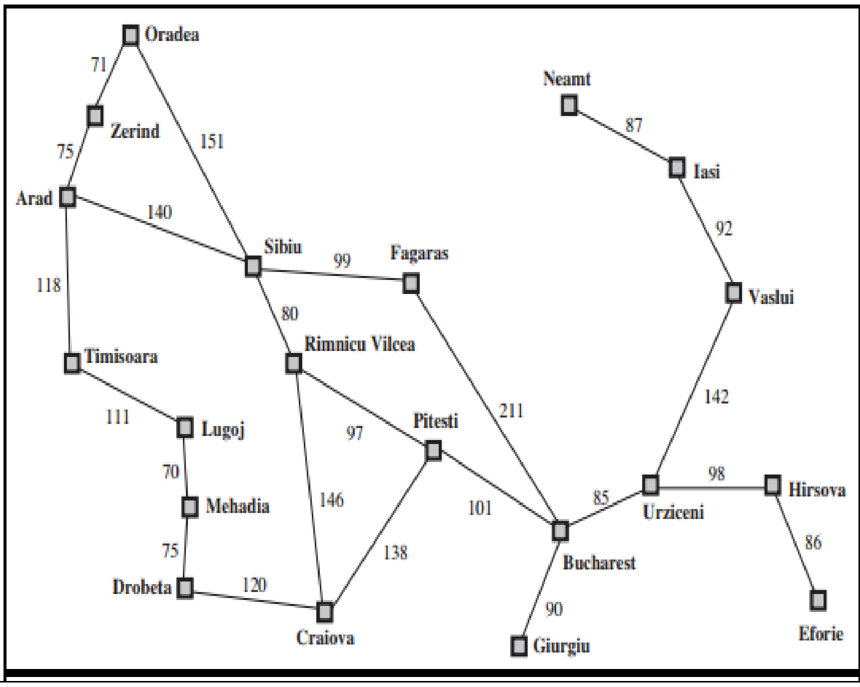
Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSP472: Artificial Intelligence Lab	CO1	1	2	3	2	2					2		2	3	2	2
	CO2	2	3	3	2	3					2		2	3	3	2
	CO3	3	3	3	3	2	1	1			1	2	3	3	2	3
	CO4	3	3	3	3	2	2	1			2	1	3	3	2	3
	CO5	2	3	3	3	3	2	2	2	3	2	2	2	3	3	2
	CO6	2	3	3	3	3	2	2	2	3	2	2	2	3	3	2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

List of Practical's:

	Unit 1	**Practical based on goal based problems**	
Week 1	A	Lab expt.1	Implementation of Water Jug Problem.
Week 2, 3	B	Lab expt.2	Introduction to Lisp, and basic programming in Lisp like following: i. Write a LISP function to compute sum of squares. ii. Write a LISP function to compute difference of squares. (if x > y return $x^2 - y^2$, Otherwise $y^2 - x^2$). iii. Write a Recursive LISP function which takes one argument as a list and return last element of the list. (Do not use last predicate.) iv. Write a Recursive LISP function which takes one argument as a list and return list except last element of the list. (Do not use butlast.) v. Write a Recursive LISP function which takes one argument as a list and return reverse of the list. (Do not use reverse predicate). vi. Write a Recursive LISP function which takes two arguments first an atom second a list returns a list after removing first occurrence of that atom within the list. vii. Write a Recursive LISP function which appends two lists together. viii. Write a recursive LISP function which takes 2 lists as arguments and returns a list containing alternate elements from each list.
Week 4	C	Lab expt.3	Advance programming in Lisp like following: i. Write a function that compute the factorial of a number.(factorial of 0 is 1, and factorial of n is n*(n-1)*...1.Factorial is defined only for integers greater than or equal to 0.) ii. Write a function that evaluate a fully parenthesized infix arithmetic expression. For examples, (infix (1+ (2*3))) should return 7. iii. Write a function that performs a depth first traversal of binary tree. The function should return a list containing the tree nodes in the order they were visited. iv. Write a LISP program for water jug problem. v. Write a LISP program that determines whether an integer is prime.
	Unit 2	**Practical related to uninformed search algorithm.**	
Week 5	a, b,	Lab expt.4	Refer following figure as map with distance details, Write a program in your preferred language to generate path from ARAD to BUCHREST, analyze result obtained by a) Depth First Search

			b) Breadth First Search c) Uniform Cost Search 
Week 6	C	Lab expt.5	Write a program in your preferred language to generate steps to solve Tower of Hanoi problem.
	Unit 3	**Practical related to informed search algorithm.**	
Week 7	Mid term		
Week 8	a,b,c	Lab expt.6	Write a program in your preferred language to solve the 8 puzzle Problem-using A* algorithm.
	Unit 4	**Practical related to knowledge representations and logical reasoning**	
Week 9	A	Lab expt.7	Write PROLOG program to Program to categorize animal characteristics.
Week 10	B	Lab expt.8	Write PROLOG program to solver for the linear equation A*X + B = 0. Let the predicate linear (A, B, X) return the root X of the equation.
Week 11	C	Lab expt.9	Write a PROLOG program that answers questions about family members and relationships includes predicates and rules which define sister, brother, father, mother, grandchild, grandfather and uncle. The program should be able to answer queries such as the following: father(x, Amit) grandson(x, y) uncle (sumit, puneet) mother (anita, x)
	Unit 5	**Practical related to machine learning algorithms**	
Week 12	a,	Project	Project Work Evaluation-0: Problem Statement
Week 13	B	Project	Project Work Evaluation-1: Design Specification

Week 14	C	Project	Project Work Evaluation-2: Development

Syllabus: Compiler Design lab

School:		**School of Engineering & Technology**	
Department		**Department of Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:CSE		**Semester:6**	
1	Course Code	CSP353	
2	Course Title	Compiler Design Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	This laboratory course is intended to make the students experiment on the basic techniques of compiler construction and tools that can used to perform syntax-directed translation of a high-level programming language into an executable code. Students will design and implement language processors in C by using tools to automate parts of the implementation process. This will provide deeper insights into the more advanced semantics aspects of programming languages, code generation, machine independent optimizations, dynamic memory allocation, and object orientation.	
6	Course Outcomes	CO1 **Apply** different compiler writing tools to implement the different Phases CO2: **Understand** and define the role of lexical analyzer, use of regular expression and transition diagrams. CO3: **Implement** a parser for different context free grammars. CO4: **Construct** the intermediate representation CO5: **Implement** Symbol table CO6: **Compare** various code optimization techniques	
7	Course Description	This self-paced course will discuss the major ideas used today in the implementation of programming language compilers, including lexical analysis, parsing, syntax-directed translation, abstract syntax trees, types and type checking, intermediate languages, dataflow analysis, program optimization, code generation, and runtime systems. As a result, you will learn how a program written in a high-level language designed for humans is systematically translated into a program written in low-level assembly more suited to machines	
8	Outline syllabus		CO Mapping
	Unit 1	**Practical based on Designing of Finite Automata and Compiler construction tools**	
		1. Design a DFA which will accept all the strings containing even number of 0's and even number of 1's over an alphabet {0, 1} and write a program to implement the DFA. 2. Design a DFA which will accept all the strings containing mod 3 of 0's over an	CO1

		alphabet {0, 1} and write a program to implement the DFA. 3. Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines	
	Unit 2	**Practical related to -- Parsing Techniques**	
		1. Write an algorithm and program on Recursive Descent parser. 2. Write an algorithm and program to compute FIRST and FOLLOW function. 3. Develop an operator precedence parser for a given language. 4. Implementation of shift reduce parsing algorithm and LR parser	CO2,CO3
	Unit 3	**Practical related to--- Syntax Directed Translations And Intermediate Code Generation**	
		1. Write code to generate abstract syntax tree. 2. Intermediate Code Generation	CO4
	Unit 4	**Practical related to---Symbol table**	
		Implement Symbol table	CO5
	Unit 5	**Practical related to---Code optimization techniques**	
		1. Implementation of Directed Acyclic Graph 2. Implementation of Code Generation	CO4,CO5
	Mode of examination	Jury/Practical/Viva	
	Weightage Distribution	CA: 25% / CE(Viva): 25% / ETE: 50%	
	Text book/s*	Aho, Sethi, Ulman, compilers Principles, Techniques, and Tools, Pearson Education, 2003	
	Other References	Lauden, Principles of Compiler Construction. 3. D. M. *Dhamdhere Compiler* Construction--Principles and Practice, Macmillan India,	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1 **Apply** different compiler writing tools to implement the different Phases	PO1,PO5,PO6,PO9,PO12,PSO1,PSO2

2.	CO2: **Understand** and define the role of lexical analyzer, use of regular expression and transition diagrams.	PO1,PO2,PO3, PO4,PO5, PO12, PSO1, PSO2
3.	CO3: **Understand** and use Context free grammar, and parse tree construction.	PO1,PO2,PO3,PSO1,PSO2
4.	CO4: **Construct** the intermediate representation	PO1,PO2,PO3, PO4,PO5,PO9, PSO2,PSO3
5.	CO5: **Implement** Symbol table	PO1,PO2,PO3, PO4,PO5,PO9,PO12,PSO1,PSO2,PSO3
6.	CO6: **Compare** various code optimization techniques	PO1, PO3,PO4, PO4,PO5,PO9,PO12 PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Compiler Design Lab (Course Code CSP353)

Cos	PO1	PO 2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO1 0	PO 11	PO1 2	PS O1	PSO2	PSO3
CO1	3	--	--	--	3	--	--	--	2	--	--	3	2	1	--
CO2	2	2	3	3	2	--	--	--	--	--	--	2	3	2	--
CO3	3	3	3	--	--	--	--	--	--	--	--	--	3	2	--
CO4	1	2	3	3	3	--	--	--	3	--	--	--	--	3	2
CO5	1	1	2	3	2	--	--	--	3	--	--	3	1	2	2
CO6	2	--	3	3	2	--	--	--	3	--	--	3	3	2	3

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Average of non-zeros entry in following table (should be auto calculated).

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	P O 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE353	**Compiler Design**	**2**	**1.3**	**2.3**	**2**	**2**	**0**	**0-**	**0**	**1.8**	**0**	**0**	**2**	**2**	**2**	**1.2**

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Syllabus: CSP 396, Technical Skill Enhancement Course-2(Application Development Lab)

School: SET		**Batch : 2023-27**	
Program: BTech		**Current Academic Year: 2023-24**	
Branch:		**Semester:6**	
1	Course Code	CSP396	
2	Course Title	Technical Skill Enhancement Course-2(Application Development Lab)	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory/Elective	
5	Course Objective	Describe the components and structure of a mobile development frameworks (Android SDK and Eclipse Android Development Tools (ADT)) and learn how and when to apply the different components to develop a working system.	
6	Course Outcomes	On successful completion of the course, the student will be able to: **CO1:**Explainthe fundamentals of Android App Development. **CO2:**Make use of UI components to create Android applications. **CO3:**Examine the services and notifications in android to perform event driven programming. **CO4:**Develop database SQLite based Android applications. **CO5:**Analyze the usage of commonly available device sensors while building Android App. **CO6:**Develop application using Android software development tools.	
7	Course Description	The course will introduce concepts of the Android platform, Android application components, Activities and their lifecycle, UI design. It will also help students to build applications according to their problem statements.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Android**	
		Configuration of android SDK and test run of application on device, Create "Hello World" application, develop an Android Application to implement Activity life cycle.	CO1,CO6
	Unit 2	**Android UI Components**	
		Create a layout of Calculator using Grid layout, develop an Android Application to implement event listener on above layout, develop an Android Application to implement implicit intent.	CO1,CO2, ,CO6
	Unit 3	**Services and Notification**	
		Develop an Android Application to implement Service life cycle, Develop an Android Application to implement status bar notification, Create a menu with 5 options and selected option should appear in text box	CO3, ,CO6
	Unit 4	**Working with SQL Lite**	

		Create and Login applicationfor above mentioned problems, Create an application to implement Create, Insert and update operation on the database, Create an application to perform Delete and retrieve operation on the database.			CO4, ,CO6
	Unit 5	**Sensor Device**			
		Develop an Android Application to detect availability of all sensors, Develop an Android Application to Fetch data from sensors, Develop an Android Application for development of compass application with help of Orientation sensor			CO5, ,CO6
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	CE(Viva)	ETE	
		25%	25%	50%	
	Text book/s*	1. AnubhavPradhan and Anil V. Deshpande, Composing Mobile Apps: Learn, Explore, Apply Using Android , 1st Edition, Wiley India.			
	Other References	1. Wei-MengLee , Beginning Android 4 Application Development. 2. Neil Smyth ,Android Studio Development essentials-Android 6			

CO and PO Mapping

Mapping between Cos and Pos, PSO's		
Sl. No.	**Course Outcomes (COs)**	**Mapped Program Outcomes and PSO's**
1	**CO1:** Explain the fundamentals of Android App Development.	**PO1,PO3,PO5,PO12,PSO1,PSO2,PSO3**
2	**CO2:** Make use of UI components to create Android applications.	**PO1,PO3,PO5,PO10,PO12,PSO1,PSO2,PSO3**
3	**CO3:** Examine the services and notifications in android to perform event driven programming.	**PO1,PO2,PO3,PO5,PO12,PSO1,PSO2,PSO3**
4	**CO4:** Develop database SQLite based Android applications.	**PO1,PO3,PO5,PO12,PSO1,PSO2,PSO3**
5	**CO5:** Analyze the usage of commonly available device sensors while building Android App.	**PO1,PO3,PO5,PO12,PSO1,PSO2,PSO3**
6	**CO6:** Develop application using Android software development tools.	**PO1,PO2,PO3,PO4,PO5,PO6,PO7,PO9,PO10,PO11,PO12,PSO1,PSO2,PSO3**

PO and PSO mapping with level of strength for Course Name Technical Skill Enhancement Course-2 (Course Code CSP 396)

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO1 1	PO 12	PSO 1	PSO2	PSO3
CO1	1	-	1	-	2	-	-	-	-	-	-	1	1	2	1
CO2	1	-	1	-	2	-	-	-	-	2	-	1	1	2	1
CO3	1	2	1	-	2	-	-	-	-	-	-	1	1	2	1
CO4	1	-	2	-	2	-	-	-	-	-	-	1	1	2	1
CO5	2	-	1	-	2	-	-	-	-	-	-	1	1	2	1
CO6	2	2	3	2	2	2	1	-	2	3	2	2	2	3	1
Avg PO attained	1	0.7	1.5	0.3	2	0.3	0.2	0	0	1	0	1	1	2.2	1

School: SET		**Batch : 2023-27**	
Program: BTech		**Current Academic Year: 2023-24**	
Branch: CSE / IT		**Semester: 6th**	
1	Course Code	**CSP398**	Course Name: Project Based Learning -4
2	Course Title	Project Based Learning -4	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-4	
	Course Status	Compulsory	
5	Course Objective	1. To align student's skill and interests with a realistic problem or project. 2.To understand the significance of problem and its scope. 3.Students will make decisions within a framework.	
6	Course Outcomes	Students will be able to: CO1: Identify and formulate problem statement. CO2: Design relational database schema. CO3: Develop the solution by using different aspects of programming language. CO4: Classify and understand various test techniques for verification and validation of project. CO5: Analyze and make use of modern for solving real word problems. CO6: Develop teamwork and need to engage in life-long learning, along with the ability to communicate effectively with others.	
7	Course Description	In PBL-4, the students will learn how to define the problem for developing projects, and Design applicable solutions in one or more application domains using software engineering approaches that integrate ethical, social, legal and economic concerns.	

8	Outline syllabus		CO Mapping
	Unit 1	Problem Definition and identification, Team/Group formation and Project Assignment. Finalizing the problem statement, resource requirement, if any.	CO1,CO4
	Unit 2	Use of the relational algebra operations from mathematical set theory (union, intersection, difference, and Cartesian product) and the relational algebra operations developed specifically for relational databases (select (restrict), project, join, and division)..	CO2,CO6
	Unit 3	Design; implement project work in any programming language.	CO3
	Unit 4	Use of various test tools and techniques for software verification and validation of project	CO4,CO5
	Unit 5	Demonstrate and execute Project with the team.	CO6
		Report should include Abstract, Hardware / Software Requirement, Problem Statement, Design/Algorithm, ER diagrams, Use Case Diagrams, State Diagrams, Sequence Diagrams, Communication Diagrams, and	

		Activity Diagrams, Implementation Detail. Validation Reports. References, Test cases if any. The presentation, report, work done during the term supported by the documentation, forms the basis of assessment.			
	Mode of examination	Practical /Viva			
	Weight age Distribution	CA			MTE
			CE(Viva)	ETE	
		25%	25%	50%	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO)
1.	CO1: Identify and formulate problem statement.	PO1, PO2, PO4,PO6, PO8,PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
2.	CO2: Design relational database schema.	PO1, PO2, PO3,PO4,PO5, PO7, PO8, PO9, PO11, PO12 , PSO1,PSO2,PSO3
3.	CO3: Develop the solution by using different aspects of programming language.	PO1, PO2, PO3,PO4,PO5, PO6, PO8, PO9, PO11, PO12, PSO1,PSO2
4.	CO4: Classify and understand various test techniques for verification and validation of project.	PO1, PO2, PO3,PO4,PO5, PO8,PO9, PO10, PO11, PO12 ,PSO1,PSO2,PSO3
5.	CO5: Analyze and make use of modern for solving real word problems.	PO1, PO2, PO5, PO6, PO7, PO8, PO9, PO12 PSO1,PSO2
6.	CO6: Develop teamwork and need to engage in life-long learning, along with the ability to communicate effectively with others.	PO2, PO4, PO8,PO9, PO10, PO11, PO12,PSO1,PSO3

PO and PSO mapping with level of strength for Course Name Project Based Learning – 4 (Course Code CSP398)

CO/PO Mapping (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Low															
Cos	Programme Outcomes(POs)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	-	2	-	1	-	1	2	-	2	1	2	2	3
CO2	3	2	2	2	2	-	-	1	2	-	2	1	2	1	1
CO3	3	2	2	2	2	3	-	1	2	-	2	1	2	2	-
CO4	3	3	2	2	3	-	-	1	2	-	-	1	2	2	2
CO5	3	2	-	-	3	-	-	1	2	-	-	1	2	2	-
CO6	-	1	-	1	-	-	-	2	2	3	3	3	1	-	1
Avg PO attained	3	2.2	1	1.5	1.7	0.7	0	1.2	2	1	2	1	2	1.5	1.2

TERM - VII

CSE451: **Artificial Intelligence**

School: SET		**Batch : 2023-27**	
Program: B.Tech		**Current Academic Year: 2023-24**	
Branch: ALL		**Semester: VII**	
1	**Course Code**	**CSE451**	**Course Name: Artificial Intelligence**
2	**Course Title**	**Artificial Intelligence**	
3	**Credits**	**3**	
4	**Contact Hours (L-T-P)**	**3-0-0**	
	Course Status	**CORE**	
5	Course Objective	The objective of the course is to introduce basic fundamental concepts in Artificial Intelligence (AI), with a practical approach in understanding them. To visualize the scope of AI and its role in futuristic development.	
6	Course Outcomes	After the completion of this course, students will be able to: 1. ***Relate*** the goals of Artificial Intelligence and AI and non-AI solution. 2. ***Analyze and*** various AI uninformed and informed search algorithms. 3. ***Extend*** knowledge representation, reasoning, and theorem proving techniques to real-world problems 4. ***Make use of:*** Machine learning algorithms in various application domains of AI. 5. ***Select*** Artificial Intelligent based applications. 6. ***Develop*** independent (or in a small group) research and communicate it effectively.	
7	Course Description	In this course students will learn basic introduction of Artificial Intelligence, problem solving agents, reasoning, learning and applications of artificial intelligence.	
8	Outline syllabus		CO Mapping
	Unit 1	**INTRODUCTION TO AI**	
	A	Foundation of AI, Goals of AI, History and AI course line	CO1
	B	Introduction to Intelligent Agents; Environment; Structure of Agent	CO1
	C	AI Solutions Vs Conventional Solutions; a philosophical approach; a practical approach	CO1, CO2
	Unit 2	**PROBLEM SOLVING AGENTS**	
	A	Problem solving using Search Techniques; Problems; Solutions; Optimality	CO1, CO2
	B	Informed Search Strategies; Greedy Best-First; A* Search; Heuristic Functions	CO1, CO2
	C	Uninformed Search Strategies; BFS; DFS; DLS; UCS; IDFS; BDS	CO1, CO2
	Unit 3	**KNOWLEDGE & REASONING**	
	A	Knowledge-Based Agents; Logic; First-Order Logic; Syntax-Semantics in FOL; Simple usage;	CO3

	B	Inference Procedure; Inference in FOL; Reduction; Inference Rules;	CO3
	C	Forward Chaining; Backward Chaining; Resolution	CO3
	Unit 4	**LEARNING**	
	A	Common Sense Vs Learning; Components; Representations; Feedback	CO1, CO2, CO3,CO4
	B	Learning Types: Supervised; Unsupervised; Reinforcement Learnings	CO1, CO2, CO3,CO4
	C	Artificial Neural Networks: Introduction, types of networks; Single Layer and Multi-Layer n/w.	CO1, CO2, CO3,CO4
	Unit 5	**APPLICATIONS**	
	A	AI Present & Future; application case studies on NLP, Image Processing;	CO3, CO4, CO5, CO6
	B	Robotics – Hardware; Vision; Navigation based case studies;	CO3, CO4, CO5, CO6
	C	Ambient Intelligence case studies;	CO3, CO4, CO5, CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 25% / MTE: 25% / ETE: 50%	
	Text book/s*	1. **Rich E& Knight K, Artificial Intelligence,** Tata McGraw Hill, Edition 3.	
	Reference Books	1. Russell S &Norvig P, *Artificial Intelligence: A Modern Approach*, Prentice Hall. 2. Dan W. Patterson, Artificial Intelligence & Expert Systems, Pearson Education with Prentice Hall India. Indian Edition.	

Course Outcomes:

Sl. No.	Course Outcome (CO)	
1.	***Relate*** the goals of Artificial Intelligence and AI and non-AI solution.	PO3, PO4, PO5, PO10, PSO1, PSO2, PSO3
2.	***Analyze and*** various AI uninformed and informed search algorithms.	PO1, PO2, PO3, PO4, PO5, PO10, PSO1, PSO2, PSO3
3.	***Extend*** knowledge representation, reasoning, and theorem proving techniques to real-world problems	PO1, PO2, PO3, PO4, PO5, PO12, PSO1, PSO2, PSO3
4.	***Make use of:*** Machine learning algorithms in various application domains of AI.	PO1, PO2, PO3, PO4, PO5, PO12, PSO1, PSO2, PSO3
5.	***Select*** Artificial Intelligent based applications.	PO1, PO2, PO3, PO4, PO5, PO9, PO10 PO12, PSO1, PSO2, PSO3
6.	***Develop*** independent (or in a small group) research and communicate it effectively.	PO1, PO2, PO3, PO4, PO5, PO9, PO10 PO12, PSO1, PSO2, PSO3

Mapping of POs & COs: **CO-PO and CO-PSO Mapping with level of strength**

Course Objectives	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	1	2	3	2	2					2		2	3	2	2
CO2	2	3	3	2	3					2		2	3	3	2
CO3	3	3	3	3	2	1	1			1	2	3	3	2	3
CO4	3	3	3	3	2	2	1			2	1	3	3	2	3
CO5	2	3	3	3	3	2	2	2	3	2	2	2	3	3	2
CO6	2	3	3	3	3	2	2	2	3	2	2	2	3	3	2

School: SET		**Batch: 2023-27**	
Program: B.Tech		**Current Academic Year: 2023-24**	
Branch: CSE / IT		**Semester: 6th**	
1	Course Code	**CSP398**	Course Name: Project Based Learning -4
2	Course Title	Project Based Learning -4	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-4	
	Course Status	Compulsory	
5	Course Objective	1. To align student's skill and interests with a realistic problem or project. 2.To understand the significance of problem and its scope. 3.Students will make decisions within a framework.	
6	Course Outcomes	Students will be able to: CO1: Identify and formulate problem statement. CO2: Design relational database schema. CO3: Develop the solution by using different aspects of programming language. CO4: Classify and understand various test techniques for verification and validation of project. CO5: Analyze and make use of modern for solving real word problems. CO6: Develop teamwork and need to engage in life-long learning, along with the ability to communicate effectively with others.	
7	Course Description	In PBL-4, the students will learn how to define the problem for developing projects, and Design applicable solutions in one or more application domains using software engineering approaches that integrate ethical, social, legal and economic concerns.	

8	Outline syllabus		CO Mapping
	Unit 1	Problem Definition and identification, Team/Group formation and Project Assignment. Finalizing the problem statement, resource requirement, if any.	CO1,CO4
	Unit 2	Use of the relational algebra operations from mathematical set theory (union, intersection, difference, and Cartesian product) and the relational algebra operations developed specifically for relational databases (select (restrict), project, join, and division)..	CO2,CO6
	Unit 3	Design; implement project work in any programming language.	CO3
	Unit 4	Use of various test tools and techniques for software verification and validation of project	CO4,CO5
	Unit 5	Demonstrate and execute Project with the team.	CO6
		Report should include Abstract, Hardware / Software Requirement, Problem Statement, Design/Algorithm, ER diagrams, Use Case Diagrams, State Diagrams, Sequence Diagrams, Communication Diagrams, and	

		Activity Diagrams, Implementation Detail. Validation Reports. References, Test cases if any. The presentation, report, work done during the term supported by the documentation, forms the basis of assessment.			
	Mode of examination	Practical /Viva			
	Weight age Distribution	CA			MTE
			CE(Viva)	ETE	
		25%	25%	50%	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO)
1.	CO1: Identify and formulate problem statement.	PO1, PO2, PO4,PO6, PO8,PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
2.	CO2: Design relational database schema.	PO1, PO2, PO3,PO4,PO5, PO7, PO8, PO9, PO11, PO12 , PSO1,PSO2,PSO3
3.	CO3: Develop the solution by using different aspects of programming language.	PO1, PO2, PO3,PO4,PO5, PO6, PO8, PO9, PO11, PO12, PSO1,PSO2
4.	CO4: Classify and understand various test techniques for verification and validation of project.	PO1, PO2, PO3,PO4,PO5, PO8,PO9, PO10, PO11, PO12 ,PSO1,PSO2,PSO3
5.	CO5: Analyze and make use of modern for solving real word problems.	PO1, PO2, PO5, PO6, PO7, PO8, PO9, PO12 PSO1,PSO2
6.	CO6: Develop teamwork and need to engage in life-long learning, along with the ability to communicate effectively with others.	PO2, PO4, PO8,PO9, PO10, PO11, PO12,PSO1,PSO3

PO and PSO mapping with level of strength for Course Name Project Based Learning – 4 (Course Code CSP398)

CO/PO Mapping (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Low															
Cos	Programme Outcomes(POs)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	-	2	-	1	-	1	2	-	2	1	2	2	3
CO2	3	2	2	2	2	-	-	1	2	-	2	1	2	1	1
CO3	3	2	2	2	2	3	-	1	2	-	2	1	2	2	-
CO4	3	3	2	2	3	-	-	1	2	-	-	1	2	2	2
CO5	3	2	-	-	3	-	-	1	2	-	-	1	2	2	-
CO6	-	1	-	1	-	-	-	2	2	3	3	3	1	-	1
Avg PO attained	3	2.2	1	1.5	1.7	0.7	0	1.2	2	1	2	1	2	1.5	1.2

Syllabus: CSE062 MOBILE COMPUTING

School: SET		**Batch: 2023-27**		
Program: B.Tech		**Current Academic Year: 2023-24**		
Branch:		**CSE**		
1	Course Code	CSE062		
2	Course Title	MOBILE COMPUTING		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core /Elective		
5	Course Objective	The objective of the course is to impart knowledge of mobile and wireless computing systems and techniques		
6	Course Outcomes (5-6)	On successful completion of this module students will be able to CO1: synthesize the basic concepts and principles in mobile computing. CO2: analyze the concept of wireless& telecommunication networks. CO3: synthesize the concepts of IEEE802.11, Bluetooth and HYPERLAN. CO4: Understand the concept of mobile IP & various Routing Protocols CO5: synthesize the concepts of Mobile Transport Layer & WAP CO6: Comparison of all the protocols		
7	Course Description	This course will cover various topics of mobile computing, networking, and systems, including but not limited to: applications of smart phones, cellular networks, embedded sensor systems, localization systems, energy efficiency of mobile devices, wearable and vehicular mobile systems, mobile security etc.		
8	Outline syllabus			CO Mapping
	Unit 1	**INTRODUCTION**		
	A	Wireless transmission , Frequencies for radio transmission		CO1
	B	Signals , Antennas , Signal Propagation , Multiplexing, Modulations		CO1
	C	Spread spectrum, MAC, SDMA , FDMA , TDMA , CDMA , Cellular Wireless Networks		CO1
	Unit 2	**TELECOMMUNICATION NETWORKS**		
	A	GSM: Mobile services, System architecture, Radio interface, Protocols		CO2
	B	Localization and calling, Handover, Security		CO2
	C	General Packet Radio Service (GPRS): GPRS Architecture, GPRS network nodes,		CO2
	Unit 3	**WIRELESS LANS**		
	A	Introduction to IEEE 802.11b/g/n		CO3
	B	Bluetooth technologies and architecture.		CO3
	C	HIPERLAN, WML programming		CO3
	Unit 4	**MOBILE NETWORK LAYER**		

	A	Mobile IP Goals, Entities, IP packet Delivery Agent Advertisement and Discovery, Registration.			CO4
	B	Hidden and exposed terminal problems ,Routing protocols classification,			CO4
	C	DSDV, DSR, AODV ,Security			CO4
	Unit 5	**Mobile Transport Layer & Wireless Application Protocol**			
	A	Traditional TCP, Indirect TCP,			CO5
	B	Snooping TCP, Mobile TCP			CO5,CO6
	C	WAP: Protocols, Architecture			CO5,CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	2. JochenSchiller : Mobile Communication, Pearson Education. 3. U. Hansman and L. Merck : Principles of Mobile Computing", 2nd Ed., Springer			
	Other References	4. A. S. Tanenbaum. : Computer Networks, 4th Ed., Pearson Education. 5. D. Milojicic, F. Douglis. : Mobility Processes, Computers and Agents",Addison Wesley 6. D.B. Lange and M. Oshima : Programming and Deploying Java Mobile Agents with Aglets, Addison Wesley.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: synthesize the basic concepts and principles in mobile computing.	PO1, PO2, PO4, PO5, PO10, PSO1, PSO2
2.	CO2: analyze the concept of wireless& telecommunication networks.	PO1, PO2, PO4, PO5, PO10, PSO1, PSO2
3.	CO3: synthesize the concepts of IEEE802.11, Bluetooth and HYPERLAN.	PO1, PO2, PO4, PO5, PO10, PSO1, PSO2
4.	CO4: Understand the concept of mobile IP & various Routing Protocols	PO1, PO2, PO4, PO5, PO10, PSO1, PSO2
5.	CO5: synthesize the concepts of Mobile Transport Layer & WAP	PO1, PO2, PO4, PO5, PO10, PSO1, PSO2
6.	CO6: Comparison of all the protocols	PO1, PO2, PO4, PO5, PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Mobile Computing (CSE 062)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSE062_	CO1	3	3	-	2	3	-	-	-	-	2	-	-	3	2	-
	CO2	3	3	-	2	3	-	-	-	-	2	-	-	3	2	-

MOBILE COMPUTI NG	CO3	3	3	-	2	3	-	-	-	-	2	-	-	2	3	-
	CO4	3	3	-	2	3	-	-	-	-	2	-	-	3	2	-
	CO5	3	3	-	2	3	-	-	-	-	2	-	-	2	2	-
	CO6	3	3	-	2	3	-	-	-	-	2	-	-	2	2	-
Avg.		3	3	-	2	3	-	-	-	-	2	-	-	2	2	-

2.1 Template A1: Syllabus for Theory Courses (SAMPLE)

School:		School of Engineering & Technology		
Department		Department of Computer Science & Engineering		
Program:		B.Tech		
Branch:		CSE		
1	Course Code	CSE063		
2	Course Title	Quantum Computing		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	2
	Course Status	Core /Elective/Open Elective		
5	Course Objective	Fundamentals of quantum information processing, including quantum computation, quantum cryptography, and quantum information theory. Topics include: the quantum circuit model, qubits, unitary operators, measurement, entanglement, quantum algorithms for factoring and search, quantum cryptographic key distribution, error-correction and fault-tolerance, information capacity of quantum channels, complexity of quantum computation.		
6	Course Outcomes (must be 6 COs, following verbs given in Bloom's Taxonomy)	CO1: Analyze the behavior of basic quantum algorithms CO2: Demonstrate simple quantum algorithms CO3: Simulate a simple quantum error-correcting code CO4: Prove basic facts about quantum information channels CO5: Explain quantum computing and quantum protocols CO6: Illustrate information channels in the quantum circuit model.		
7	Course Description	This course teaches the fundamentals of quantum information processing, including quantum computation, quantum cryptography, and quantum information theory.		

8	Outline syllabus		CO Mapping
	Unit 1	Introduction	
	A	Computers and the Strong Church–Turing Thesis, Circuit Model of Computation	
	B	A Linear Algebra Formulation of the Circuit Model, Reversible Computation	CO1
	C	Quantum Physics and Computation	CO1, CO2
	Unit 2	LINEAR ALGEBRA AND THE DIRAC NOTATION	CO1, CO2,CO4
	A	The Dirac Notation and Hilbert Spaces, Dual Vectors, Operators	
	B	The Spectral Theorem, Functions of Operators	
	C	Tensor Products, The Schmidt Decomposition Theorem	CO1, CO2
	Unit 3	A QUANTUM MODEL OF COMPUTATION	CO1, CO2
	A	The Quantum Circuit Model, Quantum Gates	CO1, CO2,CO5,CO6

	B	Universal Sets of Quantum Gates, Efficiency of Approximating Unitary Transformations			
	C	Implementing Measurements with Quantum Circuits			
	Unit 4	INTRODUCTORY QUANTUM ALGORITHMS			CO1,CO2,CO3
	A	Probabilistic Versus Quantum Algorithms, Phase Kick-Back			CO1,CO2,CO3
	B	The Deutsch Algorithm, The Deutsch–Jozsa Algorithm			CO1,CO2,CO3
	C	Simon's Algorithm			
	Unit 5				
	A	Tools for Analysing Probabilistic Algorithms			CO2,CO3,CO4
	B	Solving the Discrete Logarithm Problem When the Order of a Is Composite			CO3,CO4
	C	Computing Schmidt Decompositions			CO2, CO4,CO5
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	"An Introduction to Quantum Computing", Phillip Kaye Raymond Laflamme, Michele Mosca			
	Other References				

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Analyze the behavior of basic quantum algorithms	
2.	CO2: Demonstrate simple quantum algorithms	PO1, PO2, PO5, PO8, PO12, PSO3
3.	CO3: Simulate a simple quantum error-correcting code	PO1, PO2, PO3, PSO3
4.	CO4: Prove basic facts about quantum information channels	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
5.	CO5: Explain quantum computing and quantum protocols	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
6.	CO6: Illustrate information channels in the quantum circuit model	PO1, PO2, PO3, PO8, PO9, PSO2,

PO and PSO mapping with level of strength for Course Name Quantum Computing (Course Code CSE063)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Quantum Computing	CO 1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO 2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO 3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO 4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO 5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO 6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	Quantum Computing	3	2.7	1.1	1	1.5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Strength of Correlation

1. Addressed to *Slight (Low=1) extent* 2. Addressed to *Moderate (Medium=2) extent*
3. Addressed to *Substantial (High=3) extent*

School:		**School of Engineering & Technology**	
Department		**Department of Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Internet of Things & Applications**	
1	Course Code	CSE071	
2	Course Title	Introduction to Internet of Things	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Elective	
5	Course Objective	In this course, student will explore various concepts of Internet of things such as things, enabling technologies, M2M to IoT and IoT architecture. This course also discusses the security challenges and then provides answers on how to successfully manage IoT security and build a safe infrastructure for smart devices. In the end they will also be able to identify the challenges in IoT and its various areas of application.	
6	Course Outcomes	CO1: Define the general concepts of Internet of Things. CO2: Recognize the basic M2M Ecosystem and change from M2M to IoT. CO3: Outline the concepts of IoT platform. CO4: Explain IoT security and vulnerability threats. CO5: Examine the challenges in IoT specific application. CO6: Discuss the various domains where IOT can be applied successfully.	
7	Course Description	This course introduces the concepts for internet of things and how we can embed it into our daily lives for the development of life style. It will also help students to understand the applications according to their problem statements.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to IoT**	
	A	Defining IoT, History of IoT, Importance of IoT , IoT Basic Characteristics, Enabling Technologies of IoT	CO1
	B	About the Internet in IoT, IoT Advantages and Disadvantages, M2M Overview, M2M Features	CO1
	C	M2M Ecosystem, Comparison of the Main Characteristics of M2M and IoT, M2M Applications	CO1
	Unit 2	**IoT Architecture**	
	A	Basic Building blocks of IoT system: Sensors, Processors, gateways, Applications	CO1, CO2
	B	Physical design of IoT: Things in IOT, IoT Protocols, Logical design of IoT: IoT Functional Blocks, IoT Communication Models. IoT Communication API’s	CO1, CO2
	C	IoT Service Oriented Architecture (SOA), API Oriented Architecture.	CO1, CO2
	Unit 3	**Introduction to IoT Platform**	
	A	IoT Working, Introduction to Arduino and Raspberry Pi	CO1, CO3

	B	The SENSEnut Platform, Peripheral Hardware Specific Calls: DIO Functions, I^2C Functions			CO1, CO3
	C	MAC functions: General Functions, Coordinator Functions, genMac Functions			CO1, CO3
	Unit 4	**Vulnerabilities, Attacks, and Countermeasures**			
	A	Cyber security versus IoT security and cyber-physical systems, Need to secure IoT			CO1, CO4, CO5
	B	Primer on threats, vulnerability, and risks (TVR)			CO1, CO4, CO5
	C	Common IoT attacks, Today's IoT attacks , Threat modeling for an IoT system			CO1, CO4, CO5
	Unit 5	**Domain specific applications of IoT**			
	A	Home automation concept and case study			CO1, CO3, CO6
	B	Industry applications concept and case study			CO1, CO3, CO6
	C	Surveillance applications concept and case study, Other IoT applications			CO1, CO3, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. The Internet of Things: Connecting Objects to the Web edited by Hakima Chaouchi, Reference for Unit-1. 2. Introduction to Internet of Things, Prof. Sudip Misra, NPTEL Lectures Notes, Department of Computer Science & Engineering, Indian Institute of Technology Kharagpur, Reference for Unit 2, 3 (c), 4. 3. Internet of Things, Rajkumar Buyya, Reference for Unit 3 (c) 4. Arshdeep Bahga and Vijay Madisetti, “Internet of Things – A Hand-on Approach”, Universities press, 2015, Reference for Unit 3 (B) 5. API REFERENCE GUIDE: SENSEnuts WSN sensation 6. Practical Internet of Things Security, Brian Russell, Drew Van DurenCopyright © 2016 Packt Publishing			
	Other References	1. Charalampos Doukas , "Building Internet of Things with the Arduino", Create space, April 2002 2. Dr. Ovidiu Vermesan and Dr. Peter Friess, “Internet of Things: From research and innovation to market deployment”, River Publishers 2014. 3. Contiki : The open source for IOT, www.contiki-os.org			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the general concepts of Internet of Things.	PO1, PO2, PO3, PO6, PO7, PO12, PSO1
2.	CO2: Recognize the basic M2M Ecosystem and change from M2M to IoT.	PO1, PO2, PO3, PO6, PO7, PO12, PSO1
3.	CO3: Outline the concepts of IoT platform.	PO1, PO2, PO3, PO4, PO6, PO7, PO12, PSO1
4.	CO4: Explain IoT security and vulnerability threats.	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, P011, PO12, PSO1, PSO2, PSO3
5.	CO5: Examine the challenges in IoT specific application.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO12, PSO1
6.	CO6: Discuss the various domains where IOT can be applied successfully.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO12, PSO1

PO and PSO mapping with level of strength for Course Name Introduction to Internet of Things (Course Code CSE071**)**

Course Code_ Course Name	**CO's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
_ Introduction to Internet of Things	**CO1**	3	1	1	-	-	2	1	-	-	-	-	3	3	-	-
	CO2	2	2	1	-	-	1	3	-	-	-	-	3	3	-	-
	CO3	3	1	1	2	-	2	1	-	-	-	-	3	3	-	-
	CO4	**3**	**3**	**3**	**3**	**2**	**2**	**-**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**
	CO5	3	3	3	3	3	2	3	-	-	-	-	3	3	-	-
	CO6	2	2	2	2	3	2	3	-	-	-	-	3	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO2**
	Introduction to Internet of Things	2.7	2.0	1.8	2.5	2.7	1.8	2.2	3.0	3.0	3.0	3.0	3.0	2.8	2.0	3.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***

3. Addressed to ***Substantial (High=3) extent***

2.1 Template A1: Syllabus for Theory Courses (SAMPLE)

School:		School of Engineering & Technology			
Department		Department of Computer Science & Engineering			
Program:		B.Tech			
Branch:		CSE			
1	Course Code	CSE072			
2	Course Title	Parallel Computing Algorithms			
3	Credits	2			
4	Contact Hours (L-T-P)	2	0	2	
	Course Status	Core /Elective/Open Elective			
5	Course Objective	Design and analysis of parallel algorithms on various parallel network model, with emphasis on time complexities after implementation, a comparative study of various architecture with respect to time complexity. Understanding the fundamental of parallel algorithms.			
6	Course Outcomes (must be 6 COs, following verbs given in Bloom's Taxonomy)	CO1: Acquire the skill to design and develop parallel algorithms with efficient time complexity. CO2: Explain various terminology of parallel processing which is required to design and understand the future processor architectures. CO3: Demonstrate the skill to choose the technology to use, based on the requirements and functionality of multi-processor architecture based on the design parameters of the parallel architectures. CO4: Explain how large-scale parallel systems are architecture and how massive parallelism are implemented in accelerator architectures CO5: Design efficient parallel algorithms and applications CO6: Analyse performance and modeling of parallel programs			
7	Course Description	This course introduces critical methods and techniques related to parallel computing. Particularly, the course focuses on hardware, algorithm, and programming of parallel systems, providing students a complete picture to understand pervasive parallel computing.			
8	Outline syllabus				CO Mapping
	Unit 1	Introduction			
	A	Introduction to Parallel Processing Approach			
	B	Difference between Parallel Processing and Serial Processing, Background, Flynn's Taxonomy for serial and parallel computer architecture			CO1
	C	Parallel Algorithms, Performance of Parallel Algorithm.			CO1, CO2
	Unit 2	Basic Techniques and Different Network Architecture			CO1, CO2,CO4
	A	Criteria to evaluate processor organization			
	B	Mesh Networks, Binary Tree Networks, Hypertree Networks, Pyramid Networks, Butterfly Networks, Hypercube (Cube-Connected) Networks,			
	C	Cube-Connected Cycle Networks, Shuffle-Exchange Networks, Case Studies Based on the Parallel Network Architecture.			CO1, CO2
	Unit 3	Parallel Architectures			CO1, CO2
	A	Multiprocessors, Uniform Memory Access (UMA) Multiprocessors and Non-Uniform Memory Access, Mesh of Trees Architecture,			CO1, CO2,CO5,CO6
	B	Applications based on MoT, Advantages/Disadvantages of MoT based on parallel parameters, Multi-Mesh Architecture,			
	C	Applications based on MM, Advantages/Disadvantages of MM based on parallel parameters Multi-Mesh of Trees Architecture, Advantages of MMT over MM and MoT			

	Unit 4	Parallel Algorithms on Different Architectures			CO1,CO2,CO3
	A	One to One Communication Algorithm on Multi-Mesh Architecture and Multi-Mesh of Trees Architecture,			CO1,CO2,CO3
	B	All-to-All Algorithm Communication Algorithm on Multi-Mesh Architecture and Multi-Mesh of Trees Architecture,			CO1,CO2,CO3
	C	Sorting Algorithms on MMT, Case Studies based on MMT Architecture			
	Unit 5	Parallel computing Application			
	A	Performance measurement and analysis of parallel programs			CO2,CO3,CO4
	B	Problem solving on clusters using MapReduce			CO3,CO4
	C	Warehouse-scale computing			CO2, CO4,CO5
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	"Introduction to Parallel Computing", 2nd Ed, Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar			
	Other References	• "Using MPI: Portable Parallel Programming with the Message-Passing Interface", 3rd Ed - William Gropp, Ewing Lusk, Anthony Skjellum • "Programming Massively Parallel Processors: A Hands-on Approach", 3rd Ed. - David B. Kirk, Wen-mei W. Hwu			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Acquire the skill to design and develop parallel algorithms with efficient time complexity.	
2.	CO2: Explain various terminology of parallel processing which is required to design and understand the future processor architectures.	PO1, PO2, PO5, PO8, PO12, PSO3
3.	CO3: Demonstrate the skill to choose the technology to use, based on the requirements and functionality of multi-processor architecture based on the design parameters of the parallel architectures.	PO1, PO2, PO3, PSO3
4.	CO4: Explain how large-scale parallel systems are architecture and how massive parallelism are implemented in accelerator architectures	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
5.	CO5: Design efficient parallel algorithms and applications	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
6.	CO6: Analyse performance and modeling of parallel programs	PO1, PO2, PO3, PO8, PO9, PSO2,

PO and PSO mapping with level of strength for Course Name Parallel Computing (Course Code CSE072)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Parallel Computing	CO 1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO 2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO 3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO 4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO 5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO 6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	Parallel Computing	3	2.7	1.1	1	1.5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Strength of Correlation

1. Addressed to *Slight (Low=1) extent* 2. Addressed to *Moderate (Medium=2) extent*
3. Addressed to *Substantial (High=3) extent*

2.1 template a1: syllabus for theory courses (sample)

School:		School of Engineering & Technology		
Department		Department of Computer Science & Engineering		
Program:		B.tech		
Branch:		CSE		
1	Course code	CSE073		
2	Course title	3d printing and software tools		
3	Credits	2		
4	Contact hours (l-t-p)	2	0	0
	Course status	Core /elective/open elective		
5	Course objective	This course will help understand the technical principles and workflows of polymers, metals, and composites.		
6	Course outcomes (must be 6 cos, following verbs given in bloom's taxonomy)	Co1: apply the unique advantages of 3d printing to their designs. Co2: compare additive manufacturing to traditional technologies and choose the best technology for a given application. Co3: distinguish between various 3d printing technologies and materials and select appropriately for a given application. Co4: discuss the economic implications of 3d printing including its impact on startup businesses and supply chains Co5: evaluate real-life scenarios and recommend the appropriate use of 3d printing technology Co6: explain current and emerging 3d printing applications in a variety of industries		
7	Course description	In this course students will gain broad understanding of the advances that led to today's manufacturing environment. They will understand how humans, machines and code work together to make things.		
8	Outline syllabus		Co mapping	
	Unit 1	Introduction to 3d printing		
	A	Cutting, subtractive manufacturing		
	B	Forming	Co1	
	C	Additive manufacturing	CO1, CO2	
	Unit 2	Mesh	CO1, CO2,CO4	
	A	Review of geometry terms		
	B	Things to consider when preparing a mesh file		
	C	Making process (a reminder), making by sharing	CO1, CO2	
	Unit 3	Introduction to computer numerical control (cnc)	CO1, CO2	

	A	Numerical control, functions of a machine tool, concept of numerical control, historical development, definition			CO1, CO2,CO5,CO6
	B	Advantages of cnc machine tools, evolution of cnc, advantages of cnc, limitations of cnc, features of cnc			
	C	The machine control unit (mcu) for cnc, classification of cnc machine tools, cnc machining centers			
	Unit 4	Blue print reading			CO1,CO2,CO3
	A	Reading the machining sketches, different geometrical tolerance symbols,			CO1,CO2,CO3
	B	Reading dimensional tolerances, understanding the views,			CO1,CO2,CO3
	C	Concept of first angle & third angle projection			
	Unit 5	Cnc milling			
	A	Fundamentals of cnc milling, familiarization of control panel			CO2,CO3,CO4
	B	Fundamentals of cnc programming, part programming techniques			CO3,CO4
	C	Machining practice on cnc milling, practice session at industry			CO2, CO4,CO5
	Mode of examination	Theory/jury/practical/viva			
	Weightage distribution	Ca	Mte	Ete	
		25%	25%	50%	
	Text book/s*	Liza Wallach Kloski, Nick Kloski – “Getting Started with 3D Printing_ A Hands-on Guide to the Hardware, Software, and Services Behind the New Manufacturing Revolution”-Maker Media, Inc (2016)			
	Other references				

Co and PO mapping

S. No.	Course outcome	Program outcomes (po) & program specific outcomes (pso)
1.	Co1: apply the unique advantages of 3d printing to their designs.	
2.	Co2: compare additive manufacturing to traditional technologies and choose the best technology for a given application.	PO1, PO2, PO5, PO8, PO12, PSO3
3.	Co3: distinguish between various 3d printing technologies and materials and select appropriately for a given application.	PO1, PO2, PO3, PSO3

4.	Co4: discuss the economic implications of 3d printing including its impact on startup businesses and supply chains	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
5.	Co5: evaluate real-life scenarios and recommend the appropriate use of 3d printing technology	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
6.	Co6: explain current and emerging 3d printing applications in a variety of industries	PO1, PO2, PO3, PO8, PO9, PSO2,

Po and pso mapping with level of strength for course name 3d printing and software tools (course code CSE073)

Course code_course name	Co's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
3d printing and software tools	Co1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	Co2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	Co3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	Co4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	Co5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	Co6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course code	Course name	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	Po10	Po11	Po12	Pso1	Pso2	Pso3
	3d printing and software tools	3	2.7	1.1	1	1.5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Strength of correlation

1. Addressed to *slight (low=1) extent* 2. Addressed to *moderate (medium=2) extent*
3. Addressed to *substantial (high=3) extent*

Syllabus: CSP 497, Capstone – 1

School: SET		**Batch: 2023-27**
Program: B.tech		**Current Academic Year: 2023-24**
Branch: CSE		**Semester: 7th**
1	Course Code	**CSP497** | Course Name: **Capstone - 1**
2	Course Title	Major Project -1
3	Credits	2
4	Contact Hours (L-T-P)	0-0-0
	Course Status	Compulsory
5	Course Objective	Project being the student's last activity at the institution, it fulfills a purpose of synthesis of all the knowledge they have acquired throughout the different years. In addition, this knowledge must be used in a particular way, in order to solve a specific problem, which lets student demonstrate their aptitude by applying this knowledge.
6	Course Outcomes	Students will be able to: CO1: Identify problem statement in engineering and technology in selected field of interest. CO2: Analyze the gathered information required to develop a project. CO3: Apply prior knowledge of mathematics, computer science and engineering. CO4: Participate in different teams and to focus on getting a working project done on time with each student being held accountable for their part of the project. CO5: Prepare the designs requirements, functional and conceptual design. CO6: Initiate the actual implementation of the project work to produce the deliverables and explain the work in written and oral forms.
7	Course Description	The object of Major Project-I is to enable the student to take up investigative study in the broad field of Computer Science & Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor.

8	Outline syllabus		CO Mapping
	Unit 1	Problem identification, Literature survey/Gather & analyze information from multiple sources	CO1, CO2,CO4,
	Unit 2	Formulate solution/ Problem Description: Project Planning, Time and Cost Estimation and budgeting, Risk Management, Project scheduling and Planning Tools: Work Breakdown structure/ LRC/ Gantt charts/CPM/PERT Networks. Creating System Requirement Specifications (Functional & Non Functional)	CO1, CO2, CO3
	Unit 3	Preparing Design: Data Flow Diagrams & Flow Charts, Use of appropriate tools and techniques for project design	CO3, CO4
	Unit 4	Identify and Implement Project Modules.	CO4, CO5
	Unit 5	Use of appropriate tools/technologies for coding the modules	CO2, CO5, CO6
		Report on final problem statement, specifications, project schedule, final concept design and project schedule Report and Presentation - Project Modules development	

	Mode of examination	Practical			
	Weight age Distribution	CA	CE(Viva)	ETE	
		25%	25%	50%	
	Text book/s*				
	Other References				

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO)
1.	CO1: Identify problem statement in engineering and technology in selected field of interest.	PO1, PO2, PO3, PO4, PO5,PO6,PO7, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
2.	CO2: Analyze the gathered information required to develop a project.	PO1, PO2, PO3, PO4, PO5,PO6,PO7, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
3.	CO3: Apply prior knowledge of mathematics, computer science and engineering.	PO1, PO2, PO3, PO4, PO5,PO6,PO7, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
4.	CO4: Participate in different teams and to focus on getting a working project done on time with each student being held accountable for their part of the project.	PO1, PO2, PO3, PO4, PO5,PO6,PO7, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
5.	CO5: Prepare the designs requirements, functional and conceptual design.	PO1, PO2, PO3, PO4, PO5,PO6,PO7, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
6.	CO6: Initiate the actual implementation of the project work to produce the deliverables and explain the work in written and oral forms.	PO1, PO2, PO3, PO4, PO5, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Major Project -1 (Course Code CSP497)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	2	1	2	1	1	2	2	3	3
CO2	3	3	3	3	2	1	1	1	2	1	1	2	3	3	3
CO3	3	1	3	3	2	1	1	1	2	1	1	2	3	3	3
CO4	1	1	2	1	2	3	3	1	2	3	1	2	1	2	3
CO5	1	2	2	1	2	1	1	1	2	2	1	2	1	2	3
CO6	2	1	2	1	3	-	-	1	2	3	1	2	3	3	3

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

TERM - VIII

Syllabus: CSP498_Capstone - 2

School: SET		**Batch: 2023-27**			
Program: B.tech		**Current Academic Year: 2023-24**			
Branch: CSE / IT		**Semester: VIII**			
1	Course Code	**CSP498**	Course Name: Capstone -2		
2	Course Title	CSP498_Capstone - 2			
3	Credits	8			
4	Contact Hours (L-T-P)	0-0-16			
	Course Status	Compulsory			
5	Course Objective	1. To understand the concept of project design after the completion of project planning 2. Students making decisions within a framework 3. Continuous evaluation of the project 4. A final product to be evaluated for quality			
6	Course Outcomes	Students will be able to: CO1: Demonstrate the implementation of the project. CO2: Identify the test procedure for each implemented module. CO3: Deploy and evaluate the modules to verify the required need of the project. CO4: Use different tools for communication, testing and report writing. CO5: Develop the attitude and ethics of a professional engineer. CO6: Demonstrate an ability to present and defend their project work to a panel of experts.			
7	Course Description	The objective of Major Project-II is to enable the student to extend further the development of project till testing and deployment under the guidance of a Supervisor.			
8	Outline syllabus				CO Mapping
	Unit 1	Complete the implementation of the project. Testing of the modules, Use of appropriate tools/techniques for testing			CO1, CO2
	Unit 2	Deploy & demonstrate developed modules of the project			CO2, CO3
	Unit 3	Preparing a Project Report in the standard format for being evaluated by the Supervisor			CO4, CO5
	Unit 4	Submission of Project and Report to Departmental Committee			CO4, CO5, CO6
	Unit 5	Final Presentation before Departmental Committee			CO6
	Mode of examination	Practical			
	Weight age Distribution	CA			MTE
	Text book/s*	25%	CE(Viva)	ETE	
			25%	50%	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO)
1.	CO1: Demonstrate the implementation of the project.	PO1, PO2, PO3, PO4, PO5,PO6,PO7, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
2.	CO2: Identify the test procedure for each implemented module.	PO1, PO2, PO3, PO4, PO5,PO6,PO7, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
3.	CO3: Deploy and evaluate the modules to verify the required need of the project.	PO1, PO2, PO3, PO4, PO5,PO6,PO7, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
4.	CO4: Use different tools for communication, testing and report writing.	PO1, PO2, PO3, PO4, PO5,PO6,PO7, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
5.	CO5: Develop the attitude and ethics of a professional engineer.	PO1, PO2, PO3, PO4, PO5,PO6,PO7, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
6.	CO6: Demonstrate an ability to present and defend their project work to a panel of experts.	PO1, PO2, PO3, PO4, PO5,PO6,PO7, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Major Project -2 (Course Code CSP498)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	2	3	2	2	2	2	2	2	2	3	3	3
CO2	2	2	3	2	3	2	2	2	2	2	2	2	11	3	3
CO3	3	3	3	3	3	2	2	2	2	2	2	1	1	3	3
CO4	2	2	2	2	3	2	2	2	2	3	2	1	1	2	2
CO5	1	2	2	1	3	2	2	2	2	3	2	1	1	2	2
CO6	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Syllabus: CSE 250, Theory of Computation and Compiler Design

School: SET		**Batch: 2023-27**	
Program: B.Tech		**Current Academic Year: 2023-24**	
Branch:CSE		**Semester:**	
1	Course Code	**CSE250**	Course Name: Theory of Computation and Compiler Design
2	Course Title	Theory of Computation and Compiler Design	
3	Credits	4	
4	Contact Hours (L-T-P)	3-1-0	
	Course Status		
5	Course Objective	The objective of this course is to provide fundamental knowledge of Finite automata Learning about automata, grammar, language, and their relationships. Also, Introduces the major phases of Compiler construction and also its theoretical aspects including regular expressions, context-free grammars, Finite Automata	
6	Course Outcomes	After completing this course, students will be able to: **CO1: Design** DFA and NDFA and conversion from NDFA to DFA. Construct finite automata without output and with output. **CO2:Implement** regular expression and grammar corresponding to DFA and vice-versa. Explain the concepts and different phases of compilation with compile time error handling. **CO3: Design** Push down Automata from Context Free Language or Grammar and vice-versa. **CO 4:Compare** top down with bottom up parsers, and develop appropriate parser to produce parse tree representation of the input **CO 5: Design** syntax directed translation schemes for a given context free grammar. **CO 6:Generate** intermediate code for statements in high level language, Benefits and limitations of automatic memory management. optimization techniques to intermediate code and generate machine code for high level language program	
7	Course Description	To provide students with an overview of the issues that arise in Compiler construction as well as to throw light upon the significant theoretical developments and tools that are deep rooted into computer science.	
8	Outline syllabus		CO Mapping
	Unit 1	**Finite Automata and Regular Expression**	
	A	Introduction to languages, Kleene closures, Finite Automata (FA), Transition graph, Nondeterministic finite Automata (NFA), Deterministic finite Automata (DFA).	CO1
	B	Regular Expression, Finite Automata with null move, Regular Expression to Finite Automata, Arden Theorem	CO1,CO2
	C	FA with output: Moore machine, Mealy machine and Equivalence.	CO1
	Unit 2	**REGULAR & CONTEXT FREE LANGUAGE**	
	A	Defining grammar, Chomsky hierarchy of Languages and Grammar. Ambiguous to Unambiguous CFG.	CO1,CO2
	B	Simplification of CFGs, Normal forms for CFGs, Derivation and parse trees.	CO1,CO2
	C	Introduction to Compiler, Phases and passes, Bootstrapping, Cross-Compiler	CO1,CO2,CO4
	Unit 3	**PUSH DOWN AUTOMATA**	

	A	Description and definition of PDA and Non-Deterministic PDA			CO3
	B	Working of PDA,Acceptance of a string by PDA with final state and with Null store. Two stack PDA.			CO3
	C	Two stack PDA and PDA applications			CO3
	Unit 4	**Introduction to Lexical and Syntax Analysis & Parsing techniques**			
	A	Lexical analysis: Role of lexical analyser, Tokens, patterns & Lexemes			CO4,CO5
	B	Basic Parsing Techniques: Role of Parsers, Top Down Parsers, Algorithm to calculate FIRST and Follow, predictive parsers, LL(1) grammars, operator precedence parsing,			CO4,CO5
	C	Bottom up Parsing: Reductions, Handle Pruning, Conflicts during shift reduce parsing, Introduction to LR parsers, Items, Viable Prefixes, the canonical Collection of LR(0) items, SLR(1),CLR(1) and LALR(1) parsers.			CO4,CO5
	Unit 5	**Semantic Analysis and Three Address Code**			
	A	Syntax directed definition: Inherited and Synthesized attributes, Evaluation order for SDD's, Syntax directed translation scheme			CO5,CO6
	B	Intermediate code generation: Three address Code and its variants			CO5,CO6
	C	Code Optimization : Machine Dependent and Machine independent optimization techniques.			CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	•Introduction to Automata theory, Languages and Computation, John E. Hopcroft, Rajeev Motwani, Jeffery D. Ullman, Third Edition Pearson education. 2007 •Aho, Sethi, Ulman, compilers Principles, Techniques, and Tools, Pearson Education, 20			
	Other References	1. Lauden, Principles of Compiler Construction. 2. Fundamentals of the Theory of computation, Principles and Practice, Raymond Greenlaw, H. James Hoover, Morgan Kaufmann,1998 3. Peter Linz, “Formal Languages and Auomata”, Narosa Publishing House			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1: Design** DFA and NDFA and conversion from NDFA to DFA. Construct finite automata without output and with output.	PO1,PO2,PO3,PO4,PO5,PO8, PO9,PO12,PSO1
2.	**CO2: Implement** regular expression and grammar corresponding to DFA and vice-versa. Explain the concepts and different phases of compilation with compile time error handling.	PO1,PO2, PO3, PO4,PO5, PO8, PSO2,PSO3

3.	**CO3: Design** Push down Automata from Context Free Language or Grammar and vice-versa.	PO1,PO2,PO3,PO4, PO9, PO12,PSO1,PSO2
4.	**CO 4: Compare** Top down with bottom up parsers, and develop appropriate parser to produce parse tree representation of the input	PO1,PO2,PO3,PO5 PO8,,PO9, PO12, PSO1,PSO2,PSO2
5.	**CO 5: Design** syntax directed translation schemes for a given context free grammar.	PO1,PO2,PO3, PO4,PO5, PSO1,PSO2,PSO3
6.	**CO 6: Generate** intermediate code for statements in high level language, Benefits and limitations of automatic memory management. optimization techniques to intermediate code and generate machine code for high level language program	PO1, PO3,PO4, PO5, PO8,PO9, PO12, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Theory of Computation and Compiler Design **(Course Code CSE 250)**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	--	--	2	2	--	--	2	3	--	--
CO2	2	3	3	1	2	--	--	3	--	--	--	--	--	3	2
CO3	3	3	3	2	--	--	--	--	2	--	--	2	2	2	--
CO4	1	2	3	--	2	--	--	3	3	--	--	3	3	3	2
CO5	1	2	2	2	2	--	--	1	2	--	--	--	1	2	2
CO6	2	--	3	2	1	--	--	2	3	--	--	3	3	2	3

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CSE250	TOC& CD	**2**	**2**	**2.6**	**1.5**	**1.6**	**0**	**0**	**1.8**	**2**	**0**	**0**	**1.6**	**2**	**2**	**1.5**

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***

3. Addressed to ***Substantial (High=3) extent***

Syllabus: Theory of Computation & Compiler Design Lab

School:		**School of Engineering & Technology**
Department		**Computer Science & Engineering**
Program:		**B.Tech**
Branch:CSE		**Semester:**
1	Course Code	CSP250
2	Course Title	Theory of Computation & Compiler Design Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	
5	Course Objective	This laboratory course is intended to make the students experiment on the basic techniques of automata theory, regular expression, formal language, pushdown automaton and compiler construction that can used to perform syntax-directed translation of a high-level programming language into an executable code. Students will design and implement language processors in C by using tools to automate parts of the implementation process. This will provide deeper insights into the more advanced semantics aspects of programming languages, code generation, machine independent optimizations.
6	Course Outcomes	CO1 **Apply** different compiler writing tools to implement the different Phases CO2: **Implement** regular expression and grammar corresponding to DFA and vice-versa CO3: **Construct** Push Down Automata. CO4: **Implement** a parser for different context free grammars. CO5: **Construct** the intermediate representation CO6: **Compare** various code optimization techniques
7	Course Description	This self-paced course will discuss the major ideas used today in the implementation of programming language compilers, including lexical analysis, parsing, syntax-directed translation, abstract syntax trees, types and type checking, intermediate languages, dataflow analysis, program optimization, code generation, and runtime systems. As a result, you will learn how a program written in a high-level language designed for humans is systematically translated into a program written in low-level assembly more suited to machines

8	Outline syllabus		CO Mapping
	Unit 1	**Practical based on Designing of Finite Automata and Regular expression**	
		1. Design a DFA which will accept all the strings containing even number of 0's and even number of 1's over an alphabet {0, 1} and write a program to implement the DFA. 2. Design a DFA which will accept all the strings containing mod 3 of 0's over an alphabet {0, 1} and write a program to implement the DFA.	CO1,CO2

		3. Construct a regular expression. And Converting FA to Regular Expressions.	
	Unit 2	**Practical related to – Context free grammar & Lexical Analyzer**	
		1. Write a code to convert Ambiguous to Unambiguous CFG. 2. Write a code for simplification of Grammar. 3. Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines	CO1,CO2
	Unit 3	**Practical related to-- PUSH DOWN AUTOMATA**	
		1. Implement Push Down Automata 2. Converting PDA to CFG 3. Converting CFG to PDA	CO3
	Unit 4	**Practical related to--- Parsing techniques**	
		1. Write an algorithm and program on Recursive Descent parser. 2. Write an algorithm and program to compute FIRST and FOLLOW function. 3. Develop an operator precedence parser for a given language. 4. Implementation of shift reduce parsing algorithm and LR parser	CO4
	Unit 5	**Practical related to--- Syntax Directed Translations And Intermediate Code Generation**	
		1. Write code to generate abstract syntax tree. 2. Implement Three Address codes 3. Implementation of Code Generation	CO5,CO6
	Mode of examination	Jury/Practical/Viva	
	Weightage Distribution	CA: 25% · MTE: 25% · ETE: 50%	
	Text book/s*	1. Aho, Sethi, Ulman, compilers Principles, Techniques, and Tools, Pearson Education, 2003 2. Peter Linz, "Formal Languages and Auomata", Narosa Publishing House	
	Other References	Lauden, Principles of Compiler Construction. 1. D. M. *Dhamdhere Compiler* Construction--Principles and Practice, Macmillan India,	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)

1.	CO1 **Apply** different compiler writing tools to implement the different Phases	PO1,PO5,PO6,PO9,PO12,PSO1,PSO2
2.	CO2: **Implement** regular expression and grammar corresponding to DFA and vice-versa	PO1,PO2,PO3, PO4,PO5, PO12, PSO1, PSO2
3.	CO3: **Construct** Push Down Automata.	PO1,PO2,PO3,PSO1,PSO2
4.	CO4: **Implement** a parser for different context free grammars.	PO1,PO2,PO3, PO4,PO5,PO9, PSO2,PSO3
5.	CO5: **Construct** the intermediate representation	PO1,PO2,PO3, PO4,PO5,PO9,PO12,PSO1,PSO2,PSO3
6.	CO6: **Compare** various code optimization techniques	PO1, PO3,PO4, PO4,PO5,PO9,PO12 PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Theory of Computation and compiler Design Lab (Course Code CSP250)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	--	--	--	3	--	--	--	2	--	--	3	2	1	--
CO2	2	2	3	3	2	--	--	--	--	--	--	2	3	2	--
CO3	3	3	3	--	--	--	--	--	--	--	--	--	3	2	--
CO4	1	2	3	3	3	--	--	--	3	--	--	--	--	3	2
CO5	1	1	2	3	2	--	--	--	3	--	--	3	1	2	2
CO6	2	--	3	3	2	--	--	--	3	--	--	3	3	2	3

1-Slight (Low)   2-Moderate (Medium)   3-Substantial (High)

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSP250	**TOC&CD**	**2**	**1.3**	**2.3**	**2**	**2**	**0**	**0**	**0**	**1.8**	**0**	**0**	**2**	**2**	**2**	**1.2**

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent***   ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

B.Tech (CSE) with Specialization in Artificial Intelligence & Machine Learning

School:		**School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B. Tech**		
Branch:		**CSE with Specialization in AI & ML**		
1	**Course Code**	**CSA102**		
2	**Course Title**	**Introduction to Artificial Intelligence & Machine Learning**		
3	Credits	2		
4	Contact Hours (L-T-P)	2	0	0
	Course Status	Core		
5	Course Objective	The objective of the course is to introduce basic fundamental concepts in Artificial Intelligence (AI) and Machine Learning (ML) as well as to give a strong foundation od AI Techniques.		
6	Course Outcomes	CO-1. Define the requirement of Artificial Intelligence CO-2. Classify the functionality of agents along with acting environment of Intelligence in Artificial Intelligence. CO-3. Apply the concepts of Propositional Logic for real-world AI based problems. CO-4. Analyse the various ML techniques and apply them to solve the real world societal problems. CO-5. Explain the Use Cases of AIML in real world societal problems. CO-6. Discuss the applicability of Artificial Intelligence and Machine learning Approaches to develop sustainable solutions using professional ethics.		
7	Course Description	Artificial Intelligence (AI) and Machine Learning (ML) are increasingly necessary to translate today’s data into direct business value. This course introduces learners to the basic concepts of AI and ML, and covers how learning algorithms work. It illustrates how AI and ML fit in the data science ecosystem, and presents several real-world use cases that show how companies are implementing.		
8	**Outline syllabus**		CO Mapping	
	Unit 1	**Introduction of Artificial Intelligence**		
	A	Introduction to Artificial Intelligence, Foundation of Artificial Intelligence: Acting humanly: The Turing Test approach , Thinking humanly: The cognitive modeling approach , Thinking rationally: The laws of thought approach , Acting rationally: The rational agent approach	CO1	
	B	History of Artificial Intelligence, Applications of AI in Pattern Recognition, Autonomous planning and scheduling, Game playing, Spam filtering, Logistics planning, and Machine Translation.	CO1, CO6	

	C	Case Study on AI Solutions Vs. Conventional Solutions, Google Duplex, Do you think AI is good or evil?			CO1, CO6
	Unit 2	**Introduction to Intelligent Agents**			
	A	Introduction to Intelligent Agents, How Agents Should Act, The ideal mapping from percept sequences to actions, Properties of Agents: Intelligence, Autonomy, Ability to Learn, Cooperation.			CO2
	B	Classification of Agents: Reactive Agents, Collaborative Agents, Interface Agents, Mobile Agents, Information gathering Agents			CO2
	C	The nature of Environments: Specifying the task environment, Properties of task environments, Applications of Intelligent agents: Robotic vehicles, driver less cars			CO2
	Unit 3	**Introduction to Propositional Logic**			
	A	Introduction, What Is Logic? Why Logic is used in Artificial Intelligence, Logical Operators, Translating between English and Logic Notation, Truth Tables.			CO3
	B	Complex Truth Tables, Tautology, Equivalence			CO3
	C	Propositional Logic, Syntax, Semantics, Deduction, The Deduction Theorem			CO3
	Unit 4	**Introduction to Machine Learning**			
	A	Introduction, Training, Rote Learning , Learning Concepts, A Simple Learning Algorithm, Supervised Learning, Unsupervised Learning, Reinforcement Learning			CO4, CO6
	B	Introduction to Linear Regression, Application of Linear Regression in various application domains through case study.			CO4, CO6
	C	Introduction, Neurons, Artificial Neurons, Perceptron, Neural Networks Architecture, Feed forward Neural Networks, Applications of Neural Networks			CO4, CO6
	Unit 5	**Applications of AIML**			
	A	Case Study on applications of AI ML in Human Resource: Screening Tons Of Resumes, Attracting Talent, Schedule Management Case Study on applications of AI ML in Health Care: Virtual assistance in healthcare, Diagnostics assistance and medical imaging			CO5, CO6
	B	Use Cases on applications of AI ML in Banking, Use Cases on applications of AI ML in insurance,			CO5, CO6
	C	Use Cases on applications of AI ML in cyber security Use Cases on applications of AI ML in weather forecasting			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Coppin Ben, Artificial Intelligence Illuminated, Jones and Bartlett Publishers			

	Other References	1) Russell S & Norvig P, Artificial Intelligence: A Modern Approach, Prentice Hall 2) Rich E & Knight K, Artificial Intelligence, Tata McGraw Hill, Edition 3 3) Dan W. Patterson, Artificial Intelligence & Expert Systems, Pearson Education with Prentice Hall India. Indian Edition.	
		https://analyticsindiamag.com/top-use-cases-ai-human-resources/	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO-1. Define the requirement of Artificial Intelligence	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	CO-2. Classify the functionality of agents along with acting environment of Intelligence in Artificial Intelligence.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	CO-3. Apply the concepts of Propositional Logic for real-world AI based problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	CO-4. Analyse the various ML techniques and apply them to solve the real world societal problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	CO-5. Explain the Use Cases of AIML in real world societal problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	CO-6. Discuss the applicability of Artificial Intelligence and Machine learning Approaches to develop sustainable solutions using professional ethics.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Introduction to Artificial Intelligence & Machine Learning **(Course Code** CSA-102**)**

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Introduction to Artificial Intelligence & Machine Learning (CSA-102)	CO1	3	3	3	1	2	1	1	1	2	3	1	3	2	3	1
	CO2	3	3	3	1	2	3	3	1	2	3	1	3	2	3	2
	CO3	3	3	3	1	2	3	3	1	3	3	3	3	3	3	3
	CO4	3	3	3	1	2	3	3	1	3	3	3	3	3	3	3
	CO5	3	3	3	1	2	3	3	1	3	3	3	3	3	3	3
	CO6	3	3	3	1	2	3	3	3	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSA-102	Introduction to Artificial Intelligence & Machine Learning	3.00	3.00	3.00	1.00	2.00	2.67	2.67	1.33	2.67	3.00	2.33	3.00	2.67	3.00	2.50

School:		**School of Engineering & Technology**			
Department		**Computer Science & Engineering**			
Program:		**B. Tech**			
Branch:		**CSE with Specialization in AI & ML**			
1	Course Code	**CSA20 2**	**Concepts of Machine Learning**		
2	Course Title	**Concepts of Machine Learning**			
3	Credits				
4	Contact Hours (L-T-P)	3	0	2	
	Course Status	Core			
5	Course Objective	Students are Expected to learn and develop Comprehensive Understanding of the of the following Concepts and Techniques: 1. To introduce the ideas of learning rule and implement them based on human experience. 2. To conceptualize the working of human brain using SVM, RF and ANN. 3. To become familiar with decision boundaries that can learn from available examples and generalize to form appropriate learning rules for inference systems. 4. To provide the mathematical background for SVM, RF and Neural Network based classification techniques. 5. To understand and demonstrate how to solve patterns learning from a large series of data using computer based learning algorithms			
6	Course Outcomes	A Successful completion of this Course Ensures the following Outcomes **CO 1 : Define basics of** Machine Learning and stochastic concepts. **CO-2 : Classify and Compare** existing models to understand the applicability in solve real world societal problems. **CO-3 : Identify develop and apply** mathematical models to find sustainable solutions. **CO-4 : Analyse** the logical ability to apply feature engineering to extract hierarchical patterns existing in real life problems. **CO-5 : Evaluate** the learning models to glance the upcoming world through it. **CO-6 :** Discuss the applicability of Machine learning Approaches to develop sustainable solutions using professional ethics.			
7	Course Description	This course introduces computational learning paradigm for critical & implementable understanding for supervised and unsupervised learning based problem areas.			
8					CO Mapping
	Unit 1	**Core Concepts of Machine Learning**			
	A	What is Machine Learning? What kind of problems can be tackled using machine learning? The ML Mindset, Introduction to Machine Learning Problem Framing(Common ML Problems, ML Use Cases, Identifying Good Problems for ML, Hard ML Problems), Machine Learning Applications(Image Recognition, Speech Recognition, Medical Diagnosis, Statistical Arbitrage, Learning Associations), Standard learning tasks(Machine Learning Pipeline, Classification, Regression, Ranking, Clustering, Dimensionality reduction or Manifold learning)			CO1
	B	Learning Stages(Features, Labels, Hyperparameters, Validation Samples, Test Samples, Loss Function, Hypothesis Tests), Learning Scenarios(Supervised learning, Unsupervised learning, Semi-			CO1, CO2

		Supervised learning, Transductive inference, On-line learning, Reinforcement learning, Active learning), Generalization Supervised Learning, Unsupervised Learning, Reinforcement learning)	
	C	Data Preparation and Feature Engineering in ML(Data and Features, Information, Knowledge, Data Types, Big Data), Data Preprocessing: An Overview(Data Quality: Why Preprocess the Data?, Major Tasks in Data Preprocessing), Data Cleaning(Missing Values, Noisy Data, Data Cleaning as a Process), Data Integration(The Entity Identification Problem, Redundancy and Correlation Analysis, Tuple Duplication, Detection and Resolution of Data Value Conflicts), Data Reduction(Overview of Data Reduction Strategies, Attribute Subset Selection, Data Reduction, Histograms, Clustering, Sampling, Data Cube Aggregation), Data Transformation and Data Discretization(Overview of Data Transformation Strategies, Data Transformation by Normalization, Discretization by Binning, Discretization by Histogram Analysis, Discretization by Cluster, Decision Tree, and Correlation Analyses, Concept Hierarchy Generation for Nominal Data)	CO1, CO2
	Unit 2	**Supervised Learning Algorithms - Part One**	
	A	How Supervised Learning Algorithms Work ? Steps (Bias-variance trade off, Function complexity and amount of training data, Dimensionality of the input space, Noise in the output values, Algorithms, Other factors to consider (Heterogeneity of the data, Redundancy in the data, Presence of interactions and non-linearities	CO1, CO2, CO6
	B	Linear Regression Model Representation, Linear Regression Learning the Model (Simple Linear Regression, Ordinary Least Squares, Gradient Descent), Regularization / Shrinkage Methods (Bias-variance trade-off, Overfitting Issues, Lasso Regression, Ridge Regression), Making Predictions with Linear Regression(Cost Function, Feature Scaling, Normalization, Mean Normalization, Learning Rate, Automatic Convergence Test)	CO1, CO2, CO6
	C	Logistic Regression, The Logistic Model (Latent variable interpretation, Logistic function, odds, odds ratio, and logit, Definition of the logistic function, Definition of the inverse of the logistic function, Interpretation of these terms, Definition of the odds, The odds ratio, Multiple explanatory variables), Model fitting ("Rule of ten", Iteratively reweighted least squares (IRLS), Evaluating goodness of fit, Limitations of Logistic Regression), Linear discriminant analysis (LDA for two classes, Assumptions, Discriminant functions, Discrimination rules, Eigenvalues, Effect size), Practical use and Applications (Bankruptcy prediction, Face recognition, Marketing, Biomedical, studies), Comparison to Logistic Regression	CO1, CO2, , CO6
	Unit 3	**Supervised Learning Algorithms - Part Two**	
	A	Support Vector Machines, Linear SVM (Hard-margin, Soft-margin), Nonlinear Classification, Computing the SVM classifier(Primal, Dual, Kernel trick), Modern methods(Sub-gradient descent, Coordinate descent), Empirical risk minimization(Risk minimization, Regularization and stability, SVM and the hinge loss, Target functions), Properties(Parameter selection, Issues)	CO1,CO2,CO3 , , CO6
	B	Introduction to Artificial Neural Networks (Feed-forward Network Functions, Weight-space symmetries), Network Training (Parameter optimization, Local quadratic approximation, Use of gradient information, Gradient descent optimization), Error	CO1,CO2,CO3 , CO6

		Backpropagation(Evaluation of error-function derivatives, Simple examples, Efficiency of backpropagation)			
	C	Decision Tree Learning (Decision tree representation, ID3 learning algorithm, Entropy, Information gain, Overfitting and Evaluation, Overfitting, Validation Methods, Avoiding Overfitting in Decision Trees, Minimum-Description Length Methods, Noise in Data), Random Forests Algorithm (Preliminaries: decision tree learning, Bagging, From bagging to random forests, Extra Trees, Properties, Variable importance)			CO1,CO2,CO3 , CO6
	Unit 4	**Unsupervised Learning**			
	A	Unsupervised Learning (What is Unsupervised Learning?), Clustering Methods (Method Based on Euclidean Distance, Method Based on Probabilities, Hierarchical Clustering Methods, Method Based on Euclidean Distance)			CO2,CO3,CO4 , CO6
	B	k-means Clustering Algorithm (Standard algorithm (naive k-means), Initialization methods), Applications (Vector quantization, Cluster analysis, Feature learning) Gaussian mixture models , Expectation-Maximization method			CO2,CO3,CO4 , CO6
	C	Principal Component Analysis for making predictive models (First component, Further components, Covariances, Dimensionality reduction, Singular value decomposition), Properties and limitations of PCA (Properties, Limitations), Computing PCA using the covariance method, Typical Applications			CO2,CO3,CO4 , CO6
	Unit 5	**Parameter Estimation, Model Evaluation and Ensemble Methods**			
	A	Parameter Estimation (Point Estimation, Maximum Likelihood Estimation, Unbiased Estimation, Confidence Intervals for One Mean, Two Mean, Variances)			CO2,CO5,CO6
	B	Model Evaluation (ML Model Validation by Humans, Holdout Set Validation Method, Cross-Validation Method for Models, Leave-One-Out Cross-Validation, Random Subsampling Validation, Teach and Test Method, Bootstrapping ML Validation Method, Running AI Model Simulations, Overriding Mechanism Method), The ROC Curve			CO3,CO5,CO6
	C	**Ensemble Methods (Ensemble Theory, Ensemble Size, Voting and Averaging Based Ensemble Methods Boosting, Weightage Average, Stacking, Bagging, Boosting and Bootstrap Aggregating)**			CO4,CO5,CO6
	Mode of examination	Theory and Practical			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag. 2. Foundations of Machine Learning, Second Edition By Mehryar Mohri, Afshin Rostamizadeh and Ameet Talwalkar, MIT Press, Second Edition, 2018. 3. Introduction to Machine Learning, Third Edition, By Ethem Alpaydin, The MIT Pressmitpress.mit.edu › books › introduction-machine-learni...			
	Other References	4) Baldi, P. and Brunak, S. (2002). Bioinformatics: A Machine Learning Approach. Cambridge, MA: MIT Press. 5) Russel, S. and Norvig, P. (2003). Artifiical Intelligence: A Modern Approach. 2ndEdition. New York: Prentice-Hall. 6) Cohen, P.R. (1995) Empirical Methods in Artificial Intelligence. Cambridge, MA: MIT Press.			

		7) https://www.toptal.com/machine-learning/ensemble-methods-machine-learning.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO 1 : *Define basics of*** *Machine Learning and stochastic concepts.*	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	**CO-2 : *Classify and Compare*** *existing models to understand the applicability in solve real world societal problems.*	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	**CO-3 : *Identify develop and apply*** *mathematical models to find sustainable solutions.*	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	**CO-4 : *Analyse*** *the logical ability to apply feature engineering to extract hierarchical patterns existing in real life problems.*	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	**CO-5 : *Evaluate*** *the learning models to glance the upcoming world through it.*	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	**CO-6 :** *Discuss the applicability of Machine learning Approaches to develop sustainable solutions using professional ethics.*	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Concepts of Machine Learning **(Course Code** CSA-202**)**

Subject	**PO's / PSO's**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
Concepts of Machine Learning **(Course Code** CSA-201**)**	CO1	3	3	3	3	3	3	2	1	1	3	1	3	2	2	1
	CO2	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO3	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO4	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO5	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CSA-201	Concepts of Machine Learning	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.83**	**2.00**	**2.00**	**3.00**	**2.67**	**3.00**	**2.83**	**2.83**	**2.67**

Total- 41.83
Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School: SET		**Batch: 2023-27**
Program: B.Tech.		**Current Academic Year: 2023-24**
Branch: CSE/IT		**Semester: III**
1	**Course Code**	**CAL201**
2	**Course Title**	**Machine Learning Lab**
3	**Credits**	**1**
4	**Contact Hours (L-T-P)**	**0-0-2**
	Course Status	Core
5	Course Objective	1. Learn the basic concepts of Machine Learning algorithms. 2. Make use of Data sets in implementing the machine learning algorithms. 3. Implement the machine learning concepts and algorithms in any suitable language of choice.
6	Course Outcomes	CO 1: Show the implementation of linear and logistic Regression on real life applications. CO-2: Interpretation of existing models to understand the solution environment. CO-3: Application of existing mathematical solutions to test real world problems. CO-4: Analyze the logical ability to apply clustering approach to extract hierarchical patterns existing in real life problems. CO-5: Build the understanding of learning theory to glance the upcoming world through it. CO-6: Appraise recent trends in machine learning and applications.
7	Course Description	This course introduces computational learning paradigm for critical & implementable understanding for supervised and unsupervised learning based problem areas.

8	Outline syllabus		CO Mapping
	Unit 1	**Core Concepts of Machine Learning**	
		Write a Program to load and view data set file.	CO1
		Write a program to implement simple linear regression using housing price prediction problem.	CO1, CO2
		Write a program to implement binary logistic regression using cancer identification problem.	CO1, CO2
	Unit 2	**Supervised Learning Algorithms - Part One**	
		Write a program to implement gradient descent method for learning.	CO1, CO2, CO6
		Write a program to implement regularized linear regression.	CO1, CO2, CO6
		Write a program to implement regularized logistic regression.	CO1, CO2, , CO6
		Write a program to Normalize the data used in linear regression problem above before predicting prices, and then predict the housing prices.	CO1, CO2, CO6
	Unit 3	**Supervised Learning Algorithms - Part Two**	
		Write a program to implement Support Vector Machine regression using suitable dataset.	CO1,CO2,CO3 , , CO6
		Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.	CO1,CO2,CO3 , CO6
		Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.	CO1,CO2,CO3 , , CO6
		Write a program to demonstrate the working of the Random Forest algorithm. Use an appropriate data set for classifying a new sample.	CO1,CO2,CO3 , CO6
	Unit 4	**Unsupervised Learning**	
		Write a program to implement K-Means clustering algorithm using an appropriate dataset.	CO2,CO3,CO4 , CO6

		Write a program to implement K-Means clustering algorithm using an appropriate dataset.	CO2,CO3,CO4, CO6
	Unit 5	**Hypothesis Testing, Parameter Estimation, Model Evaluation and Ensemble Methods**	
		Write a program to implement data split into training, cross validation and testing data.	CO2,CO5,CO6
		Implement an Ensemble approach by combining different models to solve time series based prediction problem.	CO3,CO5,CO6
		Conduct hypothesis testing using some statistical toolkit on appropriate problem.	CO4,CO5,CO6
	Mode of examination	Practical	
	Weightage Distribution	CA 25% / MTE 25% / ETE 50%	
	Text book/s*	1. Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag. 2. Foundations of Machine Learning, Second Edition by Mehryar Mohri, Afshin Rostamizadeh and Ameet Talwalkar, MIT Press, Second Edition, 2018. 3. Introduction to Machine Learning, Third Edition, By EthemAlpaydin, The MIT Pressmitpress.mit.edu › books › introduction-machine-learni...	
	Other References	1) Baldi, P. and Brunak, S. (2002). Bioinformatics: A Machine Learning Approach. Cambridge, MA: MIT Press. 2) Russel, S. and Norvig, P. (2003). Artifiical Intelligence: A Modern Approach. 2ndEdition. New York: Prentice-Hall. 3) Cohen, P.R. (1995) Empirical Methods in Artificial Intelligence. Cambridge, MA: MIT Press. .	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO 1 : Show the implementation of linear and logistic Regression on real life applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	CO-2 : Interpretation of existing models to understand the solution environment.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	CO-3 : Application of existing mathematical solutions to test real world problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	CO-4 : Analyse the logical ability to apply clustering approach to extract hierarchical patterns existing in real life problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	CO-5 : Build the understanding of learning theory to glance the upcoming world	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	CO-6: Appraise recent trends in machine learning and applications	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Concepts of Machine Learning **(Course Code** CAL201**)**

Subject	PO's / PSO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Concepts of Machine Learning **(Course Code** CAL-201**)**	CO1	3	3	3	3	3	3	2	1	1	3	1	3	2	2	1
	CO2	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO3	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO4	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO5	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSA-201	Concepts of Machine Learning	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.83**	**2.00**	**2.00**	**3.00**	**2.67**	**3.00**	**2.83**	**2.83**	**2.67**

Total- 41.83
Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**			
Department		**Computer Science & Engineering**			
Program:		**B. Tech**			
Branch:		**CSE with Specialization in AI & ML**			
1	Course Code	**CSA-203**			
2	Course Title	**Concepts of Neural Networks**			
3	Credits	3			
4	Contact Hours (L-T-P)	3	0	0	
	Course Status	Core			
5	Course Objective	1. To introduce the ideas of learning rule and implement them based on human experience. 2. To conceptualize the working of human brain using ANN. 3. To become familiar with neural networks that can learn from available examples and generalize to form appropriate learning rules for inference systems. 4. To provide the mathematical background for Neural Network and classification techniques. 5. To provide the mathematical background for carrying out the optimization and familiarizing genetic algorithm for seeking global optimum in self-learning situation.			
6	Course Outcomes	On successful completion of this module students will be able to: 1. **Define** biological significance of Neural Network and list ANN components. 2. **Classify** various learning paradigms based on real file problems 3. **Apply basic concepts to build** single and multi-layer feed-forward neural networks. 4. **Analyze** and train radial-basis function and recurrent networks; 5. **Explain self-organizing map** for real life problems. 6. **Discuss** and adapt appropriate neural networks model for real life applications.			
7	Course Description	This course introduces the basic models, learning algorithms, and some applications of neural networks. After this course, we should be able to know how to use neural networks for solving different problems related to pattern recognition, function approximation, data visualization, and so on.			
8					
	Unit 1	**Introduction**			
	A	Introduction, Motivation and History, Components of a Neuron-synapses, dendrite, cell nucleus, axon			CO1

	B	Important Terminologies of ANNs: Propagation function, Activation function, output function, Components of Artificial Neural Network: common activation functions, network topologies- feed forward, recurrent networks, completely linked networks	CO1
	C	Neuron Activation order: Synchronous activation, asynchronous activation, Communication with the outside world: input and output of data in and from neural networks	CO1
	Unit 2	**Learning Paradigms**	
	A	Learning Paradigms and their real Applications, Unsupervised learning and Supervised learning, Reinforcement learning, Offline and online learning and their applications based on real life problems.	CO2, CO6
	B	Training patterns and teaching inputs, use of training samples, data set split into training, validation and testing data, Implication of splitting of data set, Learning curves and their importance in diagnostics	CO2, CO6
	C	Gradient optimization procedures, Hebbian learning rule	CO2
	Unit 3	**The Perceptron, Backpropagation and its variants**	
	A	Single layer Perceptron network, Perceptron Learning Algorithm and convergence theorem, Delta rule as a gradient based learning strategy, Limitations of Single Layer Perceptron network	CO3
	B	Multilayer Perceptron Network, Backpropagation learning and its applications	CO3
	C	Analysing effect of learning rate on learning process, Variants of Backpropagation algorithm	CO3
	Unit 4	**Radial Basis Function Neural Networks**	
	A	Components & Structure of an RBF network, Information processing of an RBF network, Information Processing in RBF neurons, analytical thoughts prior to training	CO4
	B	Equation system and gradient strategies for training, Growing RBF Networks, comparison of RBF Networks and Multilayer Perceptron’s	CO4
	C	Recurrent Neural Networks: Jordan networks, Elman Networks, Training Recurrent neural networks	CO4
	Unit 5	**Unsupervised Learning Network Paradigms**	
	A	Self-organizing feature maps, structure of a self-organizing feature map, Training of SOM, Topology function, common distance and topology functions,	CO5,CO6

		relationship between learning rates and neighborhoods, applications of SOMs			
	B	Introduction to Adaptive Resonance Theory, Task and structure of an ART Network, Learning process of an ART Network- top down and bottom up learning, Extensions- ART2, ART3			CO5,CO6
	C	Introduction to Hopfield Network, Associative Network (Homogenous & Heterogeneous), Introduction to Restricted Boltzmann Machine.			CO5,CO6
	Mode of examination				
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. David Kriesel, 2007, "A Brief Introduction to Neural Networks", available at http://www.dkriesel.com 2. Simon O. Haykin, **"Neural Networks and Learning Machines",** Pearson			
	Other References	1. ANDERSON, JAMES A., AN INTRODUCTION TO NEURAL NETWORKS, PHI Learning. 2. Christopher M. Bishop & Geoffrey Hinton, Neural Networks for Pattern Recognition, Oxford University Press.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**Define** biological significance of Neural Network and list ANN components.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	**Classify** various learning paradigms based on real life problems	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	**Apply basic concepts to build** single and multi-layer feed-forward neural networks.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	**Analyze** and train radial-basis function and recurrent networks;	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	**Explain self-organizing map** for real life problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	**Discuss** and adapt appropriate neural networks model for real life applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name: Neural networks (Course Code- CSA-203)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Neural networks (Course Code-CSA-203)	CO1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
	CO2	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
	CO3	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
	CO4	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
	CO5	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
	CO6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3
CSA-203	Neural networks	3.00	3.00	3.00	3.00	2.83	2.33	2.33	1.17	2.33	3.00	2.67	3.00	3.00	3.00	2.67

Total 40.3

Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School:		**School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B. Tech**		
Branch:		**CSE with Specialization in AI & ML**		
1	**Course Code**	**CSA301**		
2	**Course Title**	**SOFT COMPUTING**		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core		
5	Course Objective	The primary objective of this course is to provide an introduction to the basic principles, techniques, and applications of soft computing. ● Upon successful completion of the course, students will have an understanding of the basic areas of Soft Computing including Artificial Neural Networks, Fuzzy Logic and Genetic Algorithms. ● Provide the mathematical background for carrying out the optimization associated with neural network learning. ● Aim of this course is to develop some familiarity with current research problems and research methods in Soft Computing by working on a research or design project.		
6	Course Outcomes	The Completion of this Course Will Enable the Students to be able to Learn **CO1:** Define the basic concepts of soft computing. **CO2:** Explain applications & operations of Fuzzy Logic in real life problems. **CO3:** Apply different FIS models to solve optimization problems. **CO4:** Analyze and examine Evolutionary and swarm algorithms in solving real world Multi-Objective optimization problems **CO5:** Choose of different optimization algorithms to solve real-life multi objective problems. **CO6:** Discuss applications of Soft Computing and solve Problems in Varieties of Application Domains.		
7	Course Description	This course will cover fundamental concepts used in Soft computing. The concepts of Fuzzy logic (FL) will be covered first, followed by Artificial Neural Networks (ANNs) and optimization techniques using Genetic Algorithm (GA). Applications of Soft Computing techniques to solve a number of real life problems will be covered to have hands on practices.		
8			CO Mapping	
	Unit 1	**Introduction to Soft Computing**		
	A	Concept of computing systems. What is Soft Computing?	CO1	
	B	"Soft" Computing versus "Hard" computing	CO1	
	C	Characteristics of Soft computing, Some applications of Soft computing techniques	CO1, CO6	
	Unit 2	**FUZZY LOGIC**		
	A	Introduction to Fuzzy logic, Fuzzy sets and membership functions	CO2	
	B	Operations on Fuzzy sets. Fuzzy relations, rules, propositions, implications and inferences.	CO2	

	C	Defuzzification techniques, Fuzzy logic controller design, Some real life societal applications of Fuzzy logic.		CO2
	Unit 3	**Fuzzy inference System**		
	A	Fuzzy Inference Systems, Different Fuzzy Models: Madman Fuzzy Models, Surgeon Fuzzy Models		CO3
	B	Tsukamoto Fuzzy Models, Input Space Partitioning and Fuzzy Modeling.		CO3
	C	Neuro Fuzzy Modelling: Adaptive Neuro-Fuzzy Inference Systems, Architecture, Hybrid Learning Algorithm, Learning Method that Cross- fertilize ANFIS and RBFN		CO3
	Unit 4	**Swarm and Evolutionary Algorithms**		
	A	Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques		CO4
	B	Basic GA framework and different GA architectures, GA operators: Encoding, Crossover, Selection, Mutation, Solving single-objective optimization problems		CO4
	C	Swarm Optimization: Introduction to Ant Colony Optimization, Particle Swarm Optimization etc.		CO4
	Unit 5	**Multi-objective Optimization Problem Solving**		
	A	Concept of multi-objective optimization problems (MOOPs) and issues of solving them.		CO5,CO6
	B	Multi-Objective Evolutionary Algorithm (MOEA) Non-Pareto approaches to solve MOOPs, Pareto-based approaches to solve MOOPs , Some applications with MOEAs		CO5,CO6
	C			CO5,CO6
	Mode of examination	Theory and Practical		
	Weightage Distribution	CA / 25%	MTE / 25%, ETE / 50%	
	Text book/s*	1. George J. Klir and Bo Yuan, "Fuzzy sets and Fuzzy Logic", Prentice Hall, USA. 2. Goldberg D.E., Genetic Algorithms in Search, Optimization, and Machine Learning Addison Wesley. 3. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill		
	Other References	1. Jang J.S.R., Sun C.T. and Mizutani E, "Neuro-Fuzzy and Soft computing", Prentice Hall. 2. An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press, 2000. 3. Genetic Algorithms in Search, Optimization and Machine Learning, David E. Goldberg, Pearson Education, 2002. 4. Practical Genetic Algorithms, Randy L. Haupt and sue Ellen Haupt, John Willey & Sons, 2002		

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:** Define the basic concepts of soft computing.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	**CO2:** Explain applications & operations of Fuzzy Logic in real life problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	**CO3:** Apply different FIS models to solve optimization problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	**CO4:** Analyse and examine Evolutionary and swarm algorithms in solving real world Multi-Objective optimization problems	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	**CO5:** Choose of different optimization algorithms to solve real-life multi objective problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	**CO6:** Discuss applications of Soft Computing and solve Problems in Varieties of Application Domains.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name SOFT COMPUTING **(Course Code** CSA-202**)**

Subject	PO's / PSO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
SOFT COMPUTING CSA301	CO1	3	3	1	1	1	1	1	1	2	1	1	3	1	3	1
	CO2	3	3	3	3	2	3	2	2	2	2	3	3	3	3	3
	CO3	3	3	3	3	3	3	1	2	2	2	3	3	3	3	3
	CO4	3	3	3	3	3	3	3	2	2	2	3	3	3	3	3
	CO5	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3
	CO6	3	3	3	3	3	1	3	2	3	2	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA 301	**SOFT COMPUTING**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.83**	**2.00**	**2.00**	**3.00**	**2.67**	**3.00**	**2.83**	**2.83**	**2.67**

Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School:		**School of Engineering & Technology**
Program:		**Computer Science & Engineering**
Branch:		**CSE**
1	Course Code	CSA303
2	Course Title	**Pattern Recognition**
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	CORE
5	Course Objective	**Students will try to learn t**o introduce the ideas of existing patterns and implement them based on data analysis. Also, to conceptualize the working of patterns explorations using computational algorithms. In addition to it, students will aim to become familiar with feature knowledge that can be extracted from available examples and generalize to form appropriate feature models.
6	Course Outcomes	On successful completion of this module students will be able to: CO 1. Define Pattern concept and random process ideas, understand mathematical background. CO 2. Explain preliminary models to understand the solution environment. CO 3. Apply of existing mathematical solutions to test problems. and Perform Subspace analysis for classification problems CO 4. Classify patterns using Bayesian Decision Theory. CO 5. Evaluate patterns using Parametric and Non-Parametric techniques. CO 6. Discuss trajectory of recent trend in pattern recognition & understand various real world applications.
7	Course Description	Pattern recognition theory and practice is concerned with the design, analysis, and development of methods for the classification or description of patterns, objects, signals, and processes. At the heart of this discipline is our ability infer the statistical behavior of data from limited data sets, and to assign data to classes based on generalized notions of distances in a probabilistic space.

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction and mathematical preliminaries**	
	A	Introduction to Pattern recognition; Applications areas in medical, defense, E-commerce, The Design Cycle.	CO1
	B	Clustering vs. Classification; Learning and Adaptation, Relevant basics of Linear Algebra.	CO1, CO2
	C	Vector spaces, Probability Theory, Estimation Theory.	CO1, CO2
	Unit 2	**Bayes Decision Theory**	

	A	Data processing, Outliers, Correlation, Expectation, mean and covariance, classifiers	CO1, CO2, CO4
	B	Normal Distribution, Bayesian Classification, The Nearest- Neighbor Rule	CO2, CO4, CO5
	C	Introduction to Bayesian Decision Theory, Normal density and discriminant functions for the normal density	CO2, CO4
	Unit 3	**Clustering**	
	A	Basics of Clustering; similarity / dissimilarity measures; Criterion Functions for Clustering. Different distance functions and similarity measures, ,	CO1, CO2, CO3
	B	Clustering Techniques: K-means algorithm, Agglomerative hierarchical clustering	CO1, CO2, CO3
	C	K-medoids, DBSCAN, Cluster validation	CO1, CO2, CO3
	Unit 4	**Feature extraction and Feature selection**	
	A	Principal Component Analysis (PCA), Kernel PCA, Singular Value Decomposition, Fisher Linear discriminant analysis	CO2, CO3, CO5
	B	Algorithms - Branch and bound algorithm, sequential forward / backward selection algorithms, Maximum-Likelihood estimation,	CO2, CO3, CO5
	C	Probabilistic separability-based criterion functions, interclass distance-based criterion functions, K-Nearest Neighbor Estimation	CO2, CO3, CO5
	Unit 5	**Recent Advances in Patterns Recognitions**	
	A	Introduction to advanced pattern recognition schemes, Resources and tools used, Gaussian mixture models	CO2, CO3, CO6
	B	Support Vector Machine, Neural Networks, Hidden Markov Models (HMM),	CO2, CO3, CO6
	C	Basics to Biometrics: Biometric methodologies: finger prints, hand geometry, facial recognition, Iris scanning, retina scanning	CO2, CO3, CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 25%; MTE: 25%; ETE: 50%	
	Text book/s*	1. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification, John Wiley, 2001. 2. Christopher M. Bishop, “Pattern Recognition and Machine Learning”, Springer publication, 2006	
	Other References	3. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009. 4. Robert Schalkoff, “Pattern Recognition: Statistical, Structural and Neural Approaches”, John Wiley & Sons, Inc.1992. 5. K.Jain, R.Bolle, S.Pankanti, “Biometric: Personal Identification in network society”, Kluwer academic publishers, 1999.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Define Pattern concept and random process ideas, understand mathematical background.	
2.	Explain preliminary models to understand the solution environment.	
3.	Apply of existing mathematical solutions to test problems. and Perform Subspace analysis for classification problems	
4.	Classify patterns using Bayesian Decision Theory.	
5.	Evaluate patterns using Parametric and Non-Parametric techniques.	
6.	Discuss trajectory of recent trend in pattern recognition & understand various biometric technologies.	

PO and PSO mapping with level of strength for Course Name Pattern Recognition

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Define Pattern concept and random process ideas, understand mathematical background.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	Explain preliminary models to understand the solution environment.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	Apply of existing mathematical solutions to test problems. and Perform Subspace analysis for classification problems	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	Classify patterns using Bayesian Decision Theory.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	Evaluate patterns using Parametric and Non-Parametric techniques.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	Discuss trajectory of recent trend in pattern recognition & understand various biometric technologies.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Pattern Recognition CSA- 302

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Pattern Recognition CSA- 302	CO1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
	CO2	3	3	3	3	2	3	1	1	3	3	1	3	3	3	3
	CO3	3	3	3	3	2	2	2	1	2	3	1	3	3	3	3
	CO4	3	3	3	3	2	2	2	1	2	3	1	3	3	3	3
	CO5	3	3	3	3	2	3	1	1	2	3	1	3	3	3	3
	CO6	3	3	3	3	3	3	2	2	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA-302	Pattern Recognition	3.00	3.00	3.00	3.00	2.17	2.33	1.50	1.17	2.17	3.00	0.00	3.00	3.00	3.00	2.67

Total 36

Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School:		**School of Engineering & Technology**
Program:		**B. Tech**
Branch:		**Computer Science & Engineering**
1	Course Code	CAL302
2	Course Title	**Pattern Recognition Lab**
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	CORE
5	Course Objective	**Students will try to learn t**o introduce the ideas of existing patterns and implement them based on data analysis. Also, to conceptualize the working of patterns explorations using computational algorithms. In addition to it, students will aim to become familiar with feature knowledge that can be extracted from available examples and generalize to form appropriate feature models.
6	Course Outcomes	On successful completion of this module students will be able to: CO 1. Define and Show naïve Bayesian Classifier for real world pro CO 2. Classify patterns using Bayesian Decision Theory. CO 3. Apply clustering techniques on read world problems CO 4. Classify Feature extraction and Feature selection techniques. CO 5. Evaluate patterns using Parametric and Non-Parametric techniques. CO 6. Discuss trajectory of recent trend in pattern recognition & understand various biometric technologies.
7	Course Description	This course introduces neural computational paradigm for critical & implementable understanding of feature engineering.

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction and mathematical preliminaries**	
	1	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set	CO1
	2	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets	
	Unit 2	**Bayes Decision Theory**	
	3	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate	CO1, CO2, CO4

		the diagnosis of heart patients using standard Heart Disease Data Set from Repository.			
	Unit 3	**Clustering**			
	4	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program			CO1, CO2, CO3
	5	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set from Repository.			
	Unit 4	**Feature extraction and Feature selection**			
	5	Write a program to implement PCA example using scikit-learn on Iris Data-set			CO2, CO3, CO5
	7	Write a program to implement Nearest Neighbors classification on Iris Data-set and plot the decision boundaries for each class.			
	Unit 5	**Recent Advances in Patterns Recognitions**			
	8	Write a program to perform binary classification using non-linear SVC with RBF kernel.			CO2, CO3, CO6
	9	Write a program to implement SVM for classification on standard dataset			
	10	Write a program to implement Neural network for classification on standard dataset			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	3. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification, John Wiley, 2001. 4. Christopher M. Bishop, “Pattern Recognition and Machine Learning”, Springer publication, 2006			
	Other References	6. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009. 7. Robert Schalkoff, “Pattern Recognition: Statistical, Structural and Neural Approaches”, John Wiley & Sons, Inc.1992. 8. K.Jain, R.Bolle, S.Pankanti, “Biometric: Personal Identification in network society”, Kluwer academic publishers, 1999.			
	Web Link	https://scikit-learn.org/stable/auto_examples/			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Define and Show naïve Bayesian Classifier for real world pro	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	Classify patterns using Bayesian Decision Theory.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	Apply clustering techniques on read world problems	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	Classify Feature extraction and Feature selection techniques.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	Evaluate patterns using Parametric and Non-Parametric techniques.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	Discuss trajectory of recent trend in pattern recognition & understand various biometric technologies.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Pattern Recognition CAL- 302

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Pattern Recognition CAL- 302	**CO1**	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**3**	**1**	**3**	**3**	**3**	**1**
	CO2	**3**	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**3**	**3**	**1**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**3**	**1**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**3**	**1**	**3**	**3**	**3**	**3**
	CO5	**3**	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**2**	**3**	**1**	**3**	**3**	**3**	**3**
	CO6	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CAL-302	**Pattern Recognition**	**3.00**	**3.00**	**3.00**	**3.00**	**2.17**	**2.33**	**1.50**	**1.17**	**2.17**	**3.00**	**0.00**	**3.00**	**3.00**	**3.00**	**2.67**

Total 36

Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**

3. Addressed to **Substantial (High=3) extent**

School: SET		**Batch: 2023-27**	
Program: B-TECH		**Current Academic Year: 2023-24**	
Branch: CSE		**Semester:**	
1	**Course Code**	CSA303	
2	**Course Title**	**Deep Leaning and its Applications**	
3	**Credits**	**3**	
4	**Contact Hours (L-T-P)**	3-0-0	
	Course Status	CORE	
5	**Course Objective**	This course aims to present the mathematical, statistical and computational challenges of building stable representations for high-dimensional data, such as images, text and data. We will delve into selected topics of Deep Learning, discussing recent models from both supervised and unsupervised learning. Special emphasis will be on convolutional architectures, invariance learning, unsupervised learning and non-convex optimization.To understand and demonstrate how to solve general learning from a large series of data using computer based deep learning algorithms	
6	**Course Outcomes (CO's)**	On successful completion of this module students will be able to: 1. Recall Neural Networks relate it with Deep Learning concepts to solve real life applications 2. Compare and classify Regularization approaches for Deep Learning. 3. Build Convolutional Neural Networks models for image analysis and its applicability in societal problem solving. 4. Examine the Sequence models and analyse the relationships among them. 5. Assess the different Deep learning models based on their design processes. 6. Predict the behaviour of Deep learning models and apply them to solve real life applications.	
7	**Course Description**	This course starts with introduction to Deep Learning and further build, train, and deploy real world applications such as object recognition and Computer Vision, image and video processing, text analytics, Natural Language Processing, recommender systems, and other types of classifiers.	
8	**Syllabus Outline**		**CO Mapping**
	Unit 1	**Deep Feed forward Networks**	
	A	Recall Neural networks, Deep learning and its Practical aspects for real life applications ,Introduction to Simple Deep Neural Networks, Platform for Deep Learning, Deep Learning Software Libraries	CO1, CO6

	B	Introduction to Deep Feed Forward Networks ,Learning XOR, Gradient-Based Learning, Activation Functions, ReLU, Softmax, Sigmoid , Error Functions	CO1
	C	Architecture Design- Hidden Units Back-Propagation and Other Differentiation Algorithms	CO1
	Unit 2	**Regularization for Deep Learning**	
	A	Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multitask Learning, Early Stopping, Parameter Tying and Parameter Sharing, Bagging , Drop Out, Difficulty of training deep neural networks, Greedy layer wise training, Adversarial Training	CO2
	B	How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms: Stochastic Gradient Descent, Momentum, Nesterov Momentum Parameter Initialization Strategies Algorithms with Adaptive Learning Rates, AdaGrad. RMSProp. Adam	CO2
	C	Introduction to Autoencoder, Undercomplete Autoencoder, Regularized Autoencoders, Representational Power, Layer Size and Depth. Stochastic Encoders and Decoders, Applications of Encoder Decoder models	CO2
	Unit 3	**Convolutional Neural Networks**	
	A	Why CNN?, Its role, significance and applicability in societal problem solving , The Convolution Operation, Motivation, Pooling, The Neuroscientific Basis for Convolutional Networks	CO1, CO3, CO6
	B	Prior probability distribution, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data types with different dimensionalities and number of channel	CO1, CO3
	C	Efficient Convolution Algorithms, Random or Unsupervised Features of CNN , Normalization, Applications of CNN in Computer Vision – ImageNet	CO1, CO3, CO6
	Unit 4	**Sequence Modeling: Recurrent Neural Networks**	
	A	Sequence Learning Problems , Recurrent Neural Network and its significance in real world, RNN model, Backpropagation through time ,Bidirectional RNNs	CO4, CO6
	B	Different types of RNNs, Gated Recurrent Unit (GRU) Recursive Neural Networks , The Challenge of Long-Term Dependencies	CO4
	C	Introduction of Long Short Term Memory Neural Networks, Learning Algorithm of LSTM/ RNN Bidirectional LSTMs	CO4
	Unit 5	**Deep Networks and design process**	

	A	Introduction to Generative Adversarial Networks , Generative Adversarial Networks – Architecture,			CO5,CO6
	B	DCGAN, GAN hack, Applications of Generative Adversarial Networks			CO5,CO6
	C	Practical design process for deep learning techniques based on real world problems: Performance Metrics , Default Baseline Models, Determining Whether to Gather More Data, Selecting Hyperparameters, Debugging Strategies			CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	**CA**	**MTE**	**ETE**	
		25%	25%	50%	
	Text Books	1. **Deep Learning, by Goodfellow I., Bengio Y. & Courville A. (2016)** 2. **Visualizing and Understanding Convolutional Networks, by Matt Zeiler, Rob Fergus** 3. **TensorFlow: a system for large-scale machine learning, by Martín A., Paul B., Jianmin C., Zhifeng C., Andy D. et al. (2019)**			
	Reference Books	1. Deep learning in neural networks, **by JuergenSchmidhuber (2015)** 2. https://cs230.stanford.edu/syllabus/ 3. https://towardsdatascience.com/september-edition-machine-learning-case-studies-a3a61dc94f23 4. **Deep Learning: A Practitioner's Approach by Josh Patterson, Oreilly.**			

CO and PO Mapping

S. No.	Course Outcome (CO)	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1	Recall Neural Networks relate it with Deep Learning concepts to solve real life applications	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2	Compare and classify Regularization approaches for Deep Learning.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3	Build Convolutional Neural Networks models for image analysis and its applicability in societal problem solving.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4	Examine the Sequence models and analyse the relationships among them.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5	Assess the different Deep learning models based on their design processes.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6	Predict the behaviour of Deep learning models and apply them to solve real life applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name: Introduction to Deep Leaning

(Course Code- CSA302)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Deep Leaning and its Applications (Course Code-CSA303)	CO1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
	CO2	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
	CO3	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
	CO4	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
	CO5	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
	CO6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSA 303	**Deep Leaning and its Applications**	3.00	3.00	3.00	3.00	2.83	2.33	2.33	1.17	2.33	3.00	2.67	3.00	3.00	3.00	2.67

Total 40.3

Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School: SET		Batch : 2023-27
Program: B-TECH		Current Academic Year: 2023-24
Branch: CSE		Semester:
1	Course Code	CAL303
2	Course Title	**Deep Leaning and its Applications Lab**
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	CORE
5	Course Objective	This course aims to present the mathematical, statistical and computational challenges of building stable representations for high-dimensional data, such as images, text and data. We will delve into selected topics of Deep Learning, discussing recent models from both supervised and unsupervised learning. Special emphasis will be on convolutional architectures, invariance learning, unsupervised learning and non-convex optimization. To understand and demonstrate how to solve general learning from a large series of data using computer based deep learning algorithms
6	Course Outcomes (CO's)	On successful completion of this module students will be able to: 1. Define and show the implementation of Deep Learning concepts to solve real life applications 2. Compare and classify Regularization approaches for Deep Learning. 3. Build Convolutional Neural Networks models for image analysis and its applicability in societal problem solving. 4. Examine the Sequence models and analyses the relationships among them. 5. Assess the different Deep learning models based on their design processes. 6. Predict the behavior of Deep learning models and apply them to solve real life applications.
7	Course Description	This course starts with introduction to Deep Learning and further build, train, and deploy real world applications such as object recognition and Computer Vision, image and video processing, text analytics, Natural Language Processing, recommender systems, and other types of classifiers.

8	Outline syllabus		CO Mapping
	Unit 1	**Deep Feed Forward Networks**	
	1	Write a program to implement Deep Feed Forward Network to predict Housing price available on Kaggle.	**CO1**
	2	Write a program to implement classification using Deep Feed Forward Network on dataset available on Kaggle.	**CO1**
	Unit 2	**Regularization for Deep Learning**	

	3	Write a program to implement regularization to overcome over fitting problem in Housing price Prediction			CO2
	Unit 3	**Convolutional Neural Networks**			
	4	**Digit Recognition from** MNIST : Given a zip codes hand written on envelops, identify the digit for each hand written character. A model of this problem would allow a computer program to read and understand handwritten zip codes and sort envelops by geographic region.			CO1, CO3, , CO6
	5	Dog-Breed Classifier: Design and train a convolutional neural network to analyze images of dogs and correctly identify their breeds. Use transfer learning and well-known architectures to improve this model—this is excellent preparation for more advanced applications.			CO1, CO3
	Unit 4	**Sequence Modelling: Recurrent Neural Networks**			
	6	**Stock market prediction on** NASDAQ stocks: Given the current and past price movements for a stock, determine whether the stock should be bought, held or sold. A model of this decision problem could provide decision support to financial analysts.			CO4, CO6
	7	The Slot-Filling (Spoken Language Understanding) consists in assigning a label to each word given a sentence. It's a classification task.			CO4
	8	Write a program to implement credit card fraud detection prediction			CO4
	Unit 5	**Deep Networks and design process**			
	9	Implement Convolutional Autoencoders in Python with Keras on MNIST dataset			CO5,CO 6
	10	Write a program to implement Generative Adversarial Network			CO5,CO 6
	Mode of examination	Practical			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Lipschutz, "Data Structures" Schaum's Outline Series, TMH			
	Other References	1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein "Data Structures Using C and C++" , PHI 2. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication 3. Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with applications", McGraw Hill 4. R. Kruse etal, "Data Structures and Program Design in C", Pearson Education 5. G A V Pai, "Data Structures and Algorithms", TMH			
	Weblink	**https://towardsdatascience.com/getting-rich-quick-with-machine-learning-and-stock-market-predictions-696802da94fe**			

		https://www.datacamp.com/community/tutorials/autoencoder-keras-tutorial http://deeplearning.net/tutorial/rnnslu.html	

CO and PO Mapping

S. No.	Course Outcome (CO)	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1	Define and show the implementation of Deep Learning concepts to solve real life applications	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2	Compare and classify Regularization approaches for Deep Learning.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3	Build Convolutional Neural Networks models for image analysis and its applicability in societal problem solving.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4	Examine the Sequence models and analyse the relationships among them.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5	Assess the different Deep learning models based on their design processes.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6	Predict the behaviour of Deep learning models and apply them to solve real life applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name: Introduction to Deep Leaning

(Course Code- CAL303)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Deep Leaning and its Applications Lab (Course Code- CAL303)	CO1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
	CO2	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
	CO3	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
	CO4	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
	CO5	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
	CO6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CAL 303	**Deep Leaning and its Applications Lab**	3.00	3.00	3.00	3.00	2.83	2.33	2.33	1.17	2.33	3.00	2.67	3.00	3.00	3.00	2.67

Total 40.3

Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School: SET	Batch: 2023-27		
Program: B-TECH	**Current Academic Year: 2023-24**		
Branch: CSE	**Semester: VII**		

1	Course Code	**CSA402**	Course Name: Applications of AIML in healthcare/ ICT/ Computer Networks
2	Course Title	Applications of AIML in healthcare/ ICT/ Computer Networks	
3	Credits	1	
4	Contact Hours (L-T-P)	1-0-0	
	Course Status	Program Elective 5	
5	Course Objective	**Students will try to apply:** 1. Fundamental principles of AI & ML. 2. To find the solutions of real life problems and design its solutions 3. To implement the designed solution.	
6	Course Outcomes	Students will be able to: 1. Demonstrate a good understanding of key concepts and terminology in healthcare/ICT and Computer Network 2. Illustrate and describe major characteristics and potential applications of various AI-based platforms, tools and techniques 3. Examine and analyse major issues faced in implementing AI applications in healthcare/ICT and Computer Network 4. Discuss current AI trends and predict future trends in healthcare 5. Analyse key data challenges in healthcare and develop data science proposals with clear objectives towards overcoming these challenges 6. Design AI frameworks and leverage on existing Python toolboxes and techniques for solving data science problems in healthcare	
7	Course Description	This course provides students with a working knowledge of methods for design and analysis of AI& ML based applications in the field of healthcare/ICT and Computer Network.	
8	Outline syllabus		CO Mapping

Capstone Project Guidelines

The Capstone Project provides an opportunity for students to engage in high-level work focusing on an area of specialization within the profession. Capstone projects (CP) will be inquiry and practice-oriented, and will draw upon areas of interest to the student. All Capstones aim to bridge theory and practice and are aimed to have an impact on the professional life of students whether they work in classrooms, studios or community spaces.

Students will identify the topics for their Capstone Project during their course work. Capstone projects often take their inspiration from projects, papers, and experiences related to course work in the degree program. However, to ascertain students' abilities for independent work and their capacity for self-directed inquiry, capstone projects must demonstrate in what ways individual graduate students have researched, developed, and extended, or applied the ideas and strategies under investigation.

Capstone Projects encourage the application of knowledge gained on teaching and learning throughout the Bachelor of Technology program. Additionally, the Capstone Project should demonstrate the depth and extent of knowledge of students. Capstone projects may take a variety of formats (e.g., video, web, traditional text, media) of scholarly work. These may be, but are not limited to, the investigation of practices and educational ideas, the development of curricular materials, or teaching approaches.

A successful Capstone Project shall:

1) Illuminate and bring new insight to an area of the technology;

2) Demonstrate a depth and breadth of knowledge and the application of this knowledge to scholarship and/or practice;

3) Present a clearly articulated investigative framework, while situating projects within established academic practices and/or ideas;

4) Offer inquiry-based argumentation for educational/curricular change and adaptation where conceptual propositions are tied to in-the-world realities.

General Guidelines

In consultation with faculty, students will select a topic and submit a proposal to the Department of Computer Science & Engineering. Upon acceptance, students may proceed with their Capstone Project. Proposals must be submitted to the department no later than two weeks into the semester in which the capstone is to be completed. To gain proposal approval, students will submit a 5-page outline of their projects as delineated below. All capstone projects require a substantive final and polished format and will be archived by the Department of Computer Science & Engineering upon completion.

Proposals

A Capstone Project Proposal should contain the following:

1) Introduction – Explains the interest in the topic and situates the project in a scholarly and/or practical context.

2) Goals and Process – Describes the goals and purpose of the project. The section will detail the activities that will take place during the project, including who will be involved, and the role the student will play.

3) Final Product and Timeframe – Outlines the timeline for the project. This section will also detail the final format of the project and how it will be presented.

Format of Capstone Projects

A Capstone Project should encompass the following minimum parameters:

· A capstone project may take several forms and often yields the production of materials for teaching, learning, research, or for a variety of applications within the field.

· Each capstone project must show:

(a) depth and breadth of scholarly understanding, and

(b) the application of this understanding to practice.

· A condition of the capstone project is that students demonstrate the ability to gather materials, review current literature, and to examine sufficient background material to inform the development of original work.

· To this end, the capstone projects should be though in two parts:

1) A narrative-focused segment that describes and reflects upon the process, as well as a literature review sufficient to provide a scholarly contextualization of the project.

a) Length will vary but a good expectation for this section would be 20 to 25

	Pages including references 2) A practice-oriented segment where original and collected materials will be collected. a) Multimedia and web-based formats are highly encouraged in this segment of the capstone. b) Materials should be 'sharable' and aimed at impacting an area of work within technology domain.				
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	References	1. https://www.coursera.org/learn/ai-deep-learning-capstone			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Demonstrate a good understanding of key concepts and terminology in healthcare/ICT and Computer Network	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	Illustrate and describe major characteristics and potential applications of various AI-based platforms, tools and techniques	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	Examine and analyse major issues faced in implementing AI applications in healthcare/ICT and Computer Network	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	Discuss current AI trends and predict future trends in healthcare	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	Analyse key data challenges in healthcare and develop data science proposals with clear objectives towards overcoming these challenges	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	Design AI frameworks and leverage on existing Python toolboxes and techniques for solving data science problems in healthcare	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Applications of AIML in healthcare/ ICT/ Computer Networks (Course Code CSA402)

Course Objectives	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**1**	**3**	**1**	**3**	**3**	**3**	**1**
CO2	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO6	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CSA402	Applications of AIML in healthcare/ ICT/ Computer Networks	3.00	3.00	3.00	3.00	3.00	1.83	2.00	3.00	2.33	3.00	0.00	3.00	3.00	3.00	2.67

Total- 33.83
Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

<table>
<tr><td colspan="2">School: SET</td><td colspan="3">Batch: 2023-27</td></tr>
<tr><td colspan="2">Program: B-TECH</td><td colspan="3">Current Academic Year: 2023-24</td></tr>
<tr><td colspan="2">Branch: CSE</td><td colspan="3">Semester: VII</td></tr>
<tr><td>1</td><td>Course Code</td><td>CAL402</td><td colspan="2">Course Name: Applications of AIML in healthcare/ ICT/ Computer Networks Lab</td></tr>
<tr><td>2</td><td>Course Title</td><td colspan="3">Applications of AIML in healthcare/ ICT/ Computer Networks Lab</td></tr>
<tr><td>3</td><td>Credits</td><td colspan="3">3</td></tr>
<tr><td>4</td><td>Contact Hours (L-T-P)</td><td colspan="3">0-0-3</td></tr>
<tr><td></td><td>Course Status</td><td colspan="3">Program Elective 5</td></tr>
<tr><td>5</td><td>Course Objective</td><td colspan="3">Students will try to apply:
4. Fundamental principles of AI & ML.
5. To find the solutions of real life problems and design its solutions
6. To implement the designed solution.</td></tr>
<tr><td>6</td><td>Course Outcomes</td><td colspan="3">Students will be able to:
1. Demonstrate a good understanding of key concepts and terminology in healthcare/ICT and Computer Network
2. Illustrate and describe major characteristics and potential applications of various AI-based platforms, tools and techniques
3. Examine and analyse major issues faced in implementing AI applications in healthcare/ICT and Computer Network
4. Discuss current AI trends and predict future trends in healthcare
5. Analyse key data challenges in healthcare and develop data science proposals with clear objectives towards overcoming these challenges
6. Design AI frameworks and leverage on existing Python toolboxes and techniques for solving data science problems in healthcare</td></tr>
<tr><td>7</td><td>Course Description</td><td colspan="3">This course provides students with a working knowledge of methods for design and analysis of AI& ML based applications in the field of healthcare/ICT and Computer Network.</td></tr>
<tr><td>8</td><td colspan="3">Outline syllabus</td><td>CO Mapping</td></tr>
<tr><td></td><td colspan="4"><u>Capstone Project Guidelines</u>
The Capstone Project provides an opportunity for students to engage in high-level work focusing on an area of specialization within the profession. Capstone projects (CP) will be inquiry and practice-oriented, and will draw upon areas of interest to the student. All Capstones aim to bridge theory and practice and are aimed to have an impact on the professional life of students whether they work in classrooms, studios or community spaces.
Students will identify the topics for their Capstone Project during their course work. Capstone projects often take their inspiration from projects, papers, and experiences related to course work in the degree program. However, to ascertain students' abilities for independent work and their capacity for self-directed inquiry, capstone projects must</td></tr>
</table>

demonstrate in what ways individual graduate students have researched, developed, and extended, or applied the ideas and strategies under investigation.

Capstone Projects encourage the application of knowledge gained on teaching and learning throughout the Bachelor of Technology program. Additionally, the Capstone Project should demonstrate the depth and extent of knowledge of students. Capstone projects may take a variety of formats (e.g., video, web, traditional text, media) of scholarly work. These may be, but are not limited to, the investigation of practices and educational ideas, the development of curricular materials, or teaching approaches.

A successful Capstone Project shall:

1) Illuminate and bring new insight to an area of the technology;

2) Demonstrate a depth and breadth of knowledge and the application of this knowledge to scholarship and/or practice;

3) Present a clearly articulated investigative framework, while situating projects within established academic practices and/or ideas;

4) Offer inquiry-based argumentation for educational/curricular change and adaptation where conceptual propositions are tied to in-the-world realities.

General Guidelines

In consultation with faculty, students will select a topic and submit a proposal to the Department of Computer Science & Engineering. Upon acceptance, students may proceed with their Capstone Project. Proposals must be submitted to the department no later than two weeks into the semester in which the capstone is to be completed. To gain proposal approval, students will submit a 5-page outline of their projects as delineated below. All capstone projects require a substantive final and polished format and will be archived by the Department of Computer Science & Engineering upon completion.

Proposals

A Capstone Project Proposal should contain the following:

1) Introduction – Explains the interest in the topic and situates the project in a scholarly and/or practical context.

2) Goals and Process – Describes the goals and purpose of the project. The section will detail the activities that will take place during the project, including who will be involved, and the role the student will play.

3) Final Product and Timeframe – Outlines the timeline for the project. This section will also detail the final format of the project and how it will be presented.

Format of Capstone Projects

A Capstone Project should encompass the following minimum parameters:

· A capstone project may take several forms and often yields the production of materials for teaching, learning, research, or for a variety of applications within the field.

· Each capstone project must show:

(a) depth and breadth of scholarly understanding, and

(b) the application of this understanding to practice.

· A condition of the capstone project is that students demonstrate the ability to gather materials, review current literature, and to examine sufficient background material to inform the development of original work.

· To this end, the capstone projects should be though in two parts:

1) A narrative-focused segment that describes and reflects upon the process, as well as

a literature review sufficient to provide a scholarly contextualization of the project.

b) Length will vary but a good expectation for this section would be 20 to 25

	Pages including references 2) A practice-oriented segment where original and collected materials will be collected. c) Multimedia and web-based formats are highly encouraged in this segment of the capstone. d) Materials should be 'sharable' and aimed at impacting an area of work within technology domain. **SAMPLE MACHINE LEARNING PROBLEMS** **1. HEALTHCARE DOMAIN:** (i). Wine Quality Test (ii). Personality Prediction (iii) Sentiment Analysis (iv) Speech Emotion Recognition (v) Parkinson Disease Identification (vi) Breast Cancer Identification (vii) Age and gender prediction **2. NETWORKING DOMAIN** (i). Fake News Detection (ii). Credit Card Fraud Detection (iii) Customer Segmentation (iv) Catching Illegal Fishing **3. ICT DOMAIN** (i) Iris Flowers Classification (ii) Loan Prediction using Machine Learning (iii) Housing Prices Prediction (iv) Digit Classification (v) Stock Price Prediction (vi) Bitcoin Price Predictor (vii) Online Grocery Recommendation using Collaborative Filtering (viii) Movie Recommendation System

	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	References	2. https://www.coursera.org/learn/ai-deep-learning-capstone			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Demonstrate a good understanding of key concepts and terminology in healthcare/ICT and Computer Network	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8,

		PO9,PO10, PSO1,PSO2,PSO3
2.	Illustrate and describe major characteristics and potential applications of various AI-based platforms, tools and techniques	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	Examine and analyse major issues faced in implementing AI applications in healthcare/ICT and Computer Network	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	Discuss current AI trends and predict future trends in healthcare	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	Analyse key data challenges in healthcare and develop data science proposals with clear objectives towards overcoming these challenges	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	Design AI frameworks and leverage on existing Python toolboxes and techniques for solving data science problems in healthcare	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Applications of AIML in healthcare/ ICT/ Computer Networks Lab (Course Code CAL402)

Course Objectives	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**1**	**3**	**1**	**3**	**3**	**3**	**1**
CO2	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO6	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CAL402	Applications of AIML in healthcare/ ICT/ Computer Networks Lab	3.00	3.00	3.00	3.00	3.00	1.83	2.00	3.00	2.33	3.00	0.00	3.00	3.00	3.00	2.67

Total- 33.83
Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School: SET		**Batch: 2023-27**	
Program: B.Tech		**Current Academic Year: 2023-24**	
Branch: ALL		**Semester: VII**	
1	**Course Code**	**CSA401**	**Course Name: Computer Vision**
2	**Course Title**	**Computer Vision**	
3	**Credits**	**3**	
4	**Contact Hours (L-T-P)**	**3-0-0**	
	Course Status	**Program Elective**	
5	Course Objective	1. To implement fundamental image processing techniques required for computer vision 2. To develop applications using computer vision techniques	
6	Course Outcomes	Students will be able to have thorough Understanding of: CO-1 Define the Fundamentals of Computer Vision and Computer Graphics and relate them with real world applications CO-2 Explain Image formation models and Foundations for Mathematical basis for various Projection Systems CO- 3 Apply Image processing techniques such as Segmentation and Edge Detection for real time and real world applications. CO- 4 Analyze various feature extraction techniques for different problem domain. CO-5 Evaluate Pattern Recognition Using Clustering, Classification, Supervised Learning and Unsupervised Learning Techniques CO-6 Build computer vision applications for real world Applications.	
7	Course Description	In this course students will learn basic principles of image formation, image processing algorithms, extracting the features and then analyzing the underlying patterns.	

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Computer Vision**	
	A	Computer Vision and Computer Graphics , What is Computer Vision - Low-level, Mid-level, High-level	CO1
	B	Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis	CO1
	C	Face detection, Face recognition, Eigen faces, Active appearance and 3D shape models of faces, Surveillance, foreground-background separation, vehicle vision system: locating roadway, road markings, identifying road signs, locating pedestrians	CO1
	Unit 2	**Image Formation Models**	
	A	Monocular imaging system , Radiosity: The 'Physics' of Image Formation, Radiance, Irradiance, Brightness, color etc,	CO2

	B	Orthographic & Perspective Projection ,Camera model and Camera calibration, Binocular imaging systems			CO2
	C	Multiple views geometry, Structure determination, shape from shading, Weak perspective projection and orthographic projection, Concept of image coordinate system and camera coordinate system;			CO2
	Unit 3	**Image Processing**			
	A	Image preprocessing: The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Discrete Cosine Transform (DCT)			CO3, CO6
	B	Wavelet Transforms in One Dimension-The Discrete Wavelet Transform (DWT) and The Continuous Wavelet Transform. Wavelet Decomposition,			CO3, CO6
	C	Orthogonal, Euclidean, Affine, Projective, etc; Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.			CO3, CO6
	Unit 4	**Image Processing Operations**			
	A	Image Filtering (spatial domain), Mask-based (e.g., correlation, convolution), Smoothing (e.g., Gaussian), Sharpening (e.g., gradient)			CO4
	B	Segmentation : Edge-based (e.g., voting, optimization, perceptual grouping), Pixel-based (e.g., clustering)			CO4
	C	Colour fundamentals, Colour models, Colour transformation, Smoothing and Sharpening, Colour segmentation			CO4
	Unit 5	**Feature Extraction**			
	A	Edge detection: Canny, Laplacian of Gaussian; Line detectors (Hough Transform)			CO5, CO6
	B	Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH			CO5, CO6
	C	Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Milan Sonka, Vaclav Hlavac, Roger Boyle," Digital Image Processing and Computer Vision" Cengage Learning, 1st Edition, 2008 2. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.			
	Reference Books	1, Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall. 2. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992. 3. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO-1 Define the Fundamentals of Computer Vision and Computer Graphics and relate them with real world applications	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	CO-2 Explain Image formation models and Foundations for Mathematical basis for various Projection Systems	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	CO- 3 Apply Image processing techniques such as Segmentation and Edge Detection for real time and real world applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	CO- 4 Analyze various feature extraction techniques for different problem domain.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	CO-5 Evaluate Pattern Recognition Using Clustering, Classification, Supervised Learning and Unsupervised Learning Techniques	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	CO-6 Build computer vision applications for real world applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Computer Vision **(Course Code** CSA-401**)**

Subject	PO's / PSO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Computer Vision CSA-401	CO1	3	3	3	3	1	1	1	1	1	2	1	3	2	3	1
	CO2	3	3	3	3	2	1	1	1	1	2	1	3	2	3	2
	CO3	3	3	3	3	2	1	1	1	1	2	1	3	3	3	2
	CO4	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
	CO5	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
	CO6	3	3	3	3	2	3	3	1	3	2	1	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA-401	Computer Vision	3.00	3.00	3.00	3.00	1.83	1.67	1.33	1.00	1.33	2.00	1.00	3.00	2.67	3.00	2.00

Total- 32.83
Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School: SET		**Batch: 2023-27**	
Program: B.Tech		**Current Academic Year: 2023-24**	
Branch: ALL		**Semester: VII**	
1	**Course Code**	**CAL401**	**Course Name: Computer Vision Lab**
2	**Course Title**	**Computer Vision Lab**	
3	**Credits**	**1**	
4	**Contact Hours (L-T-P)**	**0-0-2**	
	Course Status	**Core**	
5	Course Objective	To implement fundamental image processing techniques required for computer vision To develop applications using computer vision techniques	
6	Course Outcomes	Students will be able to have thorough Understanding of: CO-1 Define and show the Fundamentals of Computer Vision techniques on images CO-2 Show the Image filtering and opening / closing operations on Color images CO- 3 Apply Image transformation techniques such as for real time and real world applications. CO- 4 Analyze various feature extraction techniques for different Problem domains. CO-5 Evaluate Pattern Recognition Using Clustering, Classification Techniques CO-6 Build computer vision applications for real world Problems.	
7	Course Description	In this course students will learn basic principles of image formation, image processing algorithms, extracting the features and then analyzing the underlying patterns.	

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Computer Vision**	
	1	To create a program to display grayscale image using read and write operation.	CO1
	2	To create a vision program to find histogram value and display histograph of a grayscale and color image.	CO1
		Write a program for color image processing	
	Unit 2	**Image Formation Models**	
	3	To Implement smoothing or averaging filter in spatial domain	CO2
	4	Program for opening and closing of the image.	CO2
	5	To fill the region of interest for the image	CO2
	Unit 3	**Image Processing**	
	6	To create a vision program for Non-Linear Filtering technique using edge detection	CO3, CO6
	7	To create a program to discretize an image using Fourier transformation.	CO3, CO6
	8	To create a vision program to determine the edge detection of an image using different operators.	CO3, CO6
	Unit 4	**Feature Extraction**	
	9	Program of sharpen image using gradient mask.	CO4

	10	Program for morphological operation: erosion and dilation.			CO4
	11	Write a program for image segmentation using local and global thresholding			CO4
	Unit 5	**Pattern Analysis**			
	12	Write a program to implement image classification.			CO5, CO6
	13	Write a program to implement image clustering.			CO5, CO6
	Mode of examination	Lab			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Milan Sonka, Vaclav Hlavac, Roger Boyle," Digital Image Processing and Computer Vision" Cengage Learning, 1st Edition, 2008 2. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.			
	Reference Books	1, Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall. 2. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992. 3. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO-1 Define and show the Fundamentals of Computer Vision techniques on images	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	CO-2 Show the Image filtering and opening / closing operations on Color images	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	CO- 3 Apply Image transformation techniques such as for real time and real world applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	CO- 4 Analyze various feature extraction techniques for different Problem domains.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	CO-5 Evaluate Pattern Recognition Using Clustering, Classification Techniques	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	CO-6 Build computer vision applications for real world Problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Computer Vision **(Course Code** CSA-301**)**

Subject	PO's / PSO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Computer Vision CAL-401	CO1	3	3	3	3	1	1	1	1	1	2	1	3	2	3	1
	CO2	3	3	3	3	2	1	1	1	1	2	1	3	2	3	2
	CO3	3	3	3	3	2	1	1	1	1	2	1	3	3	3	2
	CO4	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
	CO5	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
	CO6	3	3	3	3	2	3	3	1	3	2	1	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CAL-401	Computer Vision	3.00	3.00	3.00	3.00	1.83	1.67	1.33	1.00	1.33	2.00	1.00	3.00	2.67	3.00	2.00

Total- 32.83
Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School: SET		**Batch: 2023-27**	
Program:B.Tech		**Current Academic Year: 2023-24**	
Branch:IT		**Semester: IV**	
1	Course Code	CSA02 1	Course Name
2	Course Title	Human Computer Interaction	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Specialization Elective	
5	Course Objective	1. Understand fundamental design and evaluation methodologies of human computer interaction. 2. Demonstrate knowledge of human computer interaction design concepts and related methodologies. 3. Apply theories and concepts associated with effective work design to real-world application.	
6	Course Outcomes	CO1: Define the capabilities of both humans and computers from the viewpoint of human information processing. CO2: Explain typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms. CO3: Apply HCI design principles, standards and guidelines. CO4: Analyse and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems. CO5:Analyse the tasks of HCI systems. CO6:Adopt a variety of simple methods for evaluating the quality of a user interface.	
7	Course Description	Students will learn the fundamental concepts of human-computer interaction and user centred design thinking, through working in teams on an interaction design project, supported by lectures, readings, and discussions. They will learn to evaluate and design usable and appropriate software based on psychological, social, and technical analysis. They will become familiar with the variety of design and evaluation methods used in interaction design.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Why Human–Computer Interaction?, What is Hci?, Who is Involved in Hci?,Models of Interaction Theory And Hci, Human Introduction, Input–Output Channels(Vision, Hearing, Touch, Movement), Human Memory(Sensory Memory,Long-Term Memory,), Psychology And The Design Of Interactive Systems,	CO1
	B	Input Devices For Interactive Use, Allowing Text Entry, Drawing And Selection From The Screen:–(Text Entry, Pointing, 3d Interaction Devices), Output Display Devices For Interactive Use, Virtual Reality Systems And 3d Visualization, Various Devices In The Physical World, Paper Output And Input, Memory(Short-Term Memory, Long-Term Memory, Access Methods), Processing(Effects, Limitations, Networks And Impact On System Performance)	CO1
	C	The Interaction:Introduction, Models Of Interaction (Execution–Evaluation Cycle, Interaction Framework),	CO1

		Frameworks And Hci, Ergonomics, Interaction Styles, Elements Of The Wimp Interface, Interactivity, Context Of The Interaction,Experience, Engagement And Fun	
	Unit 2	**Design Process**	
	A	Interaction Design Basics: Introduction, The Process of Design, User Focus, Scenarios, Navigation Design (Local Structure, Global Structure), Screen Design And Layout (Tools For Layout, User Action And Control, Appropriate Appearance), Iteration And Prototyping	CO2
	B	HCI in The Software Process: Introduction, The Software Life Cycle (Activities, Validation and Verification, Management and Contractual Issues, Interactive Systems for Software Lifecycle), Usability Engineering, Iterative Design and Prototyping, Techniques For Prototyping, Design Rationale (Process-Oriented Design Rationale, Design Space Analysis, Psychological Design Rationale)	CO2
	C	Design Rules: Introduction, Principles to Support Usability (Learnability, Flexibility, Robustness), Standards, Guidelines, Golden Rules and Heuristics (Shneiderman's Eight Golden Rules 0f Interface Design, Norman's Seven Principles for Transforming Difficult Tasks into Simple Ones), HCI Patterns	CO2
	Unit 3	Implementation Support	
	A	Introduction of Implementation Support, Elements of Windowing Systems: Examples of Imaging Models, Architectures of Windowing Systems, Programming The Application, Using Toolkits, Usability Principles, User Interface Management Systems: UIMS As A Conceptual Architecture, Implementation Considerations)	CO3
	B	Evaluation Techniques, what is Evaluation? Goals of Evaluation, Evaluation Through Expert Analysis: Cognitive Walkthrough, Heuristic Evaluation, Model-Based Evaluation, Evaluation Through User Participation, Empirical Methods: Experimental Evaluation, Observational Techniques, Query Techniques, Evaluation Through Monitoring Physiological Responses, Choosing an Evaluation Method, A Classification Of Evaluation Techniques	CO3
	C	Universal Design: Introduction, Universal Design Principles, Multi-Modal Interaction, Sound in The Interface, Touch In The Interface, Handwriting Recognition, Gesture Recognition, Designing For Diversity: Designing For Users With Disabilities, Designing For Different Age Groups, Designing For Cultural Differences	CO3
	Unit 4	**Models and Theories**	
	A	Cognitive Models: Introduction, Goal And Task Hierarchies(GOMS, Cognitive Complexity Theory, Problems And Extensions Of Goal Hierarchies), Linguistic Models(BNF, Task–Action Grammar), Challenge Of Display-Based Systems, Physical And Device Models(Keystroke-Level Model, Three-State Model), Cognitive Architectures(The Problem Space Model, Interacting Cognitive Subsystems)	CO4
	B	Socio-Organizational Issues And Stakeholder Requirements: Introduction, Organizational Issues: Cooperation or Conflict? Invisible Worker, Automating	CO4

		Processes – Workflow and BPR, Capturing Requirements (Stakeholders, Socio-Technical Models, Soft Systems Methodology, Participatory Design, Ethnographic Methods)	
	C	Communication And Collaboration Models: Introduction, Face-To-Face Communication(Transfer Effects and Personal Space, Eye Contact and Gaze, Gestures and Body Language, Back Channels, Confirmation and Interruption, Turn-Taking), Conversation, Speech Act Theory, Text-Based Communication(Back Channels and Affective State, Grounding Constraints, Turn-Taking, Context And Deixis, Pace And Granularity, Linear Text Vs. Hypertext), Group Working.	CO4
	Unit 5	**Task Analysis**	
	A	Introduction of Task, Differences Between Task Analysis and Other Techniques, Task Decomposition, Knowledge-Based Analysis, Entity–Relationship-Based Techniques, Sources of Information and Data Collection (Documentation, Observation, Interviews, Initial Analysis, Sorting and Classification), Uses Of Task Analysis	CO5
	B	Dialog Notations and Design Introduction, Dialog: Structured Human Dialogs, Dialog Design Notations, Diagrammatic Notations (State Transition Networks, Hierarchical State Transition Nets, Concurrent Dialogs and Combinatorial Explosion of States, Escapes, Petri Nets, State Charts, Flow Charts, JSD Diagrams), Textual Dialog Notations, Dialog Semantics, Dialog Analysis and Design	CO5, CO6
	C	Standard Formalisms, Formal Notations, Model-Oriented Notations and Issues, Algebraic Notations, Temporal Logics, Interaction Models (Pie Model, Predictability, Observability, Reachability), Continuous Behavior, Modeling Rich Interaction, Status–Event Analysis, Rich Contexts (Collaboration, Information, Triggers, Artifacts, Placeholders), Low Intention and Sensor-Based Interaction	CO5, CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 25% · MTE: 25% · ETE: 50%	
	Text book/s*	5. Alan dix, janet finlay, gregory d. Abowd, russell beale, "human–computer interaction" third edition, pearson education limited	
	Other References	1. Rajiendra Kumar, " Human Computer Interaction" Second Edition, Firewall Media New Delhi. 2. Ben Shneiderman, "Design the User Interface: Strategies for Effective Human-Computer Interaction" Pearson Education.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the capabilities of both humans and computers from the viewpoint of human information processing.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

2.	CO2: Explain typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	CO3: Apply HCI design principles, standards and guidelines.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	CO4: Analyse and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5	CO5:Analyse the tasks of HCI systems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6	CO6:Adopt a variety of simple methods for evaluating the quality of a user interface.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Human Computer Interaction **(Course Code** CSA-021**)**

Subject	**PO's / PSO's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
Human Computer Interaction **(Course Code** CSA-021**)**	CO1	3	3	2	2	1	1	1	1	1	2	1	3	2	2	1
	CO2	3	3	3	3	2	1	1	1	1	2	1	3	2	3	2
	CO3	3	3	3	3	2	1	1	1	1	2	1	3	3	3	2
	CO4	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
	CO5	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
	CO6	3	3	3	3	2	1	1	1	1	2	1	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CSA-021	Human Computer Interaction	3.00	3.00	2.83	2.83	1.83	1.33	1.00	1.00	1.00	2.00	0.00	3.00	2.67	2.83	2.00

Total- 30.33

Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**

3. Addressed to **Substantial (High=3) extent**

School: SET		Batch: 2023-27	
Program: B-TECH		Current Academic Year: 2023-24	
Branch: CSE		Semester: V	
1	Course Code	CSA-022	Course Name: Introduction to Cloud Computing with ML
2	Course Title	Introduction to Cloud Computing with ML	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Specialization Elective	
5	Course Objective	This introductory course on Cloud computing will teach both the fundamental concepts of how and why Cloud systems works, as well as Cloud technologies that manifest these concepts.	
6	Course Outcomes (CO's)	At the end of the course, students will have achieved the following learning objectives. CO1. Define the basics of cloud and recall the computer Science concepts which are helpful in understanding on demand service architecture. CO2. Classify and describe the architecture and taxonomy of parallel and distributed computing, including shared and distributed memory, and data and task parallel computing. CO3. Apply the PAAS and SAAS to manage the workflow and use of cloud in scientific application. CO4. Categorize and Characterize between Infrastructure services, deployment models, and governance in cloud computing. Examine the design of task and data parallel distributed algorithms for Clouds and use them to construct Cloud applications. CO5. Evaluate the importance of cloud using monitoring and management of services for performance improvement of HPC and to follow the Governance and Compliances. CO6. Elaborate the design concept and formulate to build the solution using cloud service providers as AWS as EC2, LAMBDA, S3 and Machine Learning Service as AWS SageMaker.	
7	Course Description	This course is an introductory course for cloud computing concepts and helps in understanding the core functionalities, algorithms, models and workflows in cloud environment. In this course Students will get demonstrations of real-time cloud services for better exposure and research understanding.	

8	Syllabus Outline		CO Mapping
	Unit 1	FOUNDATIONS	
	A	**Introduction to compute** Types of Computing, Grid computing, distributed computing, Client-server computing, Three Tier Architecture, use of Sockets and Remote Procedure Call, working of RMI and CORBA, Web services, Web Sockets, Message Queues and Message Brokers.	CO1
	B	**Introduction to Cloud Computing** Cloud Computing definition, Roots of Cloud Computing, Layers and Types of Clouds, Desired Features of a Cloud, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Challenges and Risks	CO1
	C	**Migrating and Integrating into Cloud** Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud, Enriching the 'Integration as a Service' Paradigm for the Cloud Era, Evolution and Challenges of SaaS Paradigm, Integration Scenarios, The Integration Methodologies	CO1

	Unit 2	**ENTERPRISE CLOUD COMPUTING AND IAAS**	
	A	**The Enterprise Cloud Computing Paradigm** Issues for Enterprise Applications on the Cloud, Transition Challenges, Enterprise Cloud Technology and Market Evolution, Business Drivers Toward a Marketplace for Enterprise Cloud Computing, The Cloud Supply Chain	CO1,CO2
	B	**Virtual Machines Provisioning and Migration Services** Introduction to Virtual Machines,The Anatomy of Cloud Infrastructures, VM Provisioning and Manageability, Virtual Machine Migration Services, Management of Virtual Machines for Cloud Infrastructures,, Distributed Management of Virtual Infrastructures, Scheduling Techniques	CO1,CO2
	C	**Enhancing Cloud Computing Environments Using a Cluster as a Service** Introduction and Related Work, RVWS Design, Cluster as a Service: The Logical Design, Secure Distributed Data Storage in Cloud Computing, Cloud Storage, Technologies for Data Security in Cloud Computing	CO1,CO2
	Unit 3	**PLATFORM AND SOFTWARE AS A SERVICE**	
	A	**Aneka and CometCloud** Aneka—Integration of Private and Public Clouds, Technologies and Tools for Cloud Computing, Aneka Cloud Platform, CometCloud: An Autonomic Cloud Engine, Introduction of CometCloud (Architecture, Autonomic Behavior, Applications overview)	CO1,CO3
	B	**Business Solutions and WorkFlow** Cloud-Based Solutions for Business Applications (Introduction of Enterprises Demand and Cloud Computing, Dynamic ICT Services), Workflow Engine for Clouds, Workflow Management Systems, Architecture of Workflow Management Systems	CO1,CO3,CO6
	C	**Scientific Applications and MapReduce Model** Scientific Application for Cloud Environments, Classification of Scientific Applications and Services in the Cloud, SAGA-based Scientific Applications, MapReduce Programming Model, MapReduce Impacts and Research Directions	CO1,CO3,CO6
	Unit 4	**MONITORING, MANAGEMENT & GOVERNANCE**	
	A	**SLA Management in Cloud Computing** Introduction of typical Use Cases, Model for Federated Cloud Computing, Security Considerations, SLA Management in Cloud Computing: A Service Provider's Perspective, Types of SLA, Life Cycle of SLA, Automated Policy-based Management	CO1,CO4
	B	**Performance Predictions for HPC on Clouds** Introduction and Background of Grid and Cloud, HPC in the Cloud: Performance-related Issues, Game Hosting	CO1,CO4

		on Cloud Resources, Building Content Delivery Networks Using Clouds, Resource Cloud Mashups			
	C	**Security and Governance** Basic Concept of Organizational Readiness, Drivers for Changes: Common Change Management Models, Security and Risk in the Cloud, Cloud Computing and Identity, Content Level Security—Pros and Cons, Legal Issues in Cloud Computing(PCI DSS), Data Privacy and Security Issues			CO1,CO4
	Unit 5	**AWS with Machine Learning**			
	A	AWS Services:EC2, IAM, S3, Lambda, Introduction to Amazon SageMaker, Machine Learning with Amazon SageMaker, Explore, Analyze, and Process Data, Train a Model with Amazon SageMaker, Deploy a Model in Amazon SageMaker, Set Up Amazon SageMaker, Amazon SageMaker Notebook Instance			CO1,CO5,CO6
	B	Amazon SageMaker Studio, Perform Common Tasks in Amazon SageMaker Studio, Amazon SageMaker API reference, Actions and Data Types, Use Autopilot to automate model development and Problem types, Create and Manage Workforces , Use Ground Truth for Labeling(Built-in Task Types, Auto-Segmentation Tool, Data Labeling, Input and Output Data,Creating Custom Labeling Workflows)			CO1,CO5,Co6
	C	Process Data and Evaluate Models, Build Models and Choose an Algorithm, Train Models, Debugger, Perform Automatic Model Tuning, Tune Multiple Algorithms, Use Reinforcement Learning, Incremental Training, Deploy Models, Multi-Model Endpoints, Inference Pipelines, Use Batch Transform, Compile and Deploy Models with Neo , Elastic Inference, Automatically Scale Models, Monitoring and Security			CO1,CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	**CA**	**MTE**	**ETE**	
		25%	25%	50%	
	Text Books	1. CLOUD COMPUTING Principles and Paradigms, Edited by Rajkumar Buyya, Jam 2. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter			
	Reference Books	Amazon SageMaker, Developer Guide, https://docs.aws.amazon.com/sagemaker/latest/dg/sagemaker-dg.pdf#gs			
	Online Materials	https://aws.amazon.com/getting-started/hands-on/build-train-deploy-machine-learning-model-sagemaker/ https://aws.amazon.com/machine-learning/			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Define the basics of cloud and recall the computer Science concepts which are helpful in understanding on demand service architecture. Classify and describe the architecture and taxonomy of parallel and distributed computing, including shared and distributed memory, and data and task parallel computing.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	Define the basics of cloud and recall the computer	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	Apply the PAAS and SAAS to manage the workflow and use of cloud in scientific application.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	Categorize and Characterize between Infrastructure services, deployment models, and governance in cloud computing. Examine the design of task and data parallel distributed algorithms for Clouds and use them to construct Cloud applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	Evaluate the importance of cloud using monitoring and management of services for performance improvement of HPC and to follow the Governance and Compliances	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	Elaborate the design concept and formulate to build the solution using cloud service providers as AWS as EC2, LAMBDA, S3 and Machine Learning Service as AWS SageMaker.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Introduction to Cloud Computing with Machine Learning

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
Introduction to Cloud Computing with Machine Learning **CSA-022**	**CO1**	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
	CO2	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
	CO3	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
	CO4	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
	CO5	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
	CO6	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA-022	Introduction to Cloud Computing with Machine Learning	3.00	3.00	3.00	3.00	1.83	1.67	1.33	1.00	1.33	2.00	1.00	3.00	2.67	3.00	2.00

Total- 39.00
Strength of Correlation

Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School SET		**Batch: 2023-27**	
Program B-TECH		**Current Academic Year: 2023-24**	
Branch CSE		**Semester VI**	
1	Course Code	**CSA041**	Course Name **Natural Language Processing**
2	Course Title	**Natural Language Processing**	
3	Credits	3	
4	Contact Hours (L-T-P)	**3-0-0**	
	Course Status	**Specialization Elective**	
5	Course Objective	**Students will try to learn** 3. Basics of natural language processing. 4. How to apply basic algorithms in natural language processing. 5. Algorithmic description of the main language levels morphology, syntax, semantics, and pragmatics. 6. Basics of knowledge representation, inference, and relations to the artificial intelligence. 7. Techniques such as tokenization, stemming, and lemmatization.	
6	Course Outcomes	Students will be able to CO-1. **Define** Computational Linguistics phenomena and making decisions using it. CO-2. **Explain** how to access Text Corpora and Lexical Resources. CO-3. **Apply** processing of raw text using NLP programming concepts. CO-4. **Analyze** tagging of words and Extracting Information from Text. CO-5. **Discuss** analysis of sentences using CFG and Propositional Logic. CO-6. **Design** NLP based applications for different business environment.	
7	Course Description	This course provides an introduction to the field of computational linguistics, aka natural language processing (NLP). We will learn how to create systems that can understand and produce language, for applications such as information extraction, machine translation, automatic summarization, question-answering, and interactive dialogue systems. The course will cover linguistic (knowledge-based) and statistical approaches to language processing in the three major subfields of NLP: syntax (language structures), semantics (language meaning), and pragmatics/discourse (the interpretation of language in context).	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction and Computational Linguistics**	
	A	What is Natural Language Processing, hands-on demonstrations. Ambiguity and uncertainty in language. The Turing test	CO1
	B	Computing with Language Texts and Words Implementation of NLTK, Searching Text, Counting Vocabulary, A Closer Look at Python Texts as Lists of Words, Computing with Language Simple Statistics, Frequency Distributions, Fine-grained Selection of Words, Collocations and Bigrams,	CO1

	C	Making Decisions and Taking Control, Conditionals, Operating on Every Element, Nested Code Blocks, Looping with Conditions	CO1
	Unit 2	**Accessing Text Corpora and Lexical Resources**	
	A	Automatic Natural Language Understanding, Word Sense Disambiguation, Pronoun Resolution, Generating Language Output, Machine Translation, Spoken Dialog Systems, Textual Entailment, Limitations of NLP	CO2
	B	Accessing Text Corpora, Gutenberg Corpus, Web and Chat Text, Brown Corpus, Reuters Corpus, Inaugural Address Corpus, Annotated Text Corpora, Corpora in Other Languages	CO2
	C	Text Corpus Structure, Loading your own Corpus, Conditional Frequency Distributions, Conditions and Events, Counting Words by Genre, Plotting and Tabulating Distributions, Generating Random Text with Bigrams,	CO2
	Unit 3	**Processing Raw Text**	
	A	Lexical Resources,, Wordlist Corpora, A Pronouncing Dictionary, Comparative Wordlists, Shoebox and Toolbox Lexicons, WordNet, Senses and Synonyms, The WordNet Hierarchy, Lexical Relations, Semantic Similarity	CO3
	B	Accessing Text from the Web and from Disk, Strings Text Processing at the Lowest Level, Text Processing with Unicode, Regular Expressions for Detecting Word Patterns, Useful Applications of Regular Expressions Normalizing Text, Regular Expressions for Tokenizing Text, Segmentation,Formatting From Lists to Strings	CO3
	C	NLP Programming Sequences, Style, Functions for text processing, Program Development & Algorithm Design using, Python Libraries	CO3
	Unit 4	**Tagging & Information Extraction**	
	A	Categorizing and Tagging Words Using a Tagger,Tagged Corpora,Mapping Words to Properties Using Python Dictionaries, Automatic Tagging, N-Gram Tagging,Transformation-Based Tagging, Determine the Category of a Word	CO4
	B	Text classification Supervised Classification, Examples of Supervised Classification,Evaluation,Decision Trees,Naive Bayes Classifiers,Maximum Entropy Classifiers,Modeling Linguistic Patterns	CO4
	C	Extracting Information from Text Information Extraction,Chunking,Developing and Evaluating Chunkers,Recursion in Linguistic Structure,Named Entity Recognition,Relation Extraction	CO4
	Unit 5	**Analysis of sentences**	
	A	Analyzing Sentence Structure Grammatical Dilemmas,What's the Use of Syntax?,Context-Free Grammar,Parsing with Context-Free Grammar,Dependencies and Dependency Grammar,Grammar Development	CO5

	B	Analyzing the Meaning of Sentences Natural Language Understanding,Propositional Logic,First-Order Logic,The Semantics of English Sentences,Discourse Semantics			CO5
	C	Managing Linguistic DataCorpus Structure,The Life Cycle of a Corpus,Acquiring Data,Working with XML,Working with Toolbox Data,Describing Language Resources Using OLAC Metadata			CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Speech and Language processing an introduction to Natural Language Processing, Computational Linguistics and speech Recognition by Daniel Jurafsky and James H. Martin (ISBN13: 978-0131873216) 2. Ruslan Mitkov, The Oxford Handbook of Computational Linguistics, Oxford University Press, 2005			
	Other References	3. Charu C. Aggarwal and Cheng Xiang Zhai, Mining Text Data, Springer, 2012 4. Hopcroft, J.E. and Ullman, J.D., Introduction to Automata, Theory and Languages, Addison-Wesley, 1979			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**Define** Computational Linguistics phenomena and making decisions using it.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	**Explain** how to access Text Corpora and Lexical Resources.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	**Apply** processing of raw text using NLP programming concepts.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	**Analyze** tagging of words and Extracting Information from Text.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	**Discuss** analysis of sentences using CFG and Propositional Logic.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	**Design** NLP based applications for different business environment.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Natural Language Processing **(Course Code CSA041)**

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	3	1	1	1	1	3	1	3	2	3	1
CO2	3	3	3	3	3	1	1	1	1	3	1	3	3	3	2
CO3	3	3	3	3	3	2	1	1	1	3	1	3	3	3	1
CO4	3	3	3	3	3	1	2	1	1	3	1	3	3	3	3
CO5	3	3	3	3	3	2	2	1	2	3	1	3	3	3	3
CO6	3	3	3	3	3	3	3	1	3	3	2	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CSA 041	Natural Language Processing	3.00	3.00	3.00	3.00	3.00	1.67	1.67	1.00	1.50	3.00	0.00	3.00	2.83	3.00	2.17

Total- 34.83
Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School: SET		**Batch: 2023-27**		
Program: B.Tech.		**Current Academic Year: 2023-24**		
Branch: CSE		**Semester: VII**		
1	**Course Code**	**CSA051**	**Course Name- RECOMENDER SYSTEMS**	
2	**Course Title**	**RECOMENDER SYSTEMS**		
3	**Credits**	**3**		
4	**Contact Hours (L-T-P)**	**3-0-0**		
	Course Status	**Specialization Elective**		
5	Course Objective	To develop state-of-the-art recommender systems that automate a variety of choice-making strategies with the goal of providing affordable, personal, and high-quality recommendations 1. To introduce fundamental techniques in recommender systems. 2. To introduce the ideas of Non-personalized and project-association recommenders through content-based and collaborative techniques. 3. To become familiar with to various approaches for building recommender systems including collaborative, content-based, knowledge-based, and hybrid methods.		
6	Course Outcomes	After Successful completion of this course the student will be able to: CO-1. **Define** the basics of Recommender Systems and its types**.** CO-2. **Explain** the similarity measures used in formation of neighbourhood of samples of data. CO-3. **Apply** various techniques of content and knowledge based recommendation for real life applications. CO-4. **Analyse** and categorize the various recommendation techniques for hybridization. CO-5. **Choose** the suitable type of Recommender systems for societal problems CO-6. **Design** the recommender system to support all online applications of folksonomies and Social Networking sites.		
7	Course Description	Recommender systems offer personalized access to online information in product catalogs, social media networks, and document collections, among other applications. It will introduce students to various approaches for building recommender systems including collaborative, content-based, knowledge-based, and hybrid methods.		
8	Outline syllabus			CO Mapping
	Unit 1	**Introduction**		
	A	Introduction to Recommender Systems, Neighbourhood-based methods Recommendation, Applications of recommender systems, Case study of movie lens, group lens and amazon.com etc.		CO1,

	B	Introduction to Information retrieval, Introduction to collaborative filtering	CO1,
	C	Knowledge sources, Neighbourhood-based methods.	CO1
	Unit 2	**Memory and Model-based Collaborative Recommendation**	
	A	Similarity measures used in Collaborative Filtering, Model-based Collaborative Recommendation Dimensionality reduction. Regression: Slope1 and SLIM models. Association rules and Naïve Bayes models,	CO2, CO6
	B	Factorization Methods of Collaborative Recommendation, Latent factor models.	CO2, CO6
	C	Optimization techniques. Singular value decomposition, constrained matrix factorization.	CO2, CO6
	Unit 3	**Content-based and Knowledge-based Recommendation**	
	A	High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Content-based Recommendation Feature representation, extraction, and selection.	CO3, CO6
	B	User profiles. Learning models, Item profiles, Discovering features of documents, Obtaining item features from tags	CO3, CO6
	C	Knowledge-based Recommendation Constraint-based recommendation. Critiquing systems.	CO3, CO6
	Unit 4	**Hybrid recommendation and Evaluation**	CO3, CO6
	A	Hybrid Recommendation Complementarities between recommendation techniques and knowledge sources.	CO3, CO6
	B	Combining recommendation methods. Types of evaluation for recommender systems	CO3, CO6
	C	Evaluation design. Prediction metrics and ranking metrics. A/B Testing	CO3, CO6
	Unit 5	**Context-aware recommendation**	
	A	Context effects in recommendation. Types and representations of context.	CO5, CO6
	B	Pre-filtering, post-filtering and contextual modelling, Temporal and location-sensitive models	CO5, CO6
	C	Recommender Systems and communities: Communities, collaboration and recommender systems in personalized web search, Social tagging recommender systems, Trust and Recommendations, Group recommender systems and their applications in solving societal problems.	CO5, CO6
	Mode of examination	Theory	
		CA	MTE	ETE	

	Weightage Distribution	25%	25%	50%	
	Text book/s*	Aggarwal, C. C. Recommender Systems: The Textbook. Springer 2019. ISBN 978-3-319-29657-9. Available through the DePaul library.			
	Other References	http://www.deitel.com/ResourceCenters/Web20/RecommenderSystems/RecommenderSystemsCourseSyllabi/tabid/1321/Default.aspx			
	Other References	Francesco Ricci, LiorRokach and BrachaShapira Recommender Systems Handbook, 2005			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**Define** the basics of Recommender Systems and its types**.**	PO1,PO2,PO3,PO4, PO5,PO6, PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	**Explain** the similarity measures used in formation of neighbourhood of samples of data.	PO1,PO2, PO3,PO4,PO5,PO6, PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	**Apply** various techniques of content and knowledge based recommendation for real life applications.	PO1,PO2,PO3,PO4,PO5,PO6, PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	**Analyse** and categorize the various recommendation techniques for hybridization.	PO1,PO2,PO3,PO4,PO5,PO6, PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	**Choose** the suitable type of Recommender systems for societal problems	PO1,PO2,PO3,PO4, PO5,PO6, PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	**Design** the recommender system to support all online applications of folksonomies and Social Net. sites.	PO1,PO2,PO3,PO4, PO5,PO6, PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for RECOMENDER SYSTEMS (Course Code CSA051)

Subject	Course Objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
RECOMENDER SYSTEMS CSA-051	CO1	3	3	2	3	2	1	1	1	2	1	-	3	3	2	2
	CO2	3	3	3	3	3	2	2	1	2	2	-	3	3	3	2
	CO3	3	3	3	3	3	3	3	1	3	2	-	3	3	2	2
	CO4	3	3	3	3	3	2	2	1	3	2	-	3	3	3	2
	CO5	3	3	3	3	3	3	3	1	3	2	-	3	3	3	2
	CO6	3	3	3	3	3	3	3	1	3	3	-	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CSA-051	**RECOMENDER SYSTEMS**	**3.00**	**3.00**	**2.83**	**3.00**	**2.83**	**2.33**	**2.33**	**1.00**	**2.67**	**2.00**	**0.00**	**3.00**	**3.00**	**2.67**	**2.17**

Total- 35.83

School: SET		**Batch: 2023-27**	
Program: B-TECH		**Current Academic Year: 2023-24**	
Branch: CSE		**Semester: VII**	
1	**Course Code**	**CSA061**	**Course Name: Robotics and Intelligent Systems**
2	**Course Title**	**Robotics and Intelligent Systems**	
3	**Credits**	**3**	
4	**Contact Hours (L-T-P)**	**3-0-0**	
	Course Status	**Specialization Elective**	
5	Course Objective	**Students will try to learn:** 8. Fundamental principles of robot system design and operation. 9. How to apply concepts of translational and rotational motion, and gears to robot construction. 10. To design and program simple autonomous robots. 11. To implement algorithms that enables the use of sensors and actuators to facilitate intelligent behavior, learning and perception.	
6	Course Outcomes	Students will be able to: CO-1. **Define** the concept and key components of robotics technologies. CO-2. **Classify** various robot sensors and their perception principles that enable a robot to analyze their environment, reason and take appropriate actions toward the given goal. CO-3. **Apply** the learned knowledge and skills in practical robotics laboratories and experiments. CO-4. **Analyze** problems in spatial coordinate representation and spatial transformation, robot locomotion design, kinematics, motion control, localization and mapping, navigation and path planning. CO-5. **Assess** stochastic control and multi agent systems for development of a robotic system. CO-6. **Adapt** intelligent system methodology suitable for a given type of real world application problem.	
7	Course Description	Basic concepts of Robotics, Intelligent Systems and transformational modeling. This course provides students with a working knowledge of methods for design and analysis of robotic and intelligent systems. Particular attention is given to modeling dynamic systems, measuring and controlling their behavior, and making decisions about future courses of action	

8	Outline syllabus		CO Mapping
	Unit 1	**Overview and Preliminaries**	
	A	Mobile Robots, Position, and Orientation	CO1
	B	Translational and Rotational Dynamics	CO1, CO2

	C	Flying and Swimming Robots, Articulated Robots			CO1, CO2
	Unit 2	**Transformation**,			
	A	Path Planning, and Trajectories			CO1, CO2
	B	Time Response of Dynamic Systems			CO1, CO2
	C	Dynamic Effects of Feedback Control, Control Systems			CO1, CO2
	Unit 3	**Optimization**			
	A	Sensors and Actuators			CO1, CO2, CO4
	B	Numerical Optimization			CO1, CO2, CO4
	C	Dynamic Optimal Control			CO1, CO2, CO4
	Unit 4	**Formal Logic, Algorithms, and Incompleteness**			
	A	Computers, Computing, and Sets			CO3, CO5
	B	Probability and Statistics			CO3, CO5
	C	Machine Learning, Neural Networks			CO3, CO5
	Unit 5	**Information, Search and Expert Systems**			
	A	State Estimation, Stochastic Control			CO3, CO5, CO6
	B	Parameter Estimation and Adaptive Control			CO3, CO5, CO6
	C	Task Planning and Multi-Agent Systems			CO3, CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	3. http://www.princeton.edu/~stengel/RISVirText.html. 4. J. J. Craig, Introduction to Robotics, Addison Wesley Publishers, 2005, 5. Computational Principles of Mobile Robotics by Gregory Dudek and Michael Jenkin, Second Edition			
	Other References	5. M. Negnevitsky, Artificial Intelligence – A guide to intelligent systems Addison-Wesley, 2005, 6. Bharati A., Sangal R., ChaitanyaV..Natural language processing: a Paninian perspective, PHI, 2000			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO-1. **Define** the concept and key components of robotics technologies.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	CO-2. **Classify** various robot sensors and their perception principles that enable a robot to analyze their environment, reason and take appropriate actions toward the given goal.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

3.	CO-3. **Apply** the learned knowledge and skills in practical robotics laboratories and experiments.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	CO-4. **Analyze** problems in spatial coordinate representation and spatial transformation, robot locomotion design, kinematics, motion control, localization and mapping, navigation and path planning.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	CO-5. **Assess** stochastic control and multi agent systems for development of a robotic system.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	CO-6. Adapt intelligent system methodology suitable for a given type of real world application problem.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Robotics and Intelligent Systems **(Course Code CSA061)**

Course Objectives	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	3	1	1	1	1	2	3	2	3	3	1
CO2	3	3	3	3	3	1	2	1	2	2	3	2	3	3	2
CO3	3	3	3	3	3	2	1	1	2	2	3	3	3	3	3
CO4	3	3	3	3	3	1	1	1	2	2	3	2	3	3	3
CO5	3	3	3	3	3	1	1	1	2	2	3	2	3	3	3
CO6	3	3	3	3	3	2	2	2	3	3	2	2	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CSA061	Robotics and Intelligent Systems	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**1.33**	**1.33**	**1.17**	**2.00**	**2.17**	**0.00**	**2.17**	**3.00**	**3.00**	**2.50**

Total- 33.83
Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Artificial Intelligence & Machine Learning**	
1	Course Code	CSI024	
2	Course Title	Basics of Internet of Things and Raspberry Pi	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Elective	
5	Course Objective	The primary objective of this course to provide a platform to get started with the Internet of Things with Raspberry Pi along with the basic knowledge of programming and interfacing of the input/output devices.	
6	Course Outcomes	CO1: Understand the general concepts of Internet of Things. CO2: Explore the IoT components and its architecture CO3: List the hardware components of Raspberry Pi CO4: Demonstrate the programming concepts using Raspberry Pi CO5: Explain the challenges in IoT specific application. CO6: Design and develop various applications using Raspberry Pi	
7	Course Description	This course provides a gradual pace of basic concepts to advanced interfacing and programming of Raspberry Pi for IoT based projects.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to IoT**	
	A	Defining IoT, History of IoT, Importance of IoT , IoT Basic Characteristics	CO1, CO6
	B	About Objects / things in the IoT, Enabling Technologies of IoT	CO1, CO6
	C	About the Internet in IoT, IoT Advantages and Disadvantages	CO1, CO6
	Unit 2	**IoT Architecture**	
	A	Basic Building blocks of IoT system: Sensors, Processors, gateways, Applications	CO2, CO6
	B	Physical design of IoT: Things in IOT, IoT Protocols, Logical design of IoT: IoT Functional Blocks, IoT Communication Models. IoT Communication API's	CO2, CO6
	C	IoT Service Oriented Architecture (SOA), API Oriented Architecture.	CO2
	Unit 3	**Basics of Raspberry Pi**	
	A	Introduction to Raspberry Pi, Raspberry Pi Components	CO3
	B	Installation of NOOBS on SD Card and Raspbian on SD Card, Terminal Commands, Installation of Libraries on Raspberry Pi	CO3
	C	Getting the Static IP Address of Raspberry Pi, Program on Raspberry Pi, Installing the Remote Desktop Server	CO3

	Unit 4	**Programming with Raspberry Pi**			
	A	Installation of I2C Driver on Raspberry Pi, Serial Peripheral Interface with Raspberry Pi			CO4
	B	Implementation of LED and Raspberry Pi, LED Blink Using Function, Reading the Digital Input			CO4
	C	Reading an Edge-Triggered Input: Reading Switch in Pull-Down Configuration, Reading Switch in Pull-Up Configuration			CO4
	Unit 5	**Interfacing with Raspberry Pi**			
	A	Interfacing of Relay with Raspberry Pi			CO5,CO6
	B	Interfacing of DC Motor with Raspberry Pi Interfacing of LCD with Raspberry Pi			CO5, CO6
	C	Home automation concept and case study Industry applications concept and case study			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Internet of Things with Raspberry Pi and Arduino, Rajesh Singh, Anita Gehlot, Lovi Raj Gupta et.al, CRC Press			
	Other References	1. Programming the Raspberry Pi, Getting started with Python, Simon Monk, Mc Graw Hill 2. Python Programming for Raspberry Pi, Richard Blum, Christine Bresnahan, Pearson Education			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Understand the general concepts of Internet of Things.	PO1, PO2, PO3, PO6, PO7, PO12, PSO1
2.	CO2: Explore the IoT components and its architecture	PO1, PO2, PO3, PO4, PO6, PO7, PO12, PSO1
3.	CO3: List the hardware components of Raspberry Pi	PO1, PO2, PO3, PO5, PO6, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2
4.	CO4: Demonstrate the programming concepts using Raspberry Pi	PO1, PO2, PO3, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2
5.	CO5: Explain the challenges in IoT specific application.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO12, PSO1
6.	CO6: Design and develop various applications using Raspberry Pi	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Raspberry Pi and its Programming (Course Code CSI024)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
Basics of Internet of Things and Raspberry Pi	CO1	3	1	1	-	-	2	1	-	-	-	-	3	3	-	-
	CO2	3	1	1	2	-	2	1	-	-	-	-	3	3	-	-
	CO3	2	1	1	-	3	1	1	-	1	1	2	2	1	1	-
	CO4	2	2	2	-	3	2	2	2	1	1	1	2	3	2	2
	CO5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	Basics of Internet of Things and Raspberry Pi	2.67	1.67	1.67	2.67	3.00	2.00	1.67	2.33	2.00	2.00	2.25	2.67	2.67	2.00	2.00

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Game Development using Unreal Engine

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.tech CSE**	
Branch:		**CSE**	
1	Course Code		
2	Course Title	**Brain Computer Interface**	
3	Credits	4	
4	Contact Hours (L-T-P)	3-0-2	
	Course Status		
5	Course Objective	To learn different concepts of Brain Computer Interface	
6	Course Outcomes	after studying this course student will be able to: **CO1:** *Understand* the fundamental principles of brain-computer interfaces. **CO2:** *Demonstrate* knowledge of the different types of BCIs and their applications. **CO3:** *Develop* proficiency in designing and implementing classification algorithms for decoding brain signals. **CO4:** *Evaluate* the performance and effectiveness of BCI systems. **CO5:** *Assess* different techniques and tools of Brain Computer Interface. **CO6:** *Plan* the opportunities of research and development in the arear of Brain Computer Interface	
7	Course Description	The Brain-Computer Interfaces (BCI) course is designed to provide students with a comprehensive understanding of the principles, techniques, and applications of brain-computer interfaces. BCIs are innovative systems that enable direct communication between the human brain and external devices, opening up new possibilities for assistive technology, human-computer interaction, and neuroscientific research.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Brain-Computer Interfaces, Neurophysiology and Neuroimaging**	
	A	Overview of brain-computer interfaces, Historical development and milestones in BCI research, Types of BCIs	CO1

		(invasive, non-invasive, hybrid), Ethical considerations and societal implications of BCIs			
	B	Basics of neurophysiology and neuroanatomy, Neuronal signaling and brain activity measurement techniques, Electroencephalography (EEG) and event-related potentials (ERPs), Functional magnetic resonance imaging (fMRI) and other neuroimaging methods			CO2
	Unit 2	**Signal Processing and Feature Extraction, and Machine Learning for BCI**			
	A	Time-domain and frequency-domain analysis techniques Feature extraction algorithms for BCI applications, Artifact removal and noise reduction methods			CO2
	B	Introduction to machine learning and its relevance to BCI, Classification algorithms for decoding brain signals, Supervised and unsupervised learning techniques, Cross-validation and performance evaluation metrics			CO2
	Unit 3	**Brain Signal Acquisition and Processing Techniques, and BCI Applications and User Experience**			
	A	Invasive BCIs: Neural implants, microelectrode arrays Non-invasive BCIs: EEG, functional near-infrared spectroscopy (fNIRS), Hybrid BCIs: Combining multiple signal acquisition modalities, Signal processing challenges and methods for different BCI types			CO3
	B	Motor imagery-based BCIs for assistive technologies Open BCI-based BCIs for communication and control Brain-controlled gaming and virtual reality, Neurofeedback and cognitive enhancement			CO3
	Unit 4	**Human-Computer Interaction and BCI Design**			
	A	User-centered design principles for BCIs Interface design and usability considerations			CO4, CO5
	B	Real-time feedback and adaptive BCI systems BCI applications in healthcare and rehabilitation			CO4, CO5
	Unit 5	**Emerging Trends and Future Directions**			
	A	Advanced signal processing techniques (deep learning, adaptive algorithms), Closed-loop BCI systems and brain stimulation			CO5, CO6
	B	Brain-machine interfaces for neuroprosthetics and brain augmentation, Ethical, legal, and social implications of BCI technology			CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	.			

		1. "Brain-Computer Interfaces: Principles and Practice" by Jonathan Wolpaw and Elizabeth Winter Wolpaw. Publisher: Oxford University Press." 2. "Brain-Computer Interfaces: Revolutionizing Human-Computer Interaction" by Bernhard Graimann, Brendan Allison, and Gert Pfurtscheller. Publisher: Springer." 3. "Brain-Computer Interfaces: Applying our Minds to Human-Computer Interaction" by Desney Tan and Anton Nijholt. Publisher: Springer. 4. "Brain-Computer Interfaces Handbook: Technological and Theoretical Advances" edited by Chang S. Nam, Anton Nijholt, and Fabien Lotte. Publisher: CRC Press.	
	Other References	1. "Brain-Computer Interfaces: An International Assessment of Research and Development Trends" edited by Richard A. Normann and Christoph Guger. Publisher: Springer. 2. "Introduction to Neural Engineering for Motor Rehabilitation" by Dario Farina, Winnie Jensen, and Metin Akay. Publisher: Wiley. 3. "Neuroergonomics: The Brain at Work" edited by Raja Parasuraman and Matthew Rizzo. Publisher: Oxford University Press. 4. "Cognitive Neuroscience Robotics B: Analytic Approaches to Human Understanding" edited by Toshio Inui and Hiroshi Murase. Publisher: Springer.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:** *Understand* the fundamental principles of brain-computer interfaces.	PO1, PO5, PO8, PO12
2.	**CO2:** *Demonstrate* knowledge of the different types of BCIs and their applications.	PO1, PO2, PO3, PO4, PO5, PO6, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
3.	**CO3:** *Develop* proficiency in designing and implementing classification algorithms for decoding brain signals.	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, PO12, PSO1, PSO2
4.	**CO4:** *Evaluate* the performance and effectiveness of BCI systems.	PO1, PO2, PO3, PO4, PO5, PO9, PO10, PO12, PSO1, PSO2, PSO3
5.	**CO5:** *Assess* different techniques and tools of Brain Computer Interface.	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, PO12, PSO1, PSO2, PSO3
6.	**CO6:** *Plan* the opportunities of research and development in the arear of Brain Computer Interface	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO1	PSO2
Brain Computer Interface	CO1	3	-	-	-	2	-	-	2	-	-	-	2
	CO2	3	2	2	2	3	2	-	-	2	2	2	2
	CO3	3	2	2	2	3	2	-	2	2	2	-	2
	CO4	3	3	3	3	3	-	-	-	2	2	-	2
	CO5	3	3	3	3	3	3	-	2	2	2	-	3
	CO6	3	3	3	3	3	3	3	2	3	3	3	3

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
	Brain Computer Interface	3.0	2.6	2.6	2.6	2.8	2.5	3.0	2.0	2.2	2.2	2.5	2.3

Strength of Correlation

1. Addressed to ***Slight (Low=1)*** ***extent*** ***2.*** Addressed to ***Moderate (Medium=2)*** ***extent***
3. Addressed to ***Substantial (High=3)*** ***extent***

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.tech CSE**	
Branch:		**CSE**	
1	Course Code		
2	Course Title	**Brain Computer Interface Lab**	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory/Elective	
5	Course Objective	To learn different concepts of Brain Computer Interface	
6	Course Outcomes	after studying this course student will be able to: **CO1:** *Understand* the fundamental principles of brain-computer interfaces. **CO2:** *Demonstrate* knowledge of the different types of BCIs and their applications. **CO3:** *Develop* proficiency in designing and implementing classification algorithms for decoding brain signals. **CO4:** *Evaluate* the performance and effectiveness of BCI systems. **CO5:** *Assess* different techniques and tools of Brain Computer Interface. **CO6:** *Plan* the opportunities of research and development in the arear of Brain Computer Interface	
7	Course Description	The course basically deals with the concepts of unreal engine for the game development	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to BCI Lab and Tools**	
		1.1 Overview of the BCI Lab and its equipment 1.2 Introduction to software tools used in BCI research 1.3 Familiarization with hardware components 1.4 Setting up EEG acquisition systems1.5 Unreal Engine Editor Interface 1.6 Applying electrodes and ensuring good signal quality 1.7 Preprocessing techniques: filtering, artifact removal, referencing	**CO1, CO2, CO3**
	Unit 2	**Motor Imagery-Based BCI**	
		2.1 Understanding motor imagery and its role in BCI 2.2 Experimental setup for motor imagery-based BCI 2.3 Collecting and analyzing motor imagery EEG data 2.4 Implementing classification algorithms for motor imagery	**CO1, CO2, CO4**
	Unit 3	**Event-Related Potentials (ERPs) and OpenBCI Hardware -Based BCIs**	

		3.1 Introduction to ERPs and OpenBCI Kit 3.2 Designing and conducting OpenBCI Kit Experiments 3.3 ERP data acquisition and preprocessing 3.4 Implementing OpenBCI kit based BCI systems using classification algorithms			**CO1, CO2, CO5**
	Unit 4	**Feature Extraction and Classification Algorithms and Hybrid BCIs**			
		4.1 Feature extraction methods for BCI applications 4.2 Time-domain and frequency-domain feature extraction 4.3 Implementing common classification algorithms (e.g., SVM, LDA, Naive Bayes) 4.4 Combining multiple brain signals (e.g., EEG, fNIRS) in hybrid BCIs			**CO1, CO2, CO6**
	Unit 5	**Multimodal Integration and Real-Time Feedback and BCI Applications**			
		5.1 Understanding multimodal integration techniques 5.2 Collecting and integrating data from different modalities 5.3 Designing and implementing hybrid BCI systems 5.4 Implementing real-time feedback mechanisms 5.5 Developing BCI applications for control and communication 5.6 Testing and evaluating BCI performance with users 5.7 Iterative design and improvement of BCI applications			**CO1, CO2, CO6**
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	CE(viva)	ESE	
		25%	25%	50%	
	Text book/s*	1. "Brain-Computer Interfaces: Principles and Practice" by Jonathan Wolpaw and Elizabeth Winter Wolpaw. Publisher: Oxford University Press." 2. "Brain-Computer Interfaces: Revolutionizing Human-Computer Interaction" by Bernhard Graimann, Brendan Allison, and Gert Pfurtscheller. Publisher: Springer." 3. "Brain-Computer Interfaces: Applying our Minds to Human-Computer Interaction" by Desney Tan and Anton Nijholt. Publisher: Springer. 4. "Brain-Computer Interfaces Handbook: Technological and Theoretical Advances" edited by Chang S. Nam, Anton Nijholt, and Fabien Lotte. Publisher: CRC Press			
	Other References	1. "Brain-Computer Interfaces: An International			

		Assessment of Research and Development Trends" edited by Richard A. Normann and Christoph Guger. Publisher: Springer. 2. "Introduction to Neural Engineering for Motor Rehabilitation" by Dario Farina, Winnie Jensen, and Metin Akay. Publisher: Wiley. 3. "Neuroergonomics: The Brain at Work" edited by Raja Parasuraman and Matthew Rizzo. Publisher: Oxford University Press. 4. "Cognitive Neuroscience Robotics B: Analytic Approaches to Human Understanding" edited by Toshio Inui and Hiroshi Murase. Publisher: Springer.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:** *Understand* the fundamental principles of brain-computer interfaces.	PO1,PO2,PO3,PO10
2.	**CO2:** *Demonstrate* knowledge of the different types of BCIs and their applications.	PO1, PO5, PO8, PO12
3.	**CO3:** *Develop* proficiency in designing and implementing classification algorithms for decoding brain signals.	PO1, PO2, PO3, PO4, PO5, PO6, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
4.	**CO4:** *Evaluate* the performance and effectiveness of BCI systems.	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, PO12, PSO1, PSO2
5.	**CO5:** *Assess* different techniques and tools of Brain Computer Interface.	PO1, PO2, PO3, PO4, PO5, PO9, PO10, PO12, PSO1, PSO2, PSO3
6.	**CO6:** *Plan* the opportunities of research and development in the arear of Brain Computer Interface	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO1	PSO2
Brain Computer Interface Lab	CO1	3	-	-	-	2	-	-	2	-	-	-	2
	CO2	3	2	2	2	3	2	-	-	2	2	2	2
	CO3	3	2	2	2	3	2	-	2	2	2	-	2
	CO4	3	3	3	3	3	-	-	-	2	2	-	2
	CO5	3	3	3	3	3	3	-	2	2	2	-	3
	CO6	3	3	3	3	3	3	3	2	3	3	3	3

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
	Brain Computer Interface Lab	3.0	2.6	2.6	2.6	2.8	2.5	3.0	2.0	2.2	2.2	2.5	2.3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

B.Tech CSE with Specialization in Artificial Intelligence for IoT Applications

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**	
1	Course Code		
2	Course Title	Introduction to AIoT	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Core	
5	Course Objective	The objective of this course to explore various concepts of Artificial Intelligence of Things (AIoT) and to identify the various aspects of artificial intelligence (AI) and its implementation to make your IoT solutions smarter.	
6	Course Outcomes	CO1: Define the general concepts of Artificial Intelligence (AI) and Internet of Things (IoT). CO2: Interpret the infusion of AI in IoT and various AI-IoT platforms. CO3: Illustrate the IoT components and its architecture. CO4: Explain the knowledge representation, reasoning, and theorem proving techniques to real-world problems CO5: Summarize the various domains where Artificial Intelligence of Things (AIoT) can be applied successfully. CO6: Support independent (or in a small group) research and communicate it effectively.	
7	Course Description	This course introduces the concepts for artificial intelligence of things and how we can embed it into our daily lives for the development of life style. It will also help students to understand the applications according to their problem statements.	
8	Outline syllabus		CO Mapping
	Unit 1	**Principles and Foundations of IoT and AI**	
	A	Foundation and Defining AI and IoT, History of AI and IoT, Applications of AI and IoT	CO1
	B	About Objects / things in the IoT, Introduction to Enabling Technologies of IoT	CO1
	C	AI Solutions Vs Conventional Solutions**,** a philosophical approach; a practical approach	CO1
	Unit 2	**Artificial Intelligence of Things (AIoT)**	
	A	Infusion of AI – data science in IoT, Importance of AIoT, The Potential of AI and the Intelligence of Things	CO1, CO2
	B	Advantages of AI-Enabled IoT, The major AIoT segments	CO1, CO2
	C	AI platforms and IoT platforms	CO1, CO2
	Unit 3	**IoT Architecture**	
	A	Basic Building blocks of IoT system, IoT Working	CO1, CO3

	B	Physical design of IoT: Things in IOT, IoT Protocols, Logical design of IoT: IoT Functional Blocks, IoT Communication Models. IoT Communication API's			CO1, CO3
	C	Introduction to IoT Service Oriented Architecture (SOA), API Oriented Architecture			CO1, CO3
	Unit 4	**Intelligent Agents and Logics**			
	A	Introduction to Intelligent Agents; Environment; Structure of Agent			CO1, CO4, CO5
	B	Propositional logic, Inference, Predicate Logic (first order logic), Resolution			CO1, CO4, CO5
	C	ML in AI domain, Learning types, Classification and Clustering basics			CO1, CO4, CO5
	Unit 5	**Domain specific applications of AIoT**			
	A	AIoT-based waste management systems and case study			CO1, CO3, CO6
	B	AIoT technologies and applications for smart environments and case study			CO1, CO3, CO6
	C	AIoT-based e-commerce and case study, Other AIoT applications			CO1, CO3, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. The Internet of Things: Connecting Objects to the Web edited by Hakima Chaouchi, Reference for Unit-1. 2. Introduction to Internet of Things, Prof. Sudip Misra, NPTEL Lectures Notes, Department of Computer Science & Engineering, Indian Institute of Technology Kharagpur, Reference for Unit 2, 3 (c), 4. 3. Internet of Things, Rajkumar Buyya, Reference for Unit 3 (c) 4. Arshdeep Bahga and Vijay Madisetti, "Internet of Things – A Hand-on Approach", Universities press, 2015, Reference for Unit 3 (B) 5. Russell S & Norvig P, Artificial Intelligence: A Modern Approach, Prentice Hall			
	Other References	1. Charalampos Doukas , "Building Internet of Things with the Arduino", Create space, April 2002 2. Dr. Ovidiu Vermesan and Dr. Peter Friess, "Internet of Things: From research and innovation to market deployment", River Publishers 2014.			

		3. Contiki : The open source for IOT, www.contiki-os.org 4. Rich E & Knight K, Artificial Intelligence, Tata McGraw Hill, Edition 3 5. Dan W. Patterson, Artificial Intelligence & Expert Systems, Pearson Education with Prentice Hall India. Indian Edition.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the general concepts of Artificial Intelligence (AI) and Internet of Things (IoT).	PO1, PO2, PO3, PO6, PO7, PO12, PSO1
2.	CO2: Interpret the infusion of AI in IoT and various AI-IoT platforms.	PO1, PO2, PO3, PO6, PO7, PO12, PSO1
3.	CO3: Illustrate the IoT components and its architecture.	PO1, PO2, PO3, PO4, PO6, PO7, PO12, PSO1
4.	CO4: Explain the knowledge representation, reasoning, and theorem proving techniques to real-world problems	PO1, PO2, PO3, PO4, PO6, PO7, PO12, PSO1
5.	CO5: Summarize the various domains where Artificial Intelligence of Things (AIoT) can be applied successfully.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO12, PSO1
6.	CO6: Support independent (or in a small group) research and communicate it effectively.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO12, PSO1

PO and PSO mapping with level of strength for Course Name Introduction to AIoT (Course Code)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CSI104_Introduction to AIoT	CO1	3	1	1	-	-	2	1	-	-	-	-	3	3	-	-
	CO2	2	2	1	-	-	1	3	-	-	-	-	3	3	-	-
	CO3	3	1	1	2	-	2	1	-	-	-	-	3	3	-	-
	CO4	3	2	3	2	-	1	2	-	-	-	-	3	3	-	-
	CO5	3	3	3	3	3	2	3	-	-	-	-	3	3	-	-
	CO6	2	2	2	2	3	2	3	-	-	-	-	3	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI104	**Introduction to IoT**	2.7	1.8	1.8	2.3	3.0	1.7	2.2	-	-	-	-	3.0	3.0	-	-

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

-

School:		**School of Engineering & Technology**			
Department		**Computer Science & Engineering**			
Program:		**B. Tech**			
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**			
1	Course Code	**CSA202**	**Concepts of Machine Learning**		
2	Course Title	**Concepts of Machine Learning**			
3	Credits				
4	Contact Hours (L-T-P)	3	0	2	
	Course Status	Core			
5	Course Objective	Students are Expected to learn and develop Comprehensive Understanding of the of the following Concepts and Techniques: 1. To introduce the ideas of learning rule and implement them based on human experience. 2. To conceptualize the working of human brain using SVM, RF and ANN. 3. To become familiar with decision boundaries that can learn from available examples and generalize to form appropriate learning rules for inference systems. 4. To provide the mathematical background for SVM, RF and Neural Network based classification techniques. 5. To understand and demonstrate how to solve patterns learning from a large series of data using computer based learning algorithms			
6	Course Outcomes	A Successful completion of this Course Ensures the following Outcomes **CO 1 : Define basics of** Machine Learning and stochastic concepts. **CO-2 : Classify and Compare** existing models to understand the applicability in solve real world societal problems. **CO-3 : Identify develop and apply** mathematical models to find sustainable solutions. **CO-4 : Analyse** the logical ability to apply feature engineering to extract hierarchical patterns existing in real life problems. **CO-5 : Evaluate** the learning models to glance the upcoming world through it. **CO-6 :** Discuss the applicability of Machine learning Approaches to develop sustainable solutions using professional ethics.			
7	Course Description	This course introduces computational learning paradigm for critical & implementable understanding for supervised and unsupervised learning based problem areas.			
8					CO Mapping
	Unit 1	**Core Concepts of Machine Learning**			
	A	What is Machine Learning? What kind of problems can be tackled using machine learning? The ML Mindset, Introduction to Machine Learning Problem Framing(Common ML Problems, ML Use Cases, Identifying Good Problems for ML, Hard ML Problems), Machine Learning			CO1

		Applications(Image Recognition, Speech Recognition, Medical Diagnosis, Statistical Arbitrage, Learning Associations), Standard learning tasks(Machine Learning Pipeline, Classification, Regression, Ranking, Clustering, Dimensionality reduction or Manifold learning)	
	B	Learning Stages(Features, Labels, Hyperparameters, Validation Samples, Test Samples, Loss Function, Hypothesis Tests), Learning Scenarios(Supervised learning, Unsupervised learning, Semi-Supervised learning, Transductive inference, On-line learning, Reinforcement learning, Active learning), Generalization Supervised Learning, Unsupervised Learning, Reinforcement learning)	CO1, CO2
	C	Data Preparation and Feature Engineering in ML(Data and Features, Information, Knowledge, Data Types, Big Data), Data Preprocessing: An Overview(Data Quality: Why Preprocess the Data?, Major Tasks in Data Preprocessing), Data Cleaning(Missing Values, Noisy Data, Data Cleaning as a Process), Data Integration(The Entity Identification Problem, Redundancy and Correlation Analysis, Tuple Duplication, Detection and Resolution of Data Value Conflicts), Data Reduction(Overview of Data Reduction Strategies, Attribute Subset Selection, Data Reduction, Histograms, Clustering, Sampling, Data Cube Aggregation), Data Transformation and Data Discretization(Overview of Data Transformation Strategies, Data Transformation by Normalization, Discretization by Binning, Discretization by Histogram Analysis, Discretization by Cluster, Decision Tree, and Correlation Analyses, Concept Hierarchy Generation for Nominal Data)	CO1, CO2
	Unit 2	**Supervised Learning Algorithms - Part One**	
	A	How Supervised Learning Algorithms Work ? Steps (Bias-variance trade off, Function complexity and amount of training data, Dimensionality of the input space, Noise in the output values, Algorithms, Other factors to consider (Heterogeneity of the data, Redundancy in the data, Presence of interactions and non-linearities	CO1, CO2, CO6
	B	Linear Regression Model Representation, Linear Regression Learning the Model (Simple Linear Regression, Ordinary Least Squares, Gradient Descent), Regularization / Shrinkage Methods (Bias-variance trade-off, Overfitting Issues, Lasso Regression, Ridge Regression), Making Predictions with Linear Regression(Cost Function, Feature Scaling, Normalization, Mean Normalization, Learning Rate, Automatic Convergence Test)	CO1, CO2, CO6
	C	Logistic Regression, The Logistic Model (Latent variable interpretation, Logistic function, odds, odds ratio, and logit, Definition of the logistic function, Definition of the inverse of the logistic function, Interpretation of these terms, Definition of the odds, The odds ratio, Multiple explanatory variables), Model fitting ("Rule of ten", Iteratively reweighted least squares (IRLS), Evaluating goodness of fit, Limitations of Logistic Regression), Linear discriminant analysis (LDA for two classes, Assumptions, Discriminant functions, Discrimination rules, Eigenvalues, Effect size), Practical use and Applications (Bankruptcy prediction, Face	CO1, CO2, , CO6

		recognition, Marketing, Biomedical, studies), Comparison to Logistic Regression	
	Unit 3	**Supervised Learning Algorithms - Part Two**	
	A	Support Vector Machines, Linear SVM (Hard-margin, Soft-margin), Nonlinear Classification, Computing the SVM classifier(Primal, Dual, Kernel trick), Modern methods(Sub-gradient descent, Coordinate descent), Empirical risk minimization(Risk minimization, Regularization and stability, SVM and the hinge loss, Target functions), Properties(Parameter selection, Issues)	CO1,CO2,CO3 , , CO6
	B	Introduction to Artificial Neural Networks (Feed-forward Network Functions, Weight-space symmetries), Network Training (Parameter optimization, Local quadratic approximation, Use of gradient information, Gradient descent optimization), Error Backpropagation(Evaluation of error-function derivatives, Simple examples, Efficiency of backpropagation)	CO1,CO2,CO3 , CO6
	C	Decision Tree Learning (Decision tree representation, ID3 learning algorithm, Entropy, Information gain, Overfitting and Evaluation, Overfitting, Validation Methods, Avoiding Overfitting in Decision Trees, Minimum-Description Length Methods, Noise in Data), Random Forests Algorithm (Preliminaries: decision tree learning, Bagging, From bagging to random forests, Extra Trees, Properties, Variable importance)	CO1,CO2,CO3 , CO6
	Unit 4	**Unsupervised Learning**	
	A	Unsupervised Learning (What is Unsupervised Learning?), Clustering Methods (Method Based on Euclidean Distance, Method Based on Probabilities, Hierarchical Clustering Methods, Method Based on Euclidean Distance)	CO2,CO3,CO4 , CO6
	B	k-means Clustering Algorithm (Standard algorithm (naive k-means), Initialization methods), Applications (Vector quantization, Cluster analysis, Feature learning) Gaussian mixture models , Expectation-Maximization method	CO2,CO3,CO4 , CO6
	C	Principal Component Analysis for making predictive models (First component, Further components, Covariances, Dimensionality reduction, Singular value decomposition), Properties and limitations of PCA (Properties, Limitations), Computing PCA using the covariance method, Typical Applications	CO2,CO3,CO4 , CO6
	Unit 5	**Parameter Estimation, Model Evaluation and Ensemble Methods**	
	A	Parameter Estimation (Point Estimation, Maximum Likelihood Estimation, Unbiased Estimation, Confidence Intervals for One Mean, Two Mean, Variances)	CO2,CO5,CO6
	B	Model Evaluation (ML Model Validation by Humans, Holdout Set Validation Method, Cross-Validation Method for Models, Leave-One-Out Cross-Validation, Random Subsampling Validation, Teach and Test Method, Bootstrapping ML Validation Method, Running AI Model Simulations, Overriding Mechanism Method), The ROC Curve	CO3,CO5,CO6
	C	**Ensemble Methods (Ensemble Theory, Ensemble Size, Voting and Averaging Based Ensemble Methods Boosting, Weightage**	CO4,CO5,CO6

		Average, Stacking, Bagging, Boosting and Bootstrap Aggregating)			
	Mode of examination	Theory and Practical			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag. 2. Foundations of Machine Learning, Second Edition By Mehryar Mohri, Afshin Rostamizadeh and Ameet Talwalkar, MIT Press, Second Edition, 2018. 3. Introduction to Machine Learning, Third Edition, By Ethem Alpaydin, The MIT Pressmitpress.mit.edu › books › introduction-machine-learni...			
	Other References	1) Baldi, P. and Brunak, S. (2002). Bioinformatics: A Machine Learning Approach. Cambridge, MA: MIT Press. 2) Russel, S. and Norvig, P. (2003). Artifiical Intelligence: A Modern Approach. 2ndEdition. New York: Prentice-Hall. 3) Cohen, P.R. (1995) Empirical Methods in Artificial Intelligence. Cambridge, MA: MIT Press. 4) https://www.toptal.com/machine-learning/ensemble-methods-machine-learning.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO 1 :** ***Define basics of*** *Machine Learning and stochastic concepts.*	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	**CO-2 :** ***Classify and Compare*** *existing models to understand the applicability in solve real world societal problems.*	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	**CO-3 :** ***Identify develop and apply*** *mathematical models to find sustainable solutions.*	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	**CO-4 :** ***Analyse*** *the logical ability to apply feature engineering to extract hierarchical patterns existing in real life problems.*	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	**CO-5 :** ***Evaluate*** *the learning models to glance the upcoming world through it.*	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	**CO-6 :** *Discuss the applicability of Machine learning Approaches to develop sustainable solutions using professional ethics.*	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Concepts of Machine Learning **(Course Code** CSA-202**)**

Subject	**PO's / PSO's**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
Concepts of Machine Learning **(Course Code** CSA-201**)**	CO1	3	3	3	3	3	3	2	1	1	3	1	3	2	2	1
	CO2	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO3	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO4	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO5	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO 1**	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CSA-201	Concepts of Machine Learning	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.83**	**2.00**	**2.00**	**3.00**	**2.67**	**3.00**	**2.83**	**2.83**	**2.67**

Total- 41.83

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***

3. Addressed to ***Substantial (High=3) extent***

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School: SET		**Batch: 2023-27**
Program: B.Tech.		**Current Academic Year: 2023-24**
Branch: CSE/IT		**CSE with Specialization in Artificial Intelligence for IoT Applications Semester: III**
1	**Course Code**	**CAL201**
2	**Course Title**	**Machine Learning Lab**
3	**Credits**	**1**
4	**Contact Hours (L-T-P)**	**0-0-2**
	Course Status	Core
5	Course Objective	1. Learn the basic concepts of Machine Learning algorithms. 2. Make use of Data sets in implementing the machine learning algorithms. 3. Implement the machine learning concepts and algorithms in any suitable language of choice.
6	Course Outcomes	CO 1: Show the implementation of linear and logistic Regression on real life applications. CO-2: Interpretation of existing models to understand the solution environment. CO-3: Application of existing mathematical solutions to test real world problems. CO-4: Analyse the logical ability to apply clustering approach to extract hierarchical patterns existing in real life problems. CO-5 : Build the understanding of learning theory to glance the upcoming world through it. CO-6: Appraise recent trends in machine learning and applications.
7	Course Description	This course introduces computational learning paradigm for critical & implementable understanding for supervised and unsupervised learning based problem areas.

8	Outline syllabus		CO Mapping
	Unit 1	**Core Concepts of Machine Learning**	
		Write a Program to load and view data set file.	CO1
		Write a program to implement simple linear regression using housing price prediction problem.	CO1, CO2
		Write a program to implement binary logistic regression using cancer identification problem.	CO1, CO2
	Unit 2	**Supervised Learning Algorithms - Part One**	
		Write a program to implement gradient descent method for learning.	CO1, CO2, CO6
		Write a program to implement regularized linear regression.	CO1, CO2, CO6
		Write a program to implement regularized logistic regression.	CO1, CO2, , CO6
		Write a program to Normalize the data used in linear regression problem above before predicting prices, and then predict the housing prices.	CO1, CO2, CO6
	Unit 3	**Supervised Learning Algorithms - Part Two**	
		Write a program to implement Support Vector Machine regression using suitable dataset.	CO1,CO2,CO3 , , CO6
		Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.	CO1,CO2,CO3 , CO6

		Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.	CO1,CO2,CO3 , , CO6
		Write a program to demonstrate the working of the Random Forest algorithm. Use an appropriate data set for classifying a new sample.	CO1,CO2,CO3 , CO6
	Unit 4	**Unsupervised Learning**	
		Write a program to implement K-Means clustering algorithm using an appropriate dataset.	CO2,CO3,CO4 , CO6
		Write a program to implement K-Means clustering algorithm using an appropriate dataset.	CO2,CO3,CO4 , CO6
	Unit 5	**Hypothesis Testing, Parameter Estimation, Model Evaluation and Ensemble Methods**	
		Write a program to implement data split into training, cross validation and testing data.	CO2,CO5,CO6
		Implement an Ensemble approach by combining different models to solve time series based prediction problem.	CO3,CO5,CO6
		Conduct hypothesis testing using some statistical toolkit on appropriate problem.	CO4,CO5,CO6
	Mode of examination	Practical	
	Weightage Distribution	CA: 25% ; MTE: 25% ; ETE: 50%	
	Text book/s*	1. Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag. 2. Foundations of Machine Learning, Second Edition By Mehryar Mohri, Afshin Rostamizadeh and Ameet Talwalkar, MIT Press, Second Edition, 2018. 3. Introduction to Machine Learning, Third Edition, By EthemAlpaydin, The MIT Pressmitpress.mit.edu › books › introduction-machine-learni...	
	Other References	1) Baldi, P. and Brunak, S. (2002). Bioinformatics: A Machine Learning Approach. Cambridge, MA: MIT Press. 2) Russel, S. and Norvig, P. (2003). Artifiical Intelligence: A Modern Approach. 2ndEdition. New York: Prentice-Hall. 3) Cohen, P.R. (1995) Empirical Methods in Artificial Intelligence. Cambridge, MA: MIT Press. 4) https://www.toptal.com/machine-learning/ensemble-methods-machine-learning.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO 1 : Show the implementation of linear and logistic Regression on real life applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	CO-2 : Interpretation of existing models to understand the solution environment.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	CO-3 : Application of existing mathematical solutions to test real world problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8,

		PO9,PO10, PSO1,PSO2,PSO3
4.	CO-4 : Analyse the logical ability to apply clustering approach to extract hierarchical patterns existing in real life problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	CO-5 : Build the understanding of learning theory to glance the upcoming world	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	CO-6: Appraise recent trends in machine learning and applications	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Concepts of Machine Learning **(Course Code** CAL201**)**

Subject	**PO's / PSO's**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
Concepts of Machine Learning **(Course Code** CAL-201**)**	CO1	3	3	3	3	3	3	2	1	1	3	1	3	2	2	1
	CO2	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO3	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO4	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO5	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CAL -201	Concepts of Machine Learning	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.83**	**2.00**	**2.00**	**3.00**	**2.67**	**3.00**	**2.83**	**2.83**	**2.67**

Total- 41.83
Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

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School:		**School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B. Tech**		
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**		
1	Course Code	**CSA-203**		
2	Course Title	**Concepts of Neural Networks**		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core		
5	Course Objective	6. To introduce the ideas of learning rule and implement them based on human experience. 7. To conceptualize the working of human brain using ANN. 8. To become familiar with neural networks that can learn from available examples and generalize to form appropriate learning rules for inference systems. 9. To provide the mathematical background for Neural Network and classification techniques. 10. To provide the mathematical background for carrying out the optimization and familiarizing genetic algorithm for seeking global optimum in self-learning situation.		
6	Course Outcomes	On successful completion of this module students will be able to: 7. **Define** biological significance of Neural Network and list ANN components. 8. **Classify** various learning paradigms based on real file problems 9. **Apply basic concepts to build** single and multi-layer feed-forward neural networks. 10. **Analyze** and train radial-basis function and recurrent networks; 11. **Explain self-organizing map** for real life problems. 12. **Discuss** and adapt appropriate neural networks model for real life applications.		
7	Course Description	This course introduces the basic models, learning algorithms, and some applications of neural networks. After this course, we should be able to know how to use neural networks for solving different problems related to pattern recognition, function approaximation, data visualization, and so on.		
8				
	Unit 1	**Introduction**		

	A	Introduction, Motivation and History, Components of a Neuron-synapses, dendrite, cell nucleus, axon	CO1
	B	Important Terminologies of ANNs: Propagation function, Activation function, output function, Components of Artificial Neural Network: common activation functions, network topologies- feed forward, recurrent networks, completely linked networks	CO1
	C	Neuron Activation order: Synchronous activation, asynchronous activation, Communication with the outside world: input and output of data in and from neural networks	CO1
	Unit 2	**Learning Paradigms**	
	A	Learning Paradigms and their real Applications, Unsupervised learning and Supervised learning, Reinforcement learning, Offline and online learning and their applications based on real life problems.	CO2, CO6
	B	Training patterns and teaching inputs, use of training samples, data set split into training, validation and testing data, Implication of splitting of data set, Learning curves and their importance in diagnostics	CO2, CO6
	C	Gradient optimization procedures, Hebbian learning rule	CO2
	Unit 3	**The Perceptron, Backpropagation and its variants**	
	A	Single layer Perceptron network, Perceptron Learning Algorithm and convergence theorem, Delta rule as a gradient based learning strategy, Limitations of Single Layer Perceptron network	CO3
	B	Multilayer Perceptron Network, Backpropagation learning and its applications	CO3
	C	Analysing effect of learning rate on learning process, Variants of Backpropagation algorithm	CO3
	Unit 4	**Radial Basis Function Neural Networks**	
	A	Components & Structure of an RBF network, Information processing of an RBF network, Information Processing in RBF neurons, analytical thoughts prior to training	CO4
	B	Equation system and gradient strategies for training, Growing RBF Networks, comparison of RBF Networks and Multilayer Perceptrons	CO4
	C	Recurrent Neural Networks: Jordan networks, Elman Networks, Training Recurrent neural networks	CO4
	Unit 5	**Unsupervised Learning Network Paradigms**	

	A	Self-organizing feature maps, structure of a self-organizing feature map, Training of SOM, Topology function, common distance and topology functions, relationship between learning rates and neighbourhoods, applications of SOMs			CO5,CO6
	B	Introduction to Adaptive Resonance Theory, Task and structure of an ART Network, Learning process of an ART Network- top down and bottom up learning, Extensions- ART2, ART3			CO5,CO6
	C	Introduction to Hobbfield Network, Associative Network (Homogenous & Heterogeneous), Introduction to Restricted Boltzman Machine.			CO5,CO6
	Mode of examination				
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	3. David Kriesel, 2007, "A Brief Introduction to Neural Networks", available at http://www.dkriesel.com 4. Simon O. Haykin, **"Neural Networks and Learning Machines",** Pearson			
	Other References	9. ANDERSON, JAMES A., AN INTRODUCTION TO NEURAL NETWORKS, PHI Learning. 10. Christopher M. Bishop & Geoffrey Hinton, Neural Networks for Pattern Recognition, Oxford University Press.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**Define** biological significance of Neural Network and list ANN components.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	**Classify** various learning paradigms based on real life problems	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	**Apply basic concepts to build** single and multi-layer feed-forward neural networks.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	**Analyze** and train radial-basis function and recurrent networks;	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	**Explain self-organizing map** for real life problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8,

		PO9,PO10, PSO1,PSO2,PSO3
6.	**Discuss** and adapt appropriate neural networks model for real life applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name: Neural networks (Course Code- CSA-203)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Neural networks (Course Code- CSA-203)	CO1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
	CO2	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
	CO3	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
	CO4	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
	CO5	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
	CO6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA-203	Neural networks	3.00	3.00	3.00	3.00	2.83	2.33	2.33	1.17	2.33	3.00	2.67	3.00	3.00	3.00	2.67

Total 40.3

Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**	
1	Course Code	CSI202	
2	Course Title	IoT: Architecture and Programming	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Core	
5	Course Objective	This course provides a preliminary view on Logical and Physical Design of IoT systems and gives an overview of Data analytics for IoT.	
6	Course Outcomes	CO1: Recall the basic concepts of Internet of Things CO2: Explain the concepts of logical design of IoT System using Python. CO3: Demonstrate the Raspberry Pi interfaces with Python CO4: Interpret the IoT Physical Servers and Cloud Offerings CO5: Make use of data analytics for IoT using Apache Hadoop CO6: Utilize the IoT reference architecture required in building IoT based solutions.	
7	Course Description	The course focuses on understanding the vision of IoT from a global perspective, understand its applications, and dESErmine its market perspective, using gateways, devices and data management, building a state of art architecture in IoT and its applications in commercial building automation and real world design constraints.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to IoT**	
	A	Introduction, Physical Design of IOT, Logical design of IoT, IoT Levels & Development Templates	CO1
	B	Difference between IoT and M2M, SDN and NFV for IoT, Need for IoT systems management, Simple Network Management Protocol (SNMP)	CO1
	C	Network operator requirements, NETCONF, YANG, IoT systems Management with NETCONF, YANG	CO1
	Unit 2	**IoT Systems- Logical Design using Python**	
	A	Language features of Python, Data types, data structures, Control of flow	CO1, CO2
	B	Functions, modules, packaging, file handling, data/time operations, classes	CO1, CO2
	C	Python packages for Internet of Things	CO1, CO2
	Unit 3	**IoT Physical Devices and Endpoints**	
	A	Basic building blocks of an IoT device, Exemplary Device: Raspberry Pi	CO1, CO2, CO3
	B	About the board, Raspberry Pi interfaces	CO1, CO2, CO3

	C	Programming Raspberry Pi with Python			CO1, CO2, CO3
	Unit 4	**IoT Physical Servers and Cloud Offerings**			
	A	Introduction to Cloud Storage models and communication APIs			CO1, CO2, CO4
	B	Webserver – Web server for IoT, Cloud for IoT			CO1, CO2, CO4
	C	Python web application framework, Amazon Web services for IoT			CO1, CO2, CO4
	Unit 5	**Data analytics for IoT**			
	A	Introduction, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis			CO5, CO6
	B	Apache Oozie, Apache Spark, Apache Storm			CO5, CO6
	C	Using Apache Storm for Real-time Data Analysis			CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MSE	ESE	
		25%	25%	50%	
	Text book/s*	1. Arshdeep Bahga and Vijai Madisetti : A Hands-on Approach "Internet of Things", Universities Press 2015. 2. "Internet of Things with Python" Gastón C. Hillar,Published by Packt Publishing Ltd. Livery Place 35 Livery Street Birmingham B3 2PB, UK. ISBN 978-1-78588-138-1			
	Other References	1. Kamal, R., (2017), Internet of Things - Architecture and Design Principles, 1st Edition, Mcgraw Hill. 2. Misra, S., Introduction to Internet of Things, NPTEL Course Material, Department of Computer Science & Engineering, Indian Institute of Technology Kharagpur, https://nptel.ac.in/courses/106105166/ 3. Samuel Greengard, " The Internet of Things", The MIT press, 2015. 4. Adrian McEwen and Hakim Cassimally "Designing the Internet of Things "Wiley,2014.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Recall the basic concepts of Internet of Things	PO1, PO9, PO12, PSO2
2.	CO2: Explain the concepts of logical design of IoT System using Python.	PO1, PO9, PO12, PSO1, PSO2

3.	CO3: Demonstrate the Raspberry Pi interfaces with Python	PO1, PO2, PO3, PO4, PO5, PO7, PO8, PO9, PO10, PO12, PSO1, PSO2
4.	CO4: Interpret the IoT Physical Servers and Cloud Offerings	PO1, PO4, PO5, PO7, PO9, PO10, PO12, PSO2
5.	CO5: Make use of data analytics for IoT using Apache Hadoop	PO1, PO2, PO5, PO9, PO10, PO12, PSO2, PSO3
6.	CO6: Utilize the IoT reference architecture required in building IoT based solutions.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name IoT: Architecture and Programming (Course Code CSI202)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CSI202 _IoT: Architecture and Programming	CO1	2	-	-	-	-	-	-	-	1	-	-	2	-	2	-
	CO2	2	-	-	-	-	-	-	-	2	-	-	2	2	2	-
	CO3	2	3	2	3	3	-	2	1	2	3	-	2	3	2	-
	CO4	2	-	-	2	2	-	2	-	2	2	-	2	-	2	-
	CO5	2	2	-	-	3	-	-	-	2	3	-	2	-	2	2
	CO6	3	3	3	3	3	2	3	3	3	3	2	2	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	P O 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PSO 3
CSI202	IoT: Architecture and Programming	2.2	2.7	2.5	2.7	2.8	2.0	2.3	2.0	2.0	2.8	2.0	2.0	2.7	2.2	2.5

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**	
1	Course Code	CIP202	
2	Course Title	IoT: Architecture and Programming Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Core	
5	Course Objective	This course provides a preliminary view on Logical and Physical Design of IoT systems and gives an overview of Data analytics for IoT.	
6	Course Outcomes	CO1: Demonstrate the concepts of IoT for home automation and security. CO2: Develop of logical design of IoT System using Python. CO3: Construct the Raspberry Pi interfaces with Python CO4: Interpret the IoT Physical Servers and Cloud Offerings CO5: Evaluate data analytics for IoT using Apache Hadoop CO6: Utilize the IoT reference architecture required in building IoT based solutions.	
7	Course Description	The course focuses on understanding the vision of IoT from a global perspective, understand its applications, and dESErmine its market perspective, using gateways, devices and data management, building a state of art architecture in IoT and its applications in commercial building automation and real world design constraints.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to IoT**	
		Sending e-mail from IoT kit.	CO1
		Internet based home automation and home security system	CO1
	Unit 2	**IoT Systems- Logical Design using Python**	
		Python-Based Multicolored-LED control	CO1, CO2
		Water level monitoring using Python and Moisture sensing and logging using python.	CO1, CO2
	Unit 3	**IoT Physical Devices and Endpoints**	
		Touchscreen photo-booth with a Raspberry Pi	CO1, CO2, CO3
		Raspberry Pi weather forecast display and Programming Raspberry Pi for Home automation system.	CO1, CO2, CO3
	Unit 4	**IoT Physical Servers and Cloud Offerings**	
		Internet or intranet controlled motor	CO1, CO2, CO4
		Design IoT-Enabled Embedded Web Server and Server-less based web application.	CO1, CO2, CO4
	Unit 5	**Data analytics for IoT**	

		Improvement of smart city technologies to reduce pollution levels			CO5, CO6
		Enhance traffic conditions and Internet-based street light control			CO5, CO6
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	CE (Viva)	ESE	
		25%	25%	50%	
	Text book/s*	1. Arshdeep Bahga and Vijai Madisetti : A Hands-on Approach “Internet of Things”, Universities Press 2015. 2. “Internet of Things with Python” Gastón C. Hillar,Published by Packt Publishing Ltd. Livery Place 35 Livery Street Birmingham B3 2PB, UK. ISBN 978-1-78588-138-1			
	Other References	1. Kamal, R., (2017), Internet of Things - Architecture and Design Principles, 1st Edition, Mcgraw Hill. 2. Misra, S., Introduction to Internet of Things, NPTEL Course Material, Department of Computer Science & Engineering, Indian Institute of Technology Kharagpur, https://nptel.ac.in/courses/106105166/ 3. Samuel Greengard, “ The Internet of Things”, The MIT press, 2015. 4. Adrian McEwen and Hakim Cassimally “Designing the Internet of Things “Wiley,2014.			

PO and PSO mapping with level of strength for IoT: Architecture and Programming Lab (Course Code CIP202)

Course Code_ Course Name	CO’s	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CIP202_IoT: Architecture and Programming Lab	CO1	2	2	1	2	2	2	2	-	2	1	3	3	2	2	-
	CO2	2	2	2	1	2	-	-	-	2	-	2	3	2	2	-
	CO3	2	2	2	1	2	-	-	-	2	-	3	3	2	2	-
	CO4	2	2	2	1	2	-	-	2	2	-	3	3	2	2	-
	CO5	2	2	2	2	2	-	-	2	2	-	3	3	3	3	-
	CO6	2	2	2	2	2	3	2	2	3	1	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PS O 3
CIP202	**IoT: Architecture and Programming Lab**	2.0	2.0	1.8	1.5	2.0	2.5	2.0	2.0	2.2	1.0	2.8	3.0	2.3	2.3	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**			
Department		**Computer Science & Engineering**			
Program:		**B.Tech**			
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**			
1	Course Code	CSI302			
2	Course Title	IoT: Sensing & Actuator Devices			
3	Credits	3			
4	Contact Hours (L-T-P)	3-0-0			
	Course Status	Core			
5	Course Objective	The objective of this course is to introduce the students the fundamental principles of sensing technology. Also to explain the characteristics and interfacing techniques with different types of sensors and actuators.			
6	Course Outcomes	CO1: Define the general concepts of sensors used in IoT CO2: Classify proximity, ultrasound and motion sensors based on knowledge and principles of working. CO3: Compare various environmental sensors. CO4: List the various optical device drivers and displays actuators for IoT. CO5: Examine the mechanical drivers, DC motor and servo motor actuators for IoT. CO6: Develop the small IoT projects based on sensors & actuators.			
7	Course Description	This course gives an overview of sensors used in IoT with sampling frequency and bandwidth requirements for different sensors. The course also describes the interface common sensors and actuators to IoT development kits.			
8	Outline syllabus				CO Mapping
	Unit 1	**Introduction to Sensors and Sensing**			
	A	Understanding and classification of sensors and actuators, Characteristics of Sensors, Touch sensors: Button, Force sensor Capacitive sensor			CO1
	B	Light sensors: Photoresistor, Photodiode, Phototransistor			CO1
	C	Electrical characteristic sensors: Voltage sensor Current sensor			CO1
	Unit 2	**Sensors and Sensing-I**			
	A	Proximity and distance sensors: Optocoupler, Infrared sensor			CO1, CO2, CO6
	B	Ultrasound sensor, Motion dESEctor			CO1, CO2, CO6
	C	Angle sensors: PotentiomESEr, The inertial measurement unit (IMU), Hall sensor, Global positioning system			CO1, CO2, CO6
	Unit 3	**Sensors and Sensing-II**			
	A	Environment sensors: Temperature sensor			CO1, CO3, CO6

	B	Humidity sensor, Sound sensor			CO1, CO3, CO6
	C	Chemical/smoke and gas sensor Level sensor			CO1, CO3, CO6
	Unit 4	**Actuator-I**			
	A	Optical device drivers and their devices: Light-emitting diode			CO1, CO4, CO6
	B	Displays: Liquid-crystal display (LCD),			CO1, CO4, CO6
	C	Organic light-emitting diode display (OLED), Electronic ink display (E ink)			CO1, CO4, CO6
	Unit 5	**Actuator-II**			
	A	Mechanical drivers, Relay, Solenoid, Speaker			CO1, CO5, CO6
	B	DC motor (one direction)			CO1, CO5, CO6
	C	Stepper motor, Servomotor			CO1, CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MSE	ESE	
		25%	25%	50%	
	Text book/s*	1. Internet of Things, by the IOT-OPEN.EU consortium: 2016–2019, Erasmus+ 2. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies &Sensors for the Internet of Things Businesses & Market Trends 2014 - 2024',Yole Development Copyrights ,2014. 3. PESEr Waher, 'Learning Internet of Things', Packt Publishing, 2015			
	Other References	1. Editors OvidiuVermesan PESEr Friess,'Internet of Things – From Research and Innovation to Market.Deployment', River Publishers, 2014. 2. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the general concepts of sensors used in IoT	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO10, PO12, PSO1
2.	CO2: Classify proximity, ultrasound and motion sensors based on knowledge and principles of working.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
3.	CO3: Compare various environmental sensors.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
4.	CO4: List the various optical device drivers and displays actuators for IoT.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5.	CO5: Examine the mechanical drivers, DC motor and servo motor actuators for IoT.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	CO6: Develop the small IoT projects based on sensors & actuators.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name IoT: Sensing & Actuator Devices (Course Code CSI302)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CSI302_IoT: Sensing & Actuator Devices	CO1	2	1	1	1	1	1	1	1	-	1	-	2	1	-	-
	CO2	2	2	1	1	1	2	2	1	2	2	2	2	2	1	1
	CO3	2	2	1	1	1	2	3	1	2	2	2	2	2	1	1
	CO4	2	2	1	1	1	2	1	1	2	2	2	2	2	1	1
	CO5	2	2	1	1	1	2	1	1	2	2	2	2	2	1	1
	CO6	3	3	3	3	2	3	2	1	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI302	IoT: Sensing & Actuator Devices	2.2	2.0	1.3	1.3	1.2	2.0	1.7	1.0	2.2	2.0	2.2	2.2	2.0	1.4	1.2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**	
1	Course Code	CIP302	
2	Course Title	IoT: Sensing & Actuator Devices Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	The objective of this course is to introduce the students the fundamental principles of sensing technology. Also to explain the characteristics and interfacing techniques with different types of sensors and actuators.	
6	Course Outcomes	CO1: Demonstrate the use of general sensors in IoT CO2: Illustrate the use of electrical, proximity and distance sensors. CO3: Experiment with various ultrasound and motion sensors CO4: Examine the use of various environmental sensors and optical devices. CO5: Design the IoT application using mechanical drivers, DC motor and servo motor actuators. CO6: Develop the small IoT projects based on sensors & actuators.	
7	Course Description	This course gives an overview of sensors used in IoT with sampling frequency and bandwidth requirements for different sensors. The course also describes the interface common sensors and actuators to IoT development kits.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Sensors and Sensing**	
		Touch sensors: Button, Force sensor Capacitive sensor	CO1, CO6
		Light sensors: Photoresistor, Photodiode, Phototransistor	CO1, CO6
	Unit 2	**Sensors and Sensing-I**	
		Electrical characteristic sensors: Voltage sensor Current sensor	CO2, CO6
		Proximity and distance sensors: Optocoupler, Infrared sensor	CO2, CO6
	Unit 3	**Sensors and Sensing-II**	
		Ultrasound sensor, Motion dESEctor	CO3, CO6
		Angle sensors: PotentiomESEr, The inertial measurement unit (IMU), Hall sensor, Global positioning system	CO3, CO6
	Unit 4	**Actuator-I**	
		Implementation of Environment sensors	CO4, CO6
		Implementation of LCD, LED, OLED	CO4, CO6
	Unit 5	**Actuators-II**	
		Mechanical drivers, Relay, Solenoid, Speaker	CO5, CO6

		DC motor (one direction), Stepper motor, Servomotor			CO5, CO6
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	CE (Viva)	ESE	
		25%	25%	50%	
	Text book/s*	4. Internet of Things, by the IOT-OPEN.EU consortium: 2016–2019, Erasmus+ 5. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies &Sensors for the Internet of Things Businesses & Market Trends 2014 - 2024',Yole Development Copyrights ,2014. 6. PESEr Waher, 'Learning Internet of Things', Packt Publishing, 2015			
	Other References	3. Editors OvidiuVermesan PESEr Friess,'Internet of Things – From Research and Innovation to Market.Deployment', River Publishers, 2014. 4. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.			

PO and PSO mapping with level of strength for IoT: Sensing & Actuator Devices Lab (Course Code CIP302)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CIP302 _IoT: Sensing & Actuator Devices Lab	CO1	3	2	2	2	3	1	1	-	3	3	3	2	1	-	-
	CO2	3	3	2	2	3	2	2	-	3	3	3	2	2	2	-
	CO3	3	3	2	2	3	2	3	-	3	3	3	2	2	2	-
	CO4	3	3	2	2	3	2	1	-	3	3	3	2	2	2	-
	CO5	3	3	2	2	3	2	1	2	3	3	3	2	2	2	-
	CO6	3	3	3	3	3	3	2	2	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PS O 3
CIP302	IoT: Sensing & Actuator Devices Lab	3.0	2.8	2.2	2.2	3.0	2.0	1.7	2.0	3.0	3.0	3.0	2.2	2.0	2.2	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***

3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**	
1	Course Code	CSI303	
2	Course Title	Wireless Technologies for IoT	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Core	
5	Course Objective	This aim of this course is to introduce relevant concepts and emerging trends in wireless technology and its applications.	
6	Course Outcomes	CO1: Develop the basic concept of RF signals and wireless communication CO2: Identify the concepts of cellular network and generations of mobile communication CO3: List the various organization protocols of WLAN CO4: Interpret Wi-Fi hardware and software for appropriate functions CO5: Explain the functions of wireless PAN with Bluetooth, wifi and 6LoPAN CO6: Design IoT based solutions using the wireless technologies.	
7	Course Description	Wireless and mobile systems have become ubiquitous; playing a significant role in our everyday life. However, the increasing demand for wireless connectivity and the emergence of new areas such as the Internet of Things present new research challenges.	
8	Outline syllabus		CO Mapping
	Unit 1	**RF Basics: Radio Frequency (RF) Fundamentals:**	
	A	Introduction to RF & Wireless Communications Systems, RF and Microwave Spectral Analysis, Communication Standards	CO1
	B	Understanding RF & Microwave Specifications. Spectrum Analysis of RF Environment, Protocol Analysis of RF Environment, Units of RF measurements	CO1
	C	Factors affecting network range and speed, Environment, Line-of-sight, Interference, Defining differences between physical layers- OFDM.	CO1
	Unit 2	**Cellular Standards**	
	A	Cellular carriers and Frequencies, Channel allocation, Cell coverage, Cell Splitting, Microcells, Picocells	CO1, CO2
	B	Handoff, 1st, 2nd, 3rd and 4th Generation Cellular Systems (GSM, CDMA, GPRS, EDGE,UMTS),	CO1, CO2
	C	Mobile IP, WCDMA, Data Protocols (MQTT, CoAP)	CO1, CO2
	Unit 3	**WLAN**	
	A	Wi-Fi Organizations and Standards: IEEE, Wi-Fi Alliance, WLAN Connectivity	CO1, CO2, CO3

	B	WLAN QoS & Power-Save, IEEE 802.11 Standards			CO1, CO2, CO3
	C	IEEE 802.11 Standards: 802.11- 2007, 802.11a/b/g, IEEE 802.11e/h/i,802.11n			CO1, CO2, CO3
	Unit 4	**Wi-Fi Hardware & Software**			
	A	Access Points, WLAN Routers, WLAN Bridges, WLAN Repeaters,			CO1, CO2, CO4
	B	Direct-connect Aps, Distributed connect Aps, PoE Infrastructure			CO1, CO2, CO4
	C	Endpoint, Client hardware and software, Wi-Fi Applications			CO1, CO2, CO4
	Unit 5	**WSN & WPN**			
	A	Wireless Personal Area Networks, Bluetooth, Bluetooth Standards, BlueTooth Protocol Architecture,			CO5, CO6
	B	UWB, IEEE 802.15.4 standards, ZigBee, 6LoWPAN, Sub GHz, Sensor Networks,			CO5, CO6
	C	Coexistence strategies in Sensor Networks, Routing protocols in Wireless Sensor Networks.			CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MSE	ESE	
		25%	25%	50%	
	Text book/s*	1. Rappaport Theodore S "Wireless Communication, Principle and Practice", Second Edition, Pearson, 2015.			
	Other References	1. Aditya K Jagannatham , Principles of Modern Wireless Communication Systems' .1st Edition, Mcgraw Hill.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Develop the basic concept of RF signals and wireless communication	PO1, PO3, PO9, PO10, PO12
2.	CO2: Identify the concepts of cellular network and generations of mobile communication	PO1, PO2, PO8, PO9, PO10, PO12
3.	CO3: List the various organization protocols of WLAN	PO1, PO2, PO4, PO8, PO9, PO10, PO11, PO12
4.	CO4: Interpret Wi-Fi hardware and software for appropriate functions	PO1, PO2, PO3, PO8, PO9, PO10, PO11, PO12
5.	CO5: Explain the functions of wireless PAN with Bluetooth, wifi and 6LoPAN	PO1, PO2, PO4, PO5, PO7, PO8, PO9, PO10, PO11, PO12, PSO1
6.	CO6: Design IoT based solutions using the wireless technologies.	PO1, PO2, PO3, PO4, PO5, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Wireless Technologies for IoT (Course Code CSI303)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CSI303_Wireless Technologies for IoT	CO1	3	-	2	-	-	-	-	-	1	2	-	1	-	-	-
	CO2	3	2	-	-	-	-	-	1	1	2	-	1	-	-	-
	CO3	3	2	-	2	-	-	-	2	2	2	2	2	-	-	-
	CO4	3	2	2	-	-	-	-	2	2	2	2	2	-	-	-
	CO5	3	2	-	2	3	-	3	2	3	2	3	3	2	-	-
	CO6	3	3	3	3	3	-	3	3	3	3	3	3	2	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI303	Wireless Technologies for IoT	3.0	2.2	2.3	2.3	3.0	-	3.0	2.0	2.0	2.2	2.5	2.0	2.0	3.0	3.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**	
1	Course Code	CIP303	
2	Course Title	Wireless Technologies for IoT Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Core	
5	Course Objective	Study the wireless channel characteristics and performance issues. • Discuss cellular communication and modulation schemes. • Review next generation cellular standards.	
6	Course Outcomes	CO1: Utilize the path loss model to find the losses CO2: Experiment with Communication Tool box in MATLAB CO3: Inspect WLAN Multipath Channel CO4: Make use of Simulink in MATLAB CO5: Develop Spread spectrum schemes on Simulink CO6: Utilize the wireless technologies for IoT based solutions.	
7	Course Description	This course reviews the various communication standards in wireless domain. This course will provide students an understanding about the wireless standards, modes of communication and efficiency criteria	
8	Outline syllabus		CO Mapping
	Unit 1	**Free space Propagation**	
		Path Loss model to dESErmine the free space loss.	CO1,CO6
		Path Loss model to dESErmine the power received using Matlab program	CO1,CO6
	Unit 2	**Introduction to the IEEE80211.a WLAN PHY Communication Toolbox in MATLAB**	
		What is IEEE 802.11a WLAN PHY? Briefly explain the functions of each blue block in the model diagram.	CO2,CO6
		What type of shadowing is IEEE802.11 WLAN based on.	CO2,CO6
	Unit 3	**Investigation on WLAN Multipath Channel**	
		Plot BER-SNR and Bit Rate-SNR graphs for different types of fading channel i. No Fading ii. Flat Fading iii. Dispersive Fading	CO3,CO6
		Plot BER-SNR and Bit Rate-SNR graphs for different types of fading channel for Dispersive Fading	CO3,CO6
	Unit 4	**Introduction to Simulink**	
		Familiarize with the block components of Simulink in MATLAB	CO4,CO6
		Setup a basic integrator for a square wave input and note the paramESErs like amplitude, frequency etc	CO4,CO6
	Unit 5	**Implementation of Spread spectrum Simulink**	

		Implement a Direct Sequence Spread Spectrum with Matlab Simulink	CO5,CO6
		Implement a simple steganography system which can send a hidden text message enveloped by a speech signal using DSSS	CO5,CO6
	Mode of examination	Jury/Practical/Viva	
	Weightage Distribution	CA 25% | CE (Viva) 25% | ESE 50%	
	Text book/s*	Rappaport Theodore S "Wireless Communication, Principle and Practice", Second Edition, Pearson, 2015.	
	Other References	Aditya K Jagannatham , Principles of Modern Wireless Communication Systems' .1st Edition, Mcgraw Hill.	

PO and PSO mapping with level of strength for Course Name Wireless Technologies for IoT Lab (Course Code CIP303)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CIP303_Wireless Technologies for IoT Lab	CO1	3	3	-	-	2	-	-	-	2	-	-	3	-	-	-
	CO2	3	3	2	-	3	3	-	-	2	-	-	3	3	2	-
	CO3	3	3	3	2	3	3	-	-	3	-	2	3	3	2	-
	CO4	3	3	3	2	3	3	-	-	3	-	2	3	3	2	-
	CO5	3	3	3	2	3	3	-	-	3	-	3	3	3	3	-
	CO6	3	3	3	3	3	3	-	-	3	-	3	3	3	3	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CIP303	Wireless Technologies for IoT Lab	3.0	3.0	2.8	2.3	2.8	3.0	-	-	2.7	-	2.5	3.0	3.0	2.4	-

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School: SET		**Batch : 2023-27**	
Program: B-TECH		**Current Academic Year:2023-24**	
Branch: CSE		**CSE with Specialization in Artificial Intelligence for IoT Applications Semester: V**	
1	**Course Code**	**CSA-022**	**Course Name: Introduction to Cloud Computing with ML**
2	**Course Title**	**Introduction to Cloud Computing with ML**	
3	**Credits**	**3**	
4	**Contact Hours (L-T-P)**	**3-0-0**	
	Course Status	Specialization Elective	
5	**Course Objective**	This introductory course on Cloud computing will teach both the fundamental concepts of how and why Cloud systems works, as well as Cloud technologies that manifest these concepts.	
6	**Course Outcomes (CO's)**	At the end of the course, students will have achieved the following learning objectives. CO7. Define the basics of cloud and recall the computer Science concepts which are helpful in understanding on demand service architecture. CO8. Classify and describe the architecture and taxonomy of parallel and distributed computing, including shared and distributed memory, and data and task parallel computing. CO9. Apply the PAAS and SAAS to manage the workflow and use of cloud in scientific application. CO10. Categorize and Characterize between Infrastructure services, deployment models, and governance in cloud computing. Examine the design of task and data parallel distributed algorithms for Clouds and use them to construct Cloud applications. CO11. Evaluate the importance of cloud using monitoring and management of services for performance improvement of HPC and to follow the Governance and Compliances. CO12. Elaborate the design concept and formulate to build the solution using cloud service providers as AWS as EC2, LAMBDA, S3 and Machine Learning Service as AWS SageMaker.	
7	**Course Description**	This course is an introductory course for cloud computing concepts and helps in understanding the core functionalities, algorithms, models and workflows in cloud environment. In this course Students will get demonstrations of real-time cloud services for better exposure and research understanding.	
8	**Syllabus Outline**		**CO Mapping**
	Unit 1	**FOUNDATIONS**	
	A	**Introduction to compute** Types of Computing, Grid computing, distributed computing, Client-server computing, Three Tier Architecture, use of Sockets and Remote Procedure Call, working of RMI and CORBA, Web services, Web Sockets, Message Queues and Message Brokers.	CO1
	B	**Introduction to Cloud Computing** Cloud Computing definition, Roots of Cloud Computing, Layers and Types of Clouds, Desired Features of a Cloud, Cloud Infrastructure Management,	CO1

		Infrastructure as a Service Providers, Platform as a Service Providers, Challenges and Risks	
	C	**Migrating and Integrating into Cloud** Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud, Enriching the 'Integration as a Service' Paradigm for the Cloud Era, Evolution and Challenges of SaaS Paradigm, Integration Scenarios, The Integration Methodologies	CO1
	Unit 2	**ENTERPRISE CLOUD COMPUTING AND IAAS**	
	A	**The Enterprise Cloud Computing Paradigm** Issues for Enterprise Applications on the Cloud, Transition Challenges, Enterprise Cloud Technology and Market Evolution, Business Drivers Toward a Marketplace for Enterprise Cloud Computing, The Cloud Supply Chain	CO1,CO2
	B	**Virtual Machines Provisioning and Migration Services** Introduction to Virtual Machines,The Anatomy of Cloud Infrastructures, VM Provisioning and Manageability, Virtual Machine Migration Services, Management of Virtual Machines for Cloud Infrastructures,, Distributed Management of Virtual Infrastructures, Scheduling Techniques	CO1,CO2
	C	**Enhancing Cloud Computing Environments Using a Cluster as a Service** Introduction and Related Work, RVWS Design, Cluster as a Service: The Logical Design, Secure Distributed Data Storage in Cloud Computing, Cloud Storage, Technologies for Data Security in Cloud Computing	CO1,CO2
	Unit 3	**PLATFORM AND SOFTWARE AS A SERVICE**	
	A	**Aneka and CometCloud** Aneka—Integration of Private and Public Clouds, Technologies and Tools for Cloud Computing, Aneka Cloud Platform, CometCloud: An Autonomic Cloud Engine, Introduction of CometCloud (Architecture, Autonomic Behavior, Applications overview)	CO1,CO3
	B	**Business Solutions and WorkFlow** Cloud-Based Solutions for Business Applications (Introduction of Enterprises Demand and Cloud Computing, Dynamic ICT Services), Workflow Engine for Clouds, Workflow Management Systems, Architecture of Workflow Management Systems	CO1,CO3,CO6
	C	**Scientific Applications and MapReduce Model** Scientific Application for Cloud Environments, Classification of Scientific Applications and Services in the Cloud, SAGA-based Scientific Applications, MapReduce Programming Model, MapReduce Impacts and Research Directions	CO1,CO3,CO6
	Unit 4	**MONITORING, MANAGEMENT & GOVERNANCE**	
	A	**SLA Management in Cloud Computing**	CO1,CO4

		Introduction of typical Use Cases, Model for Federated Cloud Computing, Security Considerations, SLA Management in Cloud Computing: A Service Provider's Perspective, Types of SLA, Life Cycle of SLA, Automated Policy-based Management	
	B	**Performance Predictions for HPC on Clouds** Introduction and Background of Grid and Cloud, HPC in the Cloud: Performance-related Issues, Game Hosting on Cloud Resources, Building Content Delivery Networks Using Clouds, Resource Cloud Mashups	CO1,CO4
	C	**Security and Governance** Basic Concept of Organizational Readiness, Drivers for Changes: Common Change Management Models, Security and Risk in the Cloud, Cloud Computing and Identity, Content Level Security—Pros and Cons, Legal Issues in Cloud Computing(PCI DSS), Data Privacy and Security Issues	CO1,CO4
	Unit 5	**AWS with Machine Learning**	
	A	AWS Services:EC2, IAM, S3, Lambda, Introduction to Amazon SageMaker, Machine Learning with Amazon SageMaker, Explore, Analyze, and Process Data, Train a Model with Amazon SageMaker, Deploy a Model in Amazon SageMaker, Set Up Amazon SageMaker, Amazon SageMaker Notebook Instance	CO1,CO5,CO6
	B	Amazon SageMaker Studio, Perform Common Tasks in Amazon SageMaker Studio, Amazon SageMaker API reference, Actions and Data Types, Use Autopilot to automate model development and Problem types, Create and Manage Workforces , Use Ground Truth for Labeling	CO1,CO5,Co6
	C	Process Data and Evaluate Models, Build Models and Choose an Algorithm, Train Models, Debugger, Perform Automatic Model Tuning, Tune Multiple Algorithms, Use Reinforcement Learning, Incremental Training, Deploy Models, Multi-Model Endpoints,	CO1,CO5,CO6
	Mode of examination	Theory	

	Weightage Distribution	**CA**	**MTE**	**ETE**	
		25%	25%	50%	

	Text Books	1. CLOUD COMPUTING Principles and Paradigms, Edited by Rajkumar Buyya, Jam 2. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter
	Reference Books	Amazon SageMaker, Developer Guide, https://docs.aws.amazon.com/sagemaker/latest/dg/sagemaker-dg.pdf#gs
	Online Materials	https://aws.amazon.com/getting-started/hands-on/build-train-deploy-machine-learning-model-sagemaker/ https://aws.amazon.com/machine-learning/

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Define the basics of cloud and recall the computer Science concepts which are helpful in understanding on demand service architecture. Classify and describe the architecture and taxonomy of parallel and distributed computing, including shared and distributed memory, and data and task parallel computing.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	Define the basics of cloud and recall the computer	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	Apply the PAAS and SAAS to manage the workflow and use of cloud in scientific application.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	Categorize and Characterize between Infrastructure services, deployment models, and governance in cloud computing. Examine the design of task and data parallel distributed algorithms for Clouds and use them to construct Cloud applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	Evaluate the importance of cloud using monitoring and management of services for performance improvement of HPC and to follow the Governance and Compliances	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	Elaborate the design concept and formulate to build the solution using cloud service providers as AWS as EC2, LAMBDA, S3 and Machine Learning Service as AWS SageMaker.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Introduction to Cloud Computing with Machine Learning

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
Introduction to Cloud Computing with Machine Learning **CSA-022**	**CO1**	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
	CO2	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
	CO3	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
	CO4	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
	CO5	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
	CO6	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA-022	Introduction to Cloud Computing with Machine Learning	3.00	3.00	3.00	3.00	1.83	1.67	1.33	1.00	1.33	2.00	1.00	3.00	2.67	3.00	2.00

Total- 39.00
Strength of Correlation

Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**	
1	Course Code	CSI401	
2	Course Title	IoT Security	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Core	
5	Course Objective	The aim of this course is to educate students on key areas in IoT security. This also discusses the security challenges and then provides answers on how to successfully manage IoT security and build a safe infrastructure for smart devices.	
6	Course Outcomes	CO1: Define the concepts to IoT security in enterprise. CO2: Outline IoT security and vulnerability threats. CO3: Compare different IoT protocols and their security measures. CO4: Examine how to secure an IoT development CO5: Explain the Identity and Access Management (IAM) Solutions for the IoT CO6: Choose individual components that can affect the security posture of the entire system	
7	Course Description	This course describes how to implement cybersecurity solutions, IoT design best practices, and risk mitigation methodologies to address device and infrastructure threats to IoT solutions.	
8	Outline syllabus		CO Mapping
	Unit 1	**IoT in the Enterprise**	
	A	Defining the IoT, Cybersecurity versus IoT security and cyber-physical systems, IoT uses today	CO1
	B	IoT device lifecycle, The hardware, Operating systems, IoT communications, Messaging protocols, Transport protocols, Network protocols	CO1
	C	Data link and physical protocols, IoT data collection, storage, and analytics, IoT integration platforms and solutions, Need to secure IoT	CO1
	Unit 2	**Vulnerabilities, Attacks, and Countermeasures**	
	A	Primer on threats, vulnerability, and risks (TVR)	CO2, CO6
	B	Common IoT attacks, Today's IoT attacks	CO2, CO6
	C	Threat modeling an IoT system	CO2, CO6
	Unit 3	**Security Engineering for IoT Development**	
	A	Building security in to design and development, Security in agile developments, Focusing on the IoT device in operation	CO3, CO6
	B	Safety and security design, Processes and agreements	CO3, CO6

	C	Technology selection – security products and services	CO3, CO6
	Unit 4	**Cryptography and its role in securing the IoT**	
	A	Types and uses of cryptographic primitives in the IoT, Encryption and decryption, Hashes, Digital Signatures, Random number generation, Cipher suites	CO4, CO6
	B	Cryptographic key management fundamentals	CO4, CO6
	C	Cryptographic controls built into IoT communication and messaging protocols	CO4, CO6
	Unit 5	**Identity and Access Management (IAM) Solutions for the IoT**	
	A	The identity lifecycle, Establish naming conventions and uniqueness requirements	CO5, CO6
	B	Authentication credentials: Passwords, Symmetric Keys, Certificates, Biometrics	CO5, CO6
	C	IoT IAM infrastructure, Authorization and access control	CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	CA: 25%, MSE: 25%, ESE: 50%	
	Text book/s*	1. Practical Internet of Things Security, Brian Russell, Drew Van DurenCopyright © 2016 Packt Publishing	
	Other References	1. A Beginner's Guide to Internet of Things Security, Attacks, Applications, Authentication, and Fundamentals, B. B. Gupta and Aakanksha Tewari, CRC Press 2. Internet of Things Security, Challenges, Advances, and Analytics, Chintan Patel and Nishant Doshi, CRC Press	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the concepts to IoT security in enterprise.	PO1, PO2, PO3, PO4, PO8, PO12
2.	CO2: Outline IoT security and vulnerability threats.	PO1, PO2, PO3, PO4, PO8, PO12
3.	CO3: Compare different IoT protocols and their security measures.	PO1, PO2, PO3, PO4, PO5, PO8, PO12
4.	CO4: Examine how to secure an IoT development	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5.	CO5: Explain the Identity and Access Management (IAM) Solutions for the IoT	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO11, PO12, PSO1
6.	CO6: Choose individual components that can affect the security posture of the entire system	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Internet of Things Security (Course Code CSI401)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CSI401_Internet of Things Security	CO1	3	1	2	1	-	-	-	2	-	-	-	2	-	-	-
	CO2	3	1	1	1	-	-	-	2	-	-	-	2	-	-	-
	CO3	3	2	2	2	2	-	-	2	-	-	-	2	-	-	-
	CO4	3	3	3	3	2	2	-	3	3	3	3	3	2	2	3
	CO5	3	3	3	3	2	2	-	1	2	-	2	3	2	-	-
	CO6	3	3	3	3	3	3	-	2	3	3	3	3	2	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI401	Internet of Things Security	3.0	2.2	2.3	2.2	2.3	2.3	--	2.0	2.7	3.0	2.7	2.5	2.0	2.5	3.0

Strength of Correlation

1. Addressed to ***Slight (Low=1)*** ***extent*** ***2.*** Addressed to ***Moderate (Medium=2)*** ***extent***
3. Addressed to ***Substantial (High=3)*** ***extent***

School:		**School of Engineering & Technology**			
Department		**Computer Science & Engineering**			
Program:		**B.Tech**			
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**			
1	Course Code	CSI023			
2	Course Title	Micro-controller programming using Arduino			
3	Credits	2			
4	Contact Hours (L-T-P)	2-0-0			
	Course Status	Core			
5	Course Objective	This Course provides the basics of micro-controllers and sensors very quickly and can start building prototype with very little investment. This course is intended to make you comfortable in getting started with Arduino.			
6	Course Outcomes	CO1: Define Arduino programming language and IDE CO2: Illustrate the syntax and structure of Arduino Programming for IoT applications CO3: Explain various decision making statements and use with digital I/O functions available. CO4: Identify functions to read, interpret, and output analog signals. CO5: DESErmine the working of advance functions and interrupts with the Arduino's hardware interrupt pins. CO6: Design embedded applications using Arduino Platform			
7	Course Description	Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programed (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board. Arduino provides a standard form factor that breaks the functions of the micro-controller into a more accessible package.			
8	Outline syllabus				CO Mapping
	Unit 1	**The Arduino Ecosystem**			
	A	The Arduino Platform, Hardware List, Installing the Software			CO1, CO6
	B	Connecting the Arduino, Opening a Sketch, Selecting the Board and Serial Port, Uploading a Sketch			CO1, CO6
	C	Sketching in Code: Uploading the Source Code			CO1, CO6
	Unit 2	**The Structure of Arduino C**			
	A	Using Comments, Basic Functions, Statements and Syntax			CO1, CO2, CO6
	B	Verifying and Uploading, Working with Variables: Variables, Declaring Variables, Variable Names, Data Types			CO1, CO2, CO6
	C	Variable Qualifiers, Predefined Constants, Variable Scope, Using Operators			CO1, CO2, CO6

	Unit 3	**Decision Making Statements & Digital I/O**			
	A	Comparative and Logical Operators, Control Statements: If, For, While, Do, Control Statements: Switch, Break, Continue			CO1, CO2, CO3, CO6
	B	Arduino I/O Demystified, Digital Functions: pinMode(), digitalWrite(), digitalRead()			CO1, CO2, CO3, CO6
	C	State Changes, Toggle, Counting, Modality			CO1, CO2, CO3, CO6
	Unit 4	**Analog I/O**			
	A	Analog Demystified, Analog Functions: analogRead(), analogWrite(), analogReference()			CO1, CO2, CO4, CO6
	B	Analog Serial Monitor: Reading Analog Values, Using the Serial Monitor			CO1, CO2, CO4, CO6
	C	Mapping Values: map(), constrain()			CO1, CO2, CO4, CO6
	Unit 5	**Advanced Functions**			
	A	Timing Functions, Random Functions, Writing Functions			CO5, CO6
	B	Declaring Functions, Calling Functions, Function Returns, Function ParamESErs			CO5, CO6
	C	Hardware Interrupts: attachInterrupt(), detachInterrupt()			CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MSE	ESE	
		25%	25%	50%	
	Text book/s*	1. Beginning Arduino Programming, Brian Evans, Apress			
	Other References	1. Arduino: A Quick-Start Guide, Second Edition, Maik Schmidt			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define Arduino programming language and IDE	PO1, PO4, PO5, PO6, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
2.	CO2: Illustrate the syntax and structure of Arduino Programming for IoT applications	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
3.	CO3: Explain various decision making statements and use with digital I/O functions available.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
4.	CO4: Identify functions to read, interpret, and output analog signals.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5.	CO5: DESErmine the working of advance functions and interrupts with the Arduino's hardware interrupt pins.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	CO6: Design embedded applications using Arduino Platform	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Micro-controller programming using Arduino (Course Code CSI023)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CSI023_Micro-controller programming using Arduino	CO1	2	-	-	1	2	2	-	-	1	1	1	2	2	1	1
	CO2	2	2	2	1	2	2	2	-	1	1	1	2	2	1	1
	CO3	2	2	2	2	3	2	2	-	2	2	2	2	3	2	1
	CO4	2	3	2	2	3	2	2	-	2	2	2	2	3	2	1
	CO5	2	3	3	3	3	2	2	2	2	2	2	2	3	3	1
	CO6	3	3	3	3	3	2	2	3	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI023	Micro-controller programming using Arduino	2.2	2.6	2.4	2.0	2.7	2.0	2.0	2.5	1.8	1.8	1.8	2.2	2.7	2.0	1.2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**			
Department		**Computer Science & Engineering**			
Program:		**B.Tech**			
Branch:		**CSE with Specialization in Artificial Intelligence of Things (AIoT)**			
1	Course Code	CIP023			
2	Course Title	Micro-controller programming using Arduino Lab			
3	Credits	1			
4	Contact Hours (L-T-P)	0-0-2			
	Course Status	Core			
5	Course Objective	With Arduino, the student can get to know the basics of micro-controllers and sensors very quickly and can start building prototype with very little investment. This course is intended to make you comfortable in getting started with Arduino.			
6	Course Outcomes	CO1: Demonstrate Arduino programming language and IDE CO2: Experiment with variables in Arduino Programming CO3: Construct various decision making statements and use with digital I/O functions available. CO4: Implement functions to read, interpret, and output analog signals. CO5: Elaborate the working of advance functions with the Arduino's CO6: Design embedded applications using Arduino Platform			
7	Course Description	Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programed (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board. Arduino provides a standard form factor that breaks the functions of the micro-controller into a more accessible package.			
8	Outline syllabus				CO Mapping
	Unit 1	**Arduino Platform**			
		Introduction to Arduino Platform, the components that make up an Arduino board and their functions.			CO1, CO6
		Installing and working with Arduino.			CO1, CO6
	Unit 2	**Working with Variables**			
		Implement RGB Blink: Uploading the Source Code			CO2, CO6
		Implement 7-Color Blink: Uploading the Source Code			CO2, CO6
	Unit 3	**Digital Ins and Outs**			
		Implement Tilt Blink: Uploading the Source Code			CO3, CO6
		Implement Noisy Cricket: Uploading the Source Code			CO3, CO6
	Unit 4	**Analog Ins and Outs**			
		Implement Telematic Breath: Uploading the Source Code			CO4, CO6
		Implement Ambient Temps: Uploading the Source Code			CO4, CO6
	Unit 5	**Advanced Functions**			
		Implement HSB Color Mixer: Uploading the Source Code			CO5, CO6
		Implementing a case study based on the above concepts.			CO5, CO6
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	-			

PO and PSO mapping with level of strength for Course Name Micro-controller programming using Arduino Lab (Course Code CIP023)

Course Code – Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CIP023_ Micro-controller programming using Arduino Lab	CO1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
	CO2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2
	CO3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
	CO4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
	CO5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CIP023	**Micro-controller programming using Arduino Lab**	2.3	2.0	2.0	2.0	3.0	2.0	2.0	2.2	2.5	2.5	2.5	2.7	2.7	2.0	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1)*** ***extent*** ***2.*** Addressed to ***Moderate (Medium=2)*** ***extent***

3. Addressed to ***Substantial (High=3)*** ***extent***

School:		**School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B. Tech**		
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**		
1	**Course Code**	**CSA301**		
2	**Course Title**	**SOFT COMPUTING**		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core		
5	Course Objective	The primary objective of this course is to provide an introduction to the basic principles, techniques, and applications of soft computing. ● Upon successful completion of the course, students will have an understanding of the basic areas of Soft Computing including Artificial Neural Networks, Fuzzy Logic and Genetic Algorithms. ● Provide the mathematical background for carrying out the optimization associated with neural network learning. ● Aim of this course is to develop some familiarity with current research problems and research methods in Soft Computing by working on a research or design project.		
6	Course Outcomes	The Completion of this Course will Enable the Students to be able to Learn **CO1:** Define the basic concepts of soft computing. **CO2:** Explain applications & operations of Fuzzy Logic in real life problems. **CO3:** Apply different FIS models to solve optimization problems. **CO4:** Analyse and examine Evolutionary and swarm algorithms in solving real world Multi-Objective optimization problems **CO5:** Choose of different optimization algorithms to solve real-life multi objective problems. **CO6:** Discuss applications of Soft Computing and solve Problems in Varieties of Application Domains.		
7	Course Description	This course will cover fundamental concepts used in Soft computing. The concepts of Fuzzy logic (FL) will be covered first, followed by Artificial Neural Networks (ANNs) and optimization techniques using Genetic Algorithm (GA). Applications of Soft Computing techniques to solve a number of real life problems will be covered to have hands on practices.		
8				CO Mapping
	Unit 1	**Introduction to Soft Computing**		
	A	Concept of computing systems. What is Soft Computing?		CO1
	B	"Soft" Computing versus "Hard" computing		CO1
	C	Characteristics of Soft computing, Some applications of Soft computing techniques		CO1, CO6
	Unit 2	**FUZZY LOGIC**		
	A	Introduction to Fuzzy logic, Fuzzy sets and membership functions		CO2
	B	Operations on Fuzzy sets. Fuzzy relations, rules, propositions, implications and inferences.		CO2

	C	Defuzzification techniques, Fuzzy logic controller design, Some real life societal applications of Fuzzy logic.	CO2
	Unit 3	**Fuzzy inference System**	
	A	Fuzzy Inference Systems, Different Fuzzy Models: Mamdani Fuzzy Models, Sugeno Fuzzy Models	CO3
	B	Tsukamoto Fuzzy Models, Input Space Partitioning and Fuzzy Modeling.	CO3
	C	Neuro Fuzzy Modelling: Adaptive Neuro-Fuzzy Inference Systems, Architecture, Hybrid Learning Algorithm, Learning Method that Cross- fertilize ANFIS and RBFN	CO3
	Unit 4	**Swarm and Evolutionary Algorithms**	
	A	Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques	CO4
	B	Basic GA framework and different GA architectures, GA operators: Encoding, Crossover, Selection, Mutation, Solving single-objective optimization problems	CO4
	C	Swarm Optimization: Introduction to Ant Colony Optimization, Particle Swarm Optimization etc.	CO4
	Unit 5	**Multi-objective Optimization Problem Solving**	
	A	Concept of multi-objective optimization problems (MOOPs) and issues of solving them.	CO5,CO6
	B	Multi-Objective Evolutionary Algorithm (MOEA) Non-Pareto approaches to solve MOOPs, Pareto-based approaches to solve MOOPs , Some applications with MOEAs	CO5,CO6
	C		CO5,CO6
	Mode of examination	Theory and Practical	
	Weightage Distribution	CA: 25% / MTE: 25% / ETE: 50%	
	Text book/s*	1. George J. Klir and Bo Yuan, "Fuzzy sets and Fuzzy Logic", Prentice Hall, USA. 2. Goldberg D.E., Genetic Algorithms in Search, Optimization, and Machine Learning Addison Wesley. 3. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill	
	Other References	2. Jang J.S.R., Sun C.T. and Mizutani E, "Neuro-Fuzzy and Soft computing", Prentice Hall. 2. An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press, 2000. 3. Genetic Algorithms In Search, Optimization And Machine Learning, David E. Goldberg, Pearson Education, 2002. 4. Practical Genetic Algorithms, Randy L. Haupt and sue Ellen Haupt, John Willey & Sons, 2002	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:** Define the basic concepts of soft computing.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	**CO2:** Explain applications & operations of Fuzzy Logic in real life problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	**CO3:** Apply different FIS models to solve optimization problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	**CO4:** Analyse and examine Evolutionary and swarm algorithms in solving real world Multi-Objective optimization problems	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	**CO5:** Choose of different optimization algorithms to solve real-life multi objective problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	**CO6:** Discuss applications of Soft Computing and solve Problems in Varieties of Application Domains.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name SOFT COMPUTING **(Course Code** CSA-301**)**

Subject	**PO's / PSO's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
SOFT COMPUTING CSA301	CO1	3	3	1	1	1	1	1	1	2	1	1	3	1	3	1
	CO2	3	3	3	3	2	3	2	2	2	2	3	3	3	3	3
	CO3	3	3	3	3	3	3	1	2	2	2	3	3	3	3	3
	CO4	3	3	3	3	3	3	3	2	2	2	3	3	3	3	3
	CO5	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3
	CO6	3	3	3	3	3	1	3	2	3	2	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CSA 301	**SOFT COMPUTING**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.83**	**2.00**	**2.00**	**3.00**	**2.67**	**3.00**	**2.83**	**2.83**	**2.67**

Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

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School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**	
1	Course Code	CSI024	
2	Course Title	Raspberry Pi and its Programming	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Elective	
5	Course Objective	The primary objective of this course to provide a platform to get started with the Internet of Things with Raspberry Pi along with the basic knowledge of programming and interfacing of the input/output devices.	
6	Course Outcomes	CO1: List the hardware components of Raspberry Pi CO2: Demonstrate the programming concepts using Raspberry Pi CO3: Build Relay, DC Motor and LCD interfaces using Raspberry Pi CO4: Construct interfaces for DHT11, ultrasonic sensor and camera using Raspberry Pi CO5: Implementation of various analog and digital sensors using Raspberry Pi CO6: Design and develop various applications using Raspberry Pi	
7	Course Description	This course provides a gradual pace of basic concepts to advanced interfacing and programming of Raspberry Pi for IoT based projects.	
8	Outline syllabus		CO Mapping
	Unit 1	**Basics of Raspberry Pi**	
	A	Introduction to Raspberry Pi, Raspberry Pi Components	CO1, CO6
	B	Installation of NOOBS on SD Card and Raspbian on SD Card, Terminal Commands, Installation of Libraries on Raspberry Pi	CO1, CO6
	C	Getting the Static IP Address of Raspberry Pi, Run a Program on Raspberry Pi, Installing the Remote Desktop Server	CO1, CO6
	Unit 2	**Programming with Raspberry Pi**	
	A	Installation of I2C Driver on Raspberry Pi, Serial Peripheral Interface with Raspberry Pi	CO2, CO6
	B	Implementation of LED and Raspberry Pi, LED Blink Using Function, Reading the Digital Input	CO2, CO6
	C	Reading an Edge-Triggered Input: Reading Switch in Pull-Down Configuration, Reading Switch in Pull-Up Configuration	CO2
	Unit 3	**Interfacing with Raspberry Pi - I**	
	A	Interfacing of Relay with Raspberry Pi	CO3
	B	Interfacing of DC Motor with Raspberry Pi	CO3
	C	Interfacing of LCD with Raspberry Pi	CO3

	Unit 4	**Interfacing with Raspberry Pi - II**		
	A	Interfacing of DHT11 Sensor with Raspberry Pi		CO4
	B	Interfacing of Ultrasonic Sensor with Raspberry Pi		CO4
	C	Interfacing of Camera with Raspberry Pi		CO4
	Unit 5	**Interfacing with Raspberry Pi and Arduino**		
	A	Install Arduino IDE on Raspberry Pi		CO5,CO6
	B	Implementation of Digital and Analog Sensor		CO5, CO6
	C	Implementation of Actuators		CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	CA / 25%	MSE / 25%	ESE / 50%
	Text book/s*	2. Internet of Things with Raspberry Pi and Arduino, Rajesh Singh, Anita Gehlot, Lovi Raj Gupta et.al, CRC Press		
	Other References	3. Programming the Raspberry Pi, Getting started with Python, Simon Monk, Mc Graw Hill 4. Python Programming for Raspberry Pi, Richard Blum, Christine Bresnahan, Pearson Education		

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: List the hardware components of Raspberry Pi	PO1, PO2, PO3, PO5, PO6, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2
2.	CO2: Demonstrate the programming concepts using Raspberry Pi	PO1, PO2, PO3, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2
3.	CO3: Build Relay, DC Motor and LCD interfaces using Raspberry Pi	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
4.	CO4: Construct interfaces for DHT11, ultrasonic sensor and camera using Raspberry Pi	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5.	CO5: Implementation of various analog and digital sensors using Raspberry Pi	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	CO6: Design and develop various applications using Raspberry Pi	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Raspberry Pi and its Programming (Course Code CSI024)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CSI024_Raspberry Pi and its Programming	CO1	2	1	1	-	3	1	1	-	1	1	2	2	1	1	-
	CO2	2	2	2	-	3	2	2	2	1	1	1	2	3	2	2
	CO3	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
	CO4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
	CO5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI024	Raspberry Pi and its Programming	2.3	2.0	2.0	2.5	3.0	2.0	2.0	2.2	2.3	2.3	2.5	2.7	2.7	2.0	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**			
Department		**Computer Science & Engineering**			
Program:		**B.Tech**			
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**			
1	Course Code	CIP024			
2	Course Title	Raspberry Pi and its Programming Lab			
3	Credits	1			
4	Contact Hours (L-T-P)	0-0-2			
	Course Status	Elective			
5	Course Objective	The primary objective of this course to provide a platform to get started with the Internet of Things with Raspberry Pi along with the basic knowledge of programming and interfacing of the input/output devices.			
6	Course Outcomes	CO1: List the basic components of Raspberry Pi CO2: Demonstrate the Face recognition and LED Blink using Raspberry Pi CO3: Demonstrate the Pull-Down and Pull-Up Configuration using Raspberry Pi CO4: Build Relay and DC Motor using Raspberry Pi CO5: Construct interfaces for LCD and ultrasonic sensor using Raspberry Pi CO6: Design and develop various applications using Raspberry Pi			
7	Course Description	This course provides a gradual pace of basic concepts to advanced interfacing and programming of Raspberry Pi for IoT based projects.			
8	Outline syllabus				CO Mapping
	Unit 1	**Basics of Raspberry Pi**			
		Installing the Remote Desktop Server			CO1, CO6
		Raspberry Pi Camera as a USB Video Device			CO1, CO6
	Unit 2	**Programming with Raspberry Pi-I**			
		Face Recognition Using Raspberry Pi			CO2, CO6
		LED Blink Using Function			CO2, CO6
	Unit 3	**Programming with Raspberry Pi-II**			
		Pull-Down Configuration			CO3, CO6
		Pull-Up Configuration			CO3, CO6
	Unit 4	**Interfacing with Raspberry Pi - I**			
		Interfacing of Relay with Raspberry Pi			CO4, CO6
		Interfacing of DC Motor with Raspberry Pi			CO4, CO6
	Unit 5	**Interfacing with Raspberry Pi - II**			
		Interfacing of LCD with Raspberry Pi			CO5, CO6
		Interfacing of Ultrasonic Sensor with Raspberry Pi			CO5, CO6
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	CE (Viva)	ESE	
		25%	25%	50%	

	Text book/s*	3. Internet of Things with Raspberry Pi and Arduino, Anita Gehlot, Lovi Raj Gupta et.al, CRC Press	
	Other References	5. Programming the Raspberry Pi, Getting started with Python, Simon Monk, Mc Graw Hill 6. Python Programming for Raspberry Pi, Richard Blum, Christine Bresnahan, Pearson Education	

PO and PSO mapping with level of strength for Raspberry Pi and its Programming Lab (Course Code CIP024)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CIP024 _Raspberry Pi and its Programming Lab	CO1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
	CO2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2
	CO3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
	CO4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
	CO5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PS O 3
CIP024	Raspberry Pi and its Programming Lab	2.3	2.0	2.0	2.0	3.0	2.0	2.0	2.2	2.5	2.5	2.5	2.7	2.7	2.0	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**	
1	Course Code	CSI022	
2	Course Title	**Wireless Sensor Network**	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Elective	
5	Course Objective	This course aim to give knowledge of mobile ad hoc networks, design and implementation issues, and available solutions. This course also covers routing mechanisms and the three classes of approaches: proactive, on-demand, and hybrid, clustering mechanisms, 802.11 Wireless Lan (WiFi) and Bluetooth standards.	
6	Course Outcomes	CO1: Define the constraints and challenges of sensor networks CO2: Outline issues and challenges in various wireless sensor network CO3: Explain Wireless sensor network architecture and different communication standards used in WSN CO4: Categorize various routing protocols for WSN CO5: Assess various energy-aware routing protocols for wireless sensor networks CO6: Experiment with TinyOS platform for sensor networks	
7	Course Description	A wireless sensor network (WSN) generally consists of compact low power sensors, which collect information and pass the information via wireless networks to achieve a high level of desired monitoring and control in coordinated manners. WSN applications can be found in areas such as environmental monitoring, smart energy systems, battle field surveillance, home automation, medical monitoring, mobile computing, etc. WSN has integrated network engineering, embedded system engineering and sensor technology.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Introduction to Sensor Networks, Unique constraints and challenges	CO1, CO6
	B	Advantage of Sensor Networks, Applications of Sensor Networks	CO1, CO6
	C	Types of wireless sensor networks	CO1, CO6
	Unit 2	**Issues and challenges in Wireless Sensor Networks**	
	A	Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks	CO2, CO6
	B	Enabling technologies forWireless Sensor Networks	CO2, CO6
	C	Issues and challenges in wireless sensor networks	CO2
	Unit 3	**Wireless Sensor Network Architecture**	
	A	Network Protocol Stack	CO3

	B	Communication Standards: IEEE 802.11, IEEE 802.15.4			CO3
	C	Communication Standards: ZigBee, 6LoWPAN			CO3
	Unit 4	**Routing in WSN**			
	A	Flat-based Routing Algorithms, Hierarchical Routing Algorithms			CO4
	B	Information Gathering Based on Geographic Locations: Geographical Routing, Landmark-based Routing			CO4
	C	Data Aggregation, Content-based Naming			CO4
	Unit 5	**Energy Management in WSN**			
	A	Duty Cycling, Independent and Dependent Strategies			CO5,CO6
	B	Energy-aware Routing Protocols: Hierarchical Energy-aware Routing			CO5, CO6
	C	Location-based Routing and Data Aggregation-based Routing			CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MSE	ESE	
		25%	25%	50%	
	Text book/s*	1. Waltenegus Dargie , Christian Poellabauer, "Fundamentals Of Wireless Sensor Networks Theory And Practice", By John Wiley & Sons Publications, 2011			
	Other References	1. Sabrie Soloman, "Sensors Handbook" by McGraw Hill publication. 2009 2. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks", Elsevier Publications,2004 3. Kazem Sohrby, Daniel Minoli, "Wireless Sensor Networks": Technology, Protocols and Applications, Wiley-Inter science 4. Philip Levis, And David Gay "TinyOS Programming" by Cambridge University Press 2009			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the constraints and challenges of sensor networks	PO1, PO2, PO4, PO6, PO9, PO12, PSO2
2.	CO2: Outline issues and challenges in various wireless sensor network	PO1, PO2, PO4, PO6, PO9, PO12, PSO2
3.	CO3: Explain Wireless sensor network architecture and different communication standards used in WSN	PO1, PO2, PO3, PO4, PO6, PO9, PO10, PO12, PSO2
4.	CO4: Categorize various routing protocols for WSN	PO1, PO2, PO3, PO4, PO6, PO7, PO9, PO10, PO12, PSO2
5.	CO5: Assess various energy-aware routing protocols for wireless sensor networks	PO1, PO2, PO3, PO4, PO6, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2
6.	CO6: Experiment with TinyOS platform for sensor networks	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Wireless Sensor Network (Course Code CSI022)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CSI022 _Wireless Sensor Network	CO1	2	2	-	2	-	2	-	-	1	-	-	2	-	1	-
	CO2	2	2	-	2	-	2	-	-	1	-	-	2	-	1	-
	CO3	2	1	1	2	-	2	-	-	2	2	-	2	-	2	-
	CO4	2	2	1	2	-	2	2	-	2	2	-	3	-	2	-
	CO5	2	2	3	2	-	2	2	-	3	2	2	3	2	3	-
	CO6	3	3	3	2	3	2	2	2	3	2	2	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	P O 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PSO 3
CSI022	Wireless Sensor Network	2.2	2.0	2.0	2.0	3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.5	2.5	2.0	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**
Department		**Computer Science & Engineering**
Program:		**B.Tech**
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**
1	Course Code	CIP022
2	Course Title	Wireless Sensor Network IoT Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Elective
5	Course Objective	The aim of this course is to provide practical knowledge of wireless sensor network components with their design principles.
6	Course Outcomes	CO1: Outline the basic wireless sensor network components. CO2: Demonstrate TinyOS required for compiling and executing example codes. CO3: Utilize TinyOS programming concepts required to gather and sending the data. CO4: Evaluate the simulation of WSN with Tiny OS. CO5: Interpret and visualize the data collected from sensors. CO6: Experiment with TinyOS platform for sensor networks
7	Course Description	This lab is an introductory course for wireless sensor networks. Students will get hands-on experience working with sensor motes and TinyOS application development through simulation and implementation on the real hardware.

8	Outline syllabus		CO Mapping
	Unit 1	**Basics of WSN components**	
		Practical study of all hardware components related to WSNs	CO1, CO6
		Basics of WSN programming concept, General overview of TinyOS	CO1, CO6
	Unit 2	**Practice with TinyOS**	
		Downloading, installing the most recent version of TinyOS	CO2, CO6
		Simple example code that compiles, Guide to getting going with TelosB motes	CO2, CO6
	Unit 3	**Getting Relevant Data**	
		An introduction to TinyOS programming	CO3, CO6
		Sensing data using WSN motes, Gathering relevant data only	CO3, CO6
	Unit 4	**Simulation in TinyOS**	
		Simulating WSNs made up of motes running TinyOS	CO4, CO6
		TinyOS simulation framework TOSSIM	CO4, CO6
	Unit 5	**Visualization**	
		Sensing audio data and interpreting results.	CO5, CO6
		Sensing positioning data using GPS and transmitting it.	CO5, CO6

	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	CE (Viva)	ESE	
		25%	25%	50%	
	Text book/s*	1. Hands-On Artificial Intelligence for IoT, Amita Kapoor, Publisher: Packt Publishing			
	Other References				

PO and PSO mapping with level of strength for Wireless Sensor Network IoT Lab (Course Code CIP022)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CIP022_Wireless Sensor Network IoT Lab	CO1	2	1	-	-	2	-	-	-	-	-	-	2	-	-	-
	CO2	3	2	1	1	3	-	2	-	1	1	1	2	1	2	2
	CO3	3	1	2	2	3	1	3	-	2	2	2	2	3	2	2
	CO4	3	2	2	2	2	1	3	-	2	2	2	2	1	2	2
	CO5	3	2	2	2	3	2	3	-	3	3	3	3	2	3	3
	CO6	3	2	3	2	3	2	3	2	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PS O 3
CIP022	Wireless Sensor Network IoT Lab	2.8	1.7	2.0	1.8	2.7	1.5	2.8	2.0	2.2	2.2	2.2	2.3	2.0	2.4	2.4

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

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School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**	
1	Course Code	CSI301	
2	Course Title	Programming with SENSEnuts IoT Platform	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Core	
5	Course Objective	The objective of the course is to deploy a network for statistical analysis or control applications. This course can help in connecting the sensors to platform to get the desired readings using extender.	
6	Course Outcomes	CO1: Outline the concepts of SENSEnut platform CO2: Explain basic sensor functions available with SENSEnuts devices CO3: Explain advance sensor functions available with SENSEnuts devices. CO4: Discuss simulation study of Sensory Range, Transmission Range. CO5: Identify localization of the event area and Send and Receive Data from a node. CO6: Design embedded applications using SENSEnut Platform	
7	Course Description	SENSEnuts platform can be used to test newly developed routing and application layer algorithms. It provides a flexible mac with around 9 paramESErs that can be controlled at mac and 4 at physical giving user the kind of flexibility to control their network environment.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to SENSEnut Platform**	
	A	The SENSEnut Platform, Hardware List, Installing the Software	CO1, CO6
	B	Peripheral Hardware Specific Calls: DIO Functions, I^2C Functions	CO1, CO6
	C	MAC functions: General Functions, Coordinator Functions, genMac Functions	CO1, CO6
	Unit 2	**Sensor Functions**	
	A	Phy Layer Functions, Routing Functions	CO1, CO2, CO6
	B	Sensor Functions: Light Sensor Functions, Temperature Sensor Functions, Humidity Sensor Functions	CO1, CO2, CO6
	C	Pressure and Temperature sensor Functions, GPS Functions, Passive Infrared Functions	CO1, CO2, CO6
	Unit 3	**Advanced Functions**	
	A	Task Management Functions	CO1, CO2, CO3, CO6
	B	Gateway Communication Functions	CO1, CO2, CO3, CO6

	C	Node Functions, Application Functions			CO1, CO2, CO3, CO6
	Unit 4	**Simulation Studies-I**			
	A	Sensory Range, Transmission Range			CO1, CO2, CO4, CO6
	B	Defining the Sensory Range of a Sensor using SENSEnuts			CO1, CO2, CO4, CO6
	C	Setting the Transmission Range of a Sensor using SENSEnuts			CO1, CO2, CO4, CO6
	Unit 5	**Simulation Studies-II**			
	A	Localization of the event area of a Sensor using SENSEnuts			CO5, CO6
	B	Send and Receive Data from a Single Node			CO5, CO6
	C	Embedded Applications Case Study			CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MSE	ESE	
		25%	25%	50%	
	Text book/s*	1. API REFERENCE GUIDE: SENSEnuts WSN sensation			
	Other References				

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CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Outline the concepts of SENSEnut platform	PO1, PO4, PO5, PO6, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
2.	CO2: Explain basic sensor functions available with SENSEnuts devices	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
3.	CO3: Explain advance sensor functions available with SENSEnuts devices.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
4.	CO4: Discuss simulation study of Sensory Range, Transmission Range.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5.	CO5: Identify localization of the event area and Send and Receive Data from a node.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	CO6: Design embedded applications using SENSEnut Platform	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Programming with SENSEnuts IoT Platform (Course Code CSI301)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CSI301 _Programming with SENSEnuts IoT Platform	CO1	2	-	-	1	2	2	-	-	1	1	1	2	2	1	1
	CO2	2	2	2	1	2	2	2	-	1	1	1	2	2	1	1
	CO3	2	2	2	2	3	2	2	-	2	2	2	2	3	2	1
	CO4	2	3	2	2	3	2	2	-	2	2	2	2	3	2	1
	CO5	2	3	3	3	3	2	2	2	2	2	2	2	3	3	1
	CO6	3	3	3	3	3	2	2	3	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	P O 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PSO 3
CSI301	Programming with SENSEnuts IoT Platform	2.2	2.6	2.4	2.0	2.7	2.0	2.0	2.5	1.8	1.8	1.8	2.2	2.7	2.0	1.2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Artificial Intelligence of Things (AIoT)**	
1	Course Code	CIP301	
2	Course Title	Programming with SENSEnuts IoT Platform Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Core	
5	Course Objective	The objective of the course is to deploy a network for statistical analysis or control applications. This course can help in connecting the sensors to platform to get the desired readings using extender.	
6	Course Outcomes	CO1: Outline the concepts of SENSEnut platform CO2: Demonstrate Blink application using SENSEnuts devices CO3: Experiment with environment sonsors on SENSEnuts GUI. CO4: Make use of broadcast function. CO5: Identify different channel frequencies supported by 802.15.4. CO6: Design embedded applications using SENSEnut Platform	
7	Course Description	SENSEnuts platform can be used to test newly developed routing and application layer algorithms. It provides a flexible mac with around 9 parameters that can be controlled at mac and 4 at physical giving user the kind of flexibility to control their network environment.	
8	Outline syllabus		CO Mapping
	Unit 1	**Sensenut Platform**	
		Introduction to SENSEnuts Platform, the components that make up an SENSEnuts board and their functions.	CO1, CO6
		Installing and working with SENSEnuts.	CO1, CO6
	Unit 2	**Working with SENSEnuts device**	
		To develop a code for LED blinks operation for SENSEnuts device.	CO2, CO6
		To develop a code for RGB blinks operation for SENSEnuts device.	CO2, CO6
	Unit 3	**Working with Environment Sensors**	
		To develop a code to read temperature and light sensor data from sensor module attached	CO3, CO6
		To develop a code to program the temperature and light sensor with threshold values, and catch the interrupt generated by them when threshold is passed.	CO3, CO6
	Unit 4	**Broadcast Function**	
		To develop a code to broadcast the temperature and light sensor data in the network, catch it at destination and display it in GUI.	CO4, CO6
		For the previous experiment, check the change in link quality as the distance between two nodes increase.	CO4, CO6
	Unit 5	**Communication Protocol**	
		To check previous experiment at three different channel frequencies supported by 802.15.4.	CO5, CO6

		To check the impact of dynamic channel selection by PAN coordinator on the network when Pan Coordinator is switched off and then on while the network is running in a non-acknowledged broadcast network.			CO5, CO6
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	-			
	Other References				

PO and PSO mapping with level of strength for Course Name Programming with SENSEnuts IoT Platform (Course Code CIP301)

Course Code – Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CIP301_Programming with SENSEnuts IoT Platform Lab	CO1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
	CO2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2
	CO3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
	CO4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
	CO5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CIP301	**Programming with SENSEnuts IoT Platform Lab**	2.3	2.0	2.0	2.0	3.0	2.0	2.0	2.2	2.5	2.5	2.5	2.7	2.7	2.0	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***

3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**	
1	Course Code	CSI031	
2	Course Title	Artificial Intelligence for IoT	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Elective	
5	Course Objective	The aim of this course is to cover various aspects of artificial intelligence (AI) and its implementation to make IoT solutions smarter.	
6	Course Outcomes	CO1: Understand the principles and foundations of IoT and AI CO2: Demonstrate different ML paradigms for IoT based applications CO3: Construct IoT based applications with Naïve Bayes, Decision tree and ensemble learning. CO4: Improving the model using various techniques CO5: Implementing AI from case study of Smart Cities CO6: Apply different AI techniques including machine learning using TensorFlow and Keras	
7	Course Description	This course describes basic understanding of machine learning concepts. This course also involves the AI and ML techniques to develop smart systems for IoT.	
8	Outline syllabus		CO Mapping
	Unit 1	**Principles and Foundations of IoT and AI**	
	A	IoT Reference Model, IoT platforms, IoT verticals	CO1
	B	Big data and IoT, Infusion of AI- data science in IoT	CO1
	C	Cross-industry standard process for data mining, AI platforms and IoT platforms	CO1
	Unit 2	**Machine Learning for IoT-I**	
	A	ML and IoT, Learning paradigms, Prediction using linear regression	CO2, CO6
	B	Logistic regression for classification: Cross-entropy loss function	CO2, CO6
	C	Classification using support vector machines, Maximum margin hyperplane, Kernel trick	CO2, CO6
	Unit 3	**Machine Learning for IoT-II**	
	A	Naive Bayes	CO3, CO6
	B	Decision trees: Decision trees in scikit, Decision trees in action	CO3, CO6
	C	Ensemble learning: Voting classifier, Bagging and pasting	CO3, CO6
	Unit 4	**Improving the model**	
	A	Feature scaling to resolve uneven data scale	CO4, CO6

	B	Overfitting: Regularization, Cross-validation			CO4, CO6
	C	No Free Lunch theorem			CO4, CO6
	Unit 5	**AI for Smart Cities IoT**			
	A	Need of smart cities, Components of a smart city			CO5, CO6
	B	Smart traffic management, Smart parking, Smart waste management			CO5, CO6
	C	Smart policing, Smart lighting, Smart governance			CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MSE	ESE	
		25%	25%	50%	
	Text book/s*	1. Hands-On Artificial Intelligence for IoT, Amita Kapoor, Publisher: Packt Publishing			
	Other References				

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Understand the principles and foundations of IoT and AI	PO1, PO8, PO12
2.	CO2: Demonstrate different ML paradigms for IoT based applications	PO1, PO2, PO3, PO4, PO5, PO6, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
3.	CO3: Construct IoT based applications with Naïve Bayes, Decision tree and ensemble learning.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
4.	CO4: Improving the model using various techniques	PO1, PO2, PO3, PO4, PO5, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5.	CO5: Implementing AI from case study of Smart Cities	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO12, PSO1, PSO2, PSO3
6.	CO6: Apply different AI techniques including machine learning using TensorFlow and Keras	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Artificial Intelligence for IoT (Course Code CSI031)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CSI031 _Artificial Intelligence for IoT	CO1	3	-	-	-	-	-	-	2	-	-	-	2	-	-	-
	CO2	3	2	2	2	3	2	-	-	2	2	2	2	2	2	2
	CO3	3	2	2	2	3	2	3	2	2	2	2	2	2	2	-
	CO4	3	3	3	3	3	-	-	-	2	2	-	2	2	2	2
	CO5	3	3	3	3	3	3	3	2	2	2	3	3	2	3	2
	CO6	3	3	3	3	3	3	-	2	3	3	3	3	2	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	P O 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PSO 3
CSI031	Artificial Intelligence for IoT	3.0	2.6	2.6	2.6	3.0	2.5	3.0	2.0	2.2	2.2	2.5	2.3	2.0	2.4	2.3

Strength of Correlation

1. Addressed to ***Slight (Low=1)*** ***extent*** ***2.*** Addressed to ***Moderate (Medium=2)*** ***extent***
3. Addressed to ***Substantial (High=3)*** ***extent***

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School:		**School of Engineering & Technology**			
Department		**Computer Science & Engineering**			
Program:		**B.Tech**			
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**			
1	Course Code	CIP031			
2	Course Title	Artificial Intelligence for IoT Lab			
3	Credits	1			
4	Contact Hours (L-T-P)	0-0-2			
	Course Status	Elective			
5	Course Objective	The aim of this course is to cover various aspects of artificial intelligence (AI) and its implementation to make IoT solutions smarter.			
6	Course Outcomes	CO1: Understand the special DL libraries, Access and process data from various distributed sources CO2: Perform regression and logistic regressor machine learning technique for IoT data CO3: Perform SVM and Gausian Naive Bayes learning for IoT data CO4: Improving the model using various techniques CO5: Implementing AI from case study of Smart Cities CO6: Apply different AI techniques including machine learning using TensorFlow and Keras			
7	Course Description	This course describes basic understanding of machine learning concepts. This course also involves the AI and ML techniques to develop smart systems for IoT.			
8	Outline syllabus				CO Mapping
	Unit 1	**Special DL libraries**			
		Installing Tensor Flow & Keras and download datasets			CO1, CO6
		Working with different dataset formats			CO1, CO6
	Unit 2	**Machine Learning for IoT-I**			
		Electrical power output prediction using regression			CO2, CO6
		Classifying wine using logistic regressor			CO2, CO6
	Unit 3	**Machine Learning for IoT-II**			
		Classifying wine using SVM			CO3, CO6
		Gaussian Naive Bayes for wine quality			CO3, CO6
	Unit 4	**Improving the model**			
		Feature scaling to resolve uneven data scale			CO4, CO6
		HyperparamESEr tuning and grid search			CO4, CO6
	Unit 5	**AI for Smart Cities IoT**			
		Adapting IoT for smart cities and the necessary steps			CO5, CO6
		DESEcting crime using city's crime data			CO5, CO6
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	CE (Viva)	ESE	
		25%	25%	50%	

	Text book/s*	1. Hands-On Artificial Intelligence for IoT, Amita Kapoor, Publisher: Packt Publishing	
	Other References		

PO and PSO mapping with level of strength for Artificial Intelligence for IoT Lab (Course Code CIP031)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CIP031 _ Artificial Intelligence for IoT Lab	CO1	2	2	1	-	3	1	1	-	2	2	2	2	1	1	-
	CO2	3	3	2	2	3	2	2	2	1	1	1	3	3	2	3
	CO3	3	2	2	2	3	2	2	2	3	3	3	3	3	2	3
	CO4	3	3	2	2	3	2	2	2	3	3	3	3	3	2	3
	CO5	3	3	2	3	3	2	2	2	3	3	3	3	3	2	3
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PS O 3
CIP031	Artificial Intelligence for IoT Lab	2.8	2.7	2.0	2.4	3.0	2.0	2.0	2.2	2.5	2.5	2.5	2.8	2.7	2.0	3.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Artificial Intelligence of Things (AIoT)**	
1	Course Code	CSI032	
2	Course Title	Data Analytics for IoT	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective	
5	Course Objective	The objective of this course is to learn techniques to solve unique problems associated with IoT and examine and analyze data from your IoT devices	
6	Course Outcomes	CO1: Identify the main challenges of IoT analytics systems development and deployment. CO2: Utilize IoT, Cloud and BigData Integration for IoT Analytics CO3: Evaluate the development tools for real-life applications using IoT analytics CO4: Explain the paradigm for on-demand IoT analytics as a service based on the open source framework. CO5: Analyze the data in smart buildings, including data stemming from sensors and IoT devices. CO6: Assess the popular tools for IoT data analytics, along with their use in practical projects and applications.	
7	Course Description	Data Analytics has a significant role to play in the growth and success of IoT applications and investments. There are different types of data analytics that can be used and applied in the IoT investments to gain advantages.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introducing IoT Analytics**	
	A	Defining IoT analytics and IoT, The concept of constrained	CO1, CO6
	B	IoT Data and BigData, Challenges of IoT Analytics Applications	CO1, CO6
	C	IoT Analytics Lifecycle and Techniques	CO1, CO6
	Unit 2	**IoT, Cloud and BigData Integration for IoT Analytics**	
	A	Cloud-based IoT Platform, Data Analytics for the IoT, Data Collection Using Low-power, Long-range Radios	CO2
	B	WAZIUP Software Platform	CO2
	C	iKaaS Software Platform	CO2, CO6
	Unit 3	**Development Tools for IoT Analytics Applications**	

	A	Introduction, The VITAL Architecture for IoT Analytics Applications	CO3, CO6
	B	VITAL Development Environment: Overview, VITAL Nodes	CO3, CO6
	C	IoT Analytics Applications	CO3, CO6
	Unit 4	**An Open Source Framework for IoT Analytics as a Service**	
	A	Architecture for IoT Analytics-as-a-Service, Sensing-as-a-Service Infrastructure Anatomy	CO4, CO6
	B	Scheduling, Metering and Service Delivery	CO4, CO6
	C	From Sensing-as-a-Service to IoT-Analytics- as-a-Service	CO4, CO6
	Unit 5	**Data Analytics in Smart Buildings**	
	A	Addressing Energy Efficiency in Smart Buildings	CO5, CO6
	B	General Architecture for Management Systems of Smart Buildings	CO5, CO6
	C	IoT-based Information Management System for Energy Efficiency in Smart Buildings	CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	CA / MTE / ETE 30% / 20% / 50%	
	Text book/s*		
	Other References		

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Identify the main challenges of IoT analytics systems development and deployment.	PO1, PO2, PO4, PO12, PSO2
2.	CO2: Utilize IoT, Cloud and BigData Integration for IoT Analytics	PO1, PO4, PO5, PO11, PO12, PSO1, PSO2
3.	CO3: Evaluate the development tools for real-life applications using IoT analytics	PO1, PO2, PO3, PO4, PO5, PO10, PO11, PO12, PSO1, PSO2
4.	CO4: Explain the paradigm for on-demand IoT analytics as a service based on the open source framework.	PO1, PO4, PO10, PO11, PO12, PSO2
5.	CO5: Analyze the data in smart buildings, including data stemming from sensors and IoT devices.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2
6.	CO6: Assess the popular tools for IoT data analytics, along with their use in practical projects and applications.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name Data Analytics for IoT (Course Code CSI032)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSI032_ Data Analytics for IoT	CO1	2	3	-	2	-	-	-	-	-	-	-	2	-	1	-
	CO2	3	-	-	2	2	-	-	-	-	-	2	2	2	1	-
	CO3	3	2	3	2	2	-	-	-	-	2	2	2	2	1	-
	CO4	2	-	-	2	-	-	-	-	-	2	2	2	-	1	-
	CO5	3	3	3	2	2	3	2	-	2	2	2	2	2	2	-
	CO6	3	3	3	2	3	3	2	2	2	2	2	2	3	2	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI032	**Data Analytics for IoT**	2.7	2.8	3.0	2.0	2.3	3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.3	1.3	0.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***

3. Addressed to ***Substantial (High=3) extent***

-

School:		**School of Engineering & Technology**
Department		**Computer Science & Engineering**
Program:		**B.Tech**
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**
1	Course Code	CSI033
2	Course Title	Image Processing with IoT
3	Credits	2
4	Contact Hours (L-T-P)	2-0-0
	Course Status	Elective
5	Course Objective	The objective of this course is to explore multiple techniques, frameworks, and libraries for capturing, processing, and displaying digital images.
6	Course Outcomes	CO1: Recall the list the basic components of Raspberry Pi CO2: Illustrate the concept of image processing using IoT platform CO3: Make use of different basic operations on Images CO4: Assess the different advance operations on Images CO5: Apply the transformations and filter methods on images CO6: Design and develop image processing applications using Raspberry Pi
7	Course Description	The course describes the concept of image processing with the help of Python and Raspberry Pi. This course covers an interactive GUI for the image processing demos using Tkinter, scipy.misc and scipy.ndimage etc to process images.

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Raspberry Pi & Python**	
	A	The Raspberry Pi, Raspberry Pi Setup, The Raspbian OS	CO1
	B	Connecting the Raspberry Pi to a Network and to the Internet, Updating the Pi, Shutting Down and Restarting Pi	CO1
	C	Features of Python, Running a Python Program and Python Modes, IDEs for Python	CO1
	Unit 2	**Introduction to Digital Image Processing**	
	A	Signal Processing, Image Processing, Using IoT Platform and Python for Digital Image Processing (DIP)	CO1, CO2
	B	Image Sources: Using the Webcam and The Pi Camera Module	CO1, CO2
	C	Working with Images, Build in Functions, Image Properties,	CO1, CO2
	Unit 3	**Basic Operations on Images**	
	A	Image Module: Splitting and Merging Image Channels, Image Mode Conversion, Image Blending	CO3, CO6
	B	Resizing an Image, Rotating an Image, Crop and Paste Operations, Copying and Saving Images to a File	CO3, CO6

	C	Knowing the Value of a Particular Pixel, ImageChops Module, ImageOps Module			CO3, CO6
	Unit 4	**Advanced Operations on Images**			
	A	The ImageFilter Module			CO4, CO6
	B	The ImageEnhance Module			CO4, CO6
	C	Color Quantization, Histograms and Equalization			CO4, CO6
	Unit 5	**Transformations and Filters**			
	A	Transformations: shift(), zoom()			CO5, CO6
	B	Measurements:			CO5, CO6
	C	Filters: Low-Pass, High-Pass and Fourier Filters			CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MSE	ESE	
		25%	25%	50%	
	Text book/s*	1. Raspberry Pi Image Processing Programming, Ashwin Pajankar, Apress			
	Other References				

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Recall the list the basic components of Raspberry Pi	PO1, PO5, PO8, PO12
2.	CO2: Illustrate the concept of image processing using IoT platform	PO1, PO2, PO3, PO4, PO5, PO6, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
3.	CO3: Make use of different basic operations on Images	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, PO12, PSO1, PSO2
4.	CO4: Assess the different advance operations on Images	PO1, PO2, PO3, PO4, PO5, PO9, PO10, PO12, PSO1, PSO2, PSO3
5.	CO5: Apply the transformations and filter methods on images	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, PO12, PSO1, PSO2, PSO3
6.	CO6: Design and develop image processing applications using Raspberry Pi	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Image Processing with IoT (Course Code CSI033)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CSI033 _Image Processing with IoT	CO1	3	-	-	-	2	-	-	2	-	-	-	2	-	2	-
	CO2	3	2	2	2	3	2	-	-	2	2	2	2	2	2	2
	CO3	3	2	2	2	3	2	-	2	2	2	-	2	2	2	-
	CO4	3	3	3	3	3	-	-	-	2	2	-	2	2	2	2
	CO5	3	3	3	3	3	3	-	2	2	2	-	3	2	3	2
	CO6	3	3	3	3	3	3	3	2	3	3	3	3	2	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	P O 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PSO 3
CSI033	Image Processing with IoT	3.0	2.6	2.6	2.6	2. 8	2.5	3.0	2.0	2.2	2.2	2.5	2.3	2.0	2.3	2.3

Strength of Correlation

1. Addressed to ***Slight (Low=1)*** ***extent*** ***2.*** Addressed to ***Moderate (Medium=2)*** ***extent***
3. Addressed to ***Substantial (High=3)*** ***extent***

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**	
1	Course Code	CIP033	
2	Course Title	Image Processing with IoT Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Elective	
5	Course Objective	The objective of this course is to explore multiple techniques, frameworks, and libraries for capturing, processing, and displaying digital images.	
6	Course Outcomes	CO1: Recall the list the basic components of Raspberry Pi CO2: Demonstrate the Python IDEs for image processing CO3: Demonstrate the Tkinter Library to implement image properties CO4: Make use of Pillow library for image processing using Raspberry Pi CO5: Apply the transformations and filter methods on images CO6: Design and develop image processing applications using Raspberry Pi	
7	Course Description	The course describes the concept of image processing with the help of Python and Raspberry Pi. This course covers an interactive GUI for the image processing demos using Tkinter, scipy.misc and scipy.ndimage etc to process images.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Raspberry Pi**	
		Introduction and Setup of Raspberry Pi, The Raspbian OS	CO1, CO6
		Connecting the Raspberry Pi to a Network and to the Internet, Updating the Pi, Shutting Down and Restarting Pi	CO1, CO6
	Unit 2	**IDEs for Python**	
		Introduction and implementation of Geany, Set Build Commands window and Execute Commands	CO2, CO6
		Connect a Raspberry Pi to Webcam and Pi Camera Module to acquire images	CO2, CO6
	Unit 3	**Using Tkinter Library**	
		Implement Python's built-in GUI module "Tkinter" for displaying images	CO3, CO6
		Implement different image properties	CO3, CO6
	Unit 4	**Pillow library for image processing**	
		Implement basic operations on images	CO4, CO6
		Implement advanced operations on images	CO4, CO6
	Unit 5	**Transformations and Filters**	
		Use the scipy.ndimage library for processing images	CO5, CO6

		Implement Low-Pass and High-Pass filters on images			CO5, CO6
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	CE (Viva)	ESE	
		25%	25%	50%	
	Text book/s*	1. Raspberry Pi Image Processing Programming, Ashwin Pajankar, Apress			
	Other References				

PO and PSO mapping with level of strength for Image Processing with IoT Lab (Course Code CIP033)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CIP033 _Image Processing with IoT Lab	CO1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
	CO2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2
	CO3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
	CO4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
	CO5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PS O 3
CIP033	Image Processing with IoT Lab	2.3	2.0	2.0	2.0	3.0	2.0	2.0	2.2	2.5	2.5	2.5	2.7	2.7	2.0	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School SET		**Batch: 2023-27**	
Program B-TECH		**Current Academic Year: 2023-24**	
Branch CSE		**CSE with Specialization in Artificial Intelligence for IoT Applications Semester VI**	
1	Course Code	**CSA041**	Course Name **Natural Language Processing**
2	Course Title	**Natural Language Processing**	
3	Credits	3	
4	Contact Hours (L-T-P)	**3-0-0**	
	Course Status	**Specialization Elective**	
5	Course Objective	**Students will try to learn** 12. Basics of natural language processing. 13. How to apply basic algorithms in natural language processing. 14. Algorithmic description of the main language levels morphology, syntax, semantics, and pragmatics. 15. Basics of knowledge representation, inference, and relations to the artificial intelligence. 16. Techniques such as tokenization, stemming, and lemmatization.	
6	Course Outcomes	Students will be able to CO-7. **Define** Computational Linguistics phenomena and making decisions using it. CO-8. **Explain** how to access Text Corpora and Lexical Resources. CO-9. **Apply** processing of raw text using NLP programming concepts. CO-10.**Analyze** tagging of words and Extracting Information from Text. CO-11.**Discuss** analysis of sentences using CFG and Propositional Logic. CO-12.**Design** NLP based applications for different business environment.	
7	Course Description	This course provides an introduction to the field of computational linguistics, aka natural language processing (NLP). We will learn how to create systems that can understand and produce language, for applications such as information extraction, machine translation, automatic summarization, question-answering, and interactive dialogue systems. The course will cover linguistic (knowledge-based) and statistical approaches to language processing in the three major subfields of NLP: syntax (language structures), semantics (language meaning), and pragmatics/discourse (the interpretation of language in context).	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction and Computational Linguistics**	
	A	What is Natural Language Processing, hands-on demonstrations. Ambiguity and uncertainty in language. The Turing test	CO1
	B	Computing with Language Texts and Words Implementation of NLTK, Searching Text, Counting Vocabulary, A Closer Look at Python Texts as Lists of Words, Computing with Language Simple Statistics, Frequency Distributions, Fine-grained Selection of Words, Collocations and Bigrams,	CO1

	C	Making Decisions and Taking Control, Conditionals, Operating on Every Element, Nested Code Blocks, Looping with Conditions	CO1
	Unit 2	**Accessing Text Corpora and Lexical Resources**	
	A	Automatic Natural Language Understanding, Word Sense Disambiguation, Pronoun Resolution, Generating Language Output, Machine Translation, Spoken Dialog Systems, Textual Entailment, Limitations of NLP	CO2
	B	Accessing Text Corpora, Gutenberg Corpus, Web and Chat Text, Brown Corpus, Reuters Corpus, Inaugural Address Corpus, Annotated Text Corpora, Corpora in Other Languages	CO2
	C	Text Corpus Structure, Loading your own Corpus, Conditional Frequency Distributions, Conditions and Events, Counting Words by Genre, Plotting and Tabulating Distributions, Generating Random Text with Bigrams,	CO2
	Unit 3	**Processing Raw Text**	
	A	Lexical Resources,, Wordlist Corpora, A Pronouncing Dictionary, Comparative Wordlists, Shoebox and Toolbox Lexicons, WordNet, Senses and Synonyms, The WordNet Hierarchy, Lexical Relations, Semantic Similarity	CO3
	B	Accessing Text from the Web and from Disk, Strings Text Processing at the Lowest Level, Text Processing with Unicode, Regular Expressions for Detecting Word Patterns, Useful Applications of Regular Expressions Normalizing Text, Regular Expressions for Tokenizing Text, Segmentation,Formatting From Lists to Strings	CO3
	C	NLP Programming Sequences, Style, Functions for text processing, Program Development & Algorithm Design using, Python Libraries	CO3
	Unit 4	**Tagging & Information Extraction**	
	A	Categorizing and Tagging Words Using a Tagger,Tagged Corpora,Mapping Words to Properties Using Python Dictionaries, Automatic Tagging, N-Gram Tagging,Transformation-Based Tagging, Determine the Category of a Word	CO4
	B	Text classification Supervised Classification, Examples of Supervised Classification,Evaluation,Decision Trees,Naive Bayes Classifiers,Maximum Entropy Classifiers,Modeling Linguistic Patterns	CO4
	C	Extracting Information from Text Information Extraction,Chunking,Developing and Evaluating Chunkers,Recursion in Linguistic Structure,Named Entity Recognition,Relation Extraction	CO4
	Unit 5	**Analysis of sentences**	
	A	Analyzing Sentence Structure Grammatical Dilemmas,What's the Use of Syntax?,Context-Free Grammar,Parsing with Context-Free Grammar,Dependencies and Dependency Grammar,Grammar Development	CO5

	B	Analyzing the Meaning of Sentences Natural Language Understanding,Propositional Logic,First-Order Logic,The Semantics of English Sentences,Discourse Semantics			CO5
	C	Managing Linguistic DataCorpus Structure,The Life Cycle of a Corpus,Acquiring Data,Working with XML,Working with Toolbox Data,Describing Language Resources Using OLAC Metadata			CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	6. Speech and Language processing An introduction to Natural Language Processing, Computational Linguistics and speech Recognition by Daniel Jurafsky and James H. Martin (ISBN13: 978-0131873216) 7. Ruslan Mitkov, The Oxford Handbook of Computational Linguistics, Oxford University Press, 2005			
	Other References	7. Charu C. Aggarwal and Cheng Xiang Zhai, Mining Text Data, Springer, 2012 8. Hopcroft, J.E. and Ullman, J.D., Introduction to Automata, Theory and Languages, Addison-Wesley, 1979			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**Define** Computational Linguistics phenomena and making decisions using it.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	**Explain** how to access Text Corpora and Lexical Resources.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	**Apply** processing of raw text using NLP programming concepts.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	**Analyze** tagging of words and Extracting Information from Text.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	**Discuss** analysis of sentences using CFG and Propositional Logic.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	**Design** NLP based applications for different business environment.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Natural Language Processing **(Course Code CSA041)**

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	3	1	1	1	1	3	1	3	2	3	1
CO 2	3	3	3	3	3	1	1	1	1	3	1	3	3	3	2
CO 3	3	3	3	3	3	2	1	1	1	3	1	3	3	3	1
CO 4	3	3	3	3	3	1	2	1	1	3	1	3	3	3	3
CO 5	3	3	3	3	3	2	2	1	2	3	1	3	3	3	3
CO 6	3	3	3	3	3	3	3	1	3	3	2	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA 041	Natural Language Processing	3.00	3.00	3.00	3.00	3.00	1.67	1.67	1.00	1.50	3.00	0.00	3.00	2.83	3.00	2.17

Total- 34.83
Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**	
1	Course Code	CSI011	
2	Course Title	Android with IoT	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Elective	
5	Course Objective	This course aim to give an overview of Android with IoT, its architecture, challenges and applications in different context.	
6	Course Outcomes	CO1: Define the basics of Android platform CO2: Outline the Components of Android CO3: Identify IoT ecosystem and role of the Android Things CO4: Analyze Android Things with IoT cloud platforms CO5: Evaluate Android Things in IoT projects CO6: Develop an Android App with IoT	
7	Course Description	The course is intended to know fundamentals of Android Platform, Android application components; integration of Android with IoT, The main focus is on implementing IoT projects using Android Things.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Android Platform**	
	A	Features of Android, Architecture of Android	CO1
	B	Configuration of android SDK	CO1
	C	Android application structure, Generation of APK Files for Android Projects	CO1
	Unit 2	**Components of Android**	
	A	Components of Android architecture	CO1, CO2
	B	Activity, Activity life cycle	CO1, CO2
	C	Service, Service life cycle, Concept of Intent	CO1, CO2
	Unit 3	**Android and IoT**	
	A	Internet of Things overview & its components	CO3
	B	Android Things overview, Android Things board compatibility	CO3
	C	Installation of Android Things	CO3
	Unit 4	**Integrate Android Things with IoT Cloud Platforms**	
	A	IoT cloud architecture & IoT cloud platform overview	CO3, CO4
	B	IoT cloud architecture overview	CO3, CO4
	C	Android with Android Things	CO3, CO4
	Unit 5	**Android Things**	
	A	Creating the first Android Things project	CO5, CO6
	B	Streaming data to the IoT cloud platform	CO5, CO6
	C	Developing an Android app to retrieves data from Android Things	CO5, CO6

	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MSE	ESE	
		25%	25%	50%	
	Text book/s*	1. Android Things Projects by Francesco Azzola Publisher: Packt Publishing 2. Anubhav Pradhan and Anil V. Deshpande , Composing Mobile Apps: Learn, Explore, Apply Using Android , 1st Edition, Wiley India.			
	Other References				

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the basics of Android platform	PO1, PO5, PO10, PO11, PO12
2.	CO2: Outline the Components of Android	PO1, PO5, PO11, PO12
3.	CO3: Identify IoT ecosystem and role of the Android Things	PO1, PO2, PO4, PO5, PO6, PO7, PO9, PO10, PO11, PO12, PSO3
4.	CO4: Analyze Android Things with IoT cloud platforms	PO1, PO2, PO4, PO5, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5.	CO5: Evaluate Android Things in IoT projects	PO1, PO2, PO3,PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	CO6: Develop an Android App with IoT	PO1, PO2, PO3,PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Android with IoT (Course Code CSI011)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CSI011 _Android with IoT	CO1	2	-	-	-	2	-	-	-	-	1	2	2	-	-	-
	CO2	2	-	-	-	2	-	-	-	-	-	2	2	-	-	1
	CO3	2	2	-	2	2	2	3	-	2	2	2	3	-	-	-
	CO4	2	2	-	2	2	-	-	-	2	2	2	3	1	1	3
	CO5	2	2	2	3	2	3	2	2	3	3	2	3	3	3	3
	CO6	2	3	3	3	2	3	2	2	3	3	2	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI011	Android with IoT	2.0	2.3	2.5	2.5	2.0	2.7	2.3	2.0	2.5	2.2	2.0	2.7	2.3	2.3	2.5

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**	
1	Course Code	CIP011	
2	Course Title	Android with IoT Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Elective	
5	Course Objective	This course aim to give an overview of Android with IoT, its architecture, challenges and applications in different context.	
6	Course Outcomes	CO1: Demonstrate the basics of Android Things on Raspberry CO2: Build the Android Things project CO3: Construction of connecting control peripherals with Android Things CO4: Experiment with GPIO pins and PIR sensors using Android Things CO5: Develop a small Android App with IoT CO6: Build IoT application using Android Things	
7	Course Description	The course is intended to know fundamentals of Android Platform, Android application components; integration of Android with IoT, The main focus is on implementing IoT projects using Android Things.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
		Install Android Things on Raspberry	CO1, CO6
		Testing the installation: Connect Raspberry Pi to a video using the HDMI, Connect Raspberry Pi to your network using the LAN connection, Connect Raspberry Pi to your Mac/PC using a USB cable	CO1, CO6
	Unit 2	**Android Things Project**	
		Creating the first Android Things project	CO2, CO6
		Cloning the template project, Create the project manually	CO2, CO6
	Unit 3	**Connecting Control peripherals with Android Things**	
		Study the Android Things and how it works	CO3, CO6
		Create your first Android Things app	CO3, CO6
	Unit 4	**Android Things with IoT-I**	
		Creating an Alarm System Using Android Things	CO4, CO6
		Use GPIO pins and PIR sensors, handle events from a GPIO pin	CO4, CO6
	Unit 5	**Android Things with IoT-II**	
		Build an app that is independent of the board	CO5, CO6

		Implementation of notifying events from Android Things to Android	CO5, CO6
	Mode of examination	Jury/Practical/Viva	
	Weightage Distribution	CA: 25% ; CE (Viva): 25% ; ESE: 50%	
	Text book/s*	1. Android Things Projects by Francesco Azzola Publisher: Packt Publishing 2. Anubhav Pradhan and Anil V. Deshpande , Composing Mobile Apps: Learn, Explore, Apply Using Android , 1st Edition, Wiley India.	
	Other References		

PO and PSO mapping with level of strength for Android with IoT Lab (Course Code CIP011)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CIP011 _Android with IoT Lab	CO1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
	CO2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2
	CO3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
	CO4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
	CO5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PS O 3
CIP011	Android with IoT Lab	2.3	2.0	2.0	2.0	3.0	2.0	2.0	2.2	2.5	2.5	2.5	2.7	2.7	2.0	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**	
1	Course Code	CSI041	
2	Course Title	Fog Computing in IoT	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective	
5	Course Objective	The objective of this course is to provide the fundamentals and followed by the middleware and technological solutions to implement fog and edge-related applications.	
6	Course Outcomes	CO1: Define the IoT paradigm along with CIoT limitations CO2: Outline the integrated cloud-to-things system comprising cloud computing, fog computing, and the IoT CO3: Assess the optimization problems in Fog and Edge computing architecture CO4: Evaluate the conceptual architecture for the data management in fog computing environments CO5: Explain the different IoT applications with fog computing CO6: Discuss the foundations, middleware, data management and applications of fog computing.	
7	Course Description	The course covers the state-of-the-art in fog and edge computing, their applications, architectures, and technologies.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Fog Computing**	
	A	IoT and New Computing Paradigms: Fog and Edge Computing Completing the Cloud, Advantages, Hierarchy of Fog and Edge Computing	CO1, CO6
	B	Business Models, Opportunities and Challenges	CO1, CO6
	C	Addressing the Challenges in Federating Edge Resources: Networking and Management Challenge	CO1, CO6
	Unit 2	**Optimization Problems in FEC**	
	A	Introduction and Case for Optimization in Fog Computing	CO2
	B	Formal Modeling Framework for Fog Computing, Metrics: Performance, Resource Usage, Energy Consumption, Financial Cost	CO2
	C	Quality Attributes, Optimization Opportunities along the Fog Architecture, Optimization Opportunities along the Service Life Cycle	CO2, CO6
	Unit 3	**Middleware for Fog and Edge Computing**	
	A	Need for Fog and Edge Computing Middleware, Design Goals, State-of-the-Art Middleware Infrastructures	CO3, CO6
	B	System Model: Embedded Sensors or Actuators, Personal Devices, Fog Servers, Cloudlets, Cloud Servers, Proposed Architecture: API Code, Security, Device Discovery	CO3, CO6

	C	Middleware: Context Monitoring and Prediction, Selection of Participating Devices, Data Analytics, Scheduling and Resource Management, Network Management, Execution Management, Mobility Management, Sensor/Actuators	CO3, CO6
	Unit 4	**Data Management in Fog Computing**	
	A	Introduction, Fog Data Management: Fog Data Life Cycle	CO4, CO6
	B	Data Characteristics, Data Pre-Processing and Analytics	CO4, CO6
	C	Data Privacy, Data Storage and Data Placement, Proposed Architecture	CO4, CO6
	Unit 5	**Fog Computing Applications**	
	A	Fog Applications: Healthcare and Well-being, Smart Vehicle Management	CO5, CO6
	B	Fog Applications: Smart City Applications, Smart Data Management	CO5, CO6
	C	Other Emerging Application Sectors	CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	CA: 25%; MSE: 25%; ESE: 50%	
	Text book/s*	1. Fog and Edge Computing: Principles and Paradigms, Editor Buyya, Srirama, JohnWiley & Sons 2. Sensors, Cloud, and Fog: The Enabling Technologies for the Internet of Things, Sudip Misra, Subhadeep Sarkar, Subarna Chatterjee, CRC Press	
	Other References	1. Fog Computing: Concepts, Frameworks and Technologies 1st Edition, Kindle Edition by Zaigham Mahmood 2. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies & Sensors for the Internet of Things Businesses & Market Trends 2014 - 2024',Yole Development Copyrights ,2014.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the IoT paradigm along with CIoT limitations	PO1, PO2, PO12
2.	CO2: Outline the integrated cloud-to-things system comprising cloud computing, fog computing, and the IoT	PO1, PO2, PO3, PO4, PO7, PO12
3.	CO3: Assess the different design aspects of middleware for Fog and Edge computing	PO1, PO2, PO3, PO4, PO5, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2
4.	CO4: Evaluate the conceptual architecture for the data management in fog computing environments	PO1, PO2, PO3, PO4, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2
5.	CO5: Discuss various case studies of fog computing	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	CO6: Develop real-life IoT applications with fog computing	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Fog Computing in IoT (Course Code CSI041)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CSI041 _Fog Computing in IoT	CO1	2	2	-	-	-	-	-	-	-	-	-	2	-	-	-
	CO2	3	2	2	2	-	-	1	-	-	-	-	2	-	-	-
	CO3	3	2	2	2	2	-	2	-	2	2	2	3	2	2	-
	CO4	3	2	2	2	-	-	2	-	2	2	2	3	2	2	-
	CO5	3	3	3	2	3	2	2	3	3	3	3	3	2	2	2
	CO6	3	3	3	2	3	3	2	3	3	3	3	3	2	2	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI041	Fog Computing in IoT	2.8	2.3	2.4	2.0	2.7	2.5	1.8	3.0	2.5	2.5	2.5	2.7	2.0	2.0	2.5

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B.Tech**		
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**		
1	Course Code	CSI042		
2	Course Title	Industrial IoT 4.0		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Elective		
5	Course Objective	This course is designed to offer students an introduction to Industry 4.0 (or the Industrial Internet), its applications in the business world. Students will gain deep insights into how smartness is being harnessed from data and appreciate what needs to be done in order to overcome some of the challenges.		
6	Course Outcomes	CO1: Define the concept of Industry 4.0 CO2: Identify design principles under the Industry 4.0 umbrella CO3: Explain the drivers and features of Servitization and Product Service-System (PSS). CO4: Analyze 5C Cyber Physical System architecture for Industry 4.0 CO5: Discuss the impact of digital transformation on transportation and logistics. CO6: DESErmine the opportunities, challenges brought about by Industry 4.0 to earn the benefits.		
7	Course Description	Industry 4.0 refers to fourth generation of industrial activity characterized by smart systems and internet-based solutions. Applicability of 4.0 in transportation, energy and infrastructure is explored, with effects on technology, organization and operations from a systems perspective.		
8	Outline syllabus			CO Mapping
	Unit 1	**Fundamentals of IoT 4.0**		
	A	Definition of Industry 4.0, Key Paradigm of Industry 4.0, Industry 4.0 Conception: Five Main Components of Networked Production		CO1
	B	Framework of Industry 4.0: Conception and Technologies, Nine Pillars of Technological Advancement		CO1
	C	Macro Perspective of Industry 4.0, Micro Perspective of Industry 4.0, Industry 4.0 Components		CO1
	Unit 2	**Industry 4.0: Design Principles**		
	A	Interoperability, Virtualization, Decentralization, Real-Time Capability, Service Orientation, Modularity, Impact of Industry 4.0		CO1, CO2
	B	RAMI 4.0 (Reference Architecture Model Industry 4.0), Additional Details of RAMI 4.0: Function of Layers on		CO1, CO2

		Vertical Axis, Function of Layers on the Horizontal Left Axis, Hierarchical System Architecture in Industry 4.0	
	C	Industry 4.0 Component Model: Specification of the Industry 4.0 Component Model	CO1, CO2
	Unit 3	**Servitization and Product Service-System (PSS)**	
	A	The concept of Servitization, Drivers and Features of Servitization, Current State of Servitization and Impacts from Industry 4.0, Industry 4.0 Services	CO1, CO2, CO3,CO6
	B	Product Service-System (PSS), Definition, Features of a PSS: PoPSS, UoPSS, RoPSS	CO1, CO2, CO3, CO6
	C	Pervasive Computing, Applications of Pervasive Computing, Pervasive Computing and Internet of Things (IoT)	CO1, CO2, CO3, CO6
	Unit 4	**The Industry 4.0 Architecture and Cyber-Physical Systems**	
	A	Concept and Characteristics of Cyber-Physical Systems, CPS 5C Level Architecture	CO1, CO2, CO4
	B	Implementation of 5C CPS Architecture in Factories, Classification of CPS in Context of Industry 4.0	CO1, CO2, CO4, CO6
	C	IT and OT Convergence in Industrial IoT, Industry 4.0 Principles: Horizontal and Vertical Integration, Basic Functions and Uses of CPS	CO1, CO2, CO4, CO6
	Unit 5	**Industry 4.0 across the Sectors**	
	A	Introduction, Transportation 4.0: Multimodal Transportation Systems	CO4, CO5, CO6
	B	Rail 4.0, Digital Transformation of Railways	CO4, CO5, CO6
	C	Logistics 4.0	CO4, CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	CA 25% / MSE 25% / ESE 50%	
	Text book/s*	1. Handbook of Industry 4.0 and SMART Systems by Diego Galar Pascual, Pasquale Daponte, Uday Kumar, CRC Press	
	Other References	1. Industry 4.0: Managing The Digital Transformation, Duc Truong Pham, University of Birmingham, Birmingham, UK, Springer 2. The Concept Industry 4.0: An Empirical Analysis of Technologies and Applications in Production Logistics, Christoph Jan Bartodziej, Springer	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the concept of Industry 4.0	PO1, PO6, PO7, PO8, P012
2.	CO2: Identify design principles under the Industry 4.0 umbrella	PO1, PO2, PO4, PO6, PO7, PO8, PO9, PO12
3.	CO3: Explain the drivers and features of Servitization and Product Service-System (PSS).	PO1, PO2, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2
4.	CO4: Analyze 5C Cyber Physical System architecture for Industry 4.0	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2
5.	CO5: Discuss the impact of digital transformation on transportation and logistics.	PO1, PO2, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	CO6: DESErmine the opportunities, challenges brought about by Industry 4.0 to earn the benefits.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Industrial IoT 4.0 (Course Code CSI042)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CSI042_Industrial IoT 4.0	CO1	1	-	-	-	-	1	2	2	-	-	-	2	-	-	-
	CO2	2	2	-	1	-	1	2	2	1	-	-	2	-	-	-
	CO3	2	1	-	1	2	1	2	2	2	1	2	2	1	2	-
	CO4	2	2	1	2	2	1	2	2	2	1	2	2	1	2	-
	CO5	2	2	-	2	2	1	2	2	2	2	2	2	2	3	2
	CO6	2	2	2	2	3	1	2	2	3	2	3	3	2	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	P O 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PSO 3
CSI042	Industrial IoT 4.0	1.8	1.8	1.5	1.6	2. 3	1.0	2.0	2.0	2.0	1.5	2.3	2.2	1.5	2.5	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

<table>
<tr><td colspan="2">School: SET</td><td colspan="3">Batch: 2023-27</td></tr>
<tr><td colspan="2">Program: B.Tech.</td><td colspan="3">Current Academic Year: 2023-24</td></tr>
<tr><td colspan="2">Branch: CSE</td><td colspan="3">CSE with Specialization in Artificial Intelligence for IoT Applications
Semester: VII</td></tr>
<tr><td>1</td><td>Course Code</td><td>CSA051</td><td colspan="2">Course Name- RECOMENDER SYSTEMS</td></tr>
<tr><td>2</td><td>Course Title</td><td colspan="3">RECOMENDER SYSTEMS</td></tr>
<tr><td>3</td><td>Credits</td><td colspan="3">3</td></tr>
<tr><td>4</td><td>Contact Hours (L-T-P)</td><td colspan="3">3-0-0</td></tr>
<tr><td></td><td>Course Status</td><td colspan="3">Specialization Elective</td></tr>
<tr><td>5</td><td>Course Objective</td><td colspan="3">To develop state-of-the-art recommender systems that automate a variety of choice-making strategies with the goal of providing affordable, personal, and high-quality recommendations
4. To introduce fundamental techniques in recommender systems.
5. To introduce the ideas of Non-personalized and project-association recommenders through content-based and collaborative techniques.
6. To become familiar with to various approaches for building recommender systems including collaborative, content-based, knowledge-based, and hybrid methods.</td></tr>
<tr><td>6</td><td>Course Outcomes</td><td colspan="3">After Successful completion of this course the student will be able to:
CO1 :Define the basics of Recommender Systems and its types.
CO2: Explain the similarity measures used in formation of neighbourhood of samples of data.
CO3: Apply various techniques of content and knowledge based recommendation for real life applications.
CO4: Analyse and categorize the various recommendation techniques for hybridization.
CO5: Choose the suitable type of Recommender systems for societal problems
CO6:Design the recommender system to support all online applications of folksonomies and Social Networking sites.</td></tr>
<tr><td>7</td><td>Course Description</td><td colspan="3">Recommender systems offer personalized access to online information in product catalogs, social media networks, and document collections, among other applications. It will introduce students to various approaches for building recommender systems including collaborative, content-based, knowledge-based, and hybrid methods.</td></tr>
<tr><td>8</td><td colspan="3">Outline syllabus</td><td>CO Mapping</td></tr>
<tr><td></td><td>Unit 1</td><td colspan="2">Introduction</td><td></td></tr>
</table>

	A	Introduction to Recommender Systems, Neighbourhood-based methods Recommendation, Applications of recommender systems, Case study of movie lens, group lens and amazon.com etc.	CO1,
	B	Introduction to Information retrieval, Introduction to collaborative filtering	CO1,
	C	Knowledge sources, Neighbourhood-based methods.	CO1
	Unit 2	**Memory and Model-based Collaborative Recommendation**	
	A	Similarity measures used in Collaborative Filtering, Model-based Collaborative Recommendation Dimensionality reduction. Regression: Slope1 and SLIM models. Association rules and Naïve Bayes models,	CO2, CO6
	B	Factorization Methods of Collaborative Recommendation, Latent factor models.	CO2, CO6
	C	Optimization techniques. Singular value decomposition, constrained matrix factorization.	CO2, CO6
	Unit 3	**Content-based and Knowledge-based Recommendation**	
	A	High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Content-based Recommendation Feature representation, extraction, and selection.	CO3, CO6
	B	User profiles. Learning models, Item profiles, Discovering features of documents, Obtaining item features from tags	CO3, CO6
	C	Knowledge-based Recommendation Constraint-based recommendation. Critiquing systems.	CO3, CO6
	Unit 4	**Hybrid recommendation and Evaluation**	CO3, CO6
	A	Hybrid Recommendation Complementarities between recommendation techniques and knowledge sources.	CO3, CO6
	B	Combining recommendation methods. Types of evaluation for recommender systems	CO3, CO6
	C	Evaluation design. Prediction metrics and ranking metrics. A/B Testing	CO3, CO6
	Unit 5	**Context-aware recommendation**	
	A	Context effects in recommendation. Types and representations of context.	CO5, CO6
	B	Pre-filtering, post-filtering and contextual modelling, Temporal and location-sensitive models	CO5, CO6
	C	Recommender Systems and communities: Communities, collaboration and recommender systems in personalized web search, Social tagging recommender systems, Trust and Recommendations, Group recommender systems and their applications in solving societal problems.	CO5, CO6

	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Aggarwal, C. C. Recommender Systems: The Textbook. Springer 2019. ISBN 978-3-319-29657-9. Available through the DePaul library.			
	Other References	http://www.deitel.com/ResourceCenters/Web20/RecommenderSystems/RecommenderSystemsCourseSyllabi/tabid/1321/Default.aspx			
	Other References	**Francesco Ricci, LiorRokach and BrachaShapira Recommender Systems Handbook, 2005**			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**Define** the basics of Recommender Systems and its types**.**	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	**Explain** the similarity measures used in formation of neighbourhood of samples of data.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	**Apply** various techniques of content and knowledge based recommendation for real life applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	**Analyse** and categorize the various recommendation techniques for hybridization.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	**Choose** the suitable type of Recommender systems for societal problems	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	**Design** the recommender system to support all online applications of folksonomies and Social Networking sites.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for RECOMENDER SYSTEMS (Course Code CSA051)

Subject	Course Objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
RECOMMENDER SYSTEMS CSA-051	CO1	3	3	2	3	2	1	1	1	2	1	-	3	3	2	2
	CO2	3	3	3	3	3	2	2	1	2	2	-	3	3	3	2
	CO3	3	3	3	3	3	3	3	1	3	2	-	3	3	2	2
	CO4	3	3	3	3	3	2	2	1	3	2	-	3	3	3	2
	CO5	3	3	3	3	3	3	3	1	3	2	-	3	3	3	2
	CO6	3	3	3	3	3	3	3	1	3	3	-	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated)

Course Code	**Course Name**	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CSA-051	**RECOMENDER SYSTEMS**	**3.00**	**3.00**	**2.83**	**3.00**	**2.83**	**2.33**	**2.33**	**1.00**	**2.67**	**2.00**	**0.00**	**3.00**	**3.00**	**2.67**	**2.17**

Total- 35.83

Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**

3. Addressed to **Substantial (High=3) extent**

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**	
1	Course Code	CSI051	
2	Course Title	IoT in Healthcare	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective	
5	Course Objective	The objective of this course is to give an overview of a people-focused view on IoT by providing an outline of the components that may be included in an IoT-based smart health ecosystem and introduced a set of dimensions to consider in smart health applications. This course also discusses many challenges facing the wide spread adoption of smart IoT health care applications.	
6	Course Outcomes	CO1: Outline the elements of IoT-based health care ecosystems. CO2: Explain the different types of applications that utilize IoT in Healthcare CO3: Discuss the IoT that enables the realization of smart ambulance CO4: Assesses the adoption of this model for diagnosis and prognosis of chronic obstructive pulmonary disease. CO5: Elaborate security, privacy and ethical issues in smart sensor health and well-being application CO6: Discuss the integration of the IoT in patient-focused health applications.	
7	Course Description	IoT can automate patient care workflow with the help healthcare mobility solution and other new technologies, and next-gen healthcare facilities. IoT in healthcare enables interoperability, machine-to-machine communication, information exchange, and data movement that makes healthcare service delivery effective.	
8	Outline syllabus		CO Mapping
	Unit 1	**IoT and People in Health Care**	
	A	Introduction to Smart Health Care Ecosystem, The patient at the centre, Health care providers	CO1
	B	Devices and sensors, Applications and Interfaces	CO1
	C	Other Stakeholders: Social Support, Connecting the components	CO1
	Unit 2	**Dimensions of IoT Applications in Health Care**	
	A	Well-being-Illness, Physical, Temporary-Cure, Prevent-Cure, Monitor-Manage , Internal-External Measures, Health Care Provider-Individual Dimensions	CO1, CO2
	B	Examples of IoT Related Health Care Applications and Their Dimensions	CO1, CO2

	C	Challenges, Lack of Standards,Data Issues, Changing the Health Care Provider-Patient Roles	CO1, CO2
	Unit 3	**Internet of Things in Smart Ambulance and Emergency Medicine**	
	A	IoT in Emergency Medicine, Point-of-CareEnvironment	CO3, CO6
	B	Biosensing Network, Hierarchical Cloud Architecture, Weather Observation for Remote Rescue	CO3, CO6
	C	Integration and Compatibility, Operational Consistency and Reliability Assurance, Electronic Patient Record Retrieval in Multihop Communication	CO3, CO6
	Unit 4	**Case Study: Chronic Obstructive Pulmonary Disease**	
	A	On-scene Diagnosis and Prognosis, Data Acquisition and Analytics	CO4, CO6
	B	Decision and Selection Process, Patient and the Ambient Environment, Smart Ambulance Challenges, Reliability	CO4, CO6
	C	Standards, Staff Training and Operating Procedures, Security and Privacy	CO4, CO6
	Unit 5	**Security, Privacy and Ethical Issues**	
	A	Smart Health and well-being Applications Risk Analysis	CO5, CO6
	B	Cyber-Physical-Social Systems, Machine Ethics, Physical Safety	CO5, CO6
	C	Software Quality, IT Security, Privacy, Risk of Technology Misuse	CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	CA: 25% / MSE: 25% / ESE: 50%	
	Text book/s*	1. Internet of Things A to Z Technologies and Applications, Qusay F. Hassan 2. Intelligent Data Sensing and Processing for Health and Well-being Applications, Miguel Antonio Wister Ovando, Pablo Pancardo Garcia, Francisco Diego Acosta Escalante, Jose Adan Hernandez Nolasco	
	Other References		

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Outline the elements of IoT-based health care ecosystems.	PO1, PO2, PO3, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2
2.	CO2: Explain the different types of applications that utilize IoT in Healthcare	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2
3.	CO3: Discuss the IoT that enables the realization of smart ambulance	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2
4.	CO4: Assesses the adoption of this model for diagnosis and prognosis of chronic obstructive pulmonary disease.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2
5.	CO5: Elaborate security, privacy and ethical issues in smart sensor health and well-being application	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2
6.	CO6: Discuss the integration of the IoT in patient-focused health applications.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name IoT in Healthcare (Course Code CSI051)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CSI051 _IoT in Healthcare	CO1	3	2	2	-	2	3	3	2	2	2	2	3	2	2	-
	CO2	3	3	3	2	2	3	3	2	2	3	2	3	2	2	-
	CO3	3	3	3	3	2	3	3	2	3	3	3	3	3	3	-
	CO4	3	3	3	3	2	3	3	2	3	3	3	3	3	3	-
	CO5	3	3	3	3	2	3	3	2	3	3	3	3	3	3	-
	CO6	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	P O 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PSO 3
CSI051	IoT in Healthcare	3.0	2.8	2.8	2.8	2.0	3.0	3.0	2.2	2.7	2.8	2.7	3.0	2.7	2.7	3.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**	
1	Course Code	CSI052	
2	Course Title	Drones in IoT	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective	
5	Course Objective	The objective of this course is to addresses major issues and challenges in drone-based solutions proposed for IoT-enabled cellular/computer networks, routing/communication protocols, surveillances applications, secured data management, and positioning approaches.	
6	Course Outcomes	CO1: Define the concepts of UAV (Unmanned Aerial Vehicle) CO2: Explain the approaches of Drone path planning CO3: Apply the internet of things enabled UAV CO4: Categorize various data routing approaches in dynamic IoT CO5: Elaborate the common attacks and security aspect in UAV CO6: Discuss the issues and challenges of IoT-enabled UAV	
7	Course Description	The Internet of Things (IoT) is a system of inter-connected devices, objects, and organisms. Among these devices, drones are gaining lots of interest. Drones are expected to communicate with cellular networks in the next generation networks (5G and beyond) which opens the door for another exciting research area.	
8	Outline syllabus		CO Mapping
	Unit 1	**Drones in the IoT Era**	
	A	Intelligence in UAVs, Collaborative UAVs in Cloud	CO1
	B	Static Positioning of Drones	CO1
	C	Dynamic Positioning of Drones: Drones Repositioning Schemes	CO1
	Unit 2	**Drones Path Planning**	
	A	Static and Dynamic Approaches	CO1, CO2
	B	System Models: FANET Model, Cost and Communication Models and Power and Lifetime Model	CO1, CO2
	C	Least Cost Path Finder (LCPF) Approach	CO1, CO2
	Unit 3	**IoT-enabled UAVs**	
	A	For Multimedia Delivery: System Model	CO3, CO6
	B	PSO in IIoT	CO3, CO6
	C	Performance Evaluation	CO3, CO6
	Unit 4	**Data Routing in Dynamic IoT**	
	A	IoT System Model: IoT Model, IoT Node, Pricing and Communication Model	CO4, CO6
	B	Adaptive Routing Approach	CO4, CO6
	C	Use Case and Theoretical Analysis	CO4, CO6

	Unit 5	**Security in UAV/Drone**			
	A	PLS for UAV Systems: UAV as a Mobile Relay and Mobile Transmitter BS			CO5, CO6
	B	PLS for UAV Systems: Mobile Jammer, Flying UE			CO5, CO6
	C	Common Attacks in UAV Systems			CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MSE	ESE	
		25%	25%	50%	
	Text book/s*	1. Drones in IoT-enabled Spaces, Fadi Al-Turjman, CRC Press, Taylor & Francis			
	Other References				

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the concepts of UAV (Unmanned Aerial Vehicle)	PO1, PO2, PO3, PO5, PO6, PO7, PO8, PO9, PO10, PO12, PSO1, PSO2
2.	CO2: Explain the approaches of Drone path planning	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO12, PSO1, PSO2
3.	CO3: Apply the internet of things enabled UAV	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
4.	CO4: Categorize various data routing approaches in dynamic IoT	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5.	CO5: Elaborate the common attacks and security aspect in UAV	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2
6.	CO6: Discuss the issues and challenges of IoT-enabled UAV	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Drones in IoT (Course Code CSI052)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CSI052 _Drones in IoT	CO1	3	2	2	-	3	2	2	2	2	2	-	3	2	2	-
	CO2	3	3	3	2	3	3	3	2	2	3	-	3	2	2	-
	CO3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
	CO4	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
	CO5	3	3	3	3	3	3	3	2	3	3	3	3	3	3	-
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PSO 3
CSI052	Drones in IoT	3.0	2.8	2.8	2.8	3.0	2.8	2.8	2.2	2.7	2.8	3.0	3.0	2.7	2.7	2.3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School: SET		**Batch: 2023-27**	
Program: B-TECH		**Current Academic Year: 2023-24**	
Branch: CSE		**CSE with Specialization in Artificial Intelligence for IoT Applications** **Semester: VII**	
1	**Course Code**	**CSA061**	**Course Name: Robotics and Intelligent Systems**
2	**Course Title**	**Robotics and Intelligent Systems**	
3	**Credits**	**3**	
4	**Contact Hours (L-T-P)**	**3-0-0**	
	Course Status	**Specialization Elective**	
5	Course Objective	**Students will try to learn:** 17. Fundamental principles of robot system design and operation. 18. How to apply concepts of translational and rotational motion, and gears to robot construction. 19. To design and program simple autonomous robots. 20. To implement algorithms that enables the use of sensors and actuators to facilitate intelligent behavior, learning and perception.	
6	Course Outcomes	Students will be able to: **CO1:Define** the concept and key components of robotics technologies. **CO2: Classify** various robot sensors and their perception principles that enable a robot to analyze their environment, reason and take appropriate actions toward the given goal. CO3:**Apply** the learned knowledge and skills in practical robotics laboratories and experiments. **CO4: Analyze** problems in spatial coordinate representation and spatial transformation, robot locomotion design, kinematics, motion control, localization and mapping, navigation and path planning. **CO5: Assess** stochastic control and multi agent systems for development of a robotic system. CO6:**Adapt** intelligent system methodology suitable for a given type of real world application problem.	
7	Course Description	Basic concepts of Robotics, Intelligent Systems and transformational modeling. This course provides students with a working knowledge of methods for design and analysis of robotic and intelligent systems. Particular attention is given to modeling dynamic systems, measuring and controlling their behavior, and making decisions about future courses of action	
8	Outline syllabus		CO Mapping

	Unit 1	**Overview and Preliminaries**			
	A	Mobile Robots, Position, and Orientation			CO1
	B	Translational and Rotational Dynamics			CO1, CO2
	C	Flying and Swimming Robots, Articulated Robots			CO1, CO2
	Unit 2	**Transformation**,			
	A	Path Planning, and Trajectories			CO1, CO2
	B	Time Response of Dynamic Systems			CO1, CO2
	C	Dynamic Effects of Feedback Control, Control Systems			CO1, CO2
	Unit 3	**Optimization**			
	A	Sensors and Actuators			CO1, CO2, CO4
	B	Numerical Optimization			CO1, CO2, CO4
	C	Dynamic Optimal Control			CO1, CO2, CO4
	Unit 4	**Formal Logic, Algorithms, and Incompleteness**			
	A	Computers, Computing, and Sets			CO3, CO5
	B	Probability and Statistics			CO3, CO5
	C	Machine Learning, Neural Networks			CO3, CO5
	Unit 5	**Information, Search and Expert Systems**			
	A	State Estimation, Stochastic Control			CO3, CO5, CO6
	B	Parameter Estimation and Adaptive Control			CO3, CO5, CO6
	C	Task Planning and Multi-Agent Systems			CO3, CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	8. http://www.princeton.edu/~stengel/RISVirText.html. 9. J. J. Craig, Introduction to Robotics, Addison Wesley Publishers, 2005, 10. Computational Principles of Mobile Robotics by Gregory Dudek and Michael Jenkin, Second Edition			
	Other References	9. M. Negnevitsky, Artificial Intelligence – A guide to intelligent systems Addison-Wesley, 2005, 10. Bharati A., Sangal R., ChaitanyaV..Natural language processing: a Paninian perspective, PHI, 2000			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO-7. **Define** the concept and key components of robotics technologies.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	CO-8. **Classify** various robot sensors and their perception principles that enable a robot to analyze their environment, reason and take appropriate actions toward the given goal.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	CO-9. **Apply** the learned knowledge and skills in practical robotics laboratories and experiments.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	CO-10. **Analyze** problems in spatial coordinate representation and spatial transformation, robot locomotion design, kinematics, motion control, localization and mapping, navigation and path planning.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	CO-11. **Assess** stochastic control and multi agent systems for development of a robotic system.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	CO-12. Adapt intelligent system methodology suitable for a given type of real world application problem.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Robotics and Intelligent Systems **(Course Code CSA061)**

Course Objectives	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	3	1	1	1	1	2	3	2	3	3	1
CO2	3	3	3	3	3	1	2	1	2	2	3	2	3	3	2
CO3	3	3	3	3	3	2	1	1	2	2	3	3	3	3	3
CO4	3	3	3	3	3	1	1	1	2	2	3	2	3	3	3
CO5	3	3	3	3	3	1	1	1	2	2	3	2	3	3	3
CO6	3	3	3	3	3	2	2	2	3	3	2	2	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA061	Robotics and Intelligent Systems	3.00	3.00	3.00	3.00	3.00	1.33	1.33	1.17	2.00	2.17	0.00	2.17	3.00	3.00	2.50

Total- 33.83
Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School:		**School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B.Tech**		
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**		
1	Course Code	CSI061		
2	Course Title	Industrial IoT: Smart Manufacturing		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Elective		
5	Course Objective	The objective of this course is to introduce numerous concepts related to Industrial IoT, which is concerned with the use of the IoT in an industrial environment.		
6	Course Outcomes	CO1: Define the concepts of IIoT process management and protocols. CO2: Explain the adoption case studies of Industrial IoT and current technologies. CO3: Apply the Business Model Framework for IIoT CO4: List out the concerns and related business models in smart manufacturing. CO5: Elaborate the challenges and Inventory Consolidation for Industrial Logistics. CO6: Discuss the different business operations such as manufacturing, logistics for Industrial IoT smart manufacturing.		
7	Course Description	A number of adoptions of the IoT concepts are visible in all walks of life globally and the number is all set to increase to billions of connected objects before the turn of the decade. This course presents some of the use cases of the IoT in different business facets and processes, focusing more on the manufacturing sector and, hence, there is a distinct coverage of Industrial IoT (IIoT) as well.		
8	Outline syllabus			CO Mapping
	Unit 1	**Industrial IoT Paradigm**		
	A	Industrial IoT, IoT Challenges in Agile Manufacturing, Drivers for IIoT Adoption		CO1
	B	IIoT for Process Management, IIoT Protocols		CO1
	C	Product Development and IoT, Industry 4.0, IIoT, and Related Developments		CO1
	Unit 2	**IIoT Adoption**		
	A	Current Areas of Industrial IoT adoption, Emerging Areas of IoT Adoption		CO1, CO2
	B	IIoT Adoption Case Studies		CO1, CO2
	C	Overview of Current Technologies		CO1, CO2
	Unit 3	**Business Models**		
	A	Business Model Framework, The IoT Business Models		CO3, CO6
	B	The IoT Business Model Based on IT: Freemium, Digital Add-On Enhancements, Razor and Blade		CO3, CO6

		Digital Lock-In, Point of Sales (POS), Direct Selling Business Model or Solution Provider Model using Intelligent Objects Self-Service, Pay Per Use Business Model			
	C	Digitally Charged Products Business Model Data Sale, Challenges			CO3, CO6
	Unit 4	**Smart Manufacturing**			
	A	Manufacturing Concerns			CO4, CO6
	B	Industry 4.0 and Related Models			CO4, CO6
	C	Smart Manufacturing, Smart Manufacturing: Indian Case Study			CO4, CO6
	Unit 5	**Logistics Optimization**			
	A	Introduction, Challenges in Logistics, Logistics Costs, Autonomous Logistics			CO5, CO6
	B	The IoT-Enabled Activity-Based Costing, The IoT and Inventory Consolidation, The IoT and Consigned Inventory			CO5, CO6
	C	Case Study: Industrial Logistics			CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MSE	ESE	
		25%	25%	50%	
	Text book/s*	1. Internet of Things, Approach and Applicability in Manufacturing, Ravi Ramakrishnan, Loveleen Gaur, CRC Press			
	Other References				

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the concepts of IIoT process management and protocols.	PO1, PO2, PO3, PO4, PO6, PO7, PO10, PO12
2.	CO2: Explain the adoption case studies of Industrial IoT and current technologies.	PO1, PO2, PO3, PO4, PO6, PO7, PO11, PO12
3.	CO3: Apply the Business Model Framework for IIoT	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO12, PSO3
4.	CO4: List out the concerns and related business models in smart manufacturing.	PO1, PO2, PO3, PO4, PO6, PO7, PO10, PO11, PO12, PSO3
5.	CO5: Elaborate the challenges and Inventory Consolidation for Industrial Logistics.	PO1, PO2, PO3, PO4, PO6, PO7, PO9, PO10, PO12
6.	CO6: Discuss the different business operations such as manufacturing, logistics for Industrial IoT smart manufacturing.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Industrial IoT: Smart Manufacturing (Course Code CSI061)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CSI061 _Industrial IoT: Smart Manufacturing	CO1	2	2	2	2	-	2	2	-	-	1	-	2	-	-	-
	CO2	2	2	2	3	-	2	2	-	-	-	2	2	-	-	-
	CO3	3	2	2	3	3	2	2	2	-	-	-	2	-	-	2
	CO4	3	2	2	3	-	2	2	-	-	2	2	2	-	-	2
	CO5	3	2	3	3	-	2	2	-	2	2	-	2	-	-	-
	CO6	3	3	3	3	3	2	2	3	2	2	2	3	3	2	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	P O 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PSO 3
CSI061	Industrial IoT: Smart Manufacturing	2.7	2.2	2.3	2.8	3.0	2.0	2.0	2.5	2.0	1.8	2.0	2.2	3.0	2.0	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***

3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**
Department		**Computer Science & Engineering**
Program:		**B.Tech**
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**
1	Course Code	
2	Course Title	Applications of AIoT
3	Credits	1
4	Contact Hours (L-T-P)	1-0-0
	Course Status	Elective
5	Course Objective	The objective of this course to build AIoT projects. By building AIoT projects, the students can understand the basic concepts and will be able to innovate using the basics to create their own AI based IoT applications.
6	Course Outcomes	CO1: Build a simple smart environment system with involved plant sensor devices. CO2: Build a smart AIoT based Waste management system. CO3: Build a simple smart AIoT based e-commerce CO4: Build a simple smart AIoT-based water management and IoT-based smart irrigation system CO5: Build a simple AIoT in healthcare and Agriculture CO6: Build the Artificial Intelligence of Things (AIoT) projects and bring a new degree of interconnectivity to the world.
7	Course Description	Artificial Intelligence of Things (AIoT) is a ground-breaking technology that involves connecting numerous physical devices to the Internet and controlling them. Analyzing data from Internet of Things devices and converting it into something meaningful is currently driving the next level of IoT learning.

8	Outline syllabus		CO Mapping
	Unit 1	**AIoT for smart environments**	
	A	Introduction to AIoT for smart environments	CO1, CO6
	B	Smart retail, Smart office buildings	CO1, CO6
	C	AI implementation and business cases of AIoT, Business case: Tesla's autopilot and Business case: classroom monitoring systems	CO1, CO6
	Unit 2	**AIoT-based waste management systems**	
	A	Introducing IoT-based waste management system	CO1, CO6
	B	Main features of AIoT-based framework for waste management, Working of intelligent bin process	CO1, CO6
	C	Intelligent bin control by using AI	CO1, CO6
	Unit 3	**AIoT-based e-commerce**	
	A	Introducing IoT in e-commerce	CO3, CO6
	B	Applications of IoT in e-commerce: Inventory management	CO3, CO6

	C	Applications of IoT in e-commerce: Smart homes			CO3, CO6
	Unit 4	**AIoT-based water management and IoT-based smart irrigation system**			
	A	Introduction to Smart water management			CO4, CO6
	B	Smart irrigation and Required components			CO4, CO6
	C	Working of G-SM component and Working of RELAY			CO4, CO6
	Unit 5	**AIoT in healthcare and Agriculture**			
	A	IoT architecture, Challenges in IoT, AIoT, UAV			CO5, CO6
	B	Artificial intelligent IoT in healthcare			CO5, CO6
	C	AI in agriculture, Use of wireless and automation systems in agriculture			CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	3. AIoT Technologies and Applications for Smart Environments, Mamoun Alazab, Meenu Gupta, Shakeel Ahmed 4. Intelligent IoT Projects, Agus Kurniawan, Packt Publishing 5. Raspberry Pi IoT Projects, John C. Shovic, Apress			
	Other References	1. Internet of Things (IoT), Systems and Applications, Jamil Y. Khan and Mehmet R. Yuce 2. Internet of Things (IoT), Technologies, Applications, Challenges, and Solutions, B.K. Tripathy and J. Anuradha			
	Add-on Projects	Connecting an IOT Device to a Cloud Server Using IOT for RFID and MQTT Implement CitySense Lite for an Application Building a Solar Powered IOT Weather Station, Data Gathering			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Build a simple smart environment system with involved plant sensor devices.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
2.	CO2: Build a smart AIoT based Waste management system.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
3.	CO3: Build a simple smart AIoT based e-commerce	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
4.	CO4: Build a simple smart AIoT-based water management and IoT-based smart irrigation system	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5.	CO5: Build a simple AIoT in healthcare and Agriculture	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	CO6: Build the Artificial Intelligence of Things (AIoT) projects and bring a new degree of interconnectivity to the world.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Applications of AIoT (Course Code)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
Applications of AIoT	CO1	3	3	2	3	3	3	3	2	3	3	3	3	3	2	2
	CO2	3	3	3	3	3	3	3	2	3	3	3	3	3	2	2
	CO3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
	CO4	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
	CO5	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
	CO6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	P O 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PSO 3
	Applications of AIoT	3.0	3.0	2.8	3.0	3.0	3.0	3.0	2.0	3.0	3.0	3.0	3.0	3.0	2.7	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***

3. Addressed to ***Substantial (High=3) extent***

-

School:		**School of Engineering & Technology**
Department		**Computer Science & Engineering**
Program:		**B.Tech**
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**
1	Course Code	
2	Course Title	Applications of AIoT Lab
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Status	Elective
5	Course Objective	The objective of this course to build AIoT projects. By building AIoT projects, the students can understand the basic concepts and will be able to innovate using the basics to create their own AI based IoT applications.
6	Course Outcomes	CO1: Build a simple smart environment system with involved plant sensor devices. CO2: Build a smart AIoT based Waste management system. CO3: Build a simple smart AIoT based e-commerce CO4: Build a simple smart AIoT-based water management and IoT-based smart irrigation system CO5: Build a simple AIoT in healthcare and Agriculture CO6: Build the Artificial Intelligence of Things (AIoT) projects and bring a new degree of interconnectivity to the world.
7	Course Description	Artificial Intelligence of Things (AIoT) is a ground-breaking technology that involves connecting numerous physical devices to the Internet and controlling them. Analyzing data from Internet of Things devices and Artificial Intelligence and converting it into something meaningful is currently driving the next level of IoT learning.

8	Outline syllabus		CO Mapping
	Unit 1	**AIoT for smart environments**	
	A	Introduction to AIoT for smart environments	CO1, CO6
	B	Smart retail, Smart office buildings	CO1, CO6
	C	AI implementation and business cases of AIoT, Business case: Tesla's autopilot and Business case: classroom monitoring systems	CO1, CO6
	Unit 2	**AIoT-based waste management systems**	
	A	Introducing IoT-based waste management system	CO1, CO6
	B	Main features of AIoT-based framework for waste management, Working of intelligent bin process	CO1, CO6
	C	Intelligent bin control by using AI	CO1, CO6
	Unit 3	**AIoT-based e-commerce**	
	A	Introducing IoT in e-commerce	CO3, CO6
	B	Applications of IoT in e-commerce: Inventory management	CO3, CO6
	C	Applications of IoT in e-commerce: Smart homes	CO3, CO6

	Unit 4	**AIoT-based water management and IoT-based smart irrigation system**			
	A	Introduction to Smart water management			CO4, CO6
	B	Smart irrigation and Required components			CO4, CO6
	C	Working of G-SM component and Working of RELAY			CO4, CO6
	Unit 5	**AIoT in healthcare and Agriculture**			
	A	IoT architecture, Challenges in IoT, AIoT, UAV			CO5, CO6
	B	Artificial intelligent IoT in healthcare			CO5, CO6
	C	AI in agriculture, Use of wireless and automation systems in agriculture			CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		3%	20%	50%	
	Text book/s*	6. AIoT Technologies and Applications for Smart Environments, Mamoun Alazab, Meenu Gupta, Shakeel Ahmed 7. Intelligent IoT Projects, Agus Kurniawan, Packt Publishing 8. Raspberry Pi IoT Projects, John C. Shovic, Apress			
	Other References	3. Internet of Things (IoT), Systems and Applications, Jamil Y. Khan and Mehmet R. Yuce 4. Internet of Things (IoT), Technologies, Applications, Challenges, and Solutions, B.K. Tripathy and J. Anuradha			
	Add-on Projects	Connecting an IOT Device to a Cloud Server Using IOT for RFID and MQTT Implement CitySense Lite for an Application Building a Solar Powered IOT Weather Station, Data Gathering			

PO and PSO mapping with level of strength for Course Name Applications of AIoT Lab (Course Code)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
Applications of AIoT Lab	CO1	3	3	2	3	3	3	3	2	3	3	3	3	3	2	2
	CO2	3	3	3	3	3	3	3	2	3	3	3	3	3	2	2
	CO3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
	CO4	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
	CO5	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
	CO6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	P O 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PSO 3
	Applications of AIoT Lab	3.0	3.0	2.8	3.0	3. 0	3.0	3.0	2.0	3.0	3.0	3.0	3.0	3.0	2.7	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Artificial Intelligence for IoT Applications**	
1	Course Code	CSI021	
2	Course Title	**Sensor-Cloud for Internet of Things**	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Elective	
5	Course Objective	The objective of this course is to address the topic of resource management, virtualization, and green computation within cloud servers. It also covers the emergence and evolution of sensor-cloud directly that facilitates the growth of IoT through its architecture, functionalities, and life cycle.	
6	Course Outcomes	CO1: Recall the history and evolution of Cloud-Computing with different cloud deployment and service models. CO2: Outline the challenges and constraints of sensor network CO3: Explain architecture and virtualization concept for Sensor-Cloud CO4: Analyze the data management concept for Sensor-Cloud CO5: Assess various contributions that enable IoT through Sensor-Cloud CO6: Design and develop small applications based on Sensor-Cloud	
7	Course Description	SensorCloud is an IoT cloud that provides the Platform as a Service (PasS) to gather, visualize, monitor, and analyze the information coming into sensors connected by wire or wirelessly. The course describes the different challenges in realizing IoT in practice and presents the sensor-cloud paradigms.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	History and evolution of Cloud Computing, Classification of Cloud Computing, Cloud Computing Deployment Models, Cloud Computing Service Models	CO1, CO6
	B	Computation in Cloud, Resource Management, Virtualization, Green Computing	CO1, CO6
	C	Cloud Applications	CO1, CO6
	Unit 2	**Sensor Networks and the Cloud**	
	A	Background of Wireless Sensor Networks, Design of a Sensor Node	CO2, CO6
	B	Applications of Sensor Networks, Challenges and Constraints	CO2, CO6
	C	Unification of WSNs with Cloud, The Significance of Cloud Computing, Challenges	CO2
	Unit 3	**Sensor-Cloud Paradigm**	
	A	Sensor-Cloud, Architecture of the Sensor-Cloud	CO3

	B	Sensor Virtualization: Configurations and Characterization of Virtualization			CO3
	C	Sensor-Cloud Applications			CO3
	Unit 4	**Data Flow in the Sensor-Cloud**			
	A	Composition of a Virtual Sensor			CO4
	B	Data Management: Data Caching			CO4
	C	Data Management: Data Transmission			CO4
	Unit 5	**Sensor-Cloud for Internet of Things**			
	A	Scenario and model for Pricing, pH: Pricing Attributed to Hardware and Infrastructure			CO5,CO6
	B	Enabling IoT through Sensor-Cloud, Contributions through Architecture and Functionalities			CO5, CO6
	C	Contributions through the Life Cycle			CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MSE	ESE	
		25%	25%	50%	
	Text book/s*	1. Sensors, Cloud, and Fog: The Enabling Technologies for the Internet of Things, Sudip Misra, Subhadeep Sarkar and Subarna Chatterjee, CRC Press			
	Other References	1. The Internet of Things in the Cloud, A Middleware Perspective, Honbo Zhou, CRC Press 2. The Cloud in IoT-enabled Spaces, Fadi Al-Turjman, CRC Press			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Recall the history and evolution of Cloud-Computing with different cloud deployment and service models.	PO1, PO2, PO4, PO6, PO9, PO12, PSO2
2.	CO2: Outline the challenges and constraints of sensor network	PO1, PO2, PO4, PO6, PO9, PO12, PSO2
3.	CO3: Explain architecture and virtualization concept for Sensor-Cloud	PO1, PO2, PO3, PO4, PO6, PO9, PO10, PO12, PSO2
4.	CO4: Analyze the data management concept for Sensor-Cloud	PO1, PO2, PO3, PO4, PO6, PO7, PO9, PO10, PO12, PSO2
5.	CO5: Assess various contributions that enable IoT through Sensor-Cloud	PO1, PO2, PO3, PO4, PO6, PO7, PO9, PO10, PO11, PO12, PSO2
6.	CO6: Design and develop small applications based on Sensor-Cloud	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Sensor-Cloud for Internet of Things (Course Code CSI021)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CSI021 _Sensor -Cloud for Internet of Things	CO1	2	2	-	2	-	1	-	-	1	-	-	2	-	1	-
	CO2	2	2	-	2	-	1	-	-	1	-	-	2	-	1	-
	CO3	2	1	1	2	-	1	-	-	1	1	-	2	-	2	-
	CO4	2	2	1	2	-	1	2	-	2	1	-	3	-	2	-
	CO5	2	2	2	2	-	1	2	-	2	1	2	3	2	2	-
	CO6	3	3	3	2	3	2	2	2	2	2	2	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PSO 3
CSI021	Sensor-Cloud for Internet of Things	2.2	2.0	1.8	2.0	3.0	1.2	2.0	2.0	1.5	1.3	2.0	2.5	2.5	1.8	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

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B.Tech (CSE) with Specialization in Data Science & Analytics

School:		**School of Engineering & Technology**			
Department		**Computer Science & Engineering**			
Program		**B.Tech.**			
Branch		**CSE**			
1	Course number	**CSD102**			
2	Course Title	**Introduction to Data Science**			
3	Credits	**2**			
4	Contact Hours	2	0	0	
5	Course Objective	To introduce a range of topics and concepts related to the data science process			
6	Course Outcomes	Having successfully completed this module, you will be able to: CO1: Define key concepts in data science, including tools, approaches, and application scenarios CO2: Explain topics in data collection, sampling, quality assessment and repair CO3: Identify topics in statistical analysis and machine learning CO4: Analyze topics in data processing at scale CO5: Determine state-of-the-art tools to build data-science applications for different types of data. CO6: Compile the basics of concept and tools in Data Science to apply on real world data.			
7	Outline syllabus				
7.01	**Unit 1**	**Introduction: What is Data Science?**			
7.02	A	Big Data and Data Science hype; **Datafication**			CO1, CO2
7.03	B	Current Landscape of different perspectives			CO1
7.04	C	Relevant Case Study			CO1, CO2, CO4
7.05	**Unit 2**	**Exploratory Data Analysis and the Data Science Process**			
7.06	A	Philosophy of EDA - The Data Science Process, Basic tools of EDA (plots, graphs and summary statistics etc.)			CO1, CO2, CO3
7.07	B	Data Pre-processing, Data Cleaning, Data Integration, Data Transformation and Data Reduction			CO1, CO2, CO3, CO4
7.08	C	Data Generalization and Summarization Based Characterization			CO2, CO3
7.09	**Unit 3**	**Data Warehousing and Data Mining**			
7.10	A	Introduction to data warehousing, DW Lifecycle, Architecture, Evolution of decision support systems			CO1, CO2, CO3, CO4
7.11	B	Introduction to Data mining, Relation to Statistics. Steps in Data Mining Process, Architecture of a Typical Data Mining System.			CO1, CO3, CO4, CO5
7.12	C	Overview of few Data Mining Techniques, Applications and Social Impacts of Data Mining			CO3, CO4, CO5
7.13	**Unit 4**	**Classification and Prediction**			
7.14	A	Linear Regression, k-Nearest Neighbors (k-NN), k-means			CO1, CO3, CO5
7.15	B	Prediction, Cluster Analysis			CO1, CO3, CO5
7.16	C	Hierarchical Methods			CO1, CO3, CO5
7.17	**Unit 5**	**Data Visualization**			

7.18	A	Basic principles, ideas and tools for data visualization	CO1, CO4, CO5, CO6
7.19	B	Examples of inspiring (industry) projects	CO1, CO4, CO5, CO6
7.20	C	Exercise: create your own visualization of a complex dataset	CO1, CO2, CO4, CO5, CO6
8.1	Text book*	1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly. 2014.	
8.2	Further Readings	1. W. H. Inmon, "Building the Data Warehouse", 3rd edition. 2. Anahory and Murray. Data warehousing in the real world, Pearson Education/Addison Wesley. 3. Margaret Dunham, Data Mining: Introductory and Advanced Topics, Published by Prentice Hall. 4. Jiawei Han, Micheline Kamber, "Data Mining: Concepts and Techniques", Morgan Kaufmann Publishers, 2002. (www.cs.sfu.ca/~han/DMbook.html). 5. Alex Berson, Stephen J. Smith, "Data Warehousing, Data Mining, & OLAP", Tata Mcgraw- Hill, 2004. 6. George M Marakas, Modern Data Warehousing, Mining and Visualization-, Peason Education.	
8.3		Internet as the resource for reference	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:** Key concepts in data science, including tools, approaches, and application scenarios	PO1, PO2, PO3, PO5, PO7, PO12, PSO1
2.	**CO2:** Topics in data collection, sampling, quality assessment and repair	PO1, PO2, PO3, PO5, PO6, PO7, PO8, PO9, PO12, PSO1, PSO2
3.	**CO3:** Topics in statistical analysis and machine learning	PO1, PO2, PO3, PO4, PO5, PO8, PO9, PO12, PSO1, PSO2, PSO3
4.	**CO4:** Topics in data processing at scale	PO1, PO2, PO4, PO5, PO6, PO11, PO12, PSO1, PSO3
5.	**CO5:** State-of-the-art tools to build data-science applications for different types of data.	PO1, PO2, PO5, PO9, PO11, PO12, PSO3
6.	**CO6:** Compile the basics of concept and tools in Data Science to apply on real world data.	PO1, PO2, PO3, PO5, PO9, PO11, PO12, PSO3

PO and PSO mapping with level of strength for Course Name Introduction to Data Science (Course Code CSD 102)

	Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSE	CO1	3	2	3	2	2	----	1	---	1	1	---	----	3	1	1
	CO2	3	1	1	2	2	--	---	3	2	1	1	1	1	1	---
	CO3	2	1	3	2	2	----	1	---	1	1	---	----	3	2	2
	CO4	3	2	2	1	1	--	--	1	3	3	3	2	2	1	3
	CO5	3	2	1	-	2	-	-	-	2	-	3	3	-	-	3
	CO6	3	2	2	-	2	-	-	-	2	-	3	2	-	-	3

School:		**School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program		**B.Tech.**		
Branch		**CSE**		
1	Course number	**CSD201**		
2	Course Title	**Data Collection and Pre-processing**		
3	Credits	**4**		
4	Contact Hours	**3**	**0**	**2**
5				
6	Course Objective	To introduce the concept of data collection and pre-processing that remains less touched as a subject for students.		
7	Course Outcomes (CO)	On successful completion of this module students will be able to: 1. Recall the motivation behind proper process of data collection and pre-processing. 2. Demonstrate the basic understanding of data behaviour using its statistical metrics. 3. Apply the tools and techniques vital to pre-processing of datasets for analysis once collected. 4. Analyse the various apparent and hidden attributes of acquired dataset and utilizing those attributes towards knowledge discovery. 5. Assess the various methodologies of data pre-processing and preparation on basis of their algorithmic complexities and accuracy in the due process. 6. Compile various data pre-processing methodologies with their respective outcomes on the legitimacy of knowledge discovered from acquired data.		
8	Outline syllabus			
	Unit 1	**Data Preparation**		
	A	Motivation behind Data Preparation, Need for preparing data	CO1	
	B	Raw and Processed Data, Components of Tidy Data	CO1	
	C	Various sources of different Data types	CO1	
	Unit 2	**Knowing your data**		
	A	Data attributes, Discrete vs Continuous Data attributes	CO1, CO2	
	B	Statistical description of Data- Central Tendency: Mean, Median, Mode; Data dispersion: Range, Quartile, Variance, SD, Interquartile Range	CO1, CO2	
	C	Data Similarity and Dissimilarity - Data Matrix versus Dissimilarity Matrix, Proximity Measures for Nominal & Binary Attributes, Dissimilarity of Numeric Data: Minkowski Distance; Proximity Measures for Ordinal Attributes, Dissimilarity for Attributes of Mixed Types, Cosine Similarity	CO1, CO2, CO4	
	Unit 3	**Data Pre-processing - Cleaning and Integration**		
	A	Data Pre-processing - Data Quality: Why Pre-process the Data? Major Tasks in Data Pre-processing	CO1, CO2	
	B	Data Cleaning – Finding Missing values, Noisy data, Data cleaning process.	CO3, CO4	
	C	Data Integration - Entity Identification Problem, Redundancy and Correlation Analysis, Tuple Duplication, Data Value Conflict Detection and Resolution	CO3, CO4, CO5	
	Unit 4	**Data Reduction**		
	A	Data Reduction Strategies, Wavelet Transforms, PCA	CO3, CO5	

	B	Attribute subset selection, Regression and Log-Linear Models: Parametric Data Reduction	CO3, CO5, CO6
	C	Histograms, Clustering, Sampling, Data Cube Aggregation	CO3, CO5, CO6
	Unit 5	**Data Transformation and Data Discretization**	
	A	Data Transformation Strategies Overview, Data Transformation by Normalization	CO3, CO5, CO6
	B	Discretization by Binning, Discretization by Histogram Analysis	CO3, CO5, CO6
	C	Discretization by Cluster, Decision Tree, and Correlation Analyses, Concept Hierarchy Generation for Nominal Data	CO3, CO5, CO6
	Weightage Distribution	CA: 25%; MTE: 25%; ETE: 50%	
	Text book*	1. Han Jiawei, Kamber & Pei, Data Mining Concepts & Techniques 3rd Edition, Morgan Kaufman	
	Further Readings	1. M.H. Dunham, Data Mining Introductory and Advanced Topics, Pearson Education. 2. Adriaans, Data Mining, Pearson Education 3. Vikram Pudi; P. Radhakrishnan, "Data Mining", Oxford University Press	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Recall the motivation behind proper process of data collection and pre-processing.	PO1, PO2, PO4, PO6, PO8, PO10, PO11, PO12,
2.	Demonstrate the basic understanding of data behaviour using its statistical metrics.	PO1, PO2, PO3, PO4, PO5, PO10, PO12, PSO1
3.	Apply the tools and techniques vital to pre-processing of datasets for analysis once collected.	PO1, PO2, PO3, PO5, PSO12, PSO2,
4.	Analyse the various apparent and hidden attributes of acquired dataset and utilizing those attributes towards knowledge discovery.	PO3, PO4, PO5, PO9, PSO2, PSO3
5.	Assess the various methodologies of data pre-processing and preparation on basis of their algorithmic complexities and accuracy in the due process.	PO1, PO2, PO4, PO8, PSO1, PSO2, PSO3
6.	Compile various data pre-processing methodologies with their respective outcomes on the legitimacy of knowledge discovered from acquired data.	PO2, PO4, PO8, PO9, PO11, PO12, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Data Collection & Pre0-processing (Course Code CSD201)

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSD201_ Data Collection and Pre-processing	CO1	3	2	-	2	-	2	-	1	-	2	1	3	-	-	-
	CO2	3	2	2	3	2	-	-	-	-	2	-	2	1	-	-
	CO3	2	3	3	2	3	-	-	-	-	-	-	2	-	-	2
	CO4	-	-	3	3	2	-	-	-		-	-	-	-	3	2
	CO5	2	3	-	-	-	-	-	2	-	-	-	-	1	3	2
	CO6	-	2	-	3	-	-	-	2	1	-	1	3	-	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSD 201		2.5	2.4	2.7	2.6	2.3	2	0	1.7	1	2	1	2.5	1	3	2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

<table>
<tr><td colspan="2">School:</td><td colspan="3">School of Engineering & Technology</td></tr>
<tr><td colspan="2">Department</td><td colspan="3">Computer Science & Engineering</td></tr>
<tr><td colspan="2">Program:</td><td colspan="3">B.Tech.</td></tr>
<tr><td colspan="2">Branch:</td><td colspan="3">CSE</td></tr>
<tr><td>1</td><td>Course number</td><td colspan="3">CDP201</td></tr>
<tr><td>2</td><td>Course Title</td><td colspan="3">Data Collection and Pre-processing Lab</td></tr>
<tr><td>3</td><td>Credits</td><td colspan="3">1</td></tr>
<tr><td>4</td><td>Contact Hours (L-T-P)</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>5</td><td>Course Objective</td><td colspan="3">To introduce the concept of data collection and pre-processing using tangible datasets. Students will gain the skills and project-based experience needed for data pre-processing in data analysis careers.</td></tr>
<tr><td>6</td><td>Course Outcomes (CO)</td><td colspan="3">On successful completion of this module students will be able to:
CO1: Recall the motivation behind proper process of data collection and pre-processing.
CO2: Demonstrate the basic understanding of data behaviour using its statistical metrics.
CO3: Apply the tools and techniques vital to pre-processing of datasets for analysis once collected.
CO4: Analyse the various apparent and hidden attributes of acquired dataset and utilizing those attributes towards knowledge discovery.
CO5: Assess the various methodologies of data pre-processing and preparation on basis of their algorithmic complexities and accuracy in the due process.
CO6: Compile various data pre-processing methodologies with their respective outcomes on the legitimacy of knowledge discovered from acquired data.</td></tr>
<tr><td>7</td><td colspan="4">Outline syllabus</td></tr>
<tr><td></td><td></td><td colspan="2">Experiment</td><td>COs</td></tr>
<tr><td></td><td>1.</td><td colspan="2">To determine the differences between raw and processed data with the help of test samples.</td><td>CO1</td></tr>
<tr><td></td><td>2.</td><td colspan="2">To analyse statistical description of a given sample dataset using Central Tendency estimation measures</td><td>CO1, CO2</td></tr>
<tr><td></td><td>3.</td><td colspan="2">To analyse statistical description of a given sample dataset using Data dispersion estimation measures.</td><td>CO1, CO2</td></tr>
<tr><td></td><td>4.</td><td colspan="2">To analyse the effect of a) outliers and b) noisy data in a dataset.</td><td>CO1, CO2</td></tr>
<tr><td></td><td>5.</td><td colspan="2">Creating data matrices and dissimilarity matrices for a given sample dataset.</td><td>CO1, CO2, CO4</td></tr>
<tr><td></td><td>6.</td><td colspan="2">To evaluate numeric data dissimilarity using minkowski distance.</td><td>CO1, CO2, CO4</td></tr>
<tr><td></td><td>7.</td><td colspan="2">To evaluate dissimilarity for attributes of mixed types using Cosine Similarity.</td><td>CO1, CO2, CO4</td></tr>
<tr><td></td><td>8.</td><td colspan="2">To find and replace missing values in a given dataset on contextual basis.</td><td>CO3, CO4</td></tr>
<tr><td></td><td>9.</td><td colspan="2">To analyse entity identification problem, redundancy and correlation analysis on a given sample dataset.</td><td>CO3, CO4, CO5</td></tr>
<tr><td></td><td>10.</td><td colspan="2">To implement wavelet transforms and PCA (principal component analysis) for data reduction.</td><td>CO3, CO5</td></tr>
</table>

	11.	To implement parametric data reduction using Regression models and Log-linear models	CO3, CO5, CO6
	12.	To implement Clustering on a given dataset.	CO3, CO5, CO6
	13.	To implement data transformation using normalization.	CO3, CO5, CO6
	14.	To implement data discretization by binning and histogram analysis	CO3, CO5, CO6
	15.	Discretization by Cluster, Decision Tree, and Correlation Analyses	CO3, CO5, CO6
8.1	Text book*	2. Han Jiawei, Kamber & Pei, Data Mining Concepts & Techniques 3rd Edition, Morgan Kaufman	
8.2	Further Readings	4. M.H. Dunham, Data Mining Introductory and Advanced Topics, Pearson Education. 5. Adriaans, Data Mining, Pearson Education 6. Vikram Pudi; P. Radhakrishnan, "Data Mining", Oxford University Press	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Recall the motivation behind proper process of data collection and pre-processing.	PO1, PO2, PO4, PO6, PO8, PO10, PO11, PO12,
2.	Demonstrate the basic understanding of data behaviour using its statistical metrics.	PO1, PO2, PO3, PO4, PO5, PO10, PO12, PSO1
3.	Apply the tools and techniques vital to pre-processing of datasets for analysis once collected.	PO1, PO2, PO3, PO5, PSO12, PSO2,
4.	Analyse the various apparent and hidden attributes of acquired dataset and utilizing those attributes towards knowledge discovery.	PO3, PO4, PO5, PO9, PSO2, PSO3
5.	Assess the various methodologies of data pre-processing and preparation on basis of their algorithmic complexities and accuracy in the due process.	PO1, PO2, PO4, PO8, PSO1, PSO2, PSO3
6.	Compile various data pre-processing methodologies with their respective outcomes on the legitimacy of knowledge discovered from acquired data.	PO2, PO4, PO8, PO9, PO11, PO12, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Data Collection & Pre0-processing (Course Code CSD201)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CDP201_ Data Collection and Pre-processing LAB	CO 1	3	2	-	2	-	2	-	1	-	2	1	3	-	-	-
	CO 2	3	2	2	3	2	-	-	-	-	2	-	2	1	-	-
	CO 3	2	3	3	2	3	-	-	-	-	-	-	2	-	-	2
	CO 4	-	-	3	3	2	-	-	-		-	-	-	-	3	2
	CO 5	2	3	-	-	-	-	-	2	-	-	-	-	1	3	2
	CO 6	-	2	-	3	-	-	-	2	1	-	1	3	-	3	2

Strength of Correlation

*1. Addressed to **Slight (Low=1) extent***   *2. Addressed to **Moderate (Medium=2) extent***
*3. Addressed to **Substantial (High=3) extent***

School:		**School of Engineering & Technology**		
Department:		**Computer Science & Engineering**		
Program:		**Data Sciences**		
Branch:		**Computer Science & Engineering**		
1	Course Code	CSD202		
2	Course Title	Data Warehouse		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core/Elective/Open Elective		
5	Course Objective	• Make the students understand the utility and importance of data warehouses in general and in context of enterprises. Provide students with an overview of the methodologies used in and approaches used to build data warehouses for enterprises. • Make students gain insights into the challenges and limitations of different data warehouse architectures • Provide the students with implementation of alternatives of data warehouses.		
6	Course Outcomes (must be 6 COs, following verbs given in Bloom's Taxonomy)	CO1: Recall the necessary prerequisites to understand warehousing CO2: Explain the basics of warehouse architecture and component and establish its utility. CO3: Apply the acquired knowledge of warehouses to various avenues of application CO4: Identify the architecture suitable for implementation CO5: Apply the basic and advanced modelling techniques CO6: Integrating and interpreting the data sets and improving effectiveness, efficiency and quality for data analysis.		
7	Course Description	This course introduces advanced aspects of data warehousing encompassing the principles, to analyze the data, identify the problems, and choose the relevant models and algorithms to apply.		

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Data Warehousing**	
	A	The Need for Data Warehousing; Increasing Demand for Strategic Information	CO1
	B	Inability of Past Decision Support Systems, Operational V/s Decision Support System	CO1
	C	Role of Metadata, Classification of Metadata	CO1
	Unit 2	**Data Warehouse Architecture**	
	A	Data warehouse lifecycle, Top down vs Bottom Up approach, Data Warehouse vs Data Marts, OLAP vs OLTP	CO2

	B	Different Types of Architecture, Centralized data warehouse, Independent data marts, Federated, Hub and spoke, Data Mart Bus			CO2
	C	Data Extraction, Transformation and Loading (ETL)			CO2
	Unit 3	**Data Warehouse Modeling**			
	A	Introduction to data cube, drill down, roll up, slice and dice			CO3
	B	ER vs Dimensional Modeling, Dimension Modelling: Star Schema			CO3
	C	Snowflake and fact constellation schema, fact less tables.			CO3
	Unit 4	**Dimensional Modeling Advance topics**			
	A	Slowly changing dimensions: Type 1, Type 2, Type 3 changes, Junk dimensions, large dimensions			CO4, CO5
	B	Modeling: Descriptive attributes, cross dimensional attributes, convergence, shared hierarchies, incomplete hierarchies, recursive hierarchies			CO4, CO5
	C	Aggregation-additive, non-additive, convergence,			CO4, CO5
	Unit 5	**Index for data warehouse**			
	A	B+ tree index, Bitmap index, Projection Index			CO5, CO6
	B	Join and Star index, spatial index			CO5, CO6
	C	Optimizers, index dimension table, physical design elements			CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*				
	Other References				

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Recall the necessary prerequisites to understand warehousing	PO1, PO2, PO4, PO6, PO8, PO10, PO11, PO12,
2.	Explain the basics of warehouse architecture and component and establish its utility.	PO1, PO2, PO3, PO4, PO5, PO10, PO12, PSO1
3.	Apply the acquired knowledge of warehouses to various avenues of application	PO1, PO2, PO3, PO5, PSO12, PSO2,
4.	Identify the architecture suitable for implementation	PO3, PO4, PO5, PO9, PSO2, PSO3
5.	Apply the basic and advanced modeling techniques	PO1, PO2, PO4, PO8, PSO1, PSO2, PSO3
6.	Integrating and interpreting the data sets and improving effectiveness, efficiency and quality for data analysis.	PO2, PO4, PO8, PO9, PO11, PO12, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Data Warehouse (Course Code CSD202)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO 3
Data Warehouse CSD202	**CO1**	3	2	-	2	-	2	2	1	-	2	1	3	-	-	-
	CO2	3	2	2	3	2	-	-	-	1	2	-	2	1	-	-
	CO3	2	3	3	2	3	-	1	-	-	-	-	2	-	-	2
	CO4	-	-	3	3	2	-	-	-	2	-	-	-	-	3	2
	CO5	2	3	-	-	-	-	1	2	-	-	-	-	1	3	2
	CO6	-	2	-	3	-	-	-	2	1	-	1	3	-	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B.Tech.**		
Branch:		**CSE**		
1	Course Code	CSD301		
2	Course Title	Data Mining		
3	Credits	3		
4	Contact Hours (L-T-P)	2	0	2
	Course Status	Core /Elective/Open Elective		
5	Course Objective	1. Provide students with an overview of the methodologies and approaches to data mining. 2. Gain insight into the challenges and limitations of different data mining techniques. 3. Provide the students with practice on applying data mining solutions. 4. Prepare students for research in the area of data mining and related applications.		
6	Course Outcomes (must be 6 COs, following verbs given in Bloom's Taxonomy)	**CO1:** To Recall the basic data analysis process flow and data pre-processing techniques **CO2:** To Explain the interpretation, integration and preparation of data sets towards improving effectiveness, efficiency and quality for data analysis. **CO3:** To Apply the mining of datasets towards knowledge discovery from real world tangible scenarios **CO4:** To Analyse different data mining and knowledge discovery processes over a variety of real-word application areas **CO5:** To Compare and contrast and determine the data mining algorithms fit for an open variety of real-world, tangible data source **CO6:** To Adapt the acquired data mining methodologies towards societal, scientific and financially relevant outcomes.		
7	Course Description	This course introduces advanced aspects of data warehousing and data mining, encompassing the principles, to analyze the data, identify the problems, and choose the relevant models and algorithms to apply.		
8	Outline syllabus			CO Mapping
	Unit 1	**Introduction to Data Mining**		
	A	Evolution of the data mining process, revision of introductory concepts, Knowledge Discovery Process		CO1, CO2
	B	Central Tendency, Box Plots, introduction to Data Mining Techniques.		CO1
	C	Introduction to outliers, Effect of outliers on analysis outcome, handling the outliers		CO1
	Unit 2	**Data Pre-processing**		

	A	Descriptive Data Summarization, Data Cleaning			CO1, CO2
	B	Data Integration and Transformation			CO1, CO2
	C	Data Reduction, Discretization and Concept Hierarchy Generation.			CO1, CO2
	Unit 3	**Frequent Pattern Mining**			
	A	Efficient and Scalable Frequent Itemset Mining Methods: A-priori Algorithm, Naïve Algorithm			CO3, CO4, CO5
	B	FPGrowth, ECLATS			CO3, CO5
	C	Correlation Analysis, regression analysis			CO3, CO4, CO5
	Unit 4	**Classification & Prediction**			
	A	What is classification, requirements of classification, Decision Tree-ID3 Algorithm			CO3, CO4, CO5
	B	Naive Bayes Classifier, Rule Based Classification, Backpropagation			CO4
	C	Support Vector Machine for linearly separable data. Prediction: - Linear Regression, Model Evaluation Techniques			CO4, CO5
	Unit 5	**Clustering & Data Mining Applications**			
	A	Requirements of cluster analysis, Partitioning methods-k-means and k-mediods, Hierarchical Methods-Agglomerative and divisive, Density based methods- DBSCAN			CO4, CO5
	B	Data Mining for: Financial Data Analysis, Intrusion Detection and Prevention, Retail and Telecommunication Industries, Science & Engineering, Recommender Systems			CO5, CO6
	C	DM for Privacy, Security, and Social Impacts of Data Mining, Data Mining Trends			CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. J. Han, M. Kamber, J. Pei "Data Mining Concepts and Techniques", Edition:3, Morgan Kaufmann			
	Other References	1. M.H. Dunham, Data Mining Introductory and Advanced Topics, Pearson Education. 2. Adriaans, Data Mining, Pearson Education 3. Vikram Pudi & P. Radhakrishnan, "Data Mining", Oxford University Press			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: To Recall the basic data analysis process flow and data pre-processing techniques	PO1, PO2, PO4, PO6, PO8, PO10, PO11, PO12,
2.	CO2: To Explain the interpretation, integration and preparation of data sets towards improving effectiveness, efficiency and quality for data analysis.	PO1, PO2, PO3, PO4, PO5, PO10, PO12, PSO1
3.	CO3: To Apply the mining of datasets towards knowledge discovery from real world tangible scenarios	PO1, PO2, PO3, PO5, PSO12, PSO2,
4.	CO4: To Analyse different data mining and knowledge discovery processes over a variety of real-word application areas	PO3, PO4, PO5, PO9, PSO2, PSO3
5.	CO5: To Compare and contrast and determine the data mining algorithms fit for an open variety of real-world, tangible data source	PO1, PO2, PO4, PO8, PSO1, PSO2, PSO3
6.	CO6: To Adapt the acquired data mining methodologies towards societal, scientific and financially relevant outcomes.	PO2, PO4, PO8, PO9, PO11, PO12, PSO2, PSO3

PO and PSO mapping with level of strength for Data Mining (CSD301)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
Data Mining (CSD 301)	CO1	3	2	-	2	-	2	2	1	-	2	1	3	-	-	-
	CO2	3	2	2	3	2	-	-	-	1	2	-	2	1	-	-
	CO3	2	3	3	2	3	-	1	-	-	-	-	2	-	-	2
	CO4	-	-	3	3	2	-	-	-	2	-	-	-	-	3	2
	CO5	2	3	-	-	-	-	1	2	-	-	-	-	1	3	2
	CO6	-	2	-	3	-	-	-	2	1	-	1	3	-	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	P O 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PSO 3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B.Tech.**		
Branch:		**CSE**		
1	Course Code	CSD301		
2	Course Title	Data Mining LAB		
3	Credits	1		
4	Contact Hours (L-T-P)	0	0	2
	Course Status	Core /Elective/Open Elective		
5	Course Objective	1.Provide students with an overview of the methodologies and approaches to data mining. 2. Gain insight into the challenges and limitations of different data mining techniques. 3. Provide the students with practice on applying data mining solutions. 4. Prepare students for research in the area of data mining and related applications.		
6	Course Outcomes (must be 6 COs, following verbs given in Bloom's Taxonomy)	**CO1:** To Recall the basic data analysis process flow and data pre-processing techniques **CO2:** To Explain the interpretation, integration and preparation of data sets towards improving effectiveness, efficiency and quality for data analysis. **CO3:** To Apply the mining of datasets towards knowledge discovery from real world tangible scenarios **CO4:** To Analyse different data mining and knowledge discovery processes over a variety of real-word application areas **CO5:** To Compare and contrast and determine the data mining algorithms fit for an open variety of real-world, tangible data source **CO6:** To Adapt the acquired data mining methodologies towards societal, scientific and financially relevant outcomes.		
7	Course Description	This course introduces advanced aspects of data warehousing and data mining, encompassing the principles, to analyze the data, identify the problems, and choose the relevant models and algorithms to apply.		
8	Outline syllabus			
	1	Analyzing statistical description of given dataset central tendency measures.	CO1, CO2	
	2	Analyzing statistical description of given dataset using data dispersion estimation measures.	CO1, CO2	
	3	Analyze the effects of outliers on the analysis outcome. Differences in the outcomes.	CO1, CO2	
	4	Analyze the dataset for missing values, noisy data values in the given dataset.	CO1, CO2	

	5	Demonstrate frequent itemset pattern mining using Naïve algorithm from retail dataset.			CO3
	6	Demonstrate frequent itemset pattern mining using the A-priori algorithm from retail dataset.			CO3
	7	Demonstrate frequent itemset pattern mining from the given dataset using FP growth algorithm.			CO3
	8	Demonstrate association rule mining in a given dataset using the ECLAT algorithm. Compare the results with A-priori.			CO3, CO4
	9	Demonstrate correlation analysis, regression analysis for a bivariate to multivariate dataset.			CO3, CO4
	10	Demonstrate decision tree-based classification of a given dataset using the ID3 algorithm.			CO3, CO4
	11	Demonstrate the use Naive Bayes Classifier for a given dataset classification.			CO5
	12	Demonstrate the use of SVMs for linearly separable dataset.			CO5
	13	Demonstrate the prediction using Linear regression on a given dataset.			CO5
	14	Demonstrate the use of density based clustering methods using DBSCAN.			CO5
	15	Case Study: Retail and Telecommunication Industry data analysis for patterns and relatable outcomes.			CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	2. J. Han, M. Kamber, J. Pei "Data Mining Concepts and Techniques", Edition:3, Morgan Kaufmann			
	Other References	4. M.H. Dunham, Data Mining Introductory and Advanced Topics, Pearson Education. 5. Adriaans, Data Mining, Pearson Education 6. Vikram Pudi & P. Radhakrishnan, "Data Mining", Oxford University Press			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: To Recall the basic data analysis process flow and data pre-processing techniques	PO1, PO2, PO4, PO6, PO8, PO10, PO11, PO12,
2.	CO2: To Explain the interpretation, integration and preparation of data sets towards improving effectiveness, efficiency and quality for data analysis.	PO1, PO2, PO3, PO4, PO5, PO10, PO12, PSO1
3.	CO3: To Apply the mining of datasets towards knowledge discovery from real world tangible scenarios	PO1, PO2, PO3, PO5, PSO12, PSO2,
4.	CO4: To Analyse different data mining and knowledge discovery processes over a variety of real-word application areas	PO3, PO4, PO5, PO9, PSO2, PSO3
5.	CO5: To Compare and contrast and determine the data mining algorithms fit for an open variety of real-world, tangible data source	PO1, PO2, PO4, PO8, PSO1, PSO2, PSO3
6.	CO6: To Adapt the acquired data mining methodologies towards societal, scientific and financially relevant outcomes.	PO2, PO4, PO8, PO9, PO11, PO12, PSO2, PSO3

PO and PSO mapping with level of strength for Data Mining (CSD301)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
Data Mining LAB (CDP 301)	CO1	3	2	-	2	-	2	2	1	-	2	1	3	-	-	-
	CO2	3	2	2	3	2	-	-	-	1	2	-	2	1	-	-
	CO3	2	3	3	2	3	-	1	-	-	-	-	2	-	-	2
	CO4	-	-	3	3	2	-	-	-	2	-	-	-	-	3	2
	CO5	2	3	-	-	-	-	1	2	-	-	-	-	1	3	2
	CO6	-	2	-	3	-	-	-	2	1	-	1	3	-	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**			
Department		**Computer Science & Engineering**			
Program:		**B.Tech. DS**			
Branch:		**CSE**			
1	Course Code				
2	Course Title	Data Exploration and Visualization			
3	Credits	3			
4	Contact Hours (L-T-P)	2	0	2	
	Course Status	Core /Elective/Open Elective			
5	Course Objective	• To understand what is in a dataset and the characteristics of the data • To design and create data visualizations based on data available and tasks to be achieved. • To evaluate the effectiveness of visualization designs, and think critically about each design decision, such as choice of color and choice of visual encoding. • Students will create their own data visualizations, and learn to use Open Source data visualization tools, especially D3.js.			
6	Course Outcomes (must be 6 COs, following verbs given in Bloom's Taxonomy)	CO1: Design an approach to leverage data using the steps in the machine learning process. CO2: Design and create data visualizations. CO3: Craft visual presentations of data for effective communication. CO4: Design and evaluate color palettes for visualization based on principles of perception. CO5: Apply data transformations such as aggregation and filtering for visualization. CO6: Use JavaScript with D3.js to develop interactive visualizations for the Web.			
7	Course Description	This course uses ecological datasets to discuss data exploration and visualization tools. It also explain how to visualize the results of statistical models. The course also includes the JavaScript with D3.js needed to construct, visualize, and explore the main features of the data step by step.			
8	Outline syllabus				CO Mapping
	Unit 1	**INTRODUCTION**			
	A	Introduction to data exploration, Data Terminology,			CO1
	B	Data Exploration through summary statistics, Exploring data with KNIME plots, Data Exploration in Spark			CO 2, CO3
	C	Classification Techniques, Clustering Techniques, Regression Methods,			CO 1, CO2
	Unit 2	**OVERVIEW OF DATA VISUALIZATION, INTRODUCTION TO WEB TECHNOLOGIES**			

	A	Why Visualize Data?, Introduction to SVG and CSS, Introduction to JavaScript, Introduction to VizHub, Making a Face with D3.js	CO3
	B	Input for Visualization: Data and Tasks, Loading and Parsing Data with D3.js	CO2. CO3, CO4
	C	Encoding Data with Marks and Channels, Rendering Marks and Channels with D3.js and SVG, Introduction to D3 Scales, Creating a Scatter Plot with D3.js	CO3, CO4
	Unit 3	**DATA MANAGEMENT ISSUES**	
	A	Integrity and Quality of Data - Data type issues, Exploratory data analysis, simple viz.	CO1, CO4,CO5
	B	Handling missing data, Handling outliers, Attribute creation, modification conversion: categorical – numeric.	CO4, CO5
	C	Understanding and naming the attributes and files, Replicability	CO3, CO4
	Unit 4	**VISUALIZATION OF SPATIAL DATA, NETWORKS, AND TREES**	
	A	Reusable Dynamic Components using the General Update Pattern:-Reusable Scatter Plot Common Visualization Idioms with D3.js:- Bar Chart, Vertical & Horizontal, Pie Chart and Coxcomb Plot, Line Chart, Area Chart	CO2, CO3
	B	Making Maps, Visualizing Trees and Networks	CO3, CO4
	C	Encoding Data using Color, Encoding Data using Size, Stacked & Grouped Bar Chart, Stacked Area Chart & Streamgraph, Line Chart with Multiple Lines	CO4, CO5
	Unit 5	**INTERACTION TECHNIQUES**	
	A	Adding interaction with Unidirectional Data Flow, Using UI elements to control a scatter plot, Panning and Zooming on a Globe, Adding tooltips	CO1,CO2, CO3, CO5
	B	Small Multiples, Linked Highlighting with Brushing, Linked Navigation: Bird's Eye Map	CO4, CO5, CO6
	C	Case Study: Covid19 Dashboard by joining interactive techniques and spatial data networks and trees	CO4, CO5, CO6
	Mode of examination		
	Weightage Distribution	CA: 25% · MTE: 25% · ETE: 50%	
	Text book/s*	1. Advanced Methods of Data Exploration and Modelling by Brian Everitt, Graham Dunn 2. Interactive Data Visualization for the Web by Scott Murray 2nd Edition (2017)	
	Other References	1. Visualizing Data: Exploring and Explaining Data with the Processing Environment by Ben Fry 2. Visualization Analysis and Design by Tamara Munzner	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Design an approach to leverage data using the steps in the machine learning process.	PO 1, PO2
2.	CO2: Design and create data visualizations	PO1, PSO2, PSO3
3.	CO3: Craft visual presentations of data for effective communication.	PO1, PO2, PO3, PSO2
4.	CO4: Design and evaluate color palettes for visualization based on principles of perception.	PO4, PO5, PO6
5.	CO5: Apply data transformations such as aggregation and filtering for visualization.	PO1, PO2, PSO2,PSO3
6.	CO6: Use JavaScript with D3.js to develop interactive visualizations for the Web.	PO2, PO3, PO5, PSO2, PSO3

PO and PSO mapping with level of strength for Data Exploration and Visualization

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Data Exploration and Visualization	CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
	CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	3	2
	CO3	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
	CO4	-	-	-	3	2	3	-	-	-	-	-	-	-	-	-
	CO5	2	3	-	-	-	-	-	-	-	-	-	-	-	2	3
	CO6	-	2	3	-	3	-	-	-	-	-	-	-	-	3	2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B. Tech**		
Branch:		**CSE with Specialization in DS**		
1	Course Code	**CSD303**		
2	Course Title	**Big Data Analytics**		
3	Credits	3		
4	Contact Hours	2	0	2
	Course Status	Core		
5	Course Objective	Students should be able to learn about analytics techniques to handle the big data through Hadoop framework.		
6	Course Outcomes (CO) (Max of 4)	On successful completion of this module students will be able to: 1. Explore the fundamental concepts of Big Data analysis 2. Identify and successfully apply appropriate techniques and tools to solve actual Big Data problems (derive value from vast data sets) 3. Examine the distributed and parallel computing and its application for big data analysis 4. Analyse how to deal with huge amount of data and propose scalable solutions 5. Evaluate statistical packages and deriving intelligence from unstructured information 6. Compile and contrast among different big data analytics tools and how they can help solving Industry challenges		
7	**Prerequisite**	Knowledge of DBMS, Data Mining is essential		
8	**Course Contents**			
	Unit A	**Introduction to Big Data**		
	Unit A Topic 1	Introduction to Big Data, challenges of conventional systems	CO1	
	Unit A Topic 2	Evolution of analytic scalability	CO1	
	Unit A Topic 3	Modern data analytic tools	CO1, CO2	
	Unit B	**Modelling techniques**		
	Unit B Topic 1	Mining frequent itemsets, Apriori algorithm, Handling large data sets in main memory	CO1, CO2	
	Unit B Topic 2	Clustering techniques, clustering for parallelism	CO2	
	Unit B Topic 3	Classification and Prediction: Decision Tree induction, Developing models using Decision Tree Algorithms	CO2	
	Unit C	**Frameworks**		
	Unit C Topic 1	Overview of Hadoop, Hadoop Distributed File System, HDFS design and architecture	CO2, CO3	
	Unit C Topic 2	Hadoop Map reduce Framework, HBASE	CO2, CO3, CO4	
	Unit C Topic 3	Interacting HDFS using HIVE, sample programs in HIVE-PIG	CO2, CO3, CO4	
	Unit D	**Data Analysis and mining data streams**		
	Unit D Topic 1	Regression modelling, Rule Induction	CO5	
	Unit D Topic 2	Fuzzy decision trees and neural networks	CO5	
	Unit D Topic 3	Introduction to streams concepts, Real time analytics platform, case studies	CO4, CO5, CO6	

	Unit E	**Visualization**	
	Unit E Topic 1	Visual data analysis techniques, Interaction techniques	CO5
	Unit E Topic 2	Analytics using statistical packages, association intelligence from unstructured information	CO4, CO5
	Unit E Topic 3	Text analytics, industry challenges and application of analytics	CO4, CO6

9	**Course Evaluation**			
		Continuous Assessment	Mid-Term Examination	End-Term Examination
	Attendance	Mandatory	Mandatory	75%
	Assignment	Yes	--	--
	Quizzes	yes	--	--
	Projects	Yes	--	--
	Presentations	Yes	--	--
	Exam	--	Yes	Yes
	Total Marks	30	30	40

10	**Reading Content**	
	Text book*	1. Bill Franks, "Taming the big data tidal wave: finding opportunities in huge data streams with advanced analytics", John Wiley & Sons,2012
	Other references	1. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press,2012 2. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer 2007 3. Jiwaei Han, Micheline Kamber, "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Explore the fundamental concepts of Big Data analysis	PO1, PO6, PO7, PO9, PO10, PO12
2.	Identify and successfully apply appropriate techniques and tools to solve actual Big Data problems (derive value from vast data sets)	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO12, PSO2
3.	Examine the distributed and parallel computing and its application for big data analysis	PO3, PO4, PO5, PO8, PO9, PSO1, PSO2
4.	Analyse how to deal with huge amount of data and propose scalable solutions	PO2, PO3, PO4, PO5, PO6, PO7, PO10, PO11, PSO2, PSO3
5.	Evaluate statistical packages and deriving intelligence from unstructured information	PO3, PO4, PO5, PO11, PO12, PSO1, PSO2
6.	Compile and contrast among different big data analytics tools and how they can help solving Industry challenges	PO4, PO5, PO6, PO7, PO8, PO11, PO12, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name Introduction to Artificial Intelligence & Machine Learning **(Course Code** CSD-303**)**

Course Code_ Course Name	**CO's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CSD303_Big Data Analytics	**CO1**	3	2	-	-	-	1	1	-	2	2	-	3	-	-	-
	CO2	2	2	3	3	2	2	-	2	-	-	-	2	-	3	-
	CO3	-	-	3	3	2	-	-	2	3	-	-	-	2	3	-
	CO4	-	2	3	2	2	2	2	-	-	2	2	-	-	3	2
	CO5	-	-	3	2	2	-	-	-	-	-	2	2	2	3	-
	CO6	-	-	-	2	3	2	1	2	-	-	2	2	2	3	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**

Total 28

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B.Tech.**		
Branch:		**CSE**		
1	Course Code	**New Code (major changes)**		
2	Course Title	**Business Intelligence**		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core /Elective/Open Elective		
5	Course Objective	In this course, students are intended to have gained an understanding of how business professionals can use analytics techniques to formulate and solve relevant problems and how we can use analytics to support decision making. We will learn the principles of developing, reporting, and analyzing business data. In support of these activities selected analysis tools and methods will be utilized.		
6	Course Outcomes (must be 6 COs, following verbs given in Bloom's Taxonomy)	CO1. Define and recall the importance of data in business by introducing Intelligence in business strategies. CO2. Explain the process of data analytics and recognize the best practices for data mining and pitfalls of managing data analytics projects. Show how data can improve business performance and inform decisions for managing business application areas. CO3. Identify the detailed account of and discuss fundamental concepts, theories, methods and models within Business Intelligence and Data Warehousing CO4. Analyzing business intelligence using different categorization of operations such as extraction, cleansing, integrating, visualizing, and reporting to identify the functionalities of BI Life Cycle CO5. Evaluate the impact of DM and DW and identify the Issues and challenges.in managing capabilities and cost in Business by decision analysis and decision processes. CO6. Adapt the basics and learnings available to Build the relationship of data in production and operational systems for data Intelligence using BI.		
7	Course Description	After finishing the course the student will be able describe and comprehend all the concepts related with Business Intelligence, how to manage the internal and external information in order to make the best decisions for the purpose of giving the best service, and obtain a good profitability.		
8	Outline syllabus			CO Mapping
	Unit 1	**Introduction to BI**		

	A	Introduction, Definition, History and Evolution, BI Segments, Difference between Information and Intelligence, Defining BI Value Chain, Factors of BI System, Real time BI, BI Applications	CO1
	B	BI Essentials: Introduction, Creating BI Environment, BI Landscape, Types of BI, BI Platform, Dynamic roles in BI, Roles of BI in Modern Business	CO1
	C	BI Types: Introduction, Multiplicity of BI Tools, Types of BI Tools, Modern BI, the Enterprise BI, Information Workers	CO1
	Unit 2	**Data Mining (DM) Tools and Techniques**	
	A	Architecture of the Data: Introduction, Types of Data and Models (Enterprise Data, Enterprise Subject Area, Enterprise Conceptual, Enterprise Conceptual Entity), Granularity of data, Reporting and Query Tools, Data Partitioning, Metadata, TDQM.	CO2
	B	Introduction to DM, Definition, Mining parameters, How DM works? Types of relationships, Architecture of DM, Functionalities of DM, Classification on DM System, Various risks in DM, Advantages and disadvantages of DM,	CO2, CO6
	C	DM Techniques, Statistical Perspective on DM, Statistics-need, Similarity Measures, Decision Tree-Illustrations, Neural Network, Neural Network versus Conventional Computers, Genetic Algorithms, Applications of Genetic Algorithm	CO2, CO6
	Unit 3	**Data Warehouse (DW) and Knowledge Management (KM)**	
	A	Introduction to DW, Advantages and Disadvantages of DW, Data Mart, Aspects of Data Mart, Online Analytical Processing, Characteristics of OLAP, OLAP Data Modeling, Difference between OLAP and OLTP, Multidimensional Data Model, Data Modeling using Schema	CO3, CO6
	B	Different Ways of DW, Types of Business Models, B2B BI Model and Its Types, Electronic Data Interchange & E-Commerce Models, Advantages of E-Commerce for B2B, Systems for Improving B2B E-Commerce, B2C BI Model and its Need	CO3, CO6
	C	Introduction of KM, Characteristics, Knowledge Assets, Generic KM Process, KM Technologies, Essentials of KM Process	CO3, CO6
	Unit 4	**Data Extraction (DE) and BI Life Cycle (BILC)**	
	A	Introduction to DE, Role of ETL process, Importance of Source Identification, Various DE techniques, Logical and Physical extraction methods, Change data capture	CO4
	B	Introduction of BILC, Enterprise Performance Life Cycle (EPLC) Framework Elements, Life Cycle Phases, Human	CO4, CO6

		Factors in BI Implementation, BI Strategy and Objectives, BI Development Stages, Steps			
	C	BI User Model, Evolution of BI, Content Management System, End User Segmentation, Basic Reporting and Querying, Online Analytical Processing, OLAP Techniques and Applications, Applying the OLAP to Data Warehousing, Future of Business Intelligence			CO4, CO6
	Unit 5	**BI Issues and Challenges**			
	A	Critical Challenges for BI success, Cross-Organizational Partnership, Business Sponsors, Dedicated Business Representation, BI App Development methodology, Data Standardization, Business Profitability			CO5
	B	BI Strategy and Planning to implement BI Solution, Understand Limitations of BI, BI Usage, TCO, Managing the TCO of the BI, Factors that Affect TCO			CO5, CO6
	C	Implementation of BI, BI Platform, BI Platform Capability Matrix, BI Target Databases, Data Mart, BI Products and Vendor, The Big Four BI vendors			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Business Intelligence: A Managerial Approach (2014) Turban, Sharda, Delen, King, Publisher: Prentice Hall, Edition: 2nd, ISBN: 13-978-0-136-10066-9 2. Turban, Efraim, Ramesh Sharda, and Dursun Delen. Business intelligence and analytics: systems for decision support. Pearson Higher Ed, 2014. 3. Jiawei Han, Micheline Kamber, Jian Pei, Data Mining Concepts and Techniques, Third Edition			
	Other References	1. Turban, Efraim, Ramesh Sharda, and Dursun Delen. "Decision support and business intelligence systems (required)." Google Scholar (2010). 2. Chen, Hsinchun, Roger HL Chiang, and Veda C. Storey. "Business intelligence and analytics: From big data to big impact." MIS quarterly 36.4 (2012). 3. Business Intelligence Guidebook: From Data In… (Kindle Edition)by Sherman, Rick 4. Business Intelligence For Dummies (Kindle Edition)by Scheps, Swain 5. Berry, M. y Linoff, G. (2004). Data Mining Techniques. For Marketing, Sales and Customer Relationship Management. Indianapolis: Wiley Publishing Inc			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Define and recall the importance of data in business by introducing Intelligence in business strategies.	PO1, PO2, PO3, PO4,, PO9, PO11, PSO2
2.	Learn and Explain the best practices for data mining and pitfalls of managing data analytics projects. Show how data can improve business performance.	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO10, PO11, PSO1, PSO2, PSO3
3.	Identify and Use the tools to develop, implement and administrate wide range of BI artifacts	PO1, PO2, PO3, PO4, PO5, PO9, PO10, PSO1, PSO2, PSO3
4.	Analyze various modeling techniques and apply business intelligence methods to various situations	PO1, PO2, PO3, PO4, PO5, PO6, PO11, PO12, PSO1, PSO2, PSO3
5.	Evaluate the impact of DM and DW and identify the issues and challenges.in managing capabilities and cost in Business by decision analysis and decision processes.	PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO10, PO11, PSO2, PSO3
6.	Adapt the basics and learnings available to build the relationship of data in production and operational systems for data Intelligence using BI	PO1, PO2, PO3, PO4, PO5, PO6, PO9, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name xxxx (Course Code yyyy)

	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSD 401	**CO1**	3	2	2	1	1	1	1	1	1	1	1	1	2	3	2
	CO2	2	3	2	2	2	2	3	3	1	1	3	2	2	2	3
	CO3	2	3	3	2	3	3	3	1	2	2	2	1	3	2	3
	CO4	3	3	3	3	3	2	3	1	2	2	2	2	3	3	2
	CO5	2	2	2	3	2	3	3	2	1	3	2	1	2	2	3
	CO6	3	1	2	2	2	3	2	1	1	3	2	3	2	2	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	P O 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PSO 3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

<table>
<tr><td colspan="2">School</td><td colspan="3">School of Engineering & Tech</td></tr>
<tr><td colspan="2">Program</td><td colspan="3">B.Tech.</td></tr>
<tr><td colspan="2">Branch</td><td colspan="3">CSE DS</td></tr>
<tr><td>1</td><td>Course Code</td><td colspan="3">CSD021</td></tr>
<tr><td>2</td><td>Course Title</td><td colspan="3">Business Process Management</td></tr>
<tr><td>3</td><td>Credits</td><td colspan="3">3</td></tr>
<tr><td>4</td><td>Contact Hours (L-T-P)</td><td>3</td><td>0</td><td>0</td></tr>
<tr><td></td><td>Course Status</td><td colspan="3">UG</td></tr>
<tr><td>5</td><td>Course Objective</td><td colspan="3">Business Process Management course focuses on the essential skills business people require to analyze and redesign their processes</td></tr>
<tr><td>6</td><td>Course Outcomes</td><td colspan="3">After the successful completion of this course, students will be able to:
CO1: Understand Process Designer and its objectives
CO2: Understand Process Modeling and its relation to BPM
CO3: Perform translation of workflow steps into business process activities
CO4: Design complex process applications
CO5: Create dashboards and reports
CO6: Compile the tools on the basis of their performance in a said business process setup</td></tr>
<tr><td>7</td><td>Course Description</td><td colspan="3">Business Process Management (BPM) is a management discipline concerned with lifting an organization's performance through improvement, management and control of business processes. It encapsulates methods, techniques and software involved throughout all stages of the process lifecycle including analysis, design, enactment and control.</td></tr>
<tr><td>8</td><td colspan="3">Outline syllabus</td><td>CO Mapping</td></tr>
<tr><td></td><td>Unit 1</td><td colspan="2">Introduction to BPM</td><td></td></tr>
<tr><td></td><td>A</td><td colspan="2">Business Process, Business Process Management, Themes of Business Process, Goals of Business Process, Principles of Business Process, Process Choreographies and its importance, Process Designer, Administration and stakeholders of business process, Classification of Business Processes, Organizational versus Operational.</td><td>CO1</td></tr>
</table>

	B	Intraorganizational Processes versus Process, Degree of Automation, Degree of Repetition, Degree of Structuring, Goals: Structure, and Organization, Business Process Modelling Foundation, Conceptual Model and Terminology, Abstraction Concepts, Horizontal Abstraction, Vertical Abstraction from Business Functions to Business Processes Business Analysis: Business Process Analysis, Object Oriented Analysis, Structure Analysis	CO1, CO2, CO4
	C	Process Models and Process instances, Process Models, Activity Models and Gateway Models, Activity Instances. Business Process Modeling Notations.	CO1, CO2, CO3
	Unit 2	**BPM Life Cycle Methodology**	
	A	Business Process Management Activities: Modelling, Execution, Monitoring, Optimization, Components of BPM suites, BPM Technology Workflow, Managing end-to-end, Customer-facing Processes	CO2, CO3
	B	Business Process Management Life Cycle , Programming Language for BPM, Establishing a common language for business-IT alignment, Cloud Computing BPM, Market, Benefits	CO1, CO2, CO3
	C	Interaction between Business Process and Data, Business Process Management tools and simulation, Business Process Integration and reengineering	CO2
	Unit 3	**Business Process Management Overview**	
	A	Overview of Business Process Management and Process Modelling, Process Designer, Overview of Business Process Management and Process Modelling. Artifacts in Business Process Designing, Process development with the Process Centre, Process applications: Overview, Process applications and business level applications.	CO3, CO4
	B	Various Notation used to create BPD, Creating BPD	CO3, CO4
	C	Building Services, Understanding service components, Business objects and variable, Modelling events, Business objects and variables, Modelling events, Modelling event gateways, Creating user interfaces, Designing process interactions for business users, Enabling processes for tracking and reporting, Running and debugging processes with the Inspector	CO3, CO4
	Unit 4	**Creating User Interfaces**	
	A	Creating user interfaces, Coaches - Difference between Coaches and Heritage Coaches. Developing reusable Coach Views - Coach Views, Templates, Stock controls - Button, Checkbox, Date Time Picker, Horizontal Section, Output Text, Select, Table Tabs, Text, Vertical Section. Stock	CO1, CO3, CO4

		content controls, Document List - Document Viewer. Advanced items for Coach Views - Content box, Custom HTML	
	B	Boundary events. Binding views with data - Defining Coach View behavior. Architecting complex process applications - Designing process interactions for business users, Configuring a role-based business user interface. Developing flexible and efficient process applications, Integrating with other systems, Creating outbound integrations, Integration Service implementations, Web Service Integration step in an integration service.	CO1, CO3, CO4
	C	Business Process Manager SQL Integration services. Understanding the message structure, Passing complex variable types to Undercover Agents, Passing IBM BPM Structured types, Passing Record type, Passing Date/Time types, Passing Boolean type, Passing Map type etc.	CO1, CO3, CO4
	Unit 5	**Inferential Statistics and Prescriptive analytics**	
	A	Solution for Collaborative Lifecycle Management, Info Sphere Data Architect, WebSphere Operational Decision Management, and Business Process Manager Advanced, Integration. Designing process interactions for business users	CO4, CO5, CO6
	B	BPEL process interactions, Factors affecting BPEL process interactions, Defining reports in process Designer, Developing flexible and efficient process applications - Enabling processes for tracking and reporting.	CO4, CO5, CO6
	C	Case study on various Business Process Management tools i.e. IBM BPM	CO2, CO4, CO5, CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 25% · MTE: 25% · ETE: 50%	
	Text book/s*	2. Business Process Management (IBM ICE Publication) 3. Business Process Management Concepts, Languages, Architectures, Mathias Weske, Springer 4. Deliver Modern UI for IBM BPM with the Coach Framework and Other Approaches(E-Book)	
	Other References	1. Internet as a resource for reference	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Understand Process Designer and its objectives	PO1, PO3, PO6, PO8, PSO3
2.	CO2: Understand Process Modeling and its relation to BPM	PO1, PO2, PO3, PSO3
3.	CO3: Translation of workflow steps into business process activities	PO4, PO6, PO7, PO9, PSO3
4.	CO4: Architect complex process applications	PO1, PO3, PO4, PO5, PSO3
5.	CO5: Visibility through dashboards and reports	PO1, PO3, PO4, PO5, PSO3,
6.	CO6: Compile the tools on the basis of their performance in a said business process setup	PO1, PO3, PO4, PO5, PSO3

PO and PSO mapping with level of strength for Course Name Business Process Management CSD021

	Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSE	CO1	1	1	1	1	1	1	1	1	-	-	1	1	-	-	3
	CO2	2	2	2	2	1	1	1	1	1	2	1	2	1	1	3
	CO3	3	2	3	3	3	2	1	2	3	3	1	3	1	3	3
	CO4	3	1	3	3	3	1	1	2	3	3	1	3	-	-	3
	CO5	1	2	2	2	2	2	1	2	1	2	1	2	-	2	3
	CO6	3	1	3	3	3	1	1	2	3	3	1	3	-	-	3

School:		**School of Engineering & Technology**			
Department		**Computer Science & Engineering**			
Program:		**B. Tech**			
Branch:		**CSE with Specialization in DS**			
1	Course Code	CSA102			
2	Course Title	Introduction to Machine Learning for Data Science			
3	Credits	3			
4	Contact Hours (L-T-P)	2	0	2	
	Course Status	Core /Elective/Open Elective			
5	Course Objective	The objective of the course is to introduce basic fundamental concepts in Machine Learning (ML) as well as to give a strong foundation of ML Techniques used in Data Science.			
6	Course Outcomes	CO-1. Define the requirement of Machine Learning CO-2. Classify the functionality and active environment For Machine Learning. CO-3. Apply the concepts of Propositional Logic for real-world AI based problems. CO-4. Analyse the various ML techniques and apply them to solve the real-world problems. CO-5. Explain the basic concepts of pythons to understand and Evaluate the Models and Applications. CO-6. Discuss the applicability of Machine learning in Data Science			
7	Course Description	Machine Learning (ML) are increasingly necessary to translate today's data into direct business value. This course introduces learners to the basic concepts of ML, and covers how learning algorithms work. It illustrates how ML fit in the data science ecosystem, and presents several real-world use cases that show how companies are implementing.			
8	Outline syllabus				CO Mapping
	Unit 1	**Introduction to Machine Learning**			
	A	Introduction, Training, Rote Learning, Learning Concepts, A Simple Learning Algorithm, Types of learning (Supervised, Unsupervised, Reinforcement)			CO1
	B	Introduction to Regression and types of regression, Objective Function/Cost Function, Gradient Descent Learning Algorithm			CO1
	C	Concepts of Over-fitting and under-fitting, Application of Linear Regression in various application domains through case study.			CO1
	Unit 2	**Types of Learning**			
	A	Supervised Learning, Classification and Regression, Generalization, Overfitting, and Underfitting (Relation of Model Complexity to Dataset Size), Uncertainty Estimates from Classifiers (The Decision Function, Predicting Probabilities, Uncertainty in Multiclass Classification)			CO2
	B	Supervised Machine Learning Algorithms (Some Sample Datasets, k-Nearest Neighbors, Linear Models, Naive Bayes Classifiers, Decision Trees, Ensembles of Decision Trees, Kernelized Support Vector Machines, Neural Networks),			CO2
	C	Unsupervised Learning and Preprocessing, Types of Unsupervised Learning, Challenges in Unsupervised Learning			CO2
	Unit 3	**Preprocessing, Feature Extraction and Clustering**			

	A	Preprocessing and Scaling (Different Kinds of Preprocessing, Applying Data Transformations, Scaling Training and Test Data the Same Way, The Effect of Preprocessing on Supervised Learning)			CO3
	B	Dimensionality Reduction, Feature Extraction, and Manifold Learning (Principal Component Analysis (PCA), Non-Negative Matrix Factorization (NMF), Manifold Learning with t-SNE)			CO3
	C	Clustering (k-Means Clustering, Agglomerative Clustering, DBSCAN, Comparing and Evaluating Clustering Algorithms)			CO3
	Unit 4	**Data Representation and Modeling**			
	A	Representing Data and Engineering Features, Categorical Variables (One-Hot-Encoding, Numbers Can Encode Categoricals, Binning, Discretization, Linear Models, and Trees			CO4
	B	Interactions and Polynomials, Univariate Nonlinear Transformations, Automatic Feature Selection, Univariate Statistics, Model-Based Feature Selection, Iterative Feature Selection, Utilizing Expert Knowledge			CO4
	C	Model Evaluation and Improvement, Cross-Validation(Cross-Validation in scikit-learn, Benefits of Cross-Validation, Stratified k-Fold Cross-Validation and Other Strategies)			CO4
	Unit 5	**Model Evaluation and Pipelines**			
	A	Grid Search (Simple Grid Search, The Danger of Overfitting the Parameters and the Validation Set, Grid Search with Cross-Validation)			CO5, CO6
	B	Evaluation Metrics and Scoring (Keep the End Goal in Mind, Metrics for Binary Classification, Metrics for Multiclass Classification, Regression Metrics, Using Evaluation Metrics in Model Selection)			CO5, CO6
	C	Algorithm Chains and Pipelines, Parameter Selection with Preprocessing, Building Pipelines, The General Pipeline Interface, Grid-Searching Preprocessing Steps and Model Parameters			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Andreas C. Müller and Sarah Guido, “Introduction to Machine Learning with Python A Guide for Data Scientists”, O’Reilly Media.			
	Other References	1) Ethem Alpaydin, "Adaptive computation and machine learning, Introduction to machine learning, MIT Press 2)			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Define the requirement of Machine Learning	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
2.	Classify the functionality and active environment For Machine Learning.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
3.	Apply the concepts of Propositional Logic for real-world AI based problems.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
4.	Analyse the various ML techniques and apply them to solve the real-world problems.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5.	Explain the basic concepts of pythons to understand and Evaluate the Models and Applications.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	Discuss the applicability of Machine learning in Data Science	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Introduction to Artificial Intelligence & Machine Learning **(Course Code** CSA-102**)**

Course Code_ Course Name	**CO's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
Introduction to Artificial Intelligence & Machine Learning (CSA-102)	**CO1**	3	3	1	1	2	1	1	1	1	2	-	3	2	3	1
	CO2	3	3	1	1	2	1	1	1	1	2	-	3	2	3	1
	CO3	3	3	1	1	2	1	1	1	1	2	-	3	2	3	1
	CO4	3	3	1	1	2	1	1	1	1	2	-	3	2	3	1
	CO5	3	3	1	1	2	1	1	1	1	2	-	3	2	3	1
	CO6	3	3	1	1	2	1	1	1	1	2	1	3	2	3	1

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
		3	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**1**	**3**	**2**	**3**	**1**

Total 28
Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**			
Department		**Computer Science & Engineering**			
Program:		**B. Tech**			
Branch:		**CSE with Specialization in Data Science**			
1	Course Code	**CSD 021**			
2	Course Title	**Neural Networks for Data Science**			
3	Credits	3			
4	Contact Hours (L-T-P)	2	0	2	
	Course Status	Core			
5	Course Objective	1. To introduce the ideas of learning rule and implement them based on human experience. 2. To conceptualize the working of human brain using ANN. 3. To become familiar with neural networks that can learn from available examples and generalize to form appropriate learning rules for inference systems. 4. To provide the mathematical background for Neural Network and classification techniques. 5. To provide the mathematical background for carrying out the optimization and familiarizing genetic algorithm for seeking global optimum in self-learning situation.			
6	Course Outcomes	On successful completion of this module students will be able to: CO1: **Define** biological significance of Neural Network and list ANN components. CO2: **Classify** various learning paradigms based on real file problems CO3: **Apply basic concepts to build** single and multi-layer feed-forward neural networks. CO4: **Analyze** and train radial-basis function and recurrent networks; CO5: **Explain** data preparation for analysis and decision using appropriate neural network model. CO6: **Discuss** and adapt appropriate neural networks model for real life data mining applications.			
7	Course Description	This course introduces the basic models, learning algorithms, and some applications of neural networks. After this course, we should be able to know how to use neural networks for solving different problems related to pattern recognition, function approximation, data visualization, and so on.			
8					
	Unit 1	**Introduction**			
	A	Introduction, Motivation and History, Components of a Neuron-synapses, dendrite, cell nucleus, axon			CO1
	B	Important Terminologies of ANNs: Propagation function, Activation function, output function, Components of Artificial Neural Network: common			CO1

		activation functions, network topologies- feed forward, recurrent networks, completely linked networks	
	C	Neuron Activation order: Synchronous activation, asynchronous activation, Communication with the outside world: input and output of data in and from neural networks	CO1
	Unit 2	**Learning Paradigms**	
	A	Learning Paradigms and their real Applications, Unsupervised learning and Supervised learning, Reinforcement learning, Offline and online learning and their applications based on real life problems.	CO2, CO6
	B	Training patterns and teaching inputs, use of training samples, data set split into training, validation and testing data, Implication of splitting of data set, Learning curves and their importance in diagnostics	CO2, CO6
	C	Gradient optimization procedures, Hebbian learning rule	CO2
	Unit 3	**The Perceptron, Backpropagation and its variants**	
	A	Single layer Perceptron network, Perceptron Learning Algorithm and convergence theorem, Delta rule as a gradient based learning strategy, Limitations of Single Layer Perceptron network	CO3
	B	Multilayer Perceptron Network, Backpropagation learning and its applications	CO3
	C	Analyzing effect of learning rate on learning process, Variants of Backpropagation algorithm	CO3
	Unit 4	**Radial Basis Function Neural Networks & Decision Support Systems**	
	A	Components & Structure of RBF networks, Information processing of RBF networks (neuron level), analytical thoughts prior to training, Equation system and gradient strategies for training, comparison of RBF Networks and Multilayer Perceptron	CO4
	B	Data Pre-processing, Data Representations, Data Representation impact on training time, Managing Training Datasets, Data Quantity/Quality	CO4, CO5
	C	Sensitivity Analysis, Visualization, Sifting through output using Domain Knowledge.	CO4, CO5
	Unit 5	**Neural Network based Data Analysis Applications: Case Studies**	
	A	Real Estate Pricing Model: Data Selection, Data Representation, Model and Architecture Selection,	CO5, CO6

		Training and Testing the Neural Network, Maintaining the Application, Related Applications & Discussion			
	B	Customer Raking Model: Problem Definition, Data Selection, Data Representation, Model/Architecture selection, Training and Testing the Neural Network, Sensitivity Analysis, Maintaining the Application, Related Applications & Discussion			CO5, CO6
	C	Sales Forecasting: Data Selection, Data Representation, Model/Architecture selection, Training and Testing the Neural Network, Maintaining the Application, Related Applications & Discussion			CO5, CO6
	Mode of examination				
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. David Kriesel, 2007, "A Brief Introduction to Neural Networks", available at http://www.dkriesel.com 2. Joseph P. Bigus "Data mining with neural networks", McGraw Hill 3. Simon O. Haykin, **"Neural Networks and Learning Machines",** Pearson			
	Other References	1. ANDERSON, JAMES A., AN INTRODUCTION TO NEURAL NETWORKS, PHI Learning. 2. Christopher M. Bishop & Geoffrey Hinton, Neural Networks for Pattern Recognition, Oxford University Press.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**Define** biological significance of Neural Network and list ANN components.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2, PSO3
2.	**Classify** various learning paradigms based on real life problems	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2, PSO3
3.	**Apply basic concepts to build** single and multi-layer feed-forward neural networks.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2, PSO3
4.	**Analyze** and train radial-basis function and recurrent networks;	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2, PSO3
5.	**Explain** data preparation for analysis and decision using appropriate neural network model.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2, PSO3
6.	**Discuss** and adapt appropriate neural networks model for real life data mining applications	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name: Neural networks (Course Code- CSD-021)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O3
Neural networks (Course Code- CSA-042)	CO1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
	CO2	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
	CO3	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
	CO4	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
	CO5	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
	CO6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA-042	Neural networks	3.00	3.00	3.00	3.00	2.83	2.33	2.33	1.17	2.33	3.00	2.67	3.00	3.00	3.00	2.67

Total 40.3

Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

Business for Data Driven Companies

School:		**School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B.Tech.**		
Branch:		**CSE DS**		
1	Course Code	New Subject		
2	Course Title	Business for Data driven companies		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core /Elective/Open Elective		
5	Course Objective	Introduction to Data Analytics and its role in business decisions. Students will learn why data is important and how it has evolved. They will be introduced to "Big Data" and how it is used. They will also be introduced to a framework for conducting Data Analysis and what tools and techniques are commonly used.		
6	Course Outcomes (must be 6 COs, following verbs given in Bloom's Taxonomy)	Having successfully completed this module, the student will be able to: CO1: Recall the basics of Data analytics, including requirements, various aspects and framework in context of businesses and enterprises. CO2: Explain the inevitability of big data as the future of data driven companies. CO3: Apply data analytics tools and techniques for handling and analyzing enterprise data for meaningful information. CO4: Analyze clearly the roles played by Business Analysts, Business Data Analysts, and Data Scientists in a data driven company. CO5: Evaluate the explorations performed by various data analytic techniques using visualization. CO6: Adapt the data analytic techniques for big data surge in data driven companies.		
7	Course Description	This course has been designed for the students to understand the best data analytics practices data driven companies follow to become more competitive and more profitable in the market. They will be able to recognize the most critical business metrics and distinguish them from mere data.		
8	Outline syllabus			CO Mapping
	Unit 1	**Introduction: Data Analytics**		
	A	An overview of the specialization, introduction to data driven decision making		CO1

	B	What is Data Analytics? Solving common business problems using DA. Business defining decisions using DA	CO1
	C	Requirement of a DA framework, Aspects of a DA framework, Tools and techniques.	CO1
	Unit 2	**The emergence of Big data**	
	A	What is Big Data? The marketplace and emerging trends in Big Data analytics, Business impacts of technology advancements and data trends	CO1, CO2
	B	Companies' perspective on Big Data (Sample examples). Data and analytics examples at various companies.	CO2, CO3
	C	Identification, organization and processing of various kinds of Big data addressed by companies in decision making (Structures, Semi-Structures and Unstructured)	CO2, CO3
	Unit 3	**Data analytics: Tool and techniques**	
	A	Variety of data-based business problems - predictive analysis, data management, statistical sampling, survey design.	CO3, CO4
	B	Cluster analysis, Decision tree analysis, Factor analysis,	CO3, CO4
	C	Regression Analysis (correlation, multivariate analysis), Segmentation analysis, sentiment analysis, Time series analysis	CO3, CO4
	Unit 4	**Data visualization**	
	A	Analyzing trends based on data visualization (e.g. stock market trends, area wise sales data)	CO3, CO5
	B	Visual data analysis techniques, Interaction techniques	CO3, CO5
	C	Analytics using statistical packages, association intelligence from unstructured information	CO3
	Unit 5	**Big Data's Future for Industries**	
	A	Case Study - How Companies (any two examples) have harnessed the Power of Data	CO2, CO4, CO6
	B	Key trends defining big data's future	CO2, CO6
	C	The human element in generation and usage of big data	CO6
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	CA 25% · MTE 25% · ETE 50%	
	Text book/s*		
	Other References		

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Recall the basics of Data analytics, including requirements, various aspects and framework in context of businesses and enterprises.	PO1, PO2, PO3, PO6, PO8, PO9, PO11, PO12, PSO1
2.	CO2: Explain the inevitability of big data as the future of data driven companies.	PO2, PO3, PO5, PO6, PO10, PO11, PSO1
3.	CO3: Apply data analytics tools and techniques for handling and analyzing enterprise data for meaningful information.	PO1, PO2, PO3, PO4, PO5, PO11, PO12, PSO2, PSO3
4.	CO4: Analyze clearly the roles played by Business Analysts, Business Data Analysts, and Data Scientists in a data driven company.	PO3, PO4, PO6, PO8, PO9, PO11
5.	CO5: Evaluate the explorations performed by various data analytic techniques using visualization.	PO2, PO3, PO5, PO6, PO10, PO11, PSO2
6.	CO6: Adapt the data analytic techniques for big data surge in data driven companies.	PO1, PO2, PO3, PO5, PO6, PO10, PO11, PO12, PSO2

PO and PSO mapping with level of strength for Course Name xxxx (Course Code yyyy)

Course Code – Course Name	**CO's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
Yyyy_xxxx	**CO1**	**3**	**2**	**2**	**-**	**-**	**1**	**-**	**1**	**2**	**-**	**2**	**3**	**1**	**-**	**-**
	CO2	**-**	**3**	**2**	**-**	**3**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**-**	**-**
	CO3	**2**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**	**2**	**1**
	CO4	**-**	**-**	**2**	**2**	**-**	**2**	**-**	**2**	**3**	**-**	**2**	**-**	**-**	**-**	**-**
	CO5	**-**	**2**	**3**	**-**	**2**	**2**	**-**	**-**	**-**	**1**	**2**	**-**	**-**	**3**	**-**
	CO6	**2**	**2**	**3**	**-**	**2**	**1**	**-**	**-**	**-**	**2**	**2**	**2**	**-**	**3**	**-**

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	P O 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PSO 3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B.Tech. Data Science**		
Branch:		**CSE**		
1	**Course Code**	**CSA-042**		
2	**Course Title**	**Introduction to Deep Leaning**		
3	**Credits**	3		
4	**Contact Hours (L-T-P)**	2	0	2
	Course Status	Elective (AI/ML Core)		
5	**Course Objective**	This course aims to present the mathematical, statistical and computational challenges of building stable representations for high-dimensional data, such as images, text and data. We will delve into selected topics of Deep Learning, discussing recent models from both supervised and unsupervised learning. Special emphasis will be on convolutional architectures, invariance learning, unsupervised learning and non-convex optimization.To understand and demonstrate how to solve general learning from a large series of data using computer based deep learning algorithms		
6	**Course Outcomes (CO's)**	On successful completion of this module students will be able to: CO1: Recall Neural Networks and relate it with Deep Learning concepts. CO2: Compare and classify Regularization approaches for Deep Learning. CO3: Build Convolutional Neural Networks models for image analysis. CO4: Examine the Sequence models and analyse the relationships among them. CO5: Assess the different Deep learning models based on their design processes. CO6: Predict the behavior of Deep learning models and apply them.		
7	**Course Description**	This course starts with introduction to Deep Learning and further build, train, and deploy real world applications such as object recognition and Computer Vision, image and video processing, text analytics, Natural Language Processing, recommender systems, and other types of classifiers.		

8	**Syllabus Outline**		**CO Mapping**
	Unit 1	**Deep Feed forward Networks**	
	A	Recall Neural networks, Deep learning and its Practical aspects ,Introduction to Simple Deep Neural Networks, Platform for Deep Learning, Deep Learning Software Libraries	CO1

	B	Introduction to Deep Feed Forward Networks ,Learning XOR, Gradient-Based Learning, Activation Functions, ReLU, Softmax, Sigmoid , Error Functions	CO1
	C	Architecture Design- Hidden Units Back-Propagation and Other Differentiation Algorithms	CO1
	Unit 2	**Regularization for Deep Learning**	
	A	Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multitask Learning, Early Stopping	CO2
	B	Parameter Tying and Parameter Sharing, Bagging , Drop Out, Difficulty of training deep neural networks, Greedy layer wise training, Adversarial Training	CO2
	C	How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms: Stochastic Gradient Descent, Momentum, Nesterov Momentum Parameter Initialization Strategies Algorithms with Adaptive Learning Rates, AdaGrad. RMSProp. Adam Choosing the Right Optimization Algorithm	CO2
	Unit 3	**Convolutional Neural Networks**	
	A	Why CNN?, Its role, significance, The Convolution Operation, Motivation, Pooling, The Neuroscientific Basis for Convolutional Networks	CO1, CO3
	B	Prior probability distribution, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data types with different dimensionalities and number of channel	CO1, CO3
	C	Efficient Convolution Algorithms, Random or Unsupervised Features of CNN , Normalization, Applications of CNN in Computer Vision – ImageNet, Sequence Modelling –VGGNet, LeNet	CO1, CO3
	Unit 4	**Sequence Modelling: Recurrent Neural Networks**	
	A	Sequence Learning Problems , Recurrent Neural Network and its significance in real world, RNN model, Backpropagation through time ,Bidirectional RNNs	CO4
	B	Different types of RNNs, Gated Recurrent Unit (GRU) Recursive Neural Networks , The Challenge of Long-Term Dependencies	CO4
	C	Introduction of Long Short Term Memory Neural Networks, Learning Algorithm of LSTM/ RNN Bidirectional LSTMs	CO4
	Unit 5	**Deep Networks and design process**	
	A	Introduction to Autoencoder, Undercomplete Autoencoder, Regularized Autoencoders,	CO5,CO6

		Representational Power, Layer Size and Depth. Stochastic Encoders and Decoders, Applications of Encoder Decoder models			
	B	Introduction to Generative Adversarial Networks, Generative Adversarial Networks – Architecture, Applications of Generative Adversarial Networks			CO5, CO6
	C	Practical design process for deep learning techniques: Performance Metrics , Default Baseline Models, Determining Whether to Gather More Data, Selecting Hyperparameters, Debugging Strategies			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	**CA**	**MTE**	**ETE**	
		25%	25%	50%	
	Text Books	1. Deep Learning, by Goodfellow I., Bengio Y. & Courville A. (2016) 2. Visualizing and Understanding Convolutional Networks, by Matt Zeiler, Rob Fergus 3. TensorFlow: a system for large-scale machine learning, by Martín A., Paul B., Jianmin C., Zhifeng C., Andy D. et al. (2019)			
	Reference Books	4. Deep learning in neural networks, by Juergen Schmidhuber (2015) 5. https://cs230.stanford.edu/syllabus/ 6. https://towardsdatascience.com/september-edition-machine-learning-case-studies-a3a61dc94f23 7. Deep Learning: A Practitioner's Approach by Josh Patterson, O'reilly.			
	Online Materials				

CO and PO Mapping

S. No.	Course Outcome (CO)	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1	Recall Neural Networks relate it with Deep Learning concepts.	PO1, PO2, PO5, PO12, PSO1, PSO2
2	Compare and classify Regularization approaches for Deep Learning.	PO1, PO2, PO3, PO4, PO5, PO9, PO12, PSO1, PSO2, PSO3
3	Build Convolutional Neural Networks models for image analysis.	PO1, PO2, PO3, PO4, PO5, PO12, PSO1, PSO2, PSO3
4	Examine the Sequence models and analyse the relationships among them.	PO2, PO3, PO10, PO12, PSO1, PSO2, PSO3
5	Assess the different Deep learning models based on their design processes.	PO2, PO3, PO4, PO5, PO6, PO10, PSO1, PSO2, PSO3
6	Predict the behavior of Deep learning models and apply them.	PO4, PO5, PO6, PO7, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name: Neural networks (Course Code- CSA-042)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO3
Introduction to Deep Leaning (Course Code- CSA302)	CO1	3	3	-	-	3	-	-	-	-	3	-	2	3	3	-
	CO2	3	3	-	3	3	-	-	-	-	3	-	3	3	3	-
	CO3	3	3	3	3	3	2	-	-	3	3	-	3	3	3	-
	CO4	3	3	3	3	3	2	-	-	3	3	-	3	3	3	-
	CO5	3	3	3	3	3	2	3	-	3	3	-	2	3	3	-
	CO6	3	3	3	3	3	2	3	-	3	3	-	3	3	3	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA302	**Introduction to Deep Leaning**	3	3	3	1.8	2	2	3	-	3	3	-	2.6	3	3	-

Total 32.4

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

WEB AND TEXT ANALYSIS

School:		**School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B.Tech. Data Science**		
Branch:		**CSE**		
1	Course Code			
2	Course Title	Web and Text analysis		
3	Credits	3		
4	Contact Hours (L-T-P)	2	0	2
	Course Status	Core /Elective/Open Elective		
5	Course Objective	To understand the text and web data and used it for the information retrieval		
6	Course Outcomes (must be 6 COs, following verbs given in Bloom's Taxonomy)	The student should be able to CO1: Recall the basics of www and textual data in web. CO2: Explain the processing of textual data on/off web for prediction of intent. CO3: Apply relevant models for contextual information retrieval from texts towards socio-economic betterment. CO4: Analyze individual and combination of a variety of web search methods CO5: Explain the processes involved in information extraction from web based social networks. CO6: Design process based on prior information for web usage analysis.		
7	Course Description	This course provides a unique opportunity for you to learn key components of text and web analytics aided by the real world datasets and the web search and analysis methodologies.		
8	Outline syllabus		CO Mapping	
	Unit 1	**Introduction**		
	A	WWW, History of Web and Internet, Web analysis	CO1	
	B	Text analysis, Types of problems solved using text analysis, Document classification and information retrieval	CO1	
	C	Clustering and organizing documents, Information extraction, Prediction and Evaluation	CO1	
	Unit 2	**NLP based Prediction**		
	A	Document Tokenization, Lemmatization, Vector Generation and Prediction, Boundary determination, Phrase Recognition, Parsing, Feature generation	CO2	
	B	Term-Document Matrices (TDMs) from the Corpus, Problem specific novel patterns finding	CO2	

	C	Keyword search, Nearest Neighbor Methods, Similarity measures, Web based document search, Document matching,			CO2
	Unit 3	**Text information retrieval**			
	A	Clustering methods for similarity, Cluster Label Mean, Patterns and Entities,			CO3
	B	Co-reference and relationship extraction, Template Filling			CO3
	C	Applications: Information retrieval, commercial extraction systems, criminal justice, Intelligence			CO3, CO4
	Unit 4	**Web Search**			
	A	Meta search: combining multiple ranking, combination using similarity scores, Combination using rank position			CO4
	B	Web Spamming: content spamming, Link spamming, Hiding techniques, Combating spam.			CO4
	C	Social network analysis, co-citations and bibliographic coupling, Page rank, HITS, Community Discovery			CO4, CO5
	Unit 5	**Web usage analysis**			
	A	Data collection and preprocessing, data modelling for web usage			CO5, CO6
	B	Discovery and analysis for web usage methods			CO6
	C	Recommended system and collaborative filtering, Query Log Mining			CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	2%	50%	
	Text book/s*	1. Michael W. Berry, Jacob Kogan - Text Mining: Applications and Theory 2. Bing Liu - Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data			
	Other References	1. Handbook of Research on Text and Web Mining Technologies edited by Song, Min, Brook Wu, Yi-Fang			

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	What is Web and Text analysis	PO1, PO2, PO3, PO4, PO5, PO6
2.	Explain the processing of text for prediction.	PO1, PO2, PO3, PO4, PO5, PO6
3.	Apply relevant models for text retrievals	PO1, PO2, PO3, PO4, PO5, PO6
4.	Analyze web search methods	PO1, PO2, PO3, PO4, PO5, PO6
5.	Explain the process of social networking	PO1, PO6, PSO1, PSO2
6.	Estimate the web usage	PO1, PO6, PSO1, PSO2

PO and PSO mapping with level of strength for Web and Text Analysis (Course Code yyyy)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
Web and Text Analysis	CO1	3	2	2	2	3	1	1	1	1	1	1	1	1	2	1
	CO2	3	3	2	2	2	2	1	1	1	2	1	1	1	1	1
	CO3	2	3	3	3	2	2	1	1	2	1	1	1	1	1	1
	CO4	3	2	2	2	2	2	1	1	1	2	1	1	1	1	1
	CO5	3	1	1	1	1	2	1	1	1	1	1	1	3	3	1
	CO6	3	1	1	1	1	3	1	1	1	1	1	1	2	3	1

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	P O 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PSO 3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

WEB AND TEXT ANALYSIS LAB

School:		**School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B.Tech**		
Branch:		**CSE**		
1	Course Code			
2	Course Title	Web and Text analysis LAB		
3	Credits	1		
4	Contact Hours (L-T-P)	0	0	2
	Course Status	Core /Elective/Open Elective		
5	Course Objective	To understand the text and web data and used it for the information retrieval		
6	Course Outcomes (must be 6 COs, following verbs given in Bloom's Taxonomy)	The student should be able to CO1: Recall the basics of www and textual data in web. CO2: Explain the processing of textual data on/off web for prediction of intent. CO3: Apply relevant models for contextual information retrieval from texts towards socio-economic betterment. CO4: Analyze individual and combination of a variety of web search methods CO5: Explain the processes involved in information extraction from web based social networks. CO6: Design process based on prior information for web usage analysis.		
7	Course Description	This course provides a unique opportunity for you to learn key components of text and web analytics aided by the real world datasets and the web search and analysis methodologies.		
8	Outline syllabus			CO Mapping
	1	Demonstrate Web based textual data acquisition for a generic social media network		CO1
	2	Demonstrate the use of the y-TextMiner package.		CO1, CO2
	3	Demonstrate textual data pre-processing such as normalization including tokenization and lemmatization.		CO2
	4	Demonstrate Vector Generation and Prediction, Boundary determination for a given textual dataset.		CO2
	5	Demonstrate keyword search, web-based document matching and similarity searches using nearest neighbor methods.		CO3
	6	Demonstrate similarity matching and pattern matching between textual entities using clustering methods		CO3
	7	Demonstrate the process of collection and organization of domain specific unstructured data for corpus.		CO3, CO4

	8	Create a Term-document matrix for the established corpus			CO2
	9	Demonstrate the reduction of Term by document matrix for			CO2
	10	Demonstrate a polarity analysis on the incoming textual data based on the relevant corpora.			CO5, CO6
	11	Demonstrate classification and prediction based on web user transactions.			CO6
	12	The recommender system problem: K-NN, Association Rules, Matric Factorization.			CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	3. Michael W. Berry, Jacob Kogan - Text Mining: Applications and Theory 4. Bing Liu - Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data			
	Other References	2. Handbook of Research on Text and Web Mining Technologies edited by Song, Min, Brook Wu, Yi-Fang			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	What is Web and Text analysis	PO1,PO2,PO3,PO4, PO5, PO6
2.	Explain the processing of text for prediction.	PO1,PO2,PO3,PO4, PO5, PO6
3.	Apply relevant models for text retrievals	PO1,PO2,PO3,PO4, PO5, PO6
4.	Analyze web search methods	PO1,PO2,PO3,PO4, PO5, PO6
5.	Explain the process of social networking	PO1,PO6, PSO1,PSO2
6.	Estimate the web usage	PO1, PO6, PSO1,PSO2

School:		**School of Engineering & Technology**			
Department		**Computer Science & Engineering**			
Program:		**B.Tech. Data Science**			
Branch:		**CSE**			
1	Course Code				
2	Course Title	**SOCIAL MEDIA ANALYTICS**			
3	Credits	3			
4	Contact Hours (L-T-P)	2	0	2	
	Course Status				
5	Course Objective	The objective of this course is to teach students how to obtain, monitor, and evaluate digital traces from online social platforms. After finishing the course students will be prepared to approach future industry and academic problems with an understanding of how social media data can help to accomplish goals.			
6	Course Outcomes	CO1: *Illustrate* the basic concepts of social network analysis. CO2: *Formulate* fundamentals of graphs and networking theory. CO3: *Analyse* current approaches to social media data and data analytics. CO4: *Apply* social network analysis to real world problems. CO5: *Evaluate*, explore and analyse the uses of common social media analytics tools. CO6: *Examine* research and analysis that responds to the core ideas, uses tools and skill sets specific to social data analytics.			
7	Course Description	This course provides a thorough introduction to social data analysis, including influence and centrality in social media, information diffusion on networks, topic modeling and sentiment analysis, identifying social bots, and predicting behavior.			
8	Outline syllabus				CO Mapping
	Unit 1	**Introduction to Social Media Analytics**			
	A	Introduction, History of Social media Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations;			CO1
	B	Types of social networks: friend, user-generated, content, affiliation, etc., Sociograms, Sociometric studies			CO1, CO6
	C	Basics of Social Media and Business Models, Basics of Web Search Engines and Digital Advertising., Application of SMA in different areas			CO1, CO6
	Unit 2	**Graph and Matrices**			
	A	The Adjacency Matrix, Paths and Connectivity, Distance and Breadth-First Search, Network Datasets: An Overview			CO1, CO2
	B	Nodes, ties and influencers, Making connections: Link analysis. Paths			CO1,CO2
	C	Random graphs and network evolution. telephone call graph, Weighted Networks, Hypergraphs			CO1, CO2
	Unit 3	**Network fundamentals**			
	A	Network structures: equivalence, homophile, clustering, Snowball Sampling, Contact Tracing, And Random Walks,			CO1, CO2
	B	Ego-centered network, dominance hierarchies, Third-Party Records, affiliation network,			CO1,CO2
	C	Citation Networks, Peer-To-Peer Networks, Recommender Networks, Biological Networks, Genetic Regulatory Networks, Neural Networks			CO1, CO2
	Unit 4	**Social Network and Modeling**			

	A	Social contexts: Affiliation and identity. social capital, structural holes, Structural balance, Predictive modeling, Descriptive modeling: community/anomaly detection			CO3, CO4, CO5,CO6
	B	Diffusion in networks: information cascades, social influence, market experiments, Geospatial social data mining, Privacy in a Networked World, Predicting the future with social media			CO3, CO4, CO5,CO6
	C	Facebook Analytics: Introduction, parameters, demographics. Analysing page audience. Reach and Engagement analysis. Google analytics.			CO3, CO4, CO5,CO6
	Unit 5	**Processing, Visualization and Web analytics**			
	A	Processing and Visualizing Data, Influence Maximization, Link Prediction, Collective Classification, Applications in Advertising and Game Analytics, Collecting and analysing social media data; visualization and exploration			CO3, CO4, CO5,CO6
	B	Social network and web data and methods, Clickstream analysis, A/B testing, online surveys, Web crawling and Indexing.			CO3, CO4, CO5,CO6
	C	Natural Language Processing Techniques for Micro-text Analysis, Trend: social influences on judgments, opinion spread, sentiment.			CO3, CO4, CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	● Network: An Introduction by MEJ Newman, Oxford Press			
	Other References	● Networks, Crowds, and Markets: Reasoning About a Highly connected World By David Easley and Jon Kleinberg			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	*Illustrate* the basic concepts of social network analysis.	PO1, PO2, PO4, PO6, PO8, PO11, PO12, PSO1, PSO2, PSO3
2.	*Formulate* fundamentals of graphs and networking theory.	PO1, PO2, PO3, PO4, PO5, PO6, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
3.	*Analyse* current approaches to social media data and data analytics.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO11, PO12, PSO1, PSO2, PSO3
4.	*Apply* social network analysis to real world problems.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5	*Evaluate*, explore and analyse the uses of common social media analytics tools.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO10, PO11, PO12, PSO1, PSO2, PSO3
6	*Examine* research and analysis that responds to the core ideas, uses tools and skill sets specific to social data analytics.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength

Course Code_ Course Name	COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
Social Media Analytics	**CO1**	2	1	-	1	-	1	-	2	-	-	1	3	1	2	1
	CO2	3	1	3	2	1	1	-	-	2	3	2	3	2	1	2
	CO3	2	3	2	3	3	2	3	-	2	-	2	1	2	3	1
	CO4	1	3	3	3	3	3	3	3	3	2	3	2	2	3	3
	CO5	2	3	2	3	3	3	3	2	-	2	3	1	3	3	2
	CO6	2	2	1	3	3	3	3	3	2	-	2	3	2	3	3
		2.0	**2.2**	**1.8**	**2.5**	**2.2**	**2.2**	**2.0**	**1.7**	**1.5**	**1.2**	**2.2**	**2.2**	**2.0**	**2.5**	**2.0**

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	P O 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PSO 3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B. Tech.**		
Branch:		**CSE**		
1	Course Code	New Code		
2	Course Title	Healthcare and Analytics		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core /Elective/Open Elective		
5	Course Objective	This course is an introduction to healthcare analysis concepts and methods for students who have had little previous data analytics experience. Topics to be covered in this course include: creation of datasets, the structure of datasets, an introduction to data warehousing, working with large databases, an introduction to public health and healthcare datasets, methods for descriptive analytics, and an introduction to predictive analytics. Students will gain skills in data manipulation for program evaluation and analysis. In this course, students will gain an understanding of data analysis used in improvement of the healthcare system and help the professional to use information for analysis, formulate and solve relevant issues to support decision making. We will learn different tools, activities and methods to understand the principles of developing, reporting, and analyzing for Improvement of Healthcare Organizations.		
6	Course Outcomes	CO1. Define the role of data analytics in healthcare quality and performance improvement efforts. CO2. Explain the tools and techniques used for data analytics in healthcare organizations. CO3. Identify techniques to communicate insights gained from healthcare data analysis. CO4. Analyse the potential of, and challenges to, incorporating big data analytics to improve the development and testing of precision medicine / nursing interventions. CO5. Demonstrate and evaluate the knowledge of health data and undergirding the tools of big data analysis in health related research. CO6. Adapt the basics and learnings available to build the relationship of healthcare and data analytics in production and operational systems for data intelligence.		
7	Course Description	After completing the course the student will be able describe and comprehend all the concepts related with healthcare, how to manage the internal and external information in order to make the best decisions for		

		the purpose of giving the best service, and obtain quick and reliable response.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Quality Improvement and Data Analytics for healthcare**	
	A	Toward Healthcare Improvement Using Analytics, Healthcare Transformation—Challenges and Opportunities, Current State of Healthcare Costs and Quality	CO1, CO2
	B	Leveraging Information for Healthcare Improvement, Analytics Knowledge Gap, Beginning the Analytics Journey in Healthcare	CO1, CO2
	C	Fundamentals of Healthcare Analytics, How Analytics Can Improve Decision Making, Analytics, Quality, and Performance, Applications of Healthcare Analytics, Components of Healthcare Analytics	CO1, CO2
	Unit 2	**Healthcare Strategies, Quality and Governance**	
	A	Purpose of Analytics Strategy, Analytics and Business Intelligence, Strategic Development versus Development by Aggregation	CO1, CO3
	B	Analytics Strategy Framework, with a Focus on Quality/Performance Improvement, Strategies for Working Well with Stakeholders	CO1, CO4
	C	Data Quality, Management, and Governance, Developing an Analytics Strategy, Defining Healthcare Quality and Value, Components of Healthcare Quality Measurement	CO3, CO4
	Unit 3	**Working with Healthcare Data**	
	A	Data: The Raw Material of Analytics, Preparing Data for Analytics, Types of Data (Categorical, Ordinal, Interval and Ratio Data), Levels of Measurement, Getting Started with Analyzing Data, Summarizing Data Effectively	CO2, CO3, CO4
	B	The Need for Effective Data Management, Data Quality, Data Governance and Management, Data Stewardship, Enterprise-wide Visibility and Opportunity	CO3, CO4
	C	Overview of Healthcare QI, Common QI Frameworks in Healthcare, Six Sigma DMAIC Process and Methodology, Data Quality and Governance	CO3, CO4
	Unit 4	**Effective Indicators and Methods in Healthcare**	
	A	Measures, Metrics, and Indicators, Key Performance Indicators, Using Indicators to Guide Healthcare Improvement Activities, Leveraging Analytics in Quality Improvement Activities	CO4, CO5
	B	Moving from Analytics Insight to Healthcare Improvement, Analytics in the Problem Definition Stage, Using Analytics to Identify Improvement Opportunities, Analytics in the Project Execution Phase	CO4, CO5

	C	Using Analytics to Evaluate Outcomes and Maintain Sustainability, Basic Statistical Methods and Control Chart Principles, Statistical Methods for Detecting Changes in Quality or Performance, Graphical Methods for Detecting Changes in Quality or Performance			CO4, CO5
	Unit 5	**Visualization and Advanced Analytics in Healthcare**			
	A	Presentation and Visualization of Information, Data Visualization, Quality and Performance Improvement, Agents and Alerts, Providing Accessibility to and Ensuring Usability of Analytics Systems			CO5, CO6
	B	Overview of Advanced Analytics, Applications of Advanced Analytics, Enablers of Predictive Analytics in Healthcare (Methods, Data and System), Developing and Testing Advanced Analytics in Healthcare, Advanced Analytics Modeling and Deployment Process			CO5, CO6
	C	Determine the Requirements of the Healthcare Organization, Understand and Prepare Health Data, Overview of Predictive Algorithms (Regression Modeling, Machine Learning and Pattern Recognition), Analytical Healthcare Organizational Challenges, objectives and requirements, Effective Analytical Teams			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Trevor L. Strome (2013). Healthcare Analytics for Quality and Performance Improvement. John Wiley & Sons, Inc. 2. Chandan K. Reddy and Charu C. Aggarwal, Healthcare Data Analytics, CRC Press ©2015			
	Other References	1. Big Data Analytics in Healthcare, edited by Anand J. Kulkarni, Patrick Siarry, Pramod Kumar Singh, Ajith Abraham, Mengjie Zhang, Albert Zomaya, Fazle Baki 2. Health Care Information Systems: A Practical Approach for Health Care Management By Karen A. Wager, Frances W. Lee, John P. Glaser 3. Statistics & Data Analytics for Health Data Management - E-Book By Nadinia A. Davis, Betsy J. Shiland			

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Define the role of data analytics in healthcare quality and performance improvement efforts.	PO2, PO3, PO4, PO5, PSO2
2.	Explain the tools and techniques used for data analytics in healthcare organizations.	PO1, PO3, PO5, PO7, PO8, PSO2
3.	Identify techniques to communicate insights gained from healthcare data analysis.	PO2, PO3, PO7, PO8, PSO2
4.	Analyse the potential of, and challenges to, incorporating big data analytics to improve the development and testing of precision medicine / nursing interventions.	PO2, PO4, PO5, PO8, PSO2
5.	Demonstrate and evaluate the knowledge of health data and undergirding the tools of big data analysis in health related research.	PO1, PO2, PO4, PSO2
6.	Adapt the basics and learnings available to build the relationship of healthcare and data analytics in production and operational systems for data intelligence.	PO1, PO2, PO3, PO4, PO5, PO8, PSO2

PO and PSO mapping with level of strength for Course Name Healthcare and Analytics **(Course Code yyyy)**

Course Code_ Course Name	**COs**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
Health Care and Analytics	**CO1**	**-**	**2**	**3**	**1**	**2**	**-**	**-**	**-**	**2**	**3**	**1**	**2**	**-**	**3**	**-**
	CO2	**2**	**-**	**3**		**1**	**-**	**3**	**2**	**-**	**3**		**1**	**-**	**3**	**-**
	CO3	**-**			**-**	**-**	**-**					**-**	**-**	**-**	**3**	**-**
	CO4	**-**	**2**	**-**	**3**	**2**	**-**	**-**	**2**	**2**	**-**	**3**	**2**	**-**	**3**	**-**
	CO5	**2**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**3**	**-**	**-**	**3**	**-**
	CO6	**2**	**2**	**3**	**2**	**3**	**-**	**-**	**2**	**2**	**3**	**2**	**3**	**-**	**3**	**-**

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**			
Department		**Computer Science & Engineering**			
Program:		**B.Tech. Data Science**			
Branch:		**CSE**			
1	Course Code				
2	Course Title	Predictive Analytics			
3	Credits	3			
4	Contact Hours (L-T-P)	2	0	2	
	Course Status				
5	Course Objective	This course focuses on enabling students to master a scientific approach to solving problems with data. This course is designed to provide a comprehensive introduction to build models for prediction and classification.			
6	Course Outcomes	CO1: *Determine* the key concepts for predictive analytics CO2: *Apply* specific statistical and regression analysis methods applicable to predictive analytics CO3: *Interpret* the data and selecting appropriate features. CO4 : *Develop* and use various quantitative and classification predictive models CO5: *Identify* new trends and patterns, uncover relationships, create forecasts, predict likelihoods, and test predictive hypotheses. CO6: *Compare* the performance of different prediction and classification models			
7	Course Description	This course explores foundational concepts in analytics, statistical computing, data pre-processing, variable selection, dimensionality reduction, classification and prediction. After completing the course students will be able to prepare data to improve efficacy of predictive models, identify and implement a variety of predictive modeling techniques.Prerequisites of this course are: Algebra, Descriptive Statistics, and Excel			
8	Outline syllabus				CO Mapping
	Unit 1	**Introduction to Analytics**			
	A	Descriptive, Predictive and Prescriptive Analytics, Analytics in Decision Making, The Analytics Life Cycle, Introduction to Predictive Analytics			CO1
	B	Matrix Notation, Model, Method and Feature, Probability Distribution,			CO1, CO2
	C	Covariance, Correlation, Hypothesis Testing, Analysis of Variance			CO1, CO2
	Unit 2	**Linear Regression**			
	A	Review on Simple Linear Regression, Ordinary Least Squares (OLS), Model Diagnostics			CO2,CO3
	B	Dummy, Derived and Interaction Variables, Multiple Linear Regression, Weighted Least Squares (WLS), Generalized Linear Models (GLM)			CO2, CO3
	C	Multivariate Regression, Estimation of Regression Parameters, Multi-collinearity, Model Deployment			CO2,CO3
	Unit 3	**Data Pre-processing**			
	A	Variable Types, Introduction to Data Transformations, Data Transformations: Categorical to Dummy, Variables Polynomials, Box-Cox Transformation			CO3
	B	Log & Elasticity Models, Logit Transformation, Count Data Models, Centering, Standardization			CO3,CO4
	C	Rank Transformations, Lagging Data (Causal Models) basics of Data Reduction			CO3,CO4
	Unit 4	**Variable selection and Dimensionality reduction**			

	A	Variable Selection, Dimensionality Issues, Multi-Collinearity, Variable Selection Methods, Step Methods	CO3,CO4, CO5
	B	Regularization: Penalized or Shrinkage Models, Ridge Regression, LASSO	CO3,CO4, CO5
	C	Dimension Reduction Models, Principal Components Regression (PCR), Linear Discriminant Analysis, Quadratic Discriminant Analysis, Partial Least Squares (PLS)	CO3,CO4, CO5
	Unit 5	**Classification and Forecasting**	
	A	Machine Learning overview, Bias vs. Variance Trade-off, Error Measures, Cross-Validation	CO4,CO5,CO6
	B	Binomial Logistic Regression, Multinomial Logistic Regression,	CO4,CO5,CO6
	C	• Forecasting: Time Series Analysis, Additive & Multiplicative models, Exponential smoothing techniques, Forecasting Accuracy, Auto-regressive and Moving average models	CO4,CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 25% / MTE: 25% / ETE: 50%	
	Text book/s*	• Applied Predictive Modeling by Max Kuhn and Kjell Johnson	
	Other References	• Statistical and Machine-Learning Data Mining: Techniques for Better Predictive Modeling and Analysis of Big Data, Second Edition by Bruce Ratner • Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst by Dean Abbott	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	*Determine* the key concepts for predictive analytics	PO1, PO2, PO4, PO11, PO12, PSO1, PSO2, PSO3
2.	*Apply* specific statistical and regression analysis methods applicable to predictive analytics	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
3.	*Interpret* the data and selecting appropriate features.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO11, PO12, PSO1, PSO2, PSO3
4.	*Develop* and use various quantitative and classification predictive models	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5	*Identify* new trends and patterns, uncover relationships, create forecasts, predict likelihoods, and test predictive hypotheses.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6	*Compare* the performance of different prediction and classification models.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3

CO1	2	2	-	2	-	-	-	-	-	-	2	2	1	2	1
CO2	3	2	2	2	3	3	3	2	2	1	2	3	1	1	2
CO3	2	3	2	3	2	1	1	2	2	-	1	2	2	1	1
CO4	3	2	3	3	3	3	2	2	1	2	3	2	2	3	2
CO5	2	3	2	3	3	3	2	1	2	1	2	2	3	2	2
CO6	2	2	2	2	2	2	1	2	2	1	2	3	1	3	2
	2.3	2.3	1.8	2.5	2.2	2.0	1.5	1.5	1.5	0.8	2.0	2.3	1.7	2.0	1.7

B.Tech (CSE) with Specialization in Cyber Security & Forensics in association with Microsoft

School:		**School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B.tech**		
Branch:		**Computer Science & Engineering with Specialization in Cyber Security and Forensics**		
1	Course Code	CSC102		
2	Course Title	Introduction to Cyber Security & Laws		
3	Credits	2		
4	Contact Hours (L-T-P)	2-0-0		
	Course Status	CORE		
5	Course Objective	This course will provide students exposure to the key legal and policy issues related to cybersecurity, including the legal authorities and obligations of both the government and the private sector with respect to protecting computer systems and networks, as well as the national security aspects of the cyber domain including authorities related to offensive activities in cyberspace.		
6	Course Outcomes	• On successful completion of this module students will be able to • CO1: Illustrate why securing the Nation's computer systems, which has been a goal of multiple successive administrations and has broad bipartisan and public support, has proven to be so difficult to achieve. • CO2: Analyze attack methodology and combat hackers from intrusion or other suspicious attempts at connection to gain unauthorized access to a computer and its resources • CO3: Adapt Protection of data and respond to threats that occur over the Internet • CO4: Construct and implement risk analysis, security policies, and damage assessment • CO5:Plan, implement and audit operating systems' security in a networked, multi-platform and cross platform environment • CO6: Demonstrate contingency operations that include administrative planning process for incident response, disaster recovery, and business continuity planning within information security		
7	Course Description	This course introduces advanced aspects of Cyber Crime, encompassing the Laws and its domains comprising many activities such as data breaches and all, and choose the relevant countermeasures.		
8	Outline syllabus			CO Mapping
	Unit 1	**Introduction**		**Introduction**
	A	Brief overview of Networking Concepts, Information Security Concepts		CO1
	B	Security Threats and Vulnerabilities		CO1
	C	Basics of Cryptography / Encryption		CO1, CO6
	Unit 2	**Information and Network Security Cyber Law-International Perspectives**		
	A	Security Management Practices, Access Control and Intrusion Detection		CO2
	B	Security for VPN and Next Generation Technologies		CO2

	C	Security Architectures and Models, System Security, Wireless Network and Security	CO2, CO6
	Unit 3	**Cyber Law: Indian and International Perspectives**	
	A	Need for Cyber Law, Cyber Jurisprudence at International and Indian Level	CO3
	B	UN & International Telecommunication Union (ITU) Initiatives, GDPR (General Data Protection Regulation)	CO3
	C	Council of Europe - Budapest Convention on Cybercrime, Asia-Pacific Economic Cooperation (APEC), GDPR, The Data Privacy Act 1998-2018	CO3, CO6
	Unit 4	**Constitutional & Human Right Issues in CyberSpace, Cyber Torts**	
	A	Freedom of Speech and Expression in Cyberspace, Right to Access Cyberspace – Access to Internet	CO4
	B	Right to Privacy, Right to Data Protection	CO4
	C	Cyber Defamation, Different Types of Civil Wrongs under the IT Act 2000, Different offences under IT Act 2000	CO4, CO6
	Unit 5	**CyberCrime and Legal FrameWork**	
	A	Cyber Crimes against Individuals, Institution and State	CO5
	B	Hacking, Digital Forgery, Cyber Stalking/Harassment, Cyber Pornography, Identity Theft & Fraud	CO5
	C	Cyber terrorism, Cyber Defamation	CO5, CO6
	Mode of examination	Theory	Theory
	Weightage Distribution	CA: 25% / MTE: 25% / ETE: 50%	
	Text book/s*	• Chris Reed & John Angel, Computer Law, OUP, New York, (2007). • Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi, (2012). • Verma S, K, Mittal Raman, Legal Dimensions of Cyber Space, Indian Law Institute, New Delhi, (2004) • JonthanRosenoer, Cyber Law, Springer, New York, (1997). Sudhir Naib, The Information Technology Act, 2005: A Handbook, OUP, New York, (2011)	
	Other References	1. S. R. Bhansali, Information Technology Act, 2000, University Book House Pvt. Ltd., Jaipur (2003). Vasu Deva, Cyber Crimes and Law Enforcement, Commonwealth Publishers, New Delhi, (2003).	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Illustrate why securing the Nation's computer systems, which has been a goal of multiple successive administrations and has broad bipartisan and public support, has proven to be so difficult to achieve.	PO1,PO2, PO5, PO8,PO12,PSO3
2.	CO2: Analyze attack methodology and combat hackers from intrusion or other suspicious attempts at connection to gain unauthorized access to a computer and its resources	PO1, PO2, PO3, PSO3
3.	CO3: Adapt Protection of data and respond to threats that occur over the Internet	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: Construct and implement risk analysis, security policies, and damage assessment	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: Plan, implement and audit operating systems' security in a networked, multi-platform and cross platform environment	PO1, PO2, PO3,PO8,PO9,PSO2,
6.	CO6: Demonstrate contingency operations that include administrative planning process for incident response, disaster recovery, and business continuity planning within information security	PO1, PO2, PO4, PO5, PO6,PO7,PO10,PO11,PSO1

PO and PSO mapping with level of strength for Course Name Introduction to cyber security and laws CSC 102

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
Introduction to cyber security and laws CSC 102	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3
CSC102	Introduction to cyber security and laws	3	2.7	1.1	1	1.5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Strength of Correlation

1. Addressed to***Slight (Low=1)extent2.*** Addressed to***Moderate (Medium=2) extent***
3. Addressed to***Substantial (High=3) extent***

School:		School of Engineering & Technology		
Department		Computer Science & Engineering		
Program:		B.Tech		
Branch:		Computer Science & Engineering with Specialization in Cyber Security and Forensics		
1	Course Code	CSC201		
2	Course Title	Digital Forensics		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	CORE		
5	Course Objective	Provide the students with practice on applying digital forensics techniques and enhance their skills regarding practical applications of digital forensics.		

6	Course Outcomes	• On successful completion of this module students will be able to CO1:Demonstrate the principles of Digital Forensics and how resultant evidence can be applied within legal cases. CO2:Illustrate their competence in evidence recovering files, network forensics, password cracking CO3:Evaluate the effectiveness of available digital forensics tools and use them in a way that optimizes the efficiency and quality of digital forensics investigations. CO4: Apply a solid foundational grounding in computer networks, operating systems, file systems, hardware, and mobile devices to digital investigations and to the protection of computer network resources from unauthorized activity CO5: Access and critically evaluate relevant technical and legal information and emerging industry trends CO6:Adapt effectively the results of a computer, network, and/or data forensic analysis verbally, in writing, and in presentations to both technical and lay audiences.	
7	Course Description	This course introduces students to basics of Digital Forensics. Make them apply appropriate skills and knowledge in solving computer forensics problems.	
8	Outline syllabus		CO Mapping
	Unit 1	INTRODUCTION TO COMPUTER FORENSICS	
	A	History of Forensics – Computer Forensic Flaws and Risks	CO1
	B	Rules of Computer Forensics – Legal issues – Digital Forensic Principles	CO1
	C	Digital Environments – Digital Forensic Methodologies	CO1
	Unit 2	AN OVERVIEW OF DIGITAL FORENSICS INVESTIGATION	

	A	Understanding Computing Investigations–digital evidence	CO2
	B	Seizure methodology factors limiting the whole sale seizure of hardware- Demystifying computer/ cyber crime	CO2
	C	Digital Evidence Collection, Evidence Preservation	CO2, CO6
	Unit 3	DATA FORENSICS	
	A	Recovering deleted files and deleted partitions – deleted file recovery tools –	CO3
	B	deleted partitioned recovery tools – data acquisition and duplication	CO3
	C	data acquisition tools – hardware tools – backing up and duplicating data.	CO3, CO6
	Unit 4	NETWORK FORENSICS	
	A	Overview of Network Forensics and Investigating Logs –incident response techniques	CO4
	B	Identify the footprint of an attack – Denial of Service Investigations	CO4
	C	Challenges of network forensics vs. disk forensics	CO4,CO6
	Unit 5	E-MAIL FORENSICS AND STEGANOGRAPHY	
	A	E-mail Basic- Fake Emails - Spoofing	CO5,
	B	Forensics Acquisition – Processing local mail archives	CO5,CO6

	C	Steganography – Steganalysis- classification of steganography - Categories of steganography in forensics			CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	• Anthony Reyes, Jack Wiles, “Cybercrime and Digital Forenscis”, Syngress Publishers, Elsevier 2007. • John Sammons, “The Basics of Digital Forensics”, Elsevier 2012			
	Other References	• Linda Volonins, Reynalds Anzaldua, “Computer Forensics for dummies”, Wiley Publishing 2008.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Demonstrate the principles of Digital Forensics and how resultant evidence can be applied within legal cases.	PO1, PO2, PO5, PO8, PO12, PSO3
2.	CO2: Illustrate their competence in evidence recovering files, network forensics, password cracking	PO1, PO2, PO3, PSO3
3.	CO3: Evaluate the effectiveness of available digital forensics tools and use them in a way that optimizes the efficiency and quality of digital forensics investigations.	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: Apply a solid foundational grounding in computer networks, operating systems, file systems, hardware, and mobile devices to digital investigations and to the protection of computer network resources from unauthorized activity	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: Access and critically evaluate relevant technical and legal information and emerging industry trends	PO1, PO2, PO3, PO8, PO9, PSO2,
6.	CO6: Adapt effectively the results of a computer, network, and/or data forensic analysis verbally, in writing, and in presentations to both technical and lay audiences.	PO1, PO2, PO4, PO5, PO6, PO7, PO10, PO11, PSO1

PO and PSO mapping with level of strength for Course Name Digital Forensics (Course Code CSC201)

Course Code_ Course Name	CO's	PO1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
Digital Forensics (CSC201)	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSC201	Digital Forensics	3	2.7	1.1	1	1.5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Strength of Correlation

1. Addressed toSlight (Low=1)extent 2. Addressed toModerate (Medium=2) extent
3. Addressed toSubstantial (High=3) extent

School:		School of Engineering & Technology
Department		Computer Science & Engineering
Program:		B.Tech
Branch:		Computer Science & Engineering with Specialization in Cyber Security and Forensics
1	Course Code	CCP201
2	Course Title	Digital Forensics lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory/Elective
5	Course Objective	• Provide the students with practice on applying digital forensics techniques and enhance their skills regarding practical applications of digital forensics.

6	Course Outcomes	CO1:Demonstrate digital investigations that conform to accepted professional standards and are based on the investigative process: identification, preservation, examination, analysis, and reporting; CO2:Compare and adhere to the highest professional and ethical standards of conduct, including impartiality and the protection of personal privacy CO3: Evaluate collaboratively with clients, management, and/or law enforcement to advance digital investigations or protect the security of digital resources. CO4: List potential security breaches of computer data that suggest violations of legal, ethical, moral, policy, and/or societal standards CO5:Access and critically evaluate relevant technical and legal information and emerging industry trends; and CO6:Illustrate effectively the results of a computer, network, and/or data forensic analysis verbally, in writing, and in presentations to both technical and lay audiences.	
7	Course Description	This course introduces students to basics of Digital Forensics. Make them apply appropriate skills and knowledge in solving computer forensics problems.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction to computer forensics	
	A	Study of Computer Forensics and different tools used for forensic investigation	CO1
	B	Study to Recover Deleted Files using Forensics Tools	CO1,
	Unit 2	An overview of digital forensics investigation	
	A	Study the steps for hiding and extract any text file behind an image file/ Audio file using Command Prompt.	CO2

	B	View Last Activity of Your PC			CO2, CO5,CO6
	Unit 3	Data forensics			
	A	Create the forensic image of the hard drive using EnCase Forensics.			CO3
	B	Restoring the Evidence Image using EnCase Forensics			CO3
	Unit 4	Network forensics			
	A	Perform experiment of buffer overflows using c language			CO4
	B	Live Forensics Case Investigation using Autopsy			CO4
	C	Extracting Browser Artifacts			CO2, CO4,CO6
	Unit 5	E-mail forensics and steganography			
	A	Perform experiment of email hacking using any website			CO5,
	B	Collect Email Evidence in Victim PC			CO5,CO6
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	

	Text book/s*	• Anthony Reyes, Jack Wiles, "Cybercrime and Digital Forenscis", Syngress Publishers, Elsevier 2007. • John Sammons, "The Basics of Digital Forensics", Elsevier 2012	
	Other References	• Linda Volonins, Reynalds Anzaldua, "Computer Forensics for dummies", Wiley Publishing 2008.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Demonstrate digital investigations that conform to accepted professional standards and are based on the investigative process: identification, preservation, examination, analysis, and reporting;	PO1, PO2, PO5, PO8, PO12, PSO3
2.	CO2: Compare and adhere to the highest professional and ethical standards of conduct, including impartiality and the protection of personal privacy	PO1, PO2, PO3, PSO3
3.	CO3: Evaluate collaboratively with clients, management, and/or law enforcement to advance digital investigations or protect the security of digital resources;	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: List potential security breaches of computer data that suggest violations of legal, ethical, moral, policy, and/or societal standards	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: Access and critically evaluate relevant technical and legal information and emerging industry trends; and	PO1, PO2, PO3, PO8, PO9, PSO2,

6.	CO6: Illustrate effectively the results of a computer, network, and/or data forensic analysis verbally, in writing, and in presentations to both technical and lay audiences.	PO1, PO2, PO4, PO5, PO6, PO7, PO10, PO11, PSO1

PO and PSO mapping with level of strength for Course Name Digital Forensic Lab (Course Code CCP201)

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Digital Forensics (CCP201)	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CCP201	Digital Forensics Lab	3	2.7	1.1	1	1.5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Addressed to*Moderate (Medium=2) extent*
3. Addressed to*Substantial (High=3) extent*

School:		School of Engineering & Technology		
Department		Computer Science & Engineering		
Program:		B.Tech		
Branch:		Computer Science & Engineering with Specialization in Cyber Security and Forensics		
1	Course Code	CSC301		
2	Course Title	Ethical Hacking		
3	Credits	3		
4	Contact Hours (L-T-P)	2-0-2		
	Course Status	core		
5	Course Objective	To provide students about the Ethical hacking Concepts, importance of ethical hacking in IT and Working structure of hacking		
6	Course Outcomes	On successful completion of this module students will be able to: CO1: Define the description of ethical Hacking CO2: Illustrate Types of Ethical Hacking. CO3: Explain about web and network hacking CO4: Demonstrate report writing and Mitigation CO5: Formulate the use of safe techniques on the World Wide Web CO6: Analyze various digital forensic problems		
7	Course Description	This course introduces ethical hacking concept and application of ethical hacking in network security.		
8	Outline syllabus			Outline syllabus
	Unit 1	Introduction to Ethical Hacking		
	A	Security Fundamental, Security testing, Hacker and Cracker, Descriptions		CO1

	B	Test Plans-keeping It legal, Ethical and Legality	CO1, CO2
	C	The Attacker's Process, The Ethical Hacker's Process, Security and the Stack	CO1, CO2,CO4
	Unit 2	Footprinting and Scanning	
	A	Information Gathering, Determining the Network Range, Identifying Active Machines	CO1, CO2
	B	Finding Open Ports and Access Points, OS Fingerprinting Services, Mapping the Network Attack Surface	CO1, CO2
	C	Enumeration, System Hacking	CO1, CO2,CO5,CO6
	Unit 3	Malware Threats	
	A	Viruses and Worms, Trojans, Covert Communication	CO1,CO2,CO3
	B	Keystroke Logging and Spyware, Malware Counter measures	CO1,CO2,CO3
	C	Sniffers, Session Hijacking, Denial of Service and Distributed, Denial of Service	CO1,CO2,CO3
	Unit 4	Web Server Hacking	
	A	Web Server Hacking, Web Application Hacking	CO2,CO3,CO4
	B	Database Hacking	CO3,CO4
	C	Wireless Technologies, Mobile Device Operation and Security, Wireless LANs	CO2, CO4,CO5
	Unit 5	IDS, Firewalls and Honeypots	

	A	Intrusion Detection Systems, Firewalls, Honeypots			CO2,CO5,
	B	Physical Security, Social Engineering			CO3,CO5,CO6
	C	Case Studies			CO4,CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1.Ec-Council, "Ethical Hacking and Countermeasures: Attack Phases", Delmar Cengage Learning, 2009. 2. Michael T. Simpson, Kent Backman, James E. Corley, "Hands-On Ethical Hacking and Network Defense", Cengage Learning, 2012			
	Other References	3. Patrick Engebretson, "The Basics of Hacking and Penetration Testing – Ethical Hacking and Penetration Testing Made Easy", Syngress Media, Second Revised Edition, 2013. 4. Jon Erickson, "Hacking: The Art of Exploitation", No Starch Press, Second Edition, 2008.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the description of ethical Hacking	PO1,PO2, PO5, PO8,PO12,PSO3
2.	CO2: Illustrate Types of Ethical Hacking.	PO1, PO2, PO3, PSO3
3.	CO3: Explain about web and network hacking	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: Demonstrate report writing and Mitigation	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: Formulate the use of safe techniques on the World Wide Web	PO1, PO2, PO3,PO8,PO9,PSO2,
6.	CO6: Analyze various digital forensic problems	PO1, PO2, PO4, PO5, PO6,PO7,PO10,PO11,PSO1

PO and PSO mapping with level of strength for Course Name Ethical Hacking (Course Code CSC301)

Course Code_ Course Name	CO's	PO1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
Ethical Hacking (Course Code CSC301)	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSC301	Ethical Hacking	3	2.7	1.1	1	1.5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Strength of Correlation

1. Addressed toSlight (Low=1)extent 2. Addressed toModerate (Medium=2) extent
3. Addressed toSubstantial (High=3) extent

School:		School of Engineering & Technology	
Department		Computer Science & Engineering	
Program:		B.Tech	
Branch:		Computer Science & Engineering with Specialization in Cyber Security and Forensics	
1	Course Code	CCP301	
2	Course Title	Ethical Hacking Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	core	
5	Course Objective	To provide students about the Ethical hacking Concepts, importance of ethical hacking in IT and Working structure of hacking	
6	Course Outcomes	On successful completion of this module students will be able to: CO1: Define the description of ethical Hacking CO2: Illustrate Types of Ethical Hacking. CO3: Explain about web and network hacking CO4: Demonstrate report writing and Mitigation CO5: Formulate the use of safe techniques on the World Wide Web CO6: Analyze various digital forensic problems	
7	Course Description	This course introduces ethical hacking concept and application of ethical hacking in network security.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction to Ethical Hacking	

		To learn about hacking tools and skills.			CO1, CO2
	Unit 2	Footprinting and Scanning			
		To study about Footprinting and Reconnaissance			CO1, CO2
		To study about Fingerprinting.			CO1, CO2,CO3
	Unit 3	Malware Threats			
		To study about system Hacking.			CO1,CO2,CO3, CO5
	Unit 4	Web Server Hacking			
		To study about Wireless Hacking			CO2,CO3,CO4
	Unit 5	IDS, Firewalls and Honeypots			
		To learn & study about Sniffing & their tools.			CO2,CO5,CO6
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1.Ec-Council, “Ethical Hacking and Countermeasures: Attack Phases”, Delmar Cengage Learning, 2009. 2. Michael T. Simpson, Kent Backman, James E. Corley, “Hands-On Ethical Hacking and Network Defense”, Cengage Learning, 2012			

	Other References	3. Patrick Engebretson, "The Basics of Hacking and Penetration Testing – Ethical Hacking and Penetration Testing Made Easy", Syngress Media, Second Revised Edition, 2013. 4. Jon Erickson, "Hacking: The Art of Exploitation", No Starch Press, Second Edition, 2008.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the description of ethical Hacking	PO1,PO2, PO5, PO8,PO12,PSO3
2.	CO2: Illustrate Types of Ethical Hacking.	PO1, PO2, PO3, PSO3
3.	CO3: Explain about web and network hacking	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: Demonstrate report writing and Mitigation	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: Formulate the use of safe techniques on the World Wide Web	PO1, PO2, PO3,PO8,PO9,PSO2,
6.	CO6: Analyze various digital forensic problems	PO1, PO2, PO4, PO5, PO6,PO7,PO10,PO11,PSO1

PO and PSO mapping with level of strength for Course Name Ethical Hacking Lab-CCP301

Course Code_ Course Name	CO's	PO1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CCP301_Ethical Hacking Lab	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CCP301	Ethical Hacking Lab	3	2.7	1.1	1	1.5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Strength of Correlation

1. Addressed toSlight (Low=1)extent 2. Addressed toModerate (Medium=2) extent
3. Addressed toSubstantial (High=3) extent

School:		School of Engineering & Technology		
Department		Computer Science & Engineering		
Program:		B.Tech		
Branch:		Computer Science & Engineering with Specialization in Cyber Security and Forensics		
1	Course Code	CSC061		
2	Course Title	Security Threats Intelligence and Risk Management		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Elective		
5	Course Objective	The subject provides a foundational platform for Cyber Security Aspirants by providing Cyber Security Awareness and Training that heighten the chances of catching a scam or attack before it is fully enacted, minimizing damage to the resources and ensuring the protection of information technology assets.		
6	Course Outcomes	CO1: Analyze and evaluate the cyber security needs of an organization. CO2: Determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation. CO3: Measure the performance and troubleshoot cyber security systems. CO4: Implement cyber security solutions and use of cyber security, information assurance, and cyber/computer forensics software/tools. CO5: Comprehend and execute risk management processes, risk treatment methods, and key risk and performance indicators. CO6: Design and develop a security architecture for an organization.		
7	Course Description	Understand principles of web security and to guarantee a secure network by monitoring and analyzing the nature of attacks through cyber/computer forensics software/tools.		

8	Outline syllabus		CO Mapping
	Unit 1	Introduction	
	A	Security threats - Sources of security threats- Motives	CO1
	B	Target Assets and vulnerabilities – Consequences of threats- E-mail threats	CO1, CO2
	C	Web-threats - Intruders and Hackers, Insider threats, Cyber-crimes.	CO1, CO2,CO4
	Unit 2	Network Threats	
	A	Network Threats: Active/ Passive – Interference – Interception – Impersonation	CO1, CO2
	B	Worms – Virus – Spam's – Ad ware - Spy ware – Trojans and covert channels – Backdoors – Bots	CO1, CO2
	C	IP Spoofing - ARP spoofing - Session Hijacking - Sabotage-Internal treats- Environmental threats - Threats to Server security	CO1, CO2,CO5,CO6
	Unit 3	Security Threat	
	A	Security Threat Management: Risk Assessment - Forensic Analysis - Security threat correlation	CO1,CO2,CO3
	B	Threat awareness - Vulnerability sources and assessment- Vulnerability assessment tools -Threat identification - Threat Analysis - Threat Modeling - Model for Information Security Planning	CO1,CO2,CO3
	C	Concepts of risk-based planning and risk management of computer and information systems.	CO1,CO2,CO3

	Unit 4	Security Elements			
	A	Security Elements: Authorization and Authentication - types, policies and techniques			CO2,CO3,CO4
	B	Security certification - Security monitoring and Auditing - Security Requirements Specifications			CO3,CO4
	C	Security Policies and Procedures, Firewalls, IDS, Log Files, Honey Pots			CO2, CO4,CO5
	Unit 5	Access control & Human factors			
	A	Access control, Trusted Computing and multilevel security - Security models			CO2,CO5,
	B	Trusted Systems, Software security issues, Physical and infrastructure security, Human factors – Security awareness, training, Email and Internet use policies,			CO3,CO5,CO6
	C	Risk and Threat vectors in different OS			CO4,CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1.Joseph M Kizza, “Computer Network Security”, Springer Verlag, 2005 2.Swiderski, Frank and Syndex, “Threat Modeling”, Microsoft Press, 2004. 3.William Stallings and Lawrie Brown, “Computer Security: Principles and Practice”,			

	Other References	4.Brian Kahin and Charles Nesson, eds, "Borders in Cyberspace: Information Policy and the Global Information Infrastructure" Cambridge: MIT Press, 1997. 5.Philip Agree and Marc Rotenberg, "Technology and Privacy: The New Landscape" Cambridge: MIT Press, 1998.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Analyze and evaluate the cyber security needs of an organization.	PO1, PO2, PO5, PO8, PO12, PSO3
2.	CO2: Determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation.	PO1, PO2, PO3, PSO3
3.	CO3: Measure the performance and troubleshoot cyber security systems.	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: Implement cyber security solutions and use of cyber security, information assurance, and cyber/computer forensics software/tools.	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: Comprehend and execute risk management processes, risk treatment methods, and key risk and performance indicators.	PO1, PO2, PO3, PO8, PO9, PSO2,
6.	CO6: Design and develop a security architecture for an organization.	PO1, PO2, PO4, PO5, PO6, PO7, PO10, PO11, PSO1

PO and PSO mapping with level of strength for Course NameSecurity Threats Intelligence and Risk Management (CSC061)

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CSC061_Security Threats Intelligence and Risk Management	CO 1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO 2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO 3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO 4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO 5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO 6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC061	Security Threats Intelligence and Risk Management	3	2.7	2.3	3	2.2	3	3	2.6	2.5	3	3	2.5	2	2	2

Strength of Correlation

1. Addressed to *Slight (Low=1) extent* 2. Addressed to *Moderate (Medium=2) extent*
3. Addressed to *Substantial (High=3) extent*

School:		**School of Engineering & Technology**
Department		**Computer Science & Engineering**
Program:		**B. Tech**
Branch:		**Computer Science & Engineering with Specialization in Cyber Security and Forensics**
1	Course Code	CSC302
2	Course Title	Cryptography and Network Security
3	Credits	3

4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Core	
5	Course Objective	To provide students with an overview cryptography and related algorithm which is required during data communication in computer networks which are the basic building blocks of different organizations throughout world with respect to security.	
6	Course Outcomes	After the successful completion of this course, students will be able to : CO1: Analyze the conventional Network security technique which are basically designed to maintain confidentiality. CO2: Compare the techniques of algorithms developed in modern cryptographic era. CO3: Explain the tools and methodologies used to perform Security analysis. CO4: Summarize the working knowledge of the Crytography application during Network Security to maintain security. CO5. Examine security at application layer, transport layer and network layer. CO6:Interpret use of cryptographic data integrity algorithms and user authentication protocols	
7	Course Description	This course introduces concepts of Crytography & all the techniques related to it. It also imparts the knowledge of digital signature & message authentication for effective Network Security.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Network Security & Ethics**	
	A	Computer Security Concepts- OSI security Architecture, Security attacks, Services, mechanism, model of network security	CO1, CO2, CO3
	B	Classical encryption techniques- Substitution Cipher (Mono-alphabetic, Poly-alphabetic), Transposition cipher, Steganography	CO1, CO2, CO3
	C	Block Cipher- Encryption Principles, DES & strength of DES	CO1, CO2, CO3
	Unit 2	**Mathematics of Cryptography**	
	A	Euclidean, Extended Euclidean Algorithm, Euler's Totient Function, Ferment little Theorem, Euler's Theorem	CO3
	B	Primality Testing-Miller Rabin test, Chinese Remainder Theorem	CO3, CO4
	C	Exponential- square and multiply method, Discrete Logarithm	CO3, CO4
	Unit 3	**Asymmetric Cryptography & Key Exchange**	
	A	Public Key cryptography-RSA, Cryptanalysis of RSA	CO2, CO3
	B	Key management & distribution: KDC	CO2, CO3
	C	Diffie Hellman key exchange	CO3, CO4
	Unit 4	**Digital Signatures**	
	A	User Authentication protocol- Kerberos, Digital Signature – RSA, Elgamal	CO2, CO3

	B	DSS, Data integrity algorithms-Hash Functions			CO2, CO4
	C	MD5, SHA-512			CO2, CO4
	Unit 5	**Message Authentication & hash function**			
	A	Authentication requirement & functions, Message Authentication Code			CO1, CO2
	B	Security of Hash function & MAC			CO2, CO4
	C	Secure HASH & MAC algorithm.			CO2
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Atul Kahate , "Network Security ", Wiley India Pvt Ltd, 2010. 2. Michael T. Simpson, "Hands-on Cryptography & Network Security & Network Defense", Course Technology, 2010. 3. Rajat Khare, "Network Seuciryt and Cryptography & Network Security ", Luniver Press, 2006.			
	Other References	1. Bruce Schneier, “Applied Cryptography”, John Wiley & Sons Inc, 2001. 2. Behrouz A. Forouzan, “Cryptography And Network Security”- McGraw Hill 3. Internet as a resource for reference.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Analyze the conventional Network security technique which are basically designed to maintain confidentiality.	PO1, PO2, PSO1
2.	CO2: Compare the techniques of algorithms developed in modern cryptographic era.	PO1,PO2,PO3,PSO1,PSO2
3.	CO3: Explain the tools and methodologies used to perform Security analysis.	PO1, PO3, PO5, PSO1, PSO2
4.	CO4: Summarize the working knowledge of the Crytography application during Network Security to maintain security	PO1, PO4, PO6, PO7, PSO1,PSO2
5.	CO5. Examine security at application layer, transport layer and network layer.	PO5,PO7, PO8, PO9, PSO1,PSO2
6.	CO6:Interpret use of cryptographic data integrity algorithms and user authentication protocols	PO10,PO11,PO12,PSO1,PSO3

PO and PSO mapping with level of strength for Course Name Cryptography and **Network Security(Course Code CSC302)**

Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC302_ Cryptography and Network Security	CO1	3	3	-	-	2	-	-	3	-	-	3	-	-	3	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	3	3
	CO3	3	3	2	-	2	-	-	-	2	-	2	3	-	-	3
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	3	-	3
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	3	-	3
	CO6	3	3	-	3	3	3	3	-	-	3	-	3	-	-	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO1	PSO 2	PSO 3
CSE302	Cryptography and Network Security	**3**	**2.9**	**2.3**	**3**	**2.2**	**3**	**3**	**2.6**	**2.5**	**3**	**2.5**	**3**	**3**	**3**	**3**

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B. Tech**	
Branch:		**Computer Science & Engineering with Specialization in Cyber Security and Forensics**	
1	Course Code	CCP302	
2	Course Title	**Cryptography and Network Security Lab**	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Core	
5	Course Objective	To provide deeper understanding into cryptography, its application to network security, threats/vulnerabilities to networks and countermeasures. To explain various approaches to Encryption techniques. To familiarize symmetric and asymmetric cryptography, Digital Signing, Message Authentication Codes (MAC), Hashing functions.	
6	Course Outcomes	On successful completion of this module students will be able to: CO1: Illustrate basic security attacks and services CO2: Demonstrate the skill on symmetric and asymmetric key algorithms for cryptography CO3:Perform basic cryptanalysis on encryption algorithms CO4: Analyze Digitally Sign documents or data CO5: Apply various Authentication functions CO6: Perform Hashing functions on data	
7	Course Description	This course gives practical exposure on basic security attacks, encryption algorithms, authentication techniques. Apart from security algorithms, firewall configuration is also introduced.	
8	Outline syllabus		CO Mapping
	Unit 1	**Symmetric Encryption – Substitution (Stream Ciphers)**	
	A	Perform the following implementation	CO1
	B	1. Encryption and Decryption with Ceaser cipher	CO1
	C	2. Encryption and Decryption with Playfair cipher 3. Encryption and Decryption with Hill cipher 4. Encryption and Decryption with Vigenere cipher	CO1
	Unit 2	**Symmetric Encryption – Transposition Technique**	
		Perform the following implementation 1. Transposition using Rail Fence Cipher 2. Transposition using Columnar Transposition 3. Transposition using Route Cipher 4. Transposition using Scytale Cipher	CO2, CO6

	Unit 3	**Symmetric Encryption – Substitution (Block Ciphers)**			
		Perform the following implementation 1. Encryption and Decryption with DES 2. Encryption and Decryption with 3-DES 3. Encryption and Decryption with AES 4. Encryption and Decryption with IDEA			CO3
	Unit 4	**Asymmetric Encryption**			
		Perform the following implementation 1. Encryption and Decryption with RSA 2. Encryption and Decryption with Diffie-Hellman 3. Encryption and Decryption with DSA			CO4, CO6
	Unit 5	**Digital Signature & Hashing & Authentication**			
		Perform the following implementation 1. Digital signature of data using RSA 2. Digital signature of data using Diffie-Hellman 3. Hashing function – SHA-1 4. Message Authentication Code (MAC)			CO5, CO6
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1.Cryptography and Network Security, 4th Edition, William Stallings, Prentice Hall, 2005			
	Other References	1. Cryptography & Network Security by Atul Kahate, Tata McGraw-Hill, 2008. 2. Internet as a Resource for Reference.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Identify basic security attacks and services for cryptography	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PSO
2.	CO2: Use symmetric and asymmetric key algorithms	PO1, PO2, PO3, PO5, PSO
3.	CO3:Perform basic cryptanalysis on encryption algorithms	PO1, PO2,,PO3 PO5, PSO1
4	CO4: Digitally Sign documents or data	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PSO1,PSO2
5	CO5: Make use of Authentication functions	PO1, PO2, PO3,PO4, PO5, PSO1
6	CO6: Perform Hashing functions on data	PO1, PO2, PO4, PO5, PO6, PO7, PO8, PO9,PSO

PO and PSO mapping with level of strength for Course Name Cryptography and Network Security Lab (CCP302)

Course Code – Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CCP 302_ Cryptography and Network Security Lab	CO1	3	3	-	-	2	-	-	3	-	-	3	-	-	3	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	3	3
	CO3	3	3	2	-	2	-	-	-	2	-	2	3	-	-	3
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	3	-	3
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	3	-	3
	CO6	3	3	-	3	3	3	3	-	-	3	-	3	-	-	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CCP 302	Cryptography and Network Security Lab	3	2.9	2.3	3	2.2	3	3	2.6	2.5	3	2.5	3	3	3	3

Strength of Correlation

1. Addressed to***Slight (Low=1) extent*** *2.* Addressed to***Moderate (Medium=2) extent***
3. Addressed to***Substantial (High=3) extent***

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B. Tech**	
Branch:		**Computer Science & Engineering with Specialization in Cyber Security and Forensics**	
1	Course Code		
2	Course Title	**Intrusion Detection and Prevention System**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Core	
5	Course Objective	The objective of this course is to provide an in depth introduction to intrusion detection and prevention. The course covers methodologies, techniques, and tools for monitoring events in computer system or network, with the objective of preventing and detecting unwanted process activity and recovering from malicious behavior.	
6	Course Outcomes	On successful completion of this module students will be able to: CO1: illustrate in-depth introduction to the Science and Art of Intrusion Detection and Prevention CO2: demonstrate the skill to learn Unauthorized Activity CO3: demonstrate the skill to capture and analyze network packets and detection methods CO4: analyze and apply various architecture CO5: analyze apply IDS, IPS Internals **&** Snort rules, outputs, and plug-ins to detect unauthorized activity CO6: apply and analyze different tools related to traffic monitoring and analysis, snort, architecture, IDS, IPS Internals	
7	Course Description	This course introduces intrusion detection and prevention, which is one of the most essential concepts in looking at how threats and attacks are detected and mitigated.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Intrusion Detection, basics of Intrusion Detection and Intrusion Prevention, Intrusion Detection system (IDS) and its types, Intrusion Prevention System (IPS), History, Importance	CO1
	B	IDS and IPS Analysis Schemes: The Anatomy of Intrusion Analysis, Misuse detection, anomaly detection, specification-based detection, hybrid detection; Example IDS Rules; IDS/IPS Pros and Cons; Myths	CO1
	C	Attacks: DDos attacks, TCP reset attack, malformed DNS attack	CO1
	Unit 2	**Unauthorized Activity**	

	A	Limitations of IDS, Network Protocol Abuses: ARP Abuses, IP Abuses, UDP Abuses, TCP Abuses, ICMP Abuses	CO2, CO6
	B	Pros and Cons of Open Source, Types of Exploits	CO2, CO6
	C	Commonly Exploited Programs and Protocols, Viruses and Worms	CO2, CO6
	Unit 3	**Traffic monitoring & analysis**	
	A	Tcpdump Command Line, Tcpdump Output Format, Tcpdump Expressions, Bulk Capture, Bytes Transferred in Connection	CO3, CO6
	B	Tcpdump as Intrusion Detection, Tcpslice, Tcpflow, and Tcpjoin, formats of tcpdump filters, bit masking	CO3, CO6
	C	Packet capturing using wireshark, wireshark display filters, Live network packet capturing, protocol analysis	CO3, CO6
	Unit 4	**Architecture**	
	A	Tiered Architecture of IDS and IPS: Single-Tiered Architecture, Multi-Tiered Architecture, Peer-to-Peer Architecture	CO4, CO6
	B	Sensors: Sensor Functions, Network-Based Sensors, Host-Based Sensors, Sensor Deployment Considerations, Sensor Security Considerations,	CO4, CO6
	C	Agents: Agent Functions, Agent Deployment Considerations, Agent Security Considerations; Manager Component: Manager Functions, Manager Deployment Considerations, Manager Security Considerations	CO4, CO6
	Unit 5	**IDS, IPS Internals & Snort**	
	A	Information Flow in IDS and IPS, Detection of Exploits	CO5, CO6
	B	Malicious Code Detection, Output Routines, Defending IDS/IPS	CO5, CO6
	C	Snort: configuration of snort, flow process of snort, Model of operation sniffer, logger, NIDS, Writing snort rules, writing a rule for vulnerability	CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	CA: 25% / MTE: 25% / ETE: 50%	
	Text book/s*	2.Intrusion Detection & Prevention , Carl F. Endorf, Eugene Schultz and Jim Mellander, McGraw Hill Professional, 2004	
	Other References	3. Metasploit: The Penetration Tester's Guide by David Kennedy, Jim O'Gorman, Devon Kearns, Mati Aharoni 4. Internet as a Resource for Reference.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: illustrate in-depth introduction to the Science and Art of Intrusion Detection and Prevention	PO1,PO2, PO5, PO8,PO12,PSO3
2.	CO2: demonstrate the skill to learn Unauthorized Activity	PO1, PO2, PO3, PSO3
3.	CO3: demonstrate the skill to capture and analyze network packets and detection methods	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: analyze and apply various architecture	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: analyze apply IDS, IPS Internals & Snort rules, outputs, and plug-ins to detect unauthorized activity	PO1, PO2, PO3,PO8,PO9,PSO2,
6.	CO6: apply and analyze different tools related to traffic monitoring and analysis, snort, architecture, IDS, IPS Internals	PO1, PO2, PO4, PO5, PO6,PO7,PO10,PO11,PSO 1

PO and PSO mapping with level of strength for Course Name Intrusion detection and prevention system (CSC303)

Course Code_ Course Name	**CO's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CSC303_Intrusion detection and prevention system	**CO1**	3	3	-	-	2	-	-	3	-	-	3	-	-	3	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	3	3
	CO3	3	3	2	-	2	-	-	-	2	-	2	3	-	-	3
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	3	-	3
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	3	-	3
	CO6	3	3	-	3	3	3	3	-	-	3	-	3	-	-	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CSC303	Intrusion detection and prevention system	**3**	**2.7**	**1.1**	**1**	**1.5**	**1**	**.5**	**1.3**	**.8**	**.5**	**.5**	**.8**	**1**	**1**	**1**

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B. Tech**	
Branch:		**Computer Science & Engineering with Specialization in Cyber Security and Forensics**	
1	Course Code		
2	Course Title	**Intrusion Detection and Prevention System Lab**	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Core	
5	Course Objective	The objective of this course is to provide an in depth introduction to intrusion detection and prevention. The course covers methodologies, techniques, and tools for monitoring events in computer system or network, with the objective of preventing and detecting unwanted process activity and recovering from malicious behavior.	
6	Course Outcomes	On successful completion of this module students will be able to: CO1: illustrate and able to perform scanning using nmap. CO2: demonstrate the skill to capture and analyze network packets CO3: analyze packet and detection methods CO4: analyze and apply Snort rules, outputs, and plug-ins to detect unauthorized activity CO5: apply different protocol analyzers tools CO6: apply different tools related to traffic monitoring, snort, toolkits	
7	Course Description	This course introduces intrusion detection and prevention, which is one of the most essential concepts in looking at how threats and attacks are detected and mitigated.	
8	Outline syllabus		CO Mapping
	Unit 1	**nmap**	
	A	Performa an experiment to demonstrate 1. Download and install nmap. 2. Use nmap with different options to scan open ports. 3. Perform OS fingerprinting, ping scan, tcp port scan, udp port scan, etc. using nmap	CO1
	B		CO1
	C		CO1
	Unit 2	**Traffic monitoring**	

		1. Performa an experiment to demonstrate how to perform binary packet capture, formats of tcpdump filters, bit masking using tcpdump 2. Performa an experiment to demonstrate how to sniff for router traffic by using the tool wireshark - Download and install wireshark network analyzer. - Capturing live network data - Open, save and merge Capture Files - Working with captured packets	CO2, CO6
	Unit 3	**Packets Analysis**	
		Performa an experiment to demonstrate 1. Examination of fields in TCPchecksums, normal and abnormal tcp stimulus and response 2. Detection methods for application protocols, pattern matching, protocol decode and anomaly detection 3. Sample attacks http, malformed dns , DDos, tcp reset attacks	CO3
	Unit 4	**Open source IDS: Snort**	
		Performa an experiment to demonstrate 1. Installing Snort into the Operating System. 2. Configuring and Starting the Snort IDS. 3. Defines Snort rules to detect the intrusions. 4. Write and Add Snort Rule 5. Triggering an Alert for the New Rule	CO4, CO6
	Unit 5	**Analyst toolkit**	
		Performa an experiment to demonstrate 1. TCP/ UDP connectivity using ngrep, tcpflow, netcat. 2. Create , read/write, alter and send packets using jpcap 3. launch arp poisining, dns poisioning attacks using jpcap	CO5, CO6
	Mode of examination	Jury/Practical/Viva	
	Weightage Distribution	CA: 25% MTE: 25% ETE: 50%	
	Text book/s*	3.Intrusion Detection & Prevention , Carl F. Endorf, Eugene Schultz and Jim Mellander, McGraw Hill Professional, 2004	
	Other References	5. Metasploit: The Penetration Tester's Guide by David Kennedy, Jim O'Gorman, Devon Kearns, Mati Aharoni 6. Internet as a Resource for Reference.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: illustrate and able to perform scanning using nmap.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PSO
2.	CO2: demonstrate the skill to capture and analyze network packets	PO1, PO2, PO4, PO5, PSO
3.	CO3: analyze packet and detection methods	PO1, PO2, PO4, PO5, PSO
4.	CO4: analyze and apply Snort rules, outputs, and plug-ins to detect unauthorized activity	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PSO
5.	CO5: apply different protocol analyzers tools	PO1, PO2, PO4, PO5, PSO
6.	CO6: apply different tools related to traffic monitoring, snort, toolkits	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PSO

PO and PSO mapping with level of strength for Course Name Intrusion detection and prevention System Lab (CCP303)

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CCP303_Intrusion detection and prevention Lab	**CO1**	3	3	-	-	2	-	-	3	-	-	3	-	-	3	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	3	3
	CO3	3	3	2	-	2	-	-	-	2	-	2	3	-	-	3
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	3	-	3
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	3	-	3
	CO6	3	3	-	3	3	3	3	-	-	3	-	3	-	-	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CCP303	Intrusion detection and prevention System Lab	**3**	**2.7**	**1.1**	**1**	**1.5**	**1**	**.5**	**1.3**	**.8**	**.5**	**.5**	**.8**	**1**	**1**	**1**

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		School of Engineering & Technology			
Department		Computer Science & Engineering			
Program:		B.Tech			
Branch:		Computer Science & Engineering with Specialization in Cyber Security and Forensics			
1	Course Code	CSC401			
2	Course Title	Introduction to IoT and Its Security			
3	Credits	3			
4	Contact Hours (L-T-P)	3-0-0			
	Course Status	CORE			
5	Course Objective	Provide the students with practice on applying digital forensics techniques and enhance their skills regarding practical applications of digital forensics.			
6	Course Outcomes	• On successful completion of this module students will be able to:- CO1: Apply the concepts of IOT CO2: Identify the different technology. CO3: Apply IOT to different applications. CO4: Examine and evaluate hardware aspect of security in IOT. CO5: Examine and evaluate software aspect of security in IOT CO6: Analysis and evaluate the data received through sensors in IOT			
7	Course Description	This course introduces students to basics of Digital Forensics. Make them apply appropriate skills and knowledge in solving computer forensics problems.			
8	Outline syllabus				CO Mapping

	Unit 1	OVERVIEW	
	A	IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.	CO1
	B	M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management,	CO1, CO2
	C	Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management	CO1, CO2,CO4
	Unit 2	REFERENCE ARCHITECTURE	
	A	IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT reference Model	CO1, CO2
	B	IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.	CO1, CO2
	C	Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.	CO1, CO2,CO5,CO6
	Unit 3	Conceptualizing the Secure Internet of Things	
	A	The BadUSB Thumb Drive, Air-Gap Security, Stuxnet,	CO1,CO2,CO3
	B	Designing Safe and Secure Cyber-Physical Systems	CO1,CO2,CO3

	C	Constrained Computing and Moore's Law, Trusted IoT Networks and the Network Edge			CO1,CO2,CO3
	Unit 4	Base Platform Security Hardware Building Blocks			
	A	Background and Terminology			CO2,CO3,CO4
	B	Identity Crisis, Device Boot Integrity, Data Protection,			CO3,CO4
	C	RunTime Protection, Threat Mitigated			CO2, CO4,CO5
	Unit 5	IOT Software Security Building Blocks			
	A	Operating System, Hypervisors and Virtualization			CO2,CO5,
	B	Software separation and containment, Network stack and security management, Device Management			CO3,CO5,CO6
	C	System Firmware and Root of Trust Update Services, Application level language Framework, Message Orchestration			CO4,CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Sunil Cheruvu, Anil Kumar, Ned Smith, David M. Wheeler "Demystifying Internet of Things Security"			
	Other References	1. Maciej Kranz, Building the Internet of Things - Comprehensive, Business			

		Focused, Well-articulated coverage of IoT, WILEY 2. Brian Russell and Drew Van Duren, Practical Internet of Things Security, PACKT	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Apply the concepts of IOT	PO1, PO2, PO5, PO8, PO12, PSO3
2.	CO2: Identify the different technology.	PO1, PO2, PO3, PSO3
3.	CO3: Apply IOT to different applications.	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: Examine and evaluate hardware aspect of security in IOT.	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: Examine and evaluate software aspect of security in IOT	PO1, PO2, PO3, PO8, PO9, PSO2,
6.	CO6: Analysis and evaluate the data received through sensors in IOT	PO1, PO2, PO4, PO5, PO6, PO7, PO10, PO11, PSO1

PO and PSO mapping with level of strength for Course Name Introduction to IoT and Its Security (CSC401)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
Introduction to IoT and its security (CSC401)	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSC401	Introduction to IoT and its security	3	2.7	2.3	3	2.2	3	3	2.6	2.5	3	3	2.5	2	2	2

Strength of Correlation

1. Addressed to *Slight (Low=1) extent* 2. Addressed to *Moderate (Medium=2) extent*
3. Addressed to *Substantial (High=3) extent*

School:		**School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B. Tech**		
Branch:		**CSE with Specialization in Cyber Security & Forensics in association with Microsoft**		
1	Course Code		**Machine Learning**	
2	Course Title	**Machine Learning**		
3	Credits			
4	Contact Hours (L-T-P)	2	0	0
	Course Status	Core		
5	Course Objective	Students are Expected to learn and develop Comprehensive Understanding of the of the following Concepts and Techniques: 1. To introduce the ideas of learning rule and implement them based on human experience. 2. To conceptualize the working of human brain using SVM, RF and ANN. 3. To become familiar with decision boundaries that can learn from available examples and generalize to form appropriate learning rules for inference systems. 4. To provide the mathematical background for SVM, RF and Neural Network based classification techniques. 5. To understand and demonstrate how to solve patterns learning from a large series of data using computer based learning algorithms		
6	Course Outcomes	A Successful completion of this Course Ensures the following Outcomes **CO 1 : Define basics of** Machine Learning and stochastic concepts. **CO2 : Identify and Compare** different type of preprocessing methods **CO 3 : Classify and Compare** existing models to understand the applicability in solve real world societal problems. **CO-4 : Identify develop and apply** mathematical models to find sustainable solutions. **CO-5 :Analyse and Apply** the unsupervised learning and model evaluation in real life problems. **CO-6 :**Discuss the applicability of Machine learning Approaches to develop sustainable solutions using professional ethics.		
7	Course Description	This course introduces computational learning paradigm for critical & implementable understanding for supervised and unsupervised learning based problem areas.		
8				CO Mapping
	Unit 1	**Core Concepts of Machine Learning**		
	A	What is Machine Learning? What kind of problems can be tackled using machine learning? The ML Mindset, Introduction to Machine Learning Problem Framing(Common ML Problems, ML Use Cases, Identifying Good Problems for ML, Hard ML Problems).		CO1
	B	Machine Learning Applications(Image Recognition, Speech Recognition, Medical Diagnosis, Statistical Arbitrage, Learning Associations), Learning Stages(Features, Labels, Hyperparameters, Validation Samples, Test Samples, Loss Function, Hypothesis Tests).		CO1, CO2

	C	Learning Scenarios(Supervised learning, Unsupervised learning, Semi- Supervised learning, Transductive inference, On-line learning, Reinforcement learning, Active learning), Generalization Supervised Learning, Unsupervised Learning, Reinforcement learning).	CO1, CO2
	Unit 2	**Data Preprocessing**	
	A	Data Preparation and Feature Engineering in ML(Data and Features, Information, Knowledge, Data Types, Big Data), Data Preprocessing: An Overview(Data Quality: Why Preprocess the Data?, Major Tasks in Data Preprocessing), Data Cleaning(Missing Values, Noisy Data, Data Cleaning as a Process),	CO2, CO6
	B	Data Integration(The Entity Identification Problem, Redundancy and Correlation Analysis, Tuple Duplication, Detection and Resolution of Data Value Conflicts), Data Reduction(Overview of Data Reduction Strategies, Attribute Subset Selection, Data Reduction, Histograms, Clustering, Sampling, Data Cube Aggregation),	CO2, CO6
	C	Data Transformation and Data Discretization(Overview of Data Transformation Strategies, Data Transformation by Normalization, Discretization by Binning, Discretization by Histogram Analysis, Discretization by Cluster, Decision Tree, and Correlation Analyses, Concept Hierarchy Generation for Nominal Data).	CO2, CO6
	Unit 3	**Supervised Learning Algorithms - Part One**	
	A	How Supervised Learning Algorithms Work ? Steps (Bias-variance trade off, Function complexity and amount of training data, Dimensionality of the input space, Noise in the output values, Algorithms, Other factors to consider (Heterogeneity of the data, Redundancy in the data).	CO1, CO3, CO6
	B	Linear Regression Model Representation, Linear Regression Learning the Model (Simple Linear Regression, Ordinary Least Squares, Gradient Descent), Regularization / Shrinkage Methods (Bias-variance trade-off, Overfitting Issues, Lasso Regression, Ridge Regression), Making Predictions with Linear Regression(Cost Function, Feature Scaling, Normalization, Mean Normalization, Learning Rate, Automatic Convergence Test)	CO1, CO3, CO6
	C	Logistic Regression, The Logistic Model (Latent variable interpretation, Logistic function, odds, odds ratio, and logit, Definition of the logistic function, Definition of the inverse of the logistic function, Interpretation of these terms, Definition of the odds, The odds ratio, Multiple explanatory variables), Model fitting ("Rule of ten", Iteratively reweighted least squares (IRLS), Evaluating goodness of fit, Limitations of Logistic Regression).	CO1, CO3, CO6
	Unit 4	**Supervised Learning Algorithms - Part Two**	
	A	Support Vector Machines, Linear SVM (Hard-margin, Soft-margin), Nonlinear Classification, Computing the SVM classifier(Primal, Dual, Kernel trick), Modern methods(Sub-gradient descent, Coordinate descent), Empirical risk minimization(Risk minimization, Regularization and stability, SVM and the hinge loss, Target functions), Properties(Parameter selection, Issues)	CO1,CO3,CO4, CO6
	B	Introduction to Artificial Neural Networks (Feed-forward Network Functions, Weight-space symmetries), Network Training (Parameter optimization, Local quadratic approximation, Use of gradient information, Gradient descent optimization), Error Backpropagation(Evaluation of error-function derivatives, Simple examples, Efficiency of backpropagation)	CO1,CO3,CO4, CO6
	C	Decision Tree Learning (Decision tree representation, ID3 learning algorithm, Entropy, Information gain, Overfitting and Evaluation, Overfitting, Validation Methods, Avoiding Overfitting in Decision	CO1,CO3,CO4, CO6

		Trees, Minimum-Description Length Methods, Noise in Data), Random Forests Algorithm (Preliminaries: decision tree learning, Bagging, From bagging to random forests, Extra Trees, Properties, Variable importance). Introduction to Ensemble			
	Unit 5	**Unsupervised Learning & Model Evaluation**			
	A	Unsupervised Learning (What is Unsupervised Learning?), Clustering Methods (Method Based on Euclidean Distance, Method Based on Probabilities, Hierarchical Clustering Methods, Method Based on Euclidean Distance)			CO5, CO6
	B	k-means Clustering Algorithm (Standard algorithm (naive k-means), Initialization methods), Applications (Vector quantization, Cluster analysis, Feature learning).			CO5, CO6
	C	Model Evaluation (ML Model Validation by Humans, Holdout Set Validation Method, Cross-Validation Method for Models, Leave-One-Out Cross-Validation, Random Subsampling Validation, Teach and Test Method, Bootstrapping ML Validation Method, Running AI Model Simulations, Overriding Mechanism Method), The ROC Curve.			CO5, CO6
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag. 2. Foundations of Machine Learning, Second Edition By MehryarMohri, AfshinRostamizadeh and AmeetTalwalkar, MIT Press, Second Edition, 2018. 3. Introduction to Machine Learning, Third Edition, By Ethem Alpaydin, The MIT Pressmitpress.mit.edu › books › introduction-machine-learni...			
	Other References	1) Baldi, P. and Brunak, S. (2002). Bioinformatics: A Machine Learning Approach. Cambridge, MA: MIT Press. 2) Russel, S. and Norvig, P. (2003). Artifiical Intelligence: A Modern Approach. 2ndEdition. New York: Prentice-Hall. 3) Cohen, P.R. (1995) Empirical Methods in Artificial Intelligence. Cambridge, MA: MIT Press. 4) https://www.toptal.com/machine-learning/ensemble-methods-machine-learning.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO 1 : *Define basics of*** *Machine Learning and stochastic concepts.*	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	**CO2 : Identify and Compare** different type of preprocessing methods	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	**CO 3 : Classify and Compare** existing models to understand the applicability in solve real world societal problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	**CO-4 : Identify develop and apply** mathematical models to find sustainable solutions.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	**CO-5 :Analyse and Apply** the unsupervised learning and feature engineering in real life problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

6.	**CO-6 :**Discuss the applicability of Machine learning Approaches to develop sustainable solutions using professional ethics.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Machine Learning **(Course Code)**

Subject	PO's / PSO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Machine Learning **(Course Code)**	CO1	3	3	3	3	3	3	2	1	1	3	1	3	2	2	1
	CO2	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO3	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO4	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO5	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	Machine Learning	3.00	3.00	3.00	3.00	3.00	3.00	2.83	2.00	2.00	3.00	2.67	3.00	2.83	2.83	2.67

Total- 41.83
Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School: SET		Batch: 2022	
Program: B.Tech.		**Current Academic Year: 2022-2022**	
Branch: CSE/IT		**Semester: IV**	
1	**Course Code**		
2	**Course Title**	**Machine Learning Lab**	
3	**Credits**	**1**	
4	**Contact Hours (L-T-P)**	**0-0-2**	
	Course Status	Core	
5	Course Objective	1. Learn the basic concepts of Machine Learning algorithms. 2. Make use of Data sets in implementing the machine learning algorithms. 3. Implement the machine learning concepts and algorithms in any suitable language of choice.	
6	Course Outcomes	CO 1: Show the implementation of linear and logistic Regression on real life applications. CO-2: Interpretation of existing models to understand the solution environment. CO-3: Application of existing mathematical solutions to test real world problems. CO-4 : Build the understanding of learning theory to glance the upcoming world through it. CO-5: Analyse the logical ability to apply clustering approach to extract hierarchical patterns existing in real life problems. CO-6: Appraise recent trends in machine learning and applications.	
7	Course Description	This course introduces computational learning paradigm for critical & implementable understanding for supervised and unsupervised learning based problem areas.	
8	Outline syllabus		CO Mapping
	Unit 1	**Core Concepts of Machine Learning**	
		Write a Program to load and view data set file.	CO1
		Write a program to implement simple linear regression using housing price prediction problem.	CO1, CO2
		Write a program to implement binary logistic regression using cancer identification problem.	CO1, CO2
	Unit 2	**Data Preprocessing**	
		Write a Program to perform data cleaning.	CO1, CO2, CO6
		Write a Program to perform Data Integration.	CO1, CO2, CO6
		Write a Program to perform Data Reduction.	CO1, CO2, , CO6
		Write a Program to perform Data Transformation and Data Discretization.	CO1, CO2, CO6
	Unit 3	**Supervised Learning Algorithms - Part One**	
		Write a program to implement gradient descent method for learning.	CO1,CO2,CO3, , CO6
		Write a program to implement regularized linear regression.	CO1,CO2,CO3, CO6
		Write a program to implement regularized logistic regression.	CO1,CO2,CO3, , CO6
		Write a program to Normalize the data used in linear regression problem above before predicting prices, and then predict the housing prices.	CO1,CO2,CO3, CO6

	Unit 4	**Supervised Learning Algorithms - Part Two**			
		Write a program to implement Support Vector Machine regression using suitable dataset.			CO2,CO3,CO4, CO6
		Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.			CO2,CO3,CO4, CO6
		Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.			
		Write a program to demonstrate the working of the Random Forest algorithm. Use an appropriate data set for classifying a new sample.			
	Unit 5	**Unsupervised Learning & Model Evaluation**			
		Write a program to implement data split into training and testing data.			CO2,CO5,CO6
		Write a program to implement K-Means clustering algorithm using an appropriate dataset.			
		Write a program to implement K-Means clustering algorithm using an appropriate dataset.			CO3,CO5,CO6
		Write a program to implement data cross validation			CO4,CO5,CO6
	Mode of examination	Practical			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag. 2. Foundations of Machine Learning, Second Edition By Mehryar Mohri, Afshin Rostamizadeh and Ameet Talwalkar, MIT Press, Second Edition, 2018. 3. Introduction to Machine Learning, Third Edition, By EthemAlpaydin, The MIT Pressmitpress.mit.edu › books › introduction-machine-learni...			
	Other References	1) Baldi, P. and Brunak, S. (2002). Bioinformatics: A Machine Learning Approach. Cambridge, MA: MIT Press. 2) Russel, S. and Norvig, P. (2003). Artifiical Intelligence: A Modern Approach. 2ndEdition. New York: Prentice-Hall. 3) Cohen, P.R. (1995) Empirical Methods in Artificial Intelligence. Cambridge, MA: MIT Press. 4) https://www.toptal.com/machine-learning/ensemble-methods-machine-learning.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO 1 : Show the implementation of linear and logistic Regression on real life applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	CO-2 : Interpretation of existing models to understand the solution environment.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8,

		PO9,PO10, PSO1,PSO2,PSO3
3.	CO-3 : Application of existing mathematical solutions to test real world problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	CO-4 : Build the understanding of learning theory to glance the upcoming world	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	CO-5 : Analyse the logical ability to apply clustering approach to extract hierarchical patterns existing in real life problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	CO-6: Appraise recent trends in machine learning and applications	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Machine Learning Lab **(Course Code)**

Subject	**PO's / PSO's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
Machine Learning **(Course Code)**	CO1	3	3	3	3	3	3	2	1	1	3	1	3	2	2	1
	CO2	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO3	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO4	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO5	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
	Machine Learning	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.83**	**2.00**	**2.00**	**3.00**	**2.67**	**3.00**	**2.83**	**2.83**	**2.67**

Total- 41.83
Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		School of Engineering & Technology			
Department		Computer Science & Engineering			
Program:		B.Tech			
Branch:		Computer Science & Engineering with Specialization in Cyber Security and Forensics			
1	Course Code	CSC			
2	Course Title	Open source Tools for Cyber Security & Forensics			
3	Credits	3			
4	Contact Hours (L-T-P)	2-0-2			
	Course Status				
5	Course Objective	to explore the needs and effects of Open source tools controls.			
6	Course Outcomes	CO1: Analyze the emergence of Open source concept CO2: Explain various features of open source need for cyber security. CO3: Illustrate restrictions that arise due to licensing of software. CO4: Understand vital laws related to open source. CO5: Demonstrate the skills of licensing and patents. CO6: Identify and use open source cyber tools for security and audits.			
7	Course Description	The course will inculcate the skills of Open Source Tools that makes cyber security a viable domain in industry.			
8	Outline syllabus				CO Mapping
	Unit 1	Introduction			
	A	Background of open source tool			CO1
	B	Need of Open source tools			CO1, CO2
	C	Open source paradigm			CO1, CO2,CO4
	Unit 2	Open source platform for programming			
	A	Introduction to Open source operating System			CO1, CO2
	B	Understanding architecture of LINUX			CO1, CO2
	C	Directories of LINUX			CO1, CO2,CO5,CO6
	Unit 3	Licensing			
	A	Licensing, Types of licensing			CO1,CO2,CO3
	B	Intellectual Proprietary Right			CO1,CO2,CO3
	C	Commercial License versus Open Source License			CO1,CO2,CO3
	Unit 4	Open Source Licensing			
	A	Contract, and Copyright Law -Basic Principles of Copyright Law			CO2,CO3,CO4
	B	Contract and Copyright, Open Source Software Licensing, Types of OSS licenses			CO3,CO4
	C	OSS licensing strategies, Issues with Copyrights and Patents, Warranties			CO2, CO4,CO5
	Unit 5	Open Source tools for Pre-mortem and Post-mortem Cyber operations			
	A	Windows O.S Supported Tools			CO2,CO5,
	B	Linux Supported Tools			CO3,CO5,CO6
	C	MAC Supported Tools			CO4,CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	OccupyTheWeb: Linux Basics for Hackers			

	Other References	Tony Howlett : Open Source Security Tools: A Practical Guide to Security Applications	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Analyze the emergence of Open source concept	PO1, PO2, PO5, PO8, PO12, PSO3
2.	CO2: Explain various features of open source need for cyber security.	PO1, PO2, PO3, PSO3
3.	CO3: Illustrate restrictions that arises due to licensing of software	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: Understand vital laws related to open source.	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5 Demonstrate the skills of licensing and patents.	PO1, PO2, PO3, PO8, PO9, PSO2,
6.	CO6: Identify and use open source cyber tools for security and audits.	PO1, PO2, PO4, PO5, PO6, PO7, PO10, PO11, PSO1

PO and PSO mapping with level of strength for Course Name Open source Tools for Cyber Security & Forensics

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Open source Tools for Cyber Security & Forensics	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC	Open source Tools for Cyber Security & Forensics	3	2.7	2.3	3	2.2	3	3	2.6	2.5	3	3	2.5	2	2	2

School:		School of Engineering & Technology
Department		Computer Science & Engineering
Program:		B.Tech
Branch:		Computer Science & Engineering with Specialization in Cyber Security and Forensics
1	Course Code	
2	Course Title	Open source Tools for Cyber Security & Forensics Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	core
5	Course Objective	to explore the needs and effects of Open source tools controls.
6	Course Outcomes	On successful completion of this module students will be able to: CO1: Analyze the emergence of Open source concept CO2: Explain various features of open source need for cyber security. CO3: Illustrate the extent of PowerShell in windows. CO4: Understand open source tool for wireless hacking. CO5: Use concept of open source for preventive security measures. CO6: Identify and use open source cyber tools for security and audits
7	Course Description	This course introduces ethical hacking concept and application of ethical hacking in network security.

8	Outline syllabus		CO Mapping
	Unit 1	Introduction of Open-Source hacking platforms	
		Familiarizing to execution environment	CO1, CO2

	Unit 2	Linux Traversing			
		Terminal Code execution for repository interaction			CO1, CO2
		To study files structure and PowerShell terminal			CO1, CO2,CO3
	Unit 3	Tools utility			
		PowerShell program to execute kernel interaction in windows			CO1,CO2,CO3, CO5
	Unit 4	Pre-mortem			
		Perform wireless hacking using open source platforms and tools			CO2,CO3,CO4
	Unit 5	Post-Mortem			
		Auditing for malware and deleted file system using open source tools			CO2,CO5,CO6
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	OccupyTheWeb: Linux Basics for Hackers			
	Other References	Tony Howlett : Open Source Security Tools: A Practical Guide to Security Applications			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the description of ethical Hacking	PO1,PO2, PO5, PO8,PO12,PSO3
2.	CO2: Illustrate Types of Ethical Hacking.	PO1, PO2, PO3, PSO3
3.	CO3: Explain about web and network hacking	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: Demonstrate report writing and Mitigation	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: Formulate the use of safe techniques on the World Wide Web	PO1, PO2, PO3,PO8,PO9,PSO2,
6.	CO6: Analyze various digital forensic problems	PO1, PO2, PO4, PO5, PO6,PO7,PO10,PO11,PSO1

PO and PSO mapping with level of strength for Course Name Open Source Tools for Cyber Security & Forensics Lab

Course Code_ Course Name	CO's	PO1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CCP301_Ethical Hacking Lab	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
	Open source Tools for Cyber Security & Forensics Lab	3	2.7	1.1	1	1.5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Strength of Correlation

1. Addressed toSlight (Low=1)extent 2. Addressed toModerate (Medium=2) extent
3. Addressed toSubstantial (High=3) extent

School:		School of Engineering & Technology		
Department		Computer Science & Engineering		
Program:		B. Tech		
Branch:		Computer Science & Engineering		
1	Course Code			
2	Course Title	Packet Analysis		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Elective		
5	Course Objective	To prepare student able to identify different applications of computer communications networks and understand the current state of the telecommunications industry while performing the packet and protocol analysis.		
6	Course Outcomes	On successful completion of this module students will be able to: CO1: To understand security concepts, Ethics in Network Security. CO2: To comprehend and apply relevant protocol like SSL, SSH etc. CO3: To identify network security threats. CO4: To be able to determine efforts to counter them. CO5: To solve real-word network problems using Wireshark. CO6: To understand Networks characteristics and components and its analysis using tools i.e. pCap or TCP-Dump or Wireshark.		
7	Course Description	This course is to provide students with an overview of the concepts and fundamentals of network security protocols and its analysis.		
8	Outline syllabus			CO Mapping
	Unit 1	Introduction		

	A	Network Forensics Investigative Methodology- Technical Fundamentals- Sources of Network-Based Evidence- On the Wire- In the Air- Switches - Routers- DHCP Servers- Name Servers- Authentication Servers.	CO1
	B	Network Intrusion Detection /Prevention Systems- Firewalls- Web Proxies- Application Servers- Central Log Servers.	CO1
	C	Evidence Acquisition: Physical Interception-Cables- Radio Frequency- Hubs- Switches- Traffic Acquisition Software- libpcap and WinPcap.	CO1
	Unit 2	Packet Filtering	
	A	The Berkeley Packet Filter (BPF) Language- tcpdump - Wireshark- tshark- dumpcap- Active Acquisition- Common Interfaces- Inspection Without Access- Strategy.	CO2
	B	Traffic Analysis: Protocol Analysis- Protocol Analysis Tools- Protocol Analysis Techniques- Packet Analysis- Packet Analysis Tools- Packet Analysis Techniques- Flow Analysis- Flow Analysis Tools- Flow Analysis Techniques.	CO2, CO6
	C	Higher-Layer Traffic Analysis- Common Higher-Layer Protocols- Higher-Layer Analysis Tools- Higher-Layer Analysis Technique with tools.	CO2, CO6
	Unit 3	Packet Flow Analysis	
	A	Statistical Flow Analysis- Process Overview- Sensors- Sensor Types- Sensor Software- Sensor Placement.	CO3
	B	Flow Record Export Protocols- NetFlow- IPFIX- sFlow- Collection and Aggregation- Wireless Traffic Capture and Analysis- Spectrum Analysis.	CO3, CO6

	C	Wireless Passive Evidence Acquisition- Common Attacks – Sniffing- Rogue Wireless Access Points- Evil Twin- WEP Cracking- Locating Wireless Devices	CO3, CO6
	Unit 4	Network Based Packet Flow Analysis	
	A	Network Devices- Intrusion Detection and Analysis: Typical NIDS/NIPS Functionality- Sniffing - Higher-Layer Protocol Awareness- Alerting on Suspicious Bits Modes of Detection.	CO4
	B	Signature-Based Analysis- Protocol Awareness- Behavioral Analysis- Types of NIDS/NIPSs.	CO4
	C	NIDS/NIPS Evidence Acquisition - Comprehensive Packet Logging - Event Log Aggregation- Correlation- and Analysis.	CO4
	Unit 5	Packet Log Analysis	
	A	Sources of Logs - Operating System Logs - Application Logs Physical Device Logs- Network Equipment Logs- Network Log Architecture- Three Types of Logging Architectures- Remote Logging: Common Pitfalls and Strategies.	CO5
	B	Switches - Content-Addressable Memory Table- ARP- Switch Evidence- Routers-Types of Routers- Router Evidence- Firewalls -Types of Firewalls - Firewall Evidence.	CO5
	C	Advanced Topics: Network Tunneling- Tunneling for Functionality- Inter-Switch Link (ISL) - Generic Routing Encapsulation (GRE). Tunneling for Confidentiality- Internet Protocol Security (IPsec) - Transport Layer Security (TLS) and Secure Socket Layer (SSL) - Covert Tunneling- Covert Tunneling Strategies - TCP Sequence Numbers - DNS Tunnels - ICMP Tunnels.	CO6
	Mode of examination	Theory	

	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Blacharski D., “Network Security in a Mixed Environment”Practical Packet Analysis: Using Wireshark to Solve Real-Word Network problems by Chris Sanders.			
	Other References	1. “Charles P. Pfleeger “Security in computing”, Pearson Education. 2. Stalling W., “Network Security Essentials”, Pearson. 3. Garfinkel S., Spafford G., “Practical Unix and Internet Security”, O'Reilly.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: To understand security concepts, Ethics in Network Security.	PO1,PO2, PO5, PO8,PO12,PSO3
2.	CO2: To comprehend and apply relevant protocol like SSL, SSH etc.	PO1, PO2, PO3, PSO3
3.	CO3: To identify network security threats.	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: To be able to determine efforts to counter them.	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: To solve real-word network problems using Wireshark.	PO1, PO2, PO3,PO8,PO9,PSO2,
6.	CO6: To understand Networks characteristics and components and its analysis using tools i.e. pCap or TCP-Dump or Wireshark.	PO1, PO2, PO4, PO5, PO6,PO7,PO10,PO11,PSO1

PO and PSO mapping with level of strength for Course Name -

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	CO1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
	CO2	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
	CO3	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
	CO4	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
	CO5	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
Packet Analysis	CO6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	Packet Analysis	3	2.7	2.3	3	2.2	3	3	2.6	2.5	3	3	2.5	2	2	2

Strength of Correlation *1.* Addressed to *Slight (Low=1) extent* *2.* Addressed to *Moderate (Medium=2) extent* *3.* Addressed to *Substantial (High=3) extent*

School: SET		Batch: 2022
Program: B.Tech.		Current Academic Year:
Branch: CSE		Semester:
1	Course Code	
2	Course Title	Packet Analysis Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	PE
5	Course Objective	To prepare student able to identify different applications of computer communications networks and understand the current state of the telecommunications industry while performing the packet and protocol analysis.
6	Course Outcomes	CO1: To understand security concepts, Ethics in Network Security. CO2: To comprehend and apply relevant protocol like SSL, SSH etc. CO3: To identify network security threats. CO4: To be able to determine efforts to counter them. CO5: To solve real-word network problems using Wireshark. CO6: To understand Networks characteristics and components and its analysis using tools i.e. pCap or TCP-Dump or Wireshark.
7	Course Description	This course is to provide students with an overview of the concepts and fundamentals of network security protocols and its analysis.
8	Outline syllabus	CO Mapping

	Unit 1	Introduction	
		Implement the following executing protocols of Internet in action using Wireshark Lab.	CO1
		Packet Capture and Observations using Packet Sniffer.	CO2
	Unit 2	Packet Filtering	
		Explore various aspects of HTTP Protocol	CO2, CO3, CO4
		Tracing DNS with Wireshark.	
	Unit 3	Packet Flow Analysis	
		Analysis and Obtain various parameters-Values for TCP Protocol in action	CO3, CO4
		Analysis and Obtain various parameters-Values for UDP Protocol in action	
	Unit 4	Network Based Packet Flow Analysis	
		Analysis and Obtain various parameters-Values for IP Protocol in action. Analysis and Obtain various parameters-Values for NAT Protocol in action. Analysis and Obtain various parameters-Values for ICMP Protocol in action. Analysis and Obtain various parameters-Values for Ethernet and ARP Protocols in action. Analysis and Obtain various parameters-Values for DHCP Protocol in action.	CO3, CO4,CO5
	Unit 5	Packet Log Analysis	

		Analysis and Obtain various parameters-Values for 802.11 Wireless Network Protocol in action. Analysis and Obtain various parameters-Values for SSL Protocol in action. Network tool Introduction – Packet Tracer, NS2, RF Planner (Not for Evaluation)			CO3, CO4,CO6
	Mode of examination	Practical			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	The Wireshark Problems with solution are available as Supplements: Wireshark Labs at : http://www-net.cs.umass.edu/wireshark-labs/			
	Other References	Companion Manual for the text book Computer Networking : A Top-Down Approach at : http://wps.pearsoned.com/ecs_kurose_compnetw_6/216/55463/14198700.cw/ BenchMark LAN Trainer User Manual by Prof. Timothy A. Gonsalves, Department of Computer Science & Engineering, IIT-Madras.			

Course outline This course introduces the features of Wireshark for Packet Analysis. To gain basic and core knowledge in Networking Software Development for OSI and TCP/IP Models with their corresponding Layers, Issues , Functionalities and Protocol Design.

Course Evaluation	
Attendance	None

Any other	CA judged on the practical conducted in the lab , weightage may be specified
References	
Text book	Companion Manual for the text book Computer Networking : A Top-Down Approach at : http://wps.pearsoned.com/ecs_kurose_compnetw_6/216/55463/14198700.cw/
Other References	The Wireshark Problems with solution are available as Supplements: Wireshark Labs at : http://www-net.cs.umass.edu/wireshark-labs/
Software	Windows, Unix / Any Unix family OS baased Wireshark, TCPDump.

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: To understand security concepts, Ethics in Network Security.	PO1,PO2,PO3,PO4,PSO1
2.	CO2: To comprehend and apply relevant protocol like SSL, SSH etc.	PO1, PO3, PO4, PSO2
3.	CO3: To identify network security threats.	PO1,PO2,PO3,PO4
4.	CO4: To be able to determine efforts to counter them.	PO9, PO10,PO11, PSO3
5.	CO5: To solve real-word network problems using Wireshark.	PO1,PO2,PO8,PO9,PO10,PSO1
6.	CO6: To understand Networks characteristics and components and its analysis using tools i.e. pCap or TCP-Dump or Wireshark.	PO1,PO2,PO10,PO11,PSO1,PSO2

PO and PSO mapping with level of strength for Course Name Packet Analysis Lab (Course Code -)

	Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	CO1	3	3	3	3	--	--	--	2	2	1	2	1	3	2	2
	CO2	3	2	3	3	--	--	--	2	2	2	1	1	2	3	2
	CO3	3	3	3	3	--	--	--	1	1	1	3	2	3	2	1
	CO4	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
	Co5	2	2	3	-	-	-	-	3	3	1	2	-	3	-	-
	CO6	3	2	-	-	-	-	-	-	-	2	3	-	2	2	-

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**Computer Science & Engineering with Specialization in Cyber Security and Forensics**	
1	Course Code	CSC021	
2	Course Title	Mobile and Wireless Security	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective	
5	Course Objective	To learn about Systems, protocols and cryptographic functions for realizing security properties, such as authentication, key distribution, integrity, confidentiality, in wireless access networks.	
6	Course Outcomes	On successful completion of this module students will be able to: CO1: acquire knowledge of information security technology and methods for communication systems that provide services for mobile users by wireless access networks. CO2: about some of the models, design principles, mechanisms and solutions used in wireless network security to obtain authentication and key transport protocols. CO3: acquire practice and analytical skills in information security assessment of technology CO4: apply security mechanisms and protocols in wireless communication networks. CO5: illustrate network security to obtain authentication and key transport protocols CO6: demonstrate security measures in wireless communication for WPAN, WLAN, mobile networks, and new emerging technology.	
7	Course Description	The course presents a selection of security functionalities employed in existing wireless communication for WPAN, WLAN, mobile networks, and new emerging technology.	
8	Outline syllabus		CO Mapping
	Unit 1	Wireless Network Basics	
	A	Distinction between wired and wireless networks from information theory;	CO1
	B	Effect of mobility on networks & systems - Mobile Ad Hoc Networks - Wireless Sensor Networks - Location Discovery	CO1, CO2
	C	In-Network Processing - Routing - Energy Efficiency - Clustering	CO1, CO2,CO4
	Unit 2	Security in Wireless Networks	
	A	Issues of security in wireless; IP broadcast, Satellite broadcast; issues of information capacity; issues of 802.11 protocols;	CO1, CO2
	B	design of secure protocols; Secure routing - Secure localization - Secure and resilient data aggregation - Key pre-distribution and management	CO1, CO2

	C	Encryption and authentication - Security in group communication - Impact on IP stack from MAC layer and up	CO1, CO2,CO5,CO6
	Unit 3	Source authentication	
	A	Source authentication of transmissions, and non-repudiation;	CO1,CO2,CO3
	B	Power management and selfishness issues, attacks in wireless networks;	CO1,CO2,CO3
	C	DOS and DDOS attacks, reaction to attacks, information processing for sensor networks.	CO1,CO2,CO3
	Unit 4	Socket Programming	
	A	Introduction to socket programming- Concurrent Processing in Client-Server Software-Byte ordering and address conversion functions	CO2,CO3,CO4
	B	Socket Interface - System calls used with sockets - Iterative server and concurrent server- Multi protocol and Multi service server- TCP/UDP Client server programs	CO3,CO4
	C	Thread Creation and Termination – TCP Echo Server using threads- Remote Procedure Call.	CO2, CO4,CO5
	Unit 5	Next Generation Internet Protocol	
	A	Introduction to IPv6 – IPv6 Advanced Features –V4 and V6 header comparison	CO2,CO5,
	B	V6 Address types –Stateless auto configuration	CO3,CO5,CO6
	C	IPv6 routing protocols – IPV4- V6 Tunneling and Translation Techniques.	CO4,CO5,CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 25% / MTE: 25% / ETE: 50%	
	Text book/s*	1. Douglas E. Comer ,"Internetworking with TCP/IP, Principles, Protocols, and Architecture", Addison-Wesley, 5th edition, Vol 1. 2005. 2. Douglas E. Comer, David L. Stevens ,"Internetworking with TCP/IP Vol. III, Client-Server Programming and Applications", Addison-Wesley, 2 nd edition, 2000. 3. Wendell Odom, "CCNP Route 642-902, CCIE", Official Certification Guide, Pearson education, 2010.	
	Other References	1. Behrouz A. Forouzan, "Data Communications and Networking", McGraw-Hill, 5th edition, 2012.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: acquire knowledge of information security technology and methods for communication systems that provide services for mobile users by wireless access networks.	PO1, PO2, PO5, PO8, PO12, PSO3
2.	CO2: about some of the models, design principles, mechanisms and solutions used in wireless network security to obtain authentication and key transport protocols.	PO1, PO2, PO3, PSO3
3.	CO3: Acquire practice and analytical skills in information security assessment of technology	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: Apply security mechanisms and protocols in wireless communication networks.	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: illustrate network security to obtain authentication and key transport protocols	PO1, PO2, PO3, PO8, PO9, PSO2,
6.	CO6: demonstrate security measures in wireless communication for WPAN, WLAN, mobile networks, and new emerging technology.	PO1, PO2, PO4, PO5, PO6, PO7, PO10, PO11, PSO1

PO and PSO mapping with level of strength for Course NameMobile and Wireless Security (CSC021)

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC021_ Mobile and Wireless Security	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC 021	Mobile and Wireless Security	3	2.7	2.3	3	2.2	3	3	2.6	2.5	3	3	2.5	2	2	2

School:		School of Engineering & Technology	
Department		Computer Science & Engineering	
Program:		B.Tech	
Branch:		Computer Science & Engineering with Specialization in Cyber Security and Forensics	
1	Course Code	CSC 031	
2	Course Title	Exploit Writing	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective	
5	Course Objective	to explore the needs and effects of leveraging modern exploit mitigation controls.	
6	Course Outcomes	CO1: Analyze fuzz testing to enhance your company's SDL process. CO2: Explain network devices and assess network application protocols. CO3: Illustrate restricted environments on Linux and Windows. CO4: Test cryptographic implementations. CO5: Model the techniques used by attackers to perform 0-day vulnerability discovery and exploit development. CO6: Develop more accurate quantitative and qualitative risk assessments through validation.	
7	Course Description	The course will describe how to use essential skills for advanced penetration testers and software security professionals.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction	

	A	Exploit Development Life Cycle	CO1
	B	System Architecture	CO1, CO2
	C	Memory Organisation	CO1, CO2,CO4
	Unit 2	Programming languages	
	A	Powershell Programming	CO1, CO2
	B	Python Scripts to perform exploits	CO1, CO2
	C	Assembly Language	CO1, CO2,CO5 ,CO6
	Unit 3	Protection	
	A	GDB usage -operating debugger, decompilers	CO1,CO2 ,CO3
	B	Prevention and Bypassing Address Space Layout	CO1,CO2 ,CO3
	C	Randomization & DEP protection mechanisms	CO1,CO2 ,CO3
	Unit 4	Techniques	
	A	Shell Code- Shell-Spawning, Port Binding, Connect-Back, Fuzzing with SPIKE	CO2,CO3 ,CO4
	B	Challenges: KSTET and GMON, Bypassing Antivirus Software	CO3,CO4
	C	Safe SEH Based Overflow, Egg Hunting, Exploiting Character Set Restrictions	CO2, CO4,CO5
	Unit 5	Applications	

	A	Windows Buffer Overflow Exploitation, Linux Buffer Overflow Exploitation, Windows Kernel Driver Exploitation			CO2,CO5 ,
	B	Kernel Pool Exploitation			CO3,CO5 ,CO6
	C	RCE on Windows and Linux			CO4,CO5 ,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*				
	Other References	Enrico Perla and Massimiliano Oldani, A Guide to Kernel Exploitation: Attacking the Core			

School:		School of Engineering & Technology		
Department		Computer Science & Engineering		
Program:		B. Tech		
Branch:		Computer Science & Engineering with Specialization in Cyber Security and Forensics		
1	Course Code	CSC032		
2	Course Title	Malware Analysis		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Elective		
5	Course Objective	The objective of this course is to provide an insight to fundamentals of malware analysis, detection and prevention such as different types of malware, static and dynamic analysis, functionality and detection technique of malware.		
6	Course Outcomes	On successful completion of this module students will be able to: CO1: illustrate the nature of malware, its capabilities, types and its analysis CO2: apply the tools and methodologies used to perform static analysis. CO3: apply the tools and methodologies used to perform dynamic analysis. CO4: explain executable formats, Windows internals and API, and analysis techniques. CO5: utilize the techniques of signature-based and non-signature based of malware detection. CO6: identify and apply the techniques for real world problems in the domain		

7	Course Description	This course is to provide students with an overview of the concepts and fundamentals of malware, static analysis, dynamic analysis, malware functionality, Covert malware launching, malware detection techniques and Case Studies.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction	
	A	The Goals of Malware Analysis, Introduction to malware, OS security concepts, malware threats, evolution of malware, General Rules for Malware Analysis.	CO1
	B	Malware types, viruses, worms, rootkits, Trojans, bots, spyware, adware, logic bombs,	CO1
	C	Malware analysis, Malware Analysis Techniques: Basic Static Analysis, Basic Dynamic Analysis, Advanced Static Analysis, Advanced Dynamic Analysis	CO1
	Unit 2	Static Analysis	
	A	Antivirus Scanning: A Useful First Step, Hashing: A Fingerprint for Malware, Finding Strings, Packed and Obfuscated Malware, Portable Executable File Format, Linked Libraries and Functions	CO2
	B	Static Analysis in Practice, PotentialKeylogger.exe: An Unpacked Executable, PackedProgram.exe: A Dead End, The PE File Headers and Sections	CO2, CO6
	C	Malware analysis in virtual machines : The Structure of a Virtual Machine, Creating Your Malware Analysis Machine, Configuring VMware, Using Your Malware Analysis Machine	CO2, CO6
	Unit 3	Dynamic Analysis	

	A	Sandboxes: The Quick-and-Dirty Approach, using a Malware Sandbox, Sandbox Drawbacks, Running Malware, Monitoring with Process Monitor, The Procmon Display, Filtering in Procmon	CO3
	B	Viewing Processes with Process Explorer: The Process Explorer Display, Using the Verify Option, Comparing Strings, Using Dependency Walker, Analyzing Malicious Documents. Comparing Registry Snapshots with Regshot, faking a Network: Using ApateDNS, Monitoring with Netcat	CO3, CO6
	C	Packet Sniffing with Wireshark, Using INetSim, Basic Dynamic Tools in Practice	CO3, CO6
	Unit 4	Malware Functionality	
	A	Downloaders and Launchers, Backdoors, Credential Stealers	CO4
	B	Persistence Mechanisms, Privilege Escalation, Covering Its Tracks—User-Mode Rootkits	CO4
	C	Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection	CO4
	Unit 5	Malware Detection Techniques	
	A	Signature-based techniques: malware signatures, packed malware signature, metamorphic and polymorphic malware signature	CO5
	B	Non-signature-based techniques: similarity-based techniques, machine-learning methods, invariant inferences	CO5
	C	Case Studies – Plankton, DroidKungFu, AnserverBot, Smartphone (Apps) Security	CO6
	Mode of examination	Theory	

	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Michael Sikorski and Andrew Honig, "Practical Malware Analysis : The Hands-On Guide to Dissecting Malicious Software", No Starch Press,2012.			
	Other References	1. Jamie Butler and Greg Hoglund, "Rootkits: Subverting the Windows Kernel", Addison-Wesley, 2005. 2. Dang, Gazet, Bachaalany, "Practical Reverse Engineering", Wiley, 2014. 3. Reverend Bill Blunden, "The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System" Second Edition, Jones & Bartlett, 2012. 4. Monnappa K A, "Learning Malware Analysis: Explore the concepts, tools, and techniques to analyze and investigate Windows malware"			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: illustrate the nature of malware, its capabilities, types and its analysis	PO1,PO2, PO5, PO8,PO12,PSO3
2.	CO2: apply the tools and methodologies used to perform static analysis.	PO1, PO2, PO3, PSO3
3.	CO3: apply the tools and methodologies used to perform dynamic analysis.	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: explain executable formats, Windows internals and API, and detection and prevention techniques	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: utilize the techniques of signature-based and non-signature based of malware detection.	PO1, PO2, PO3,PO8,PO9,PSO2,

6.	CO6: identify and apply the techniques for real world problems in the domain	PO1, PO2, PO4, PO5, PO6,PO7,PO10,PO11,PSO1

PO and PSO mapping with level of strength for Course Name Malware Analysis (CSC032)

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
CSC032_Malware Analysis	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC032	Malware Analysis	3	2.7	2.3	3	2.2	3	3	2.6	2.5	3	3	2.5	2	2	2

Strength of Correlation

1. Addressed to *Slight (Low=1) extent* 2. Addressed to *Moderate (Medium=2) extent*
3. Addressed to *Substantial (High=3) extent*

School:		School of Engineering & Technology
Department		Computer Science & Engineering
Program:		B. Tech
Branch:		Computer Science & Engineering with Specialization in Cyber Security and Forensics
1	Course Code	CSC041
2	Course Title	Cloud Security
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Elective
5	Course Objective	1. Provide students with an overview of the fundamental concepts of Cloud Computing. 2. Gain insight into the challenges and limitations Models of cloud computing. 3. To learn the various technologies of the cloud computing paradigm and learn about recent advances in Cloud Computing and enabling technologies. 4. Prepare students for research in the area of cloud Computing risks and cloud security challenges. 5. Enhance students' communication and problem solving skills
6	Course Outcomes	Students will be able to: CO1: To identify the cloud computing Concepts. CO2: Explain how and why this paradigm came about and the influence of several enabling technologies physical and logical infrastructure CO3: Examine cloud access control methods CO4: Analyze of Cloud monitoring, auditing and management CO5:Compare types and objectives of virus CO6: Evaluate the different type of intrusion detection and firewall design principles.

7	Course Description	This course introduces advanced aspects of Cloud Computing, encompassing the principles, to analyze the cloud, identify the problems, and choose the relevant models and algorithms to apply.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction Cloud Computing	
	A	Introduction to distributed systems, Defining Cloud Computing	CO1, CO2
	B	Understanding of Cloud Architecture: Composability, Infrastructure, Platform	CO1, CO2
	C	Virtual Appliances, Communication Protocols, Applications, Understanding Services: SaaS, PaaS, IaaS	CO1, CO2
	Unit 2	Secure Isolation of Physical & Logical Infrastructure	
	A	Isolation: Compute, Network and Storage	CO1, CO2, CO4
	B	Common attack vectors and threats, Secure Isolation Strategies, Multitenancy, Virtualization strategies	CO1, CO2, CO4
	C	Inter-tenant network segmentation strategies, Storage isolation strategies	CO1, CO2, CO4
	Unit 3	Data Protection for Cloud Infrastructure and Services	
	A	Understand the Cloud based Information Life Cycle, Data protection for Confidentiality and Integrity	CO1, CO2, CO3
	B	Common attack vectors and threats, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key Management, Assuring data deletion	CO1, CO2, CO3

	C	Data retention, deletion and archiving procedures for tenant data, Data Protection Strategies			CO1, CO2, CO3
	Unit 4	Enforcing Access Control for Cloud Infrastructure based Services			
	A	Understand the access control requirements for Cloud infrastructure,			CO1, CO2, CO3
	B	Authentication and Authorization, Roles-based Access Control, Multi-factor authentication			CO1, CO2, CO3
	C	Securing remote access, Verified and measured boot, Firewalls, IDS, IPS and honeypots			CO1, CO2, CO3
	Unit 5	Monitoring, Auditing and Management			
	A	Proactive activity monitoring, Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges, intrusion detection, events and alerts			CO1, CO2, CO3
	B	Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs			CO1, CO2, CO3
	C	Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management			CO1, CO2, CO3
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	

	Text book/s* Other References	1. Barrie Sosinsky "*Cloud Computing (Bible)*",Wiley 2. Anthony T.Velte, Toby J. Velte, Robert Elsenpeter"Cloud Computing: A Practical Approach" TATA McGRAW-HILL Edition. 3. Ronald L. Krutz and Russell Dean Vines, "Cloud Security: A comprehensive Guide to Secure Cloud Computing", WILEY.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: To understand the cloud computing Concepts.	PO1, PO2, PO3, PO4, PSO1
2.	CO2: Explain how and why this paradigm came about and the influence of several enabling technologies physical and logical infrastructure	PO1, PO3, PO4, PSO2
3.	CO3: cloud access control methods	PO1, PO2, PO3, PO4,PO6
4.	CO4: Understanding of Cloud monitoring, auditing and management	PO9, PO10, PO11, PSO5,PO7
5.	CO5. Examine security at application layer, transport layer and network layer.	PO5,PO7, PO8, PO9, PSO1,PSO2
6.	CO6:Interpret use of cryptographic data integrity algorithms and user authentication protocols	PO10,PO11,PO12,PSO1,PSO3

PO and PSO mapping with level of strength for Course Name Cloud Security (CSC041)

Course Code, Course Name	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

Cloud Security (CSC041)	CO1	3	3	2	2	--	--	--	2	2	1	2	1	3	2
	CO2	2	2	3	3	--	--	--	2	2	2	1	1	2	3
	CO3	3	3	3	3	--	2	--	1	1	1	3	2	3	2
	CO4	2	2	2	2	2	--	-2	2	3	3	3	1	2	2
	CO5	-	-	-	-	2	-	2	2	2		-	-	2	-
	CO6	-	-	-	-	-	-	-	-	-	2	2	2	2	-

verage of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC041	Cloud Security	2.5	2.5	2.5	2	2	2	2	2	2	2	2	2	2	2	2

Strength of Correlation

1. Addressed to*Slight (Low=1) extent*　　2. Addressed to*Moderate (Medium=2) extent*

3. Addressed to*Substantial (High=3) extent*

School:		School of Engineering & Technology	
Department		Computer Science & Engineering	
Program:		B.Tech	
Branch:		Computer Science & Engineering with Specialization in Cyber Security and Forensics	
1	Course Code	CSC042	
2	Course Title	Penetration Testing	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective	
5	Course Objective	1. Students will learn fundamentals of penetration testing via lectures and assignments. 2. Students will investigate various problem and regulation of penetration testing through projects and assignments.	
6	Course Outcomes	Students will be able to: CO1: acquire knowledge on Penetration Testing CO2: acquire the ability to identify Legal and ethical consideration CO3: explain Social Engineering Attacks CO4: explain and analyze Performing Host Reconnaissance CO5: explain and analyze attacking the network CO6: acquire the knowledge to prevent threats in targeted attacks and real time systems.	
7	Course Description	This course aims to introduce students to the fundamental concepts and techniques in penetration testing, and giving students an overview of attack and securing methods	

8	Outline syllabus		CO Mapping
	Unit 1	Understanding Penetration Testing	
	A	Defining penetration testing, proliferation of Viruses and worm, Wireless LANs.	CO1, CO2, CO3
	B	Complexity of networks today, frequency of software updates, availability of hacking tools, the nature of open source	CO1, CO2, CO3
	C	Unmonitored mobile users and telecommuters, marketing demands, industry regulation, administrator trust, Hacktivism, Attack Stages	CO1, CO3
	Unit 2	Legal and ethical consideration	
	A	Ethics of penetration testing, Laws: US Law, Computer Fraud and abuse act (CFAA), State Laws	CO1, CO4, CO3
	B	Regulatory Laws: Health Insurance Portability and Accountability Act (HIPAA), Graham-Leach-Bliley (GLB)	CO1, CO2, CO3
	C	Federal Information Security Management Act (FISMA), Sarbanes-Oxley Act (SOX)	CO1, CO2, CO3
	Unit 3	Performing Social Engineering	
	A	Human Psychology: conformity persuasion, logic persuasion, need-based persuasion, authority based persuasion, reciprocation based social engineering, similarity based social engineering, information based social engineering	CO2, CO3
	B	First Impressions and the social engineer, tech support impersonation, third-party impersonation	CO2, CO3
	C	E-Mail impersonation, end user impersonation, customer impersonation, Reverse Social engineering	CO2, CO3

	Unit 4	Performing Host Reconnaissance			
	A	Passive host reconnaissance, active host reconnaissance			CO1, CO2
	B	Port Scanning: TCP scan, SYN scan, NULL scan, FIN scan, ACK scan, Xmas-tree scan, Dump scan			CO4
	C	NMap, Detecting a Scan: intrusion detection, Anomaly Detection system, misuse detection system,			CO1, CO2,CO4
	Unit 5	Attacking the Network			
	A	Bypassing Firewall, Evading Intruder Detection Systems, Testing Routers for Vulnerabilities: CDP, HTTP service, Password Cracking, Modifying Routing Tables			CO2,CO5, CO6
	B	Testing Switches for Vulnerability: VLAN Hopping, Spanning Tree Attacks, MAC Table Flooding, ARP Attacks, VTP Attacks			CO3,CO5, CO6
	C	Securing the Network; Securing Firewalls, Securing Routers, Securing Switches. Case Study			CO3,CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	

	Text book/s*	1. Penetration Testing and Network Defence, Andrew Whitaker, Daniel P. Newman 2. David Kennedy, Jim O'Gorman, Devon Kearns, and Mati Aharoni, METASPLOIT The Penetration Tester's Guide, No Starch Press,2011. 3. Wil Allsopp, Advanced Penetration Testing: Hacking theworlds most Secure Networks, 1st Edition, John Wiley & Sons,2017	
	Other References	1. Sean-Philip Oriyano, Penetration Testing Essentials, John Wiley & Sons, 2017. 2. Leebrotherston, Amanda Berlin, Defensive Security handbook, O'reilly, 2017	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: acquire knowledge on Penetration Testing	PO1, PO2, PO5, PO8, PO12, PSO3
2.	CO2: acquire the ability to identify Legal and ethical consideration	PO1, PO2, PO3, PSO3
3.	CO3: explain Social Engineering Attacks	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: explain and analyze Performing Host Reconnaissance	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: explain and analyze attacking the network	PO1, PO2, PO3, PO8, PO9, PSO2,
6.	CO6: acquire the knowledge to prevent threats in targeted attacks and real time systems.	PO1, PO2, PO4, PO5, PO6, PO7, PO10, PO11, PSO1

PO and PSO mapping with level of strength for Course Name Penetration Testing (Course Code CSC042)

CSC042_Penetration Testing	Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	CO1		3	3	-	-	2	-	-	3	-	-	-	3	-	-
	CO2		3	3	2	-	-	-	-	-	-	-	-	-	-	-
	CO3		3	3	2	-	2	-	-	-	2	-	-	2	3	-
	CO4		3	3	-	3	2	3	-	2	-	-	-	-	-	3
	CO5		3	2	3	-	-	-	-	3	3	-	-	-	-	3
	CO6		3	3	-	3	3	3	3	-	-	3	3	-	3	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC042	Penetration Testing	3	2.7	2.3	3	2.2	3	3	2.6	2.5	3	3	2.5	2	2	2

Strength of Correlation

1. Addressed to *Slight (Low=1) extent* 2. Addressed to *Moderate (Medium=2) extent*

3. Addressed to *Substantial (High=3) extent*

School:		School of Engineering & Technology
Department		Computer Science & Engineering
Program:		B.Tech
Branch:		Computer Science & Engineering with Specialization in Cyber Security and Forensics
1	Course Code	
2	Course Title	Penetration Testing Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	core
5	Course Objective	to explore the area of penetration testing which deals with finding vulnerability in the target element.
6	Course Outcomes	On successful completion of this module students will be able to: CO1: Analyze the need of penetration testing for security CO2: Explain various tools and their installation process. CO3: Understand the need of reconnaissance. CO4: Understand and find weakness in privacy of the target system. CO5: Use concept to understand the need of salt for high priority data. CO6: understand various exploit that could be executed on existing vulnerability on the system.
7	Course Description	This course introduces ethical hacking concept and application of ethical hacking in network security.
8	Outline syllabus	CO Mapping

	Unit 1	Introduction, software installation, Pre-engagement, scoping			
		Penetration test report structure and components			CO1, CO2
	Unit 2	Reconnaissance			
		DNS, web reconnaissance			CO1, CO2
		TCP, UDP, connections			CO1, CO2,CO3
	Unit 3	Scanning			
		Scanning using nmap, Encryption essentials , Windows passwords, hashes			CO1,CO2,CO3, CO5
	Unit 4	Windows			
		Passwords, hash, Rainbow tables, hashes with salt			CO2,CO3,CO4
	Unit 5	Vulnerability			
		Searching Linux and Windows file systems, Databases, SQL, SQL injection			CO2,CO5,CO6
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Georgia Weidman: A Hands-On Introduction to Hacking			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Analyze the need of penetration testing for security	PO1,PO2, PO5, PO8,PO12,PSO3
2.	CO2: Explain various tools and their installation process.	PO1, PO2, PO3, PSO3
3.	CO3: Understand the need of reconnaissance.	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: Understand and find weakness in privacy of the target system.	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: Use concept to understand the need of salt for high priority data.	PO1, PO2, PO3,PO8,PO9,PSO2,
6.	CO6: understand various exploit that could be executed on existing vulnerability on the system.	PO1, PO2, PO4, PO5, PO6,PO7,PO10,PO11,PSO1

PO and PSO mapping with level of strength for Course Penetration Testing Lab

Course Code_ Course Name	CO's	PO1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CCP301_Ethical Hacking Lab	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	Penetration Testing Lab	3	2.7	1.1	1	1.5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Strength of Correlation

1. Addressed to*Slight (Low=1)extent* 2. Addressed to*Moderate (Medium=2) extent*
3. Addressed to*Substantial (High=3) extent*

School:		School of Engineering & Technology			
Department		Computer Science & Engineering			
Program:		B.Tech			
Branch:		Computer Science & Engineering with Specialization in Cyber Security and Forensics			
1	Course Code	CSC062			
2	Course Title	Web Application Security			
3	Credits	3			
4	Contact Hours (L-T-P)	3-0-0			
	Course Status	Elective			
5	Course Objective	Provide the students with practice on applying digital forensics techniquesin Web Application and enhance their skills regarding practical applications of Web security.			
6	Course Outcomes	CO1: Enhance students communication and problem solving skills CO2: Identify, explain and demonstrate the problems in insecure coding practices and methods to rectify the same in Web Application. CO3: Provide students with an overview of the IT infrastructure on web application Security CO4: Gain insight into the challenges and limitations of application security techniques CO5: Design with practice on applying data mining solutions in Web Application Security. CO6:Examine security on Database and Web Specific Input issues			
7	Course Description	This course contains exploring of security problems that are being successfully tackled with web application , describe insecure coding practices and methods			
8	Outline syllabus				CO Mapping
	Unit 1	INTRODUCTION			
	A	Need for secure systems-			CO1, CO2, CO3
	B	Proactive security development process-			CO1, CO2, CO3
	C	Security principles to live by and threat modeling.			CO1, CO2, CO3
	Unit 2	SECURE CODING IN C			
	A	Character strings- String manipulation errors – String Vulnerabilities and exploits			CO1, CO2, CO3
	B	Mitigation strategies for strings- Pointers – Mitigation strategies in pointer-based vulnerabilities			CO1, CO2, CO3
	C	Buffer Overflow based vulnerabilities.			CO1, CO2, CO3
	Unit 3	SECURE CODING IN C++ AND JAVA			
	A	Dynamic memory management- Common errors in dynamic memory management-			CO1, CO2, CO3
	B	Memory managers- Double			CO1, CO6, CO3
	C	free vulnerabilities –Integer security Mitigation strategies.			CO1, CO2, CO3
	Unit 4	DATABASE AND WEB SPECIFIC INPUT ISSUES			

	A	Quoting the Input – Use of stored procedures-	CO1, CO3, CO4
	B	Building SQL statements securely	CO1, CO2, CO4
	C	XSS related attacks and remedies	CO1, CO2, CO5
	Unit 5	SOFTWARE SECURITY ENGINEERING	
	A	Requirements engineering for secure software	CO1, CO2, CO6
	B	Misuse and abuse cases QUARE process model- and	CO1, CO4, CO5
	C	Software security practices - knowledge for architecture and design.	CO1, CO2, CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 25%; MTE: 25%; ETE: 50%	
	Text book/s*	1. J.Han,J. Pei "Web Security *Concepts and Techniques"*,Edition:3 , Morgan Kaufmann	
	Other References	1. M.H. Dunham, *Data Mining Introductory and Advanced Topics*, Pearson Education. 2. Adriaans, *Data Mining*, Pearson Education 3. Vikram Pudi & P. Radhakrishnan, "Data Mining", Oxford University Press	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Enhance students communication and problem solving skills	PO1, PO2, PO5, PO8, PO12, PSO3
2.	CO2: Identify, explain and demonstrate the problems in insecure coding practices and methods to rectify the same in Web Application.	PO1, PO2, PO3, PSO3
3.	CO3: Provide students with an overview of the IT infrastructure on web application Security.	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: Gain insight into the challenges and limitations of application security techniques .	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: Design with practice on applying data mining solutions in Web Application Security.	PO1, PO2, PO3, PO8, PO9, PSO2,
6.	CO6:Examine security on Database and Web Specific Input issues	PO1, PO2, PO4, PO5, PO6, PO7, PO10, PO11, PSO1

PO and PSO mapping with level of strength for Course Name Web Application Security (CSC062)

Course Code_Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC062_Web Application Security	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CSC 062	Web Application Security	3	2.7	1.1	1	1.5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Strength of Correlation

1. Addressed to Slight (Low=1) extent
2. Addressed to Moderate (Medium=2) extent
3. Addressed to Substantial (High=3) extent

School:		School of Engineering & Technology		
Department		Computer Science & Engineering		
Program:		B.Tech		
Branch:		Computer Science & Engineering with Specialization in Cyber Security and Forensics		
1	Course Code	CSC022		
2	Course Title	Disaster Recovery Management		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Elective		
5	Course Objective	Students will learn fundamentals of Disaster Recovery via lectures and assignments and, investigate various problem and regulation of BCM through projects and assignments.		
6	Course Outcomes	Students will be able to: CO1: Explain Disaster and risk reduction CO2: Illustrate Disaster management cycle CO3: Adapt to the knowledge of Business continuity Management CO4: summarize the application of BCM development process CO5: Analyse and evaluate research work on the field of emergencies and disaster while demonstrating insight into the potential and limitations of science, its role in society and people's responsibility for how it is used. CO6: Demonstrate Capacity to manage the Public Health aspects of the disasters.		
7	Course Description	This course aims to introduce students to the fundamental concepts and techniques in disaster recovery and business continuity management.		
8	Outline syllabus			CO Mapping

	Unit 1	Introduction to Disaster	
	A	Concepts of Hazard, Vulnerability, Risks, Natural Disasters (earthquake, Cyclone, Floods, Volcanoes), and Man-Made Disaster (Armed conflicts and civil strip, Technological disasters, Human Settlement, Slow Disasters (famine, draught, epidemics) and Rapid Onset Disasters (Air Crash, tidal waves, Tsunami) Risks	CO1
	B	Difference between Accidents and Disasters, Simple and Complex Disasters, Refugee problems, Political, Social, Economic impacts of Disasters, Gender and Social issues during disasters, principles of psychosocial issues and recovery during emergency situations, Equity issues in disasters	CO1, CO2
	C	Relationship between Disasters and Development and vulnerabilities, different stake holders in Disaster Relief. Refugee operations during disasters, Human Resettlement and Rehabilitation issues during and after disasters, Inter-sectoral coordination during disasters, Models in Disasters	CO1, CO2,CO4
	Unit 2	Approaches to Disaster Risk Reduction	
	A	Disaster Risk Reduction Strategies, Disaster Cycle, Phases of Disaster, Preparedness Plans, Action Plans and Procedures, Early warning Systems Models in disaster preparedness, Components of Disaster Relief-(Water, food, sanitation, shelter, Health and Waste Management), Community based DRR, Structural non-structural measures in DRR	CO1, CO2
	B	Factors affecting Vulnerabilities, Main streaming disaster risk reduction in development, Undertaking risk and vulnerability assessments, Policies for Disaster Preparedness Programs, Preparedness Planning, Roles and Responsibilities, Public Awareness and Warnings, Conducting a participatory capacity and vulnerability analysis	CO1, CO2

	C	Sustainable Management, Survey of Activities Before Disasters Strike, Survey of Activities During Disasters, DRR Master Planning for the Future, Capacity Building, Sphere Standards. Rehabilitation measures and long-term reconstruction. Psychosocial care provision during the different phases of disaster	CO1, CO2,CO5,CO6
	Unit 3	Disaster Management Cycle and Framework	
	A	Disaster Management Cycle – Paradigm Shift in Disaster Management Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development	CO1,CO2,CO3
	B	Awareness During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation – Post-disaster – Damage and Needs Assessment	CO1,CO2,CO3
	C	Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR, Yokohama Strategy, Hyogo Framework of Action	CO1,CO2,CO3
	Unit 4	Business Continuity Management	
	A	Introduction, Definition and Scope of Business	CO2,CO3,CO4
	B	Business Continuity Management (BCM), Drivers of Business continuity management	CO3,CO4
	C	Roles and Responsibility of BCM	CO2, CO4,CO5
	Unit 5	Development of BCM	
	A	Developing effective BCM Capabilities	CO2,CO5,

	B	Software application that support BCM			CO3,CO5,CO6
	C	BCM in Action: Example of "Good" Practices			CO4,CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Dr. Mrinalini Pandey Disaster Management Wiley India Pvt. Ltd. 2. Tushar Bhattacharya Disaster Science and Management McGraw Hill Education (India) Pvt. Ltd. 3. Jagbir Singh Disaster Management : Future Challenges and Opportunities K W Publishers Pvt. Ltd.			
	Other References	1. J. P. Singhal Disaster Management Laxmi Publications. 2. Shailesh Shukla, Shamna Hussain Biodiversity, Environment and Disaster Management Unique Publications 3. C. K. Rajan, Navale Pandharinath Earth and Atmospheric Disaster Management : Nature and Manmade B S Publication			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Explain Disaster and risk reduction	PO1,PO2, PO5, PO8,PO12,PSO3
2.	CO2: Illustrate Disaster management cycle	PO1, PO2, PO3, PSO3
3.	CO3: Adapt to the knowledge of Business continuity Management	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: summarize the application of BCM development process	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: Analyse and evaluate research work on the field of emergencies and disaster while demonstrating insight into the potential and limitations of science, its role in society and people's responsibility for how it is used.	PO1, PO2, PO3,PO8,PO9,PSO2,
6.	CO6: Demonstrate Capacity to manage the Public Health aspects of the disasters.	PO1, PO2, PO4, PO5, PO6,PO7,PO10,PO11,PSO1

PO and PSO mapping with level of strength for Course Disaster Recovery Management CSC022

Course Code_ Course Name	CO's	PO1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CSC022_Disaster Recovery Management	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CSC-022	Disaster Recovery Management	3	2.7	2.3	3	2.2	3	3	2.6	2.5	3	3	2.5	2	2	2

Strength of Correlation

1. Addressed to *Slight (Low=1) extent* *2.* Addressed to *Moderate (Medium=2) extent*

3. Addressed to *Substantial (High=3) extent*

School:		School of Engineering & Technology	
Department		Computer Science & Engineering	
Program:		B. Tech	
Branch:		Computer Science & Engineering with Specialization in Cyber Security and Forensics	
1	Course Code	CSC052	
2	Course Title	Information Security and Audit Monitoring	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective	
5	Course Objective	Students will learn various information security & auditing concepts, and technologies via lectures and assignments. Students will investigate various information security and auditing related topics	
6	Course Outcomes	After the successful completion of this course, students will be able to : Students will be able to: CO1: Identify security weaknesses in information systems, and rectify them with appropriate security mechanisms CO2: Analyze the latest trend of computer security threats and defense CO3: Explain the security controls in the aspects of physical, logical and operational security control CO4: Examine the security of information systems CO5:Compare types and objectives of virus CO6: Evaluate the different type of intrusion detection and firewall design principles.	

7	Course Description	This course aims to introduce students to the fundamental concepts and techniques in computer and network security, and giving students an overview of information security and auditing, and to expose students to the latest trend of computer attack and defense. Other advanced topics on information security such as mobile computing security, security and privacy of cloud computing, as well as secure information system development will also be discussed.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction to Information Security and IS Auditing	
	A	Objectives of IS audit and control,	CO1, CO3
	B	The structure of an IS audit and audit reports,	CO1, CO3
	C	IS auditing standards, Computer assisted audit tools	CO1, CO3
	Unit 2	Organization Security and Controls	
	A	Physical security controls: contingency plan, disaster recovery and reconstruction	CO1, CO2, CO3
	B	Logical security controls: operating system security and access control, Operating controls: segregation of duties, monitoring and logging controls	CO1, CO2, CO3
	C	Personnel security and management practices: user training and incident reporting, third-party access and outsourcing, Application software control: software development control, input, processing and output control	CO1, CO2, CO3
	Unit 3	Basics of Cryptographic Technologies	
	A	Symmetric encryption, Asymmetric encryption	CO2, CO3

	B	Basics of message authentication and cryptographic hash functions			CO2, CO3
	C	Digital signatures and digital certificates, Public-key Infrastructure & Web of Trust			CO2, CO3
	Unit 4	Network Security & Network Defense			
	A	Network Security: User Authentication, Access Control and Identity Management			CO1, CO4
	B	Network Security – Attack & Defense, Network Attacks: Host based attacks, Network attacks, Web based attacks			CO4,CO5
	C	Network Defense: Intrusion detection systems & firewall, IPSec and DNSSec, IPv6, Cloud Computing			CO2, CO5
	Unit 5	Information System Security Auditing, Computer Forensic and Other Security Technologies			
	A	Security auditing and security standards			CO2,CO6
	B	Incident handling and computer forensic			CO3,CO6
	C	Other security technologies including blockchain			CO4,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	

	Text book/s*	1. William Stallings and Lawrie Brown, Computer Security Principles and Practice, (3rd Edition), Pearson, 2014 2. Bruce Schneier, Applied Cryptography: Protocols, Algorithms and Source Code in C, Wiley, 2015 3. Niels Ferguson, Bruce Schneier, and Tadayoshi Kohno, Cryptography Engineering: Design Principles and Practical Applications, John Wiley & Sons, 2010. 4. Julia H. Allen, Sean J. Barnum, Robert J. Ellison, Gary McGraw, Nancy R. Mead, Software Security Engineering: A Guide for Project Managers, Addison-Wesley, 2008.	
	Other References	1. Julia H. Allen, Sean J. Barnum, Robert J. Ellison, Gary McGraw, Nancy R. Mead, Software Security Engineering: A Guide for Project Managers, Addison-Wesley, 2008. 2. ISO/IEC 27001:2013	

CO and PO Mapping

No.	Course Outcome	ogram Outcomes (PO) & Program pecific Outcomes (PSO)
	O1: Identify security weaknesses in information ystems, and rectify them with appropriate security echanisms	PO1, PO2, PSO1,PSO2
	O2: Analyze the latest trend of computer security reats and defense	PO1,PO2,PO3,PSO1,PSO2
	O3: Explain the security controls in the aspects of hysical, logical and operational security control	PO1, PO3, PO5, PSO1, PSO2
	O4: Examine the security of information systems	PO1, PO4, PO6, PO7, PSO1,PSO2
	O5:Compare types and objectives of virus	PO5,PO7, PO8, PO9, PSO1,PSO2
	O6: Evaluate the different type of intrusion detection nd firewall design principles.	PO10,PO11,PO12,PSO1,PSO3

PO and PSO mapping with level of strength for Course Name Information Security and Audit Monitoring (Course Code CSC052)

Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC052_Information Security and Audit Monitoring	CO1	2	2		-	-	-	-	-	-	-	-	-	2	2	-
	CO2	2	2	2	-	-	-	-	-	-	-	-	-	2	2	-
	CO3	2	-	2	-	2	-	-	-	-	-	-	-	2	2	-
	CO4	2	-	-	2	-	2	2	-	-	-	-	-	2	2	
	CO5	-	-	-	-	2	-	2	2	2		-	-	2	-	-
	CO6	-	-	-	-	-	-	-	-	-	2	2	2	2	-	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CSE052	Cryptography & Network Sec.	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Strength of Correlation

1. Addressed to*Slight (Low=1)* *extent* *2.* Addressed to*Moderate (Medium=2)* *extent*
3. Addressed to*Substantial (High=3)* *extent*

School:		**School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B.Tech**		
Branch:		**Computer Science & Engineering with Specialization in Cyber Security and Forensics**		
1	Course Code			
2	Course Title	**Network & Cyber Forensics**		
3	Credits	2		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Elective		
5	Course Objective	Provide the students with practice on applying digital forensics techniques and enhance their skills regarding practical applications of digital forensics.		
6	Course Outcomes	• On successful completion of this module students will be able to **CO1:**Demonstrate the principles of Network & Cyber Forensics and how resultant evidence can be applied within legal cases. **CO2:**Illustrate their competence in recovering files, network forensics, traffic analysis **CO3:**Evaluate the effectiveness of available network & cyber forensics tools and use them in a way that optimizes the efficiency and quality of network & cyber forensics investigations. **CO4:**Apply a solid foundational grounding in computer networks, operating systems, file systems, hardware, and mobile devices to digital investigations and to the protection of computer network resources from unauthorized activity **CO5:**Access and critically evaluate relevant technical and legal informationof email and emerging industry trends **CO6:**Adapteffectively the results of a computer, network, and/or cyber forensic analysis verbally, in writing, and in presentations to both technical and lay audiences.		
7	Course Description	This course introduces students to basics of Network & Cyber Forensics. Make them apply appropriate skills and knowledge in solving computer forensics problems.		
8	Outline syllabus		CO Mapping	
	Unit 1	**INTRODUCTION**		
	A	Introduction to Computer Forensics.Use of Computer Forensics in Law Enforcement,Computer Forensics Assistance to HumanResources/Employment Proceedings,Computer Forensics Services	CO1	
	B	Benefits ofprofessional Forensics Methodology, Steps taken by Computer Forensics Specialists.	CO1	
	C	Network forensic overview, TCP/IP fundamentals, the OSI model, TCP vs UDP, application protocols, IP addressing, NAT, and an overview of proxy servers.	CO1, CO6	
	Unit 2	**AN OVERVIEW OF NETWORK FORENSICS INVESTIGATION**		
	A	privacy, security,and legal issues oncomputer networks and theinternet.	CO2	
	B	Procedures for network forensics.	CO2	

	C	Understanding Traffic Analysis Scanning –Port Scanning, Network Scanning, Vulnerability Scanning			CO2, CO6
	Unit 3	**NETWORK INTRUSIONS AND CYBER CRIME**			
	A	Investigating NetworkIntrusions and Cyber Crime, Network Forensics and Investigating logs,			CO3
	B	network packet capture tools – Wireshark			CO3
	C	Checking of Live system using IP Scanner and Ping Sweep			CO3, CO6
	Unit 4	**CYBER FORENSICS**			
	A	Standards, Guidelines and Best Practices- Handling the Digital Crime Scene			CO4
	B	Digital Evidence Examination Guidelines –ACPO, Daubert guidelines			CO4
	C	Cyber forensics tools and case studies			CO4, CO6
	Unit 5	**E-MAIL FORENSICS**			
	A	Exploring the role of email investigation, Exploring the role of client and server in email			CO5,
	B	Investigating E-mail crimes and violations, Examining E-mail Messages, Viewing E-mailheaders, Examining E-mail headers, Examining additional E-mail files.			CO5,CO6
	C	Tracing an e-mailmessage, using network E-mail logs, Understanding E-mail servers.			CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	• Ric Messier, "Network Forensics", Wiley 2017. • Dejey, S. Murugan, "Cyber Forensics", Oxford University Press 2018			
	Other References	• Gulshan Shrivastava, Prabhat Kumar, B. B. Gupta, Suman Bala, Nilanjan Dey, "Handbook of Research on Network Forensics and Analysis Techniques", IGI Global 2018.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:** Demonstrate the principles of network & cyber forensics and how resultant evidence can be applied within legal cases.	PO1,PO2, PO5, PO8,PO12,PSO3
2.	**CO2:** Illustrate their competence in recovering files, network forensics, traffic analysis	PO1, PO2, PO3, PSO3
3.	**CO3:** Evaluate the effectiveness of available network & cyber forensics tools and use them in a way that optimizes the efficiency and quality of digital forensics investigations.	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	**CO4:** Apply a solid foundational grounding in computer networks, operating systems, file systems, hardware, and mobile devices to digital	PO1, PO2, PO4, PO5, PO6, PO8, PSO2

	investigations and to the protection of computer network resources from unauthorized activity	
5.	**CO5:** Access and critically evaluate relevant technical and legal information of email and emerging industry trends	PO1, PO2, PO3,PO8,PO9,PSO2,
6.	**CO6:**Adapt effectively the results of a computer, network, and/or cyber forensic analysis verbally, in writing, and in presentations to both technical and lay audiences.	PO1, PO2, PO4, PO5, PO6,PO7,PO10,PO11,PSO1

PO and PSO mapping with level of strength for Course Name Digital Forensics (Course Code CSC201)

Course Code_ Course Name	CO's	PO1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO 3
Network & Cyber Forensics	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	Network & Cyber Forensics	**3**	**2.7**	**1.1**	**1**	**1.5**	**1**	**.5**	**1.3**	**.8**	**.5**	**.5**	**.8**	**1**	**1**	**1**

Strength of Correlation

1. Addressed to***Slight (Low=1)extent2.*** Addressed to***Moderate (Medium=2) extent***
3. Addressed to***Substantial (High=3) extent***

School:		School of Engineering & Technology		
Department		Computer Science & Engineering		
Program:		B.Tech		
Branch:		Computer Science & Engineering with Specialization in Cyber Security and Forensics		
1	Course Code			
2	Course Title	Data Privacy and Protection		
3	Credits	2		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Elective		
5	Course Objective	This course will make students understand data privacy laws in India. It will inculcate the knowledge of laws and regulations concerning cross border flow of data protection and law enforcement perspectives and will help to gain insights on data localization and processing sensitive personal information. The students will get to know individual participation rights, regulation, and enforcement.		
6	Course Outcomes	On successful completion of this module students will be able to: CO1: Understand the concepts of privacy in today's environment CO2: Obtain the understanding of to apply fundamental principles of the data protection regime and information privacy. CO3: Obtain the knowledge of data protection issues arising in the specific Contexts CO4: understanding of how emerging issues are affecting society and business, with a concentration on how information security must shape corporate practices. CO5: utilize the techniques to resolve current challenges faced by data controllers, data subjects, policy makers and regulators. CO6: identify and apply the techniques for real world problems in the domain		

7	Course Description	This course is to provide students with an overview of the concepts and fundamentals of data privacy and its laws in India.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction	
	A	A Digital India in a Digital World, Data Protection: Genesis and Rationale, Data Protection, and the Value of Privacy, and why it matters, Statistics, Data Privacy Attacks, Data linking and profiling.	CO1
	B	The Evolution of Privacy Principle, Comparative Approaches to Data Protection, Data Protection in India,	CO1
	C	Judicial Developments on Right to Privacy, Legislative Developments.	CO1
	Unit 2	Framework Data Privacy and Protection Law	
	A	Risk in Data Privacy, Data Privacy Law, Protecting Privacy, Privacy Threats	CO2
	B	Different act for protection of privacy, Privacy in media, privacy in surveillance, privacy in Data, Privacy in All around the word.	CO2, CO6
	C	Data Protection in Healthcare, Indian IT act 2000 and International Laws i.e. MIPSA, FACTA, UK GDPR	CO2, CO6
	Unit 3	Data Localization	
	A	Introduction, Issues, Role of data transfer in trade,	CO3
	B	Digitization of Product and Service Offerings,	CO3, CO6
	C	International Practices	CO3, CO6

	Unit 4	Processing & IPR			
	A	Introduction, issues, processing of sensitive personal data,			CO4
	B	International practices			CO4
	C	Individual Participation Rights			CO4, CO6
	Unit 5	Regulation and Enforcement			
	A	Enforcement Models, Accountability, Adjudication Process, Remedies			CO5
	B	Examination of privacy matters specific to the World Wide Web,			CO5, CO6
	C	Protections provided by the Freedom of Information Act or the requirement for search warrants.			CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. L. Sweeney, Computational Disclosure Control: A Primer on Data Privacy Protection, MIT Computer Science, 2002.			
	Other References	1. White Paper of The Committee Of Experts On A Data Protection Framework For India, Justice B.N. Srikrishna			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Understand the concepts of privacy in today’s environment	PO1, PO2, PO5, PO8, PO12, PSO3
2.	CO2: Obtain the understanding of to apply fundamental principles of the data protection regime and information privacy.	PO1, PO2, PO3, PSO3
3.	CO3: Obtain the knowledge of data protection issues arising in the specific Contexts	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: understanding of how emerging issues are affecting society and business, with a concentration on how information security must shape corporate practices.	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: utilize the techniques to resolve current challenges faced by data controllers, data subjects, policy makers and regulators.	PO1, PO2, PO3,PO8,PO9,PSO2,
6.	CO6: identify and apply the techniques for real world problems in the domain	PO1, PO2, PO4, PO5, PO6,PO7,PO10,PO11,PSO1

PO and PSO mapping with level of strength for Course Name Malware Analysis, Detection & Prevention (Course Code CSE641)

Course Code_ Course Name	CO's	PO1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
Data Privacy and Protection	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	Data Privacy and Protection	3	2.7	1.1	1	1.5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Strength of Correlation

1. Addressed to *Slight (Low=1) extent* *2.* Addressed to *Moderate (Medium=2) extent*
3. Addressed to *Substantial (High=3) extent*

B.Tech (CSE) with Specialization in Block chain Technology

Introduction to Blockchain Technology

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School:		**Sharda Sharda School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B.Tech - CSE**		
Branch:		**Blockchain**		
1	Course Code	BCC102	Semester- 2	
2	Course Title	Introduction to Blockchain Technology		
3	Credits	2		
4	Contact Hours (L-T-P)	2	0	0
	Course Status	Core		
5	Course Objective	By the end of the course, students will be able to: 1. Understand how blockchain systems work, 2. To securely interact with them, 3. Design, build, and deploy smart contracts and distributed applications, 4. Integrate ideas from blockchain technology into their own projects		
6	Course Outcomes	1. Explain Abstract model of blockchain and consensus problem. 2. List and describe differences between proof-of-work and proof-of-stake consensus. 3. Summarizing the benefits of cryptographic basics for cryptocurrency in case of various attacks 4. Analyzing properties of Bitcoin and Ethereum 5. List Ethereum Virtual Machine (EVM) and its benefits 6. List topics like SNARK and zcash along with various applications of blockcahin technology		
7	Course Description	Decentralized blockchain-based systems, such as Bitcoin and Ethereum, are successful beyond all expectations. Although still in their infancy, they promise to revolutionize how we think of financial, information, and other infrastructures. This course covers the technical aspects of public distributed ledgers, blockchain systems, cryptocurrencies, and smart contracts. Students will learn how these systems are built, how to interact with them, how to design and build secure distributed applications.		
8	Outline syllabus			CO Mapping

	Unit 1	**Introduction**	
	A	The consensus problem - Asynchronous Byzantine Agreement and its analysis	CO1 , CO2
	B	Abstract Models for BLOCKCHAIN - GARAY Model - RLA Model	CO1 , CO2
	C	Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS)	CO1 , CO2
	Unit 2	**Cryptographic Basics For Cryptocurrency**	
	A	A Short Overview of Hashing	CO1, CO3
	B	Signature Schemes,	CO1, CO3
	C	Encryption Schemes	CO1, CO3
	Unit 3	**Bitcoin - Wallet**	
	A	Merkley Tree - Hardness of Mining	CO3, CO4
	B	Transaction Verifiability - Anonymity - Forks - Double Spending	CO3, CO4
	C	Mathematical Analysis of Properties Of Bitcoin	CO3, CO4
	Unit 4	**Ethereum**	
	A	Ethereum Virtual Machine (EVM) - Wallets for Ethereum	CO4,CO5
	B	Smart Contracts - some attacks on smart contracts	CO3,CO5
	C	Vulnerability, Attacks, Sidechain	CO3,CO5
	Unit 5	**Application and future of Blockchain**	
	A	Zero Knowledge proofs and protocols in Blockchain	CO5, CO6
	B	Succinct non interactive argument for Knowledge (SNARK)	CO5, CO6
	C	Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain, Zcash	CO5, CO6
	Mode of examination	Theory	
	Weightage Distribution	CA / MTE / ETE	
		25% / 25% / 50%	
	Text book/s*	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.	
	Other References	1. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015 (article available for free download) { curtain raiser kind of generic article, written by seasoned experts and pioneers}. 2. J.A.Garay et al, The bitcoin backbone protocol - analysis and applications EUROCRYPT 2015 LNCS VOl 9057, (VOLII),	

		pp 281-310. (Also available at eprint.iacr.org/2016/1048) . (serious beginning of discussions related to formal models for bitcoin protocols). 3. R.Pass et al, Analysis of Blockchain protocol in Asynchronous networks, EUROCRYPT 2017, (eprint.iacr.org/2016/454) . A significant progress and consolidation of several principles). 4. R.Pass et al, Fruitchain, a fair blockchain, PODC 2017 (eprint.iacr.org/2016/916).

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1	Explain Abstract model of blockchain and consensus problem.	PO1, PO2,PO3,PO4,PO5, PO6,PO11,PSO1, PSO2,PSO3
2	List and describe differences between proof-of-work and proof-of-stake consensus.	PO1, PO2,PO3,PO4,PO5,PO7,PO10,PO12 PSO2,PSO3
3	Summarizing the benefits of cryptographic basics for cryptocurrency in case of various attacks	PO1, PO2,PO3,PO4,PO5,PO8,PO9, PSO1, PSO2,PSO3
4	Analyzing properties of Bitcoin and Ethereum	PO1, PO2,PO3,PO4,PO5, PO8,PO9,PO12,PSO1, PSO2
5	List Ethereum Virtual Machine (EVM) and its benefits	PO1, PO2,PO3,PO4,PO5, PO7,PO10,PSO1, PSO2,PSO3
6	List topics like SNARK and zcash along with various applications of blockcahin technology	PO1, PO2,PO3,PO4,PO5, PO6, PO11,PO12,PSO1, PSO2,PSO3

PO and PSO mapping with level of strength

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BCC102_ Introduction to Blockchain Technology	**CO1**	3	2	2	2	2	1	-	-	-	-	1	-	1	3	1
	CO2	3	3	2	2	2	-	1	-	-	1	-	1	-	3	2
	CO3	3	3	3	2	2	-	-	1	1	-	-	-	1	3	1
	CO4	2	3	2	2	2	-	-	1	1	-	-	1	1	3	-
	CO5	2	2	2	3	2	-	1	-	-	1	-	-	2	3	1
	CO6	2	3	2	2	3	1	-	-	-	-	1	1	1	3	1

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BCC102	Introduction to Blockchain Technology	2.5	2.7	2.2	2.2	2.2	0.3	0.3	0.3	0.3	0.3	0.3	0.5	1.0	3.0	1.0

Strength of Correlation

1. Addressed to ***Slight (Low=1)*** ***extent*** ***2.*** Addressed to ***Moderate (Medium=2)*** ***extent***
3. Addressed to ***Substantial (High=3)*** ***extent***

BITCOIN AND CRYPTOCURRENCIES

School:		**Sharda School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B.Tech - CSE**		
Branch:		**Blockchain**		
1	Course Code	BCC201	Semester- 3	
2	Course Title	**BITCOIN AND CRYPTOCURRENCIES**		
3	Credits	4		
4	Contact Hours (L-T-P)	3	1	0
	Course Status	Core		
5	Course Objective	The objective of the course is to introduce basic fundamental concepts in Bitcoins and Cryptocurrencies, with a practical approach in understanding them. To visualize the scope of bitcoin and cryptocurrencies, and its role in futuristic development.		
6	Course Outcomes	On successful completion of this module students will be able to CO-1: Explain the working of bitcoin and cryptocurrencies. CO-2: Discover bitcoin mechanism and network. CO-3: Interpret different bitcoin blocks. CO-4: Compare online wallets and exchanges. CO-5: Design bitcoin and cryptocurrency based application. CO-6: Discuss distributed systems and future of blockchain.		
7	Course Description	The fundamental concepts in Bitcoins and Cryptocurrencies, with a practical approach in understanding them will be discussed.		

8	Outline syllabus		CO Mapping
	Unit 1	**INTRODUCTION TO CRYPTO AND CRYPTOCURRENCIES**	
	A	Introduction, Cryptographic Hash Functions, Hash Pointers and Data Structures	CO1, CO2
	B	Digital Signatures, Public Keys as Identities	CO1, CO2
	C	A Simple Cryptocurrency	CO1, CO2,CO3
	Unit 2	**BITCOIN BASICS**	
	A	Bitcoin Protocol and Consensus: A High Level Overview,	CO1, CO2,CO3
	B	Bitcoin and Blockchain History,	CO2, CO3
	C	Bitcoin Mechanics and Optimizations: A Technical Overview, Bitcoin IRL: Wallets, Mining, and More	CO1, CO2,CO3
	Unit 3	**MECHANICS OF BITCOIN**	
	A	Bitcoin Transactions, Bitcoin Scripts	CO2,CO3,CO4
	B	Applications of Bitcoin Scripts, Bitcoin Blocks	CO2,CO3,CO4
	C	The Bitcoin Network, Limitations & Improvements	CO2,CO3,CO4
	Unit 4	**STORE AND USE BITCOINS**	
	A	How to Store and Use Bitcoins, Hot and Cold Storage	CO4,CO5
	B	Online Wallets and Exchanges, Payment Services	CO4,CO5
	C	Transaction Fees, Currency Exchange Markets	CO3,CO4,CO5
	Unit 5	**APPLICATIONS AND SCALING**	

	A	Enabling a Decentralized Future, Distributed Systems and Alternative Consensus,			CO2,CO5,CO6
	B	How to Destroy Bitcoin, Crypto economics and Proof-of-State,			CO2,CO5,CO6
	C	Scaling Blockchain: Cryptocurrencies for the Masses, Enterprise Blockchain: Real-World Applications, Anonymity: Mixing and Altcoins, Conclusion: Future of Blockchains			CO3,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	● Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies ● Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System			
	Other References	● Wattenhofer, The Science of the Blockchain ● Dr. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO-1: Explain the working of bitcoin and cryptocurrencies.	PO1, PO2, PO3, PO4, PO5, PO7, PO11, PO12, PSO1, PSO2,PSO3
2.	CO-2: Discover bitcoin mechanism and network.	PO1, PO2, PO3, PO4, PO11, PO12, PSO1, PSO2, PSO3
3.	CO-3: Interpret different bitcoin blocks.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO11, PO12, PSO1, PSO2, PSO3
4.	CO-4: Compare online wallets and exchanges.	PO1, PO2, PO3, PO4, PO5, PO8, PO11, PO12, PSO1, PSO2, PSO3
5	CO-5: Design bitcoin and cryptocurrency based application.	PO1, PO2, PO3, PO5, PO6, PO11, PO12, PSO1, PSO2, PSO3
6	CO-6: Discuss distributed systems and future of blockchain.	PO1, PO2, PO3, PO4, PO5,PO6, PO7, PO8, PO9, PO10, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	1	3	1	2	-	1	-	-	-	1	2	1	2	1
CO2	1	3	3	2	-	-	-	-	-	-	2	3	1	2	2
CO3	3	1	2	1	1	1	1	-	-	-	2	1	2	2	1
CO4	2	2	1	3	1	-	-	2	-	-	1	1	2	3	1
CO5	2	2	1	-	2	2	-	-	-	-	2	1	1	2	2
CO6	1	3	2	2	3	2	2	2	2	2	-	2	1	3	1
	1.8	2.0	2.0	1.5	1.5	0.8	0.7	0.7	0.3	0.3	1.3	1.7	1.3	2.3	1.3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
B CC 201	BITCOIN AND CRYPTOCURRENCIES	1.8	2	2	1.5	1.5	0.8	0.7	0.7	0.3	0.3	1.3	1.7	1.3	2.3	1.3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Blockchain using Multichain

-

School:		**Sharda School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B.Tech - CSE**		
Branch:		**Blockchain**		
1	Course Code	BCC202	Semester: 4	
2	Course Title	Blockchain using Multichain		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core		

5	Course Objective	By the end of the course, students will be able to 1. Understand how multi chain systems Platform work 2. How securely interact with multichain 3. How to Create streams	
6	Course Outcomes	On completion of this course the student should be able to: 1. Synthesize the basic concepts and principles of block chain AND multichain 2. Setup a Private blockchain Using Multichain 3. To learn the approaches followed in smart contracts 4. Understand the functioning of streams 5. To learn concept of Decentralized and Distributed Ledger. 6. To maintain security, privacy, and efficiency of a given system.	
7	Course Description	**Blockchain using Multichain**	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	What is Block chain? Basic ideas behind blockchain, how it is changing the landscape of digitalization, Uses of Blockchain. Abstract Models for BLOCKCHAIN - GARAY model - RLA Model	CO1
	B	What is Multichain? Objective of Multichain, Features of Multichain, Uses of Multichain, Process of mining in Multichain technology	CO1
	C	Analyse Multichain platform, why it is better than other open platforms	CO1
	Unit 2	**Privacy and Permissions in Multichain,**	
	A	Privacy and Permissions in Multichain, compare Multichain Core, and Bitcoin Core, Hand-Shaking Process, Private blockchains Multichain	CO1, CO6

	B	Multiple configurable Blockchains using Multichain, Decentralized exchange	CO1, CO6
	C	Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts	CO1, CO3, CO6
	Unit 3	**DECENTRALIZED APPLICATIONS (DAPPS)**	
	A	Characteristics of Decentralized application, Setting up a Private Blockchain, Multiple configurable Blockchains using Multichain	CO2, CO5, CO6
	B	Deployment scenarios of Multichain, Centralized currency settlement, Bond issuance and peer-to-peer trading	CO2, CO5, CO6
	C	Consumer-facing rewards scheme in Decentralized Applications	CO2, CO5, CO6
	Unit 4	**Introducing Multichain Feeds**	
	A	Multichain feed Adapters, MultiChain Feeds for Database Integration, feed file adaptors, MultiChain streams	CO4
	B	Purpose of Multichain streams, off chain data vs on chain data, JSON and Unicode text, Streams required to implement database, Streams and the MultiChain roadmap,	CO4
	C	Three areas of high-level functionality, create the streams, publish the data into streams, retrieve the data from the streams using the key, and give permission to others to publish the data into the same streams.	CO4
	Unit 5	**Smart contract approaches**	
	A	Hyperledger Fabric, smart filters, R3 Corda, Transaction rules in Hyperledger Fabric, smart filters, R3 Corda, Multichain , Etherium, Conflict transaction	CO4, CO5
	B	Hyperledger Fabric vs MultiChain vs Ethereum vs Corda, Multichain Tools: MultiChain Explore, Multichain web demo	CO4, CO5
	C	Applications of Multi chain: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain	CO1
	Mode of examination	Theory	
	Weightage Distribution	CA 25% / MTE 25% / ETE 50%	
	Text book/s*	1. Blockchain From Concept to Execution: BitCoin, Ethereum, Quorum, Ripple, R3 Corda, Hyperledger Fabric/SawTooth/Indy, MultiChain, IOTA, CoCo Kindle Edition by Debajani Mohanty (Author) 2. Beginner's Guide to Ontology: The Public Multi-Chain & Distributed Trust Collaboration Platform: (crypto, cryptocurrency, forex, trading, bitcoin, invest, earn	

		money, invest, ethereum, blockchain) Kindle Edition by Juan Jimenez (Author) 3. Mastering Blockchain, Second Edition Paperback – 1 January 2018 by Imran Bashir (Author)	
	Other References	1. https://www.multichain.com/ 2. https://www.multichain.com/download/MultiChain-White-Paper.pdf	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1	Synthesize the basic concepts and principles of block chain AND multichain	PO1, PO2,PO3,PO4,PO5, PO6, PO8, PSO2
2	Setup a Private blockchain Using Multichain	PO1, PO2,PO3,PO4,PO5, PO6, PSO2
3	To learn the approaches followed in smart contracts	PO1, PO2,PO3,PO4,PO5, PO6, PSO2
4	Understand the functioning of streams	PO1, PO2,PO3,PO4,PO5, PO6, PO8, PSO2
5	To learn concept of Decentralized and Distributed Ledger.	PO1, PO2,PO3,PO4,PO5, PO6, PO8, PO10,PSO1,PSO2,PSO3
6	To maintain security, privacy, and efficiency of a given system.	PO1, PO2,PO3,PO4,PO5, PO6, PO8, PSO2,PSO3

PO and PSO mapping with level of strength

Course Code_ Course Name	CO's	PO 1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
BCC202_ Blockchain using Multichain	CO1	2	3	1	1	2	2	-	2	-	-	-	-	-	2	-
	CO2	2	2	3	2	3	2	-	-	-	-	-	-	-	2	-
	CO3	2	2	3	2	3	2	-	-	-	-	-	-	-	2	-
	CO4	2	3	1	1	2	2	-	1	-	-	-	-	-	2	-
	CO5	3	3	3	1	1	1	--	1	-	1	-	-	1	2	2
	CO6	3	3	3	1	2	1	-	1	-	-	-	-	-	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BCC202	Blockchain using Multichain	2.3	2.7	2.3	1.3	2.2	1.7	0.0	0.8	0.0	0.2	0.0	0.0	0.2	2.2	0.7

Strength of Correlation

1. Addressed to ***Slight (Low=1)*** ***extent*** ***2.*** Addressed to ***Moderate (Medium=2)*** ***extent***

3. Addressed to ***Substantial (High=3)*** ***extent***

School: SET		**Batch : 2023-27**	
Program: B.TECH-CSE		**Current Academic Year: 2023-24**	
Branch: BLOCKCHAIN		**Semester: 5**	
1	Course Code	BCC301	
2	Course Title	Programming in GO	
3	Credits	3	
4	Contact Hours (L-T-P)	2-0-2	
	Course Status	CORE	
5	Course Objective	The objective of the course is a short, concise introduction to computer programming using the language Go	
6	Course Outcomes	Students will be able to: CO1. Implement GO fundamentals in programming concepts by identifying classes, objects, members of a class and relationships among them needed for a specific problem. CO2. Write GO programs to solve problems of applications in the real world scenarios. CO3.The ability to handle Concurrency primitives via go routines and channels makes concurrent programming easy. CO4. Create their own Stand-alone command-line apps or scripts Network and Web server's software. CO5. Analyse and evaluate the code coverage by your tests, benchmarking tests and writing example code that is used in generating your code documentation. CO6: design and develop GO program.	
7	Course Description	The course is about short, concise introduction to computer programming using the language Go	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Introduction to GO programming, Advantages of GO, Concurrency	CO1, CO2
	B	Installing Go, Workspaces & Packages, Go Tool	CO1, CO2
	C	Variables, Variable Initialization	CO1, CO2
	Unit 2	**Data Types**	
	A	Overview, Pointers, Variable Scope, Deallocating Memory, Garbage Collection	CO1
	B	Comments, Printing, Integers, Ints, Floats, Strings, String Packages	CO1
	C	Constants, Control Flow, Control Flow, Scan	CO1, CO2

	Unit 3	**Functions in GO**			
	A	Function Declaration, Function types, variadic Parameters, result parameters			CO1, CO2
	B	Passing parameter value, Higher order functions, Error signalling and handling			CO1,CO2
	C	Deferring function call, Function panic and recovery			CO1,CO2
	Unit 4	**Go Packages and Programs**			
	A	Understanding the GO package, the workspace, creating a workspace, The import path			CO1, CO2
	B	Declaring the package, Multi File Package, Naming Package, Installing a Package, Package visibility			CO1,CO2,CO4, CO5
	C	Importing a package, Package initialization, creating programs, remote packages.			CO1,CO2,CO4, CO5,CO6
	Unit 5	**Concurrency**			
	A	Go routines, GO routines scheduling, Channels and channel type, channel length and capacity, closing a channel			CO1,CO2,CO4
	B	Writing concurrent program , synchronization, streaming data, Generator function, Selecting from multiple channels, channel time out			CO2,CO3,CO4
	C	The sync package, synchronizing with mutex locks, synchronizing with composite values, concurrency barrier with sync.Waitgroup, Detecting race condition, parallelism in GO			CO2,CO3,CO4
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	**Learning Go Programming** By Vladimir Vivien			
	Other References	1. The Go Programming Language, Alan A. A. Donovan, Brian W. Kernighan 2. Programming in Go: Creating Applications for the 21st Century, Mark Summerfield			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1. Implement GO fundamentals in programming concepts by identifying classes, objects, members of a class and relationships among them needed for a specific problem.	PO1, PO2, PO3,PO6, PO7, PO8, PO11, PO12,PSO1, PSO2, PSO3
2.	CO2. Write GO programs to solve problems of applications in the real world scenarios.	PO1, PO2, PO3, PO4, PO5, PO10, PO12, PSO1, PSO2, PSO3
3.	CO3.The ability to handle Concurrency primitives via go routines and channels makes concurrent programming easy.	PO1, PO2, PO3, PO4, PO5, PO10, PO12, PSO1, PSO2, PSO3
4.	CO4. Create their own Stand-alone command-line apps or scripts Network and Web server's software.	PO1, PO2, PO3, PO4, PO7, PO8, PO9,PO10,PSO1, PSO2, PSO3
5.	CO5. Analyse and evaluate the code coverage by your tests, benchmarking tests and writing example code that is used in generating your code documentation.	PO1, PO2, PO3, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	CO6: design and develop GO program.	PO1, PO2,PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO11,PSO1, PSO2, PSO3

PO and PSO mapping with level of strength

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	-	-	3	3	2	-	-	3	1	1	2	1
CO2	2	3	1	2	2	-	-	-	-	2	-	2	1	3	-
CO3	1	2	3	3	2	-	1	2	-	2	-	2	1	2	1
CO4	2	1	2	2	-	-	2	2	1	1	-	-	1	3	2
CO5	3	2	2	-	-	-	-	-	2	2	1	2	1	3	1
CO6	2	3	2	1	2	2	1	1	2	-	2	-	1	2	1

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3
BCC3 01	Programmi ng in GO	2. 0	2. 0	2. 0	2. 0	2. 0	2. 5	1. 8	1. 8	1. 7	1. 8	2. 0	1. 8	1. 0	2. 5	1. 2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Programming in GO LAB

School: SET		**Batch : 2023-27**	
Program:B.TECH-CSE		**Current Academic Year: 2023-24**	
Branch: BLOCKCHAIN		**Semester: 5**	
1	Course Code	BCL301	
2	Course Title	Programming in GO LAB	
3	Credits	1	
4	Contact Hours (L-T-P)	2-0-2	
	Course Status	CORE	
5	Course Objective	The main objective is after undergoing this course it will be easier for achieving higher performance in digital devices that require multicore architectures which are different from machines level languages like C++ and Java.	
6	Course Outcomes	Students will be able to: CO1. This course is also known as Go Language programming is a great language for writing concurrent programs that are statically typed like C++. CO2. Write GO programs to solve problems of applications in the real world scenarios. CO3.This course includes concepts for building large scale and complex software. CO4. Create their own Stand-alone command-line apps or scripts Network and Web server's software. CO5. In this course, you will also learn about methods, arrays, channels, collection functions, expressions, rate limiting, implementation of interfaces, atomic counter and mutex, string functions, etc. CO6: In this course, this section is very important because it covers almost all the basic and important topics to understand and easily code the Golang codes.	
7	Course Description	Go is a procedural programming language. It was developed in 2007 by Robert Griesemer, Rob Pike, and Ken Thompson at Google but launched in 2009 as an open-source programming language. Programs are assembled by using packages, for efficient management of dependencies. This language also supports environment adopting patterns alike to dynamic languages.	
8	Outline syllabus		CO Mapping
	Unit 1	**IntroductionGo Programming**	
	A	Introduction to GO programming, online IDEsGO, Go Playground, repl.it	CO1, CO2
	B	Installing Go, Text editor and Compiler, Go Tool	CO1, CO2
	C	Finding a Go Compiler	CO1, CO2

	Unit 2	**Developed in Go Language**	
	A	Overview, How to Install and Run Go on Windows 10, How to Write your First Hello World in Go	CO1
	B	Write backslash in Golang string, How to Convert string to float type in Go?	CO1
	C	Constants, Control Flow, Control Flow, Scan	CO1, CO2
	Unit 3	**Loop Control Statements in Go Language, Sorting in GO**	
	A	Functions in Go Language,Break, Goto, Continue, Golang program for implementation of Insertion Sort, Golang program for implementation of Radix Sort	CO1, CO2
	B	Golang program for implementation of Longest Common Sub-sequence	CO1,CO2
	C	Concurrently printing array elements using goroutines and channels	CO1,CO2
	Unit 4	**Arrays in Go**	
	A	Creating and accessing an Array, Go program to illustrate value type array	CO1, CO2
	B	Multi-Dimensional Array, How to find the length of the array	CO1,CO2,CO4, CO5
	C	How to compare two arrays, How to Calculate the Average using Arrays in Golang?	CO1,CO2,CO4, CO5,CO6
	Unit 5	**Queue in Go Language**	
	A	How to implement Queue in Go Language? Implement Queue Using Slices in Go Language	CO1,CO2,CO4
	B	Implement Queue Using Structures in Go Language	CO2,CO3,CO4
	C	Implement queue Using LinkList	CO2,CO3,CO4
	Mode of examination	Theory	
	Weightage Distribution	CA: 25% / MTE: 25% / ETE: 50%	
	Text book/s*	Learning Go Programming By Vladimir Vivien	
	Other References	1. Golang or Go programming language was introduced first by Google in late 2007 and was released in 2009 by Robert Griesemer, Rob Pike, and Ken Thompson. 2. The Go Programming Language, written by Alan A. A. Donovan and Brian W. Kernighan in 2015. 3. Go in Action, written by William Kennedy, Brian Ketelsen, and Erik St. Martin and was published back in 2015.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1. The demand for the programmer having experience in the GO language is increasing day by day. Just for your information, Amazon has started to shift some of its modules from Node. js to GO.	PO1, PO2, PO3,PO6, PO7, PO8, PO11, PO12,PSO1, PSO2, PSO3
2.	CO2. Write GO programs to solve problems of applications in the real world scenarios.	PO1, PO2, PO3, PO4, PO5, PO10, PO12, PSO1, PSO2, PSO3
3.	CO3.This GoLang course will give you full hands-on experience of working with GO rather than theoretical knowledge.	PO1, PO2, PO3, PO4, PO5, PO10, PO12, PSO1, PSO2, PSO3
4.	CO4. Create their own Stand-alone command-line apps or scripts Network and Web server's software.	PO1, PO2, PO3, PO4, PO7, PO8, PO9,PO10,PSO1, PSO2, PSO3
5.	CO5. Analyse and evaluate the code coverage by your tests, benchmarking tests and writing example code that is used in generating your code documentation.	PO1, PO2, PO3, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	CO6: In this course, this section is very important because it covers almost all the basic and important topics to understand and easily code the Golang codes.	PO1, PO2,PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO11,PSO1, PSO2, PSO3

PO and PSO mapping with level of strength

COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	2	-	-	3	3	2	-	-	3	1	1	2	1
CO2	2	3	1	2	2	-	-	-	-	2	-	2	1	3	-
CO3	1	2	3	3	2	-	1	2	-	2	-	2	1	2	1
CO4	2	1	2	2	-	-	2	2	1	1	-	-	1	3	2
CO5	3	2	2	-	-	-	-	-	2	2	1	2	1	3	1
CO6	2	3	2	1	2	2	1	1	2	-	2	-	1	2	1

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3
BCL30 1	Programming in GO LAB	2. 0	2. 0	2. 0	2. 0	2. 0	2. 5	1. 8	1. 8	1. 7	1. 8	2. 0	1. 8	1. 0	2. 5	1. 2

Strength of Correlation

1. Addressed to***Slight (Low=1)extent2.*** Addressed to***Moderate (Medium=2) extent***
3. Addressed to***Substantial (High=3) extent***

SMART CONTRACTS USING ETHEREUM

School:		**Sharda School of Engineering & Technology**			
Department		**Computer Science & Engineering**			
Program:		**B.Tech - CSE**			
Branch:		**Blockchain**			
1	Course Code	BCC302	Semester- 6		
2	Course Title	**SMART CONTRACTS USING ETHEREUM**			
3	Credits	4			
4	Contact Hours (L-T-P)	3	1	0	
	Course Status	Core			

5	Course Objective	The objective of the course is to introduce basic fundamental concepts in Smart Contracts using Ethereum with a practical approach in understanding them. To visualize the scope of smart contracts and Ethereum its role in futuristic development.	
6	Course Outcomes	On successful completion of this module students will be able to CO-1: Develop smart contract, solidarity, ethereum based application. CO-2: Compare bitcoin, ethereum, hyperledger and various crpyocurrencies concept. CO-3: Discuss decentralization and crowfunding systems. CO-4: Explain smart contracts, their technical capabilities, practical applications, limitations and security constraints. CO-5: Discuss the most prominent smart contract platform and Ethereum. CO-6: Improve other smart contract problems.	
7	Course Description	The fundamental concepts in Smart Contracts using Ethereum with a practical approach in understanding them have been discussed.	
8	Outline syllabus		CO Mapping
	Unit 1	**INTRODUCTION TO SMART CONTRACTS**	
	A	Smart Contract Basics: Why Smart Contracts? Contract lifecycle,	CO1, CO2
	B	Solidity: Structure, Basic Data Types & Statements,	CO1, CO2
	C	Contract lifecycle, distinction between a payment system and a decentralized applications platform	CO1, CO2
	Unit 2	**ETHEREUM**	
	A	Ethereum – Introduction, Multitude of clients in Ethereum,	CO1, CO2, CO3
	B	Production and test networks in Ethereum , Public, private and development deployments	CO1, CO2, CO3
	C	Comparing Bitcoin and Ethereum, Ethereum sub-protocols	CO1, CO2, CO3
	Unit 3	**SOLIDITY**	
	A	Demonstration of smart contract , Introduction to Solidity, Solidity in depth, Building blocks , Contract lifecycle,	CO1, CO2, CO3, CO4
	B	Solidity for Contract Writing, Developing, Compiling and Deploying MyContract	CO1, CO2, CO3, CO4

	C	Interacting with the Contract, Limitations of Remix			CO1, CO2, CO3, CO4
	Unit 4	**DECENTRALIZATION**			
	A	Decentralized Autonomous Organization (DAO), Decentralized Applications			CO3, CO4, CO5
	B	A Central Bank or Your Own Coin, A Crowdfunding System			CO3, CO4, CO5
	C	State, Merkle Patricia Tree, Client Applications , Objects of smart contracts			CO3, CO4, CO5
	Unit 5	**USE AND APPLICATION OF SMART CONTRACTS**			
	A	Examples of using smart contracts, Time Elements in developing smart contracts			CO4,CO5, CO6
	B	Features of smart contracts: Autonomy, Trust, Savings, Safety, Efficiency			CO4,CO5, CO6
	C	Other smart contract platforms, Quality of decentralized applications, Code patterns , Discussion of future prospects			CO4,CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	● Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction A. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder Princeton University Press 2016 ● Mastering Bitcoin by Andreas Antonopoulos, O'Reilly Publishing 2014 978-0691171692			
	Other References	● Ethereum White Paper Vitalik Buterin Online 2017 ● Ethereum documentation (http://www.ethdocs.org/en/latest) ● Solidity documentation ((https://solidity.readthedocs.io/en/develop))			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO-1: Develop smart contract, solidarity, ethereum based application.	PO1, PO2, PO3,PO6, PO7, PO8, PO11, PO12,PSO1, PSO2, PSO3
2.	CO-2: Compare bitcoin, ethereum, hyperledger and various crpyocurrencies concept.	PO1, PO2, PO3,PO4,PO5,PO10, PO12, PSO1, PSO2, PSO3
3.	CO-3: Discuss decentralization and crowfunding systems.	PO1, PO2, PO3,PO4, PO5, PO7, PO8, PO10,PO12,PSO1, PSO2, PSO3
4.	CO-4: Explain smart contracts, their technical capabilities, practical applications, limitations and security constraints.	PO1, PO2, PO3,PO4, PO7, PO8, PO9, PO10, PSO1, PSO2, PSO3
5.	CO-5: Discuss the most prominent smart contract platform and Ethereum.	PO1, PO2, PO3,PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	CO-6: Improve other smart contract problems.	PO1, PO2, PO3,PO4, PO5, PO6, PO7, PO8,PO9,PO11,PSO1,PSO2, PSO3

PO and PSO mapping with level of strength

COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	2	1	2	-	-	3	1	1	-	-	1	1	1	2	1
CO2	2	3	1	2	2	-	-	-	-	1	-	2	1	2	2
CO3	1	2	3	3	2	-	1	1	-	1	-	2	1	2	1
CO4	2	1	2	2	-	-	1	1	1	1	-	-	1	3	2
CO5	3	2	3	-	-	-	-	-	2	1	1	2	1	2	1
CO6	2	3	2	1	2	2	1	1	1	-	1	-	1	2	1

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BCC302	SMART CONTRACTS USING ETHEREUM	2	2	2.2	1.3	1	0.8	0.7	0.7	0.7	0.7	0.5	1.2	1	2.2	1.3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***

3. Addressed to ***Substantial (High=3) extent***

Smart Contracts using Hyperledger Fabric

<table>
<tr><td colspan="2">School:</td><td colspan="3">Sharda School of Engineering & Technology</td></tr>
<tr><td colspan="2">Department</td><td colspan="3">Computer Science & Engineering</td></tr>
<tr><td colspan="2">Program:</td><td colspan="3">B.Tech -CSE</td></tr>
<tr><td colspan="2">Branch:</td><td colspan="3">Blockchain</td></tr>
<tr><td>1</td><td>Course Code</td><td>BCC303</td><td colspan="2">SEMESTER: 6</td></tr>
<tr><td>2</td><td>Course Title</td><td colspan="3">Smart Contracts using Hyperledger Fabric</td></tr>
<tr><td>3</td><td>Credits</td><td colspan="3">4</td></tr>
<tr><td>4</td><td>Contact Hours (L-T-P)</td><td>3</td><td>1</td><td>0</td></tr>
<tr><td></td><td>Course Status</td><td colspan="3">CORE</td></tr>
<tr><td>5</td><td>Course Objective</td><td colspan="3">This course is designed for Developers and system programmers who are interested in blockchain technology but have little to no experience with blockchain and chaincode.</td></tr>
<tr><td rowspan="6">6</td><td rowspan="6">Course Outcomes</td><td colspan="3">CO1. Understand the concept of smart contracts and chaincode in blockchain</td></tr>
<tr><td colspan="3">CO2. Understanding the key concepts of Hyperledger fabric</td></tr>
<tr><td colspan="3">CO3. Explore Block chain application using Hyperledger Fabric</td></tr>
<tr><td colspan="3">CO4. Understand the architecture and framework of hyperledger and smart contracts</td></tr>
<tr><td colspan="3">CO5. Understand Hyperledger Explorer fabric & Hyperledger Composer environment</td></tr>
<tr><td colspan="3">CO6. Develop Solutions to business modules.</td></tr>
<tr><td>7</td><td>Course Description</td><td colspan="3">Blockchain is an emerging technology pattern that can radically improve banking, supply-chain, and other transaction networks, creating new opportunities for innovation.Blockchain technology offers exciting possibilities to radically improve transactions networks, enabling innovations for asset transfer while reducing the cost and risk. Blockchain technology provides the basis for a dynamic shared ledger that can be applied to save time when recording transactions between parties, remove costs associated with intermediaries, and reduce risks of fraud and tampering. All industries can benefit from this technology, from manufacturing to finance and intellectual property.</td></tr>
<tr><td>8</td><td colspan="3">Outline syllabus</td><td>CO Mapping</td></tr>
</table>

	Unit 1	**Blockchain and smart contracts**	
	A	Smart contracts: Introduction, Legal design of small contracts, Developing a smart contract,Communicating between smart codes	CO1, CO2
	B	System chaincode, chain code API,valid transactions, channels and chaincode definitions	CO1, CO2
	C	Blockchain network, MSP, Identity	CO1, CO2
	Unit 2	**Exploring Hyperledger Fabric**	
	A	Hyperledger Fabric Model terminology, tools	CO2
	B	Frameworks of hyperledger fabric, component design	CO2
	C	Use cases for design philosophy	CO2, CO3
	Unit 3	**ARCHITECTURE OF HYPERLEDGER FABRIC V1.1**	
	A	Architecture of hyperledger Fabric : Reference and run time architecture, Transaction, Ledger	CO3,CO4
	B	Nodes, peer, Endorser, Ordering nodes	CO3,CO4
	C	Channels, certification authority, Transaction flow.	CO3
	Unit 4	**Hyperledger Explorer**	
	A	Hyperledger explorer, Definition , Structure, Components	CO5,CO6
	B	Block code peer list, Chaincode list, Transaction details	CO5,CO6
	C	Technical requirements: Installation and setting up environment, Configuring with fabric	CO5,CO6
	Unit 5	**Hyperledger Composer**	
	A	Hyperledger Composer, Definition and structure	CO5,CO6

	B	Benefits, Components of Hyperledger composer			CO5,CO6
	C	Hyperledger composer solution, Installation and configuration			CO5,CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	"1. Mastering Hyperledger Fabric: Master The Art of Hyperledger Fabric on Kubernetes			
		By Narendranath Reddy Thota"			
		"2. Developing a Blockchain Business Network with Hyperledger Composer using the ...			
		By Vance Morris, Rohit Adivi, Ratnakar Asara, Matthew Cousens, Nick Gupta, Nicholas Lincoln, Barry Mosakowski, Hong Wei Sun, IBM Redbooks"			
	Other References	https://www.hyperledger.org/wp-content/uploads/2018/08/HL_Whitepaper_IntroductiontoHyperledger.pdf			
		https://www.hyperledger.org/projects/explorer			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1	Understand the concept of smart contracts and chaincode in blockchain	PO1,PO2,PO3,PO5, PO7,PO8,PO12,PSO1,PSO2
2	Understanding the key concepts of Hyperledger fabric	PO1,PO3,PO5,PSO1,PSO2
3	Explore Block chain application using Hyperledger Fabric	PO1,PO2,PO3,PO5, PO8,PSO2,PSO3
4	Understand the architecture and framework of hyperledger and smart contracts	PO1,PO2,PO4,PO6, PSO1
5	Understand Hyperledger Explorer fabric and Hyperledger Composer environment	PO5,PO10,PSO2
6	Develop Solutions to business modules.	PO1,PO2,PO3,PO5, PO6,PO8,PO11,PSO1,PSO2

PO and PSO mapping with level of strength for Course Name Smartcontracts using hyperledger fabric

Course Code_ Course Name	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BCC303_Smartcontracts_for hyperledger fabric	CO1	2	2	3	-	2	-	1	3	-	-	-	1	1	3	-
	CO2	2	-	1	-	1	-	-	-	-	-	-	-	1	1	-
	CO3	3	3	2	-	2	-	-	3	-	-	-	-	-	2	1
	CO4	2	2	-	1	-	1	-	-	-	-	-	-	2	-	-
	CO5	-	-	-	-	2	-	-	-	-	1	-	-	-	1	-
	CO6	2	2	3	-	3	2	-	3	-	-	1	-	2	3	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BCC 303	Smart Contracts using Hyperledger Fabric	1.8	1.5	1.5	0.1	1.6	0.5	0.15	0.15	1.5	0	0.15	0.15	1	1.6	0.15

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Cyber Security in Blockchain Technology

-

School:		**Sharda School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B.Tech - CSE**		
Branch:		**Blockchain**		
1	Course Code	BCC401	Semester- 7	
2	Course Title	Cyber Security in Blockchain Technology		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core		

5	Course Objective	By the end of the course, students will be able to: 1. define cyber security challenges in blockchain technology 2. analyze public key cryptography in blockchain technology 3. understand role of time stamping in blockchain technology	
6	Course Outcomes	1. Classifying Attacks On Blockchain Technology 2. Explain Consensus Algorithms To Prevent Attacks 3. Demonstrate Public Key Cryptography 4. Construct Digital Signature From Blockchain Context 5. Demonstrate Time Stamping Algorithms 6. Explain Use Cases Of Blockchain In Cyber Security	
7	Course Description	This course provides insight to Cyber Security in Blockchain Technology	
8	Outline syllabus		CO Mapping
	Unit 1	**Privacy, Security issues in Blockchain**	
	A	Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation	CO1 , CO2
	B	attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks - -advent of algorand	CO1 , CO2
	C	Sharding based consensus algorithms to prevent these attacks	CO1 , CO2
	Unit 2	**Cryptography**	
	A	Public Key Infrastructure (PKI) and Cryptography	CO1, CO3
	B	Conventional PKI , Blockchain as a Form of Distributed PKI , Blockchain vs PKI	CO1, CO3
	C	Blockchain - Public Key Cryptography, Decentralized Public Key Infrastructure (DPKI)	CO1, CO3
	Unit 3	**Digital Signature**	
	A	Digital Signature from Blockchain context	CO3, CO4
	B	Undeniable signature	CO3, CO4

	C	Diffie–Hellman, Digital signature scheme for information non-repudiation in blockchain			CO3, CO4
	Unit 4	**Blockchain-based time stamping**			
	A	Time stamping Metadata Using Blockchain			CO4,CO5
	B	Decentralized Trusted Time stamping Based on Blockchains			CO3,CO5
	C	Content Time stamping			CO3,CO5
	Unit 5	**Use Cases of Blockchain In Cyber security**			
	A	Decentralized Storage Solutions, How Guardtime uses blockchain technology to safeguard data			CO5, CO6
	B	IoT Security, Safer DNS, Using blockchains to prevent DDoS attacks			CO5, CO6
	C	Implementing Security in Private Messaging			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Blockchain Technology Basics: Blockchain cryptography and cybersecurity Kindle Edition by Raghava Shankar (Author), Srikanth RC Cherukupalli M.Tech (Author)			
	Other References	Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks Kindle Edition by Imran Bashir (Author) Format: Kindle Edition			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1	classifying attacks on blockchain technology	PO1, PO2,PO3,PO4,PO5, PSO1, PSO2,PSO3
2	explain consensus algorithms to prevent attacks	PO1, PO2,PO3,PO4,PO5, PO6,PO7,PO8,PO9, PSO1, PSO2,PSO3
3	demonstrate public key cryptography	PO1, PO2,PO3,PO4,PO5, PO6,PO7,PO8,PO9, PSO1, PSO2,PSO3
4	construct digital signature from blockchain context	PO1, PO2,PO3,PO4,PO5, PO10,PO11,PO12,PSO1, PSO2,PSO3
5	demonstrate time stamping algorithms	PO1, PO2,PO3,PO4,PO5, PO10,PO11,PO12,PSO1, PSO2,PSO3
6	explain Use Cases of Blockchain In Cyber security	PO1, PO2,PO3,PO4,PO5, PO10,PO11,PO12,PSO1, PSO2,PSO3

PO and PSO mapping with level of strength

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	-	-	-	-	-	-	-	2	2	2
CO2	3	2	3	2	2	1	1	1	1	-	-	-	2	1	2
CO3	2	2	3	2	2	1	1	1	1	-	-	-	1	2	2
CO4	2	1	3	1	2	-	-	-	-	2	2	2	2	2	1
CO5	2	2	2	2	2	-	-	-	-	2	1	2	1	1	1
CO6	2	1	1	1	1	-	-	-	-	1	1	1	1	1	1

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3
BCC401	**Cyber Security in Blockchain Technology**	2.1	1.6	2.3	1.6	1.8	0.3	0.3	0.3	0.3	0.8	0.6	0.8	1.5	1.5	1.5

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Blockchain for Business

School:		**Sharda School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B.Tech-CSE**		
Branch:		**Blockchain**		
1	Course Code	BCC011	Semester : 4	
2	Course Title	**Blockchain for Business**		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Program Elective		
5	Course Objective	It aims at eliminating the middleman, or data gatekeeper, blockchain allows companies to quickly and easily trace products and transactions all the way back to their roots. Because data is shared on multiple systems in multiple countries — and validated before it's recorded — it's more secure.		
6	Course Outcomes	CO1. Define how the concept of money and relate in the concept of DLT CO2. Interpret various blockchain functionalities to extend existing business models and make correct & fully informed decisions. CO 3. Apply Blockchain technology in various business domains of financial and commodities CO 4. Discover Blockchain from Big data perspective CO 5. Recommend new Business application for the Blockchain CO 6. Imagine CO current issues of blockchain and propose potential solutions.		
7	Course Description	Blockchain will bring about profound changes to business, and even to the nature of business itself. This technology will disrupt how enterprises are funded and managed, how they create value, and even how they perform basic functions like marketing and accounting. In this course you will learn how blockchain technology will penetrate into the structures of organizations. You will explore how blockchain will transform the roles of the C-Suite, and how a blockchain can be used to manage and protect intellectual property. You will be able to identify the different layers of the blockchain technology stack, and explain how these affect the governance of blockchain systems. As well, you will be able to identify seven qualities that a region in the world needs in order to attract technology startups and to build a vibrant blockchain ecosystem.		
8	Outline syllabus			CO Mapping
	Unit 1	**Introduction to Blockchain and business applications**		
	A	Evolution of blockchain, creation, Growth, Rise of crypto currencies		CO2
	B	Blockchain Principles, Qualities , Popular blockchain platforms		CO2
	C	Brief history of money, Impact of blockchain: Financial sector, internet		CO1,CO2

	Unit 2	**Financial Services& Government Public Sectors**	
	A	Blockchain and Smart Contracts, Transparency in government services, Land Right Management, real world use cases	CO2,CO3
	B	Manufacturing & Industrial: Blockchain for Supply chain, Logistics, IOT	CO3
	C	Health Care and Life Sciences: Recordkeeping, Pharmaceuticals, Public health	C03,CO2,CO5
	Unit 3	**Data Management and cyber security**	
	A	Data management: Blockchain for big data,CCT,Cloud based blockchain	CO3,CO4
	B	Monetizing Big data, Blockchain and Big Data Analytics, Challenges	CO3,CO4
	C	Blockchain for Gaming, Blockchain and cyber security	CO3
	Unit 4	**Implementing blockchain in Enterprises**	
	A	Identifying opportunities and threats, People and partners	CO5,CO6
	B	Determining use cases and impact on processes, Conceptual model of implementation	CO5,CO6
	C	New Business applications of blockchain :Smart Cities, Digital Medicine, M2M Transactions	CO5,CO6
	Unit 5	**Current Issues and Potential solutions to blockchain to the next level**	
	A	Issues faced, Solutions for scalability issues	CO5,CO6
	B	On-chain solutions: Proof of stake,sharding Off-chain solutions: Payment or state channels, Plasma Truebit	CO5,CO6
	C	Next generation blockchain projects, A case study: The exciting world of blockchain	CO5,CO6
	Mode of examination	Theory/Jury/Practical/Viva	

	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	

	Text book/s*	" "1. Applications of Blockchain Technology in Business: Challenges and Opportunities By Mohsen Attaran, Angappa Gunasekaran" "2. Blockchain for Business 2019: A user-friendly introduction to blockchain ... By Peter Lipovyanov"	
	Other References	1. Blockchain and Business: Applications and Implications https://www.coursera.org/learn/blockchain-business/home/welcome 2. Blockchain for Business Professional https://www.edx.org/professional-certificate/linuxfoundationx-blockchain-for-business	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
CO1	Define how the concept of money and relate in the concept of DLT	PO1,PO2,PO3,PO8,PO11, PSO1,PSO3
CO2	Interpret various blockchain functionalities to extend existing business models and make correct & fully informed decisions.	PO1,PO3,PO5,PO8,PO11, PSO1,PSO2
CO3	Apply Blockchain technology in various business domains of financial and commodities	PO1,PO2,PO8,PSO2,PSO3
CO4	Discover Blockchain from Big data perspective	PO1,PO2,PO3,O4,PO7,PO8, PSO2
CO5	Recommend new Business application for the Blockchain	PO3,PO4,PO5,PO8,PSO2, PSO1
CO6	Imagine current issues of block chain and propose potential solutions.	PO1,PO2,,PO5,PO6,PO8,PO11,PSO1,PSO2

PO and PSO mapping with level of strength for Course Name Blockchain for business

Course Code_ Course Name	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BCC011_Blockchain for Business	CO1	2	2	1	-	-	-	-	3	-	-	1	-	1	-	1
	CO2	2	-	1	-	1	-	-	2	-	-	2	-	1	1	-
	CO3	1	2	-	-	-	-	-	3	-	-	-	-	-	1	1
	CO4	2	2	2	3	-	-	2	2	-	-	-	-	-	3	-
	CO5	-	-	1	1	2	-	-	1	-	-	-	-	2	1	-
	CO6	1	1	1	-	2	2	-	1	-	-	1	-	1	1	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BCC 011	Blockchain for Business	1.3	1.1	1	0.6	0.8	0.3	0.3	2	0	0	0.6	0	0.8	1.1	0.3

Strength of Correlation

1. Addressed to ***Slight (Low=1)*** ***extent*** *2.* Addressed to ***Moderate (Medium=2)*** ***extent***
3. Addressed to ***Substantial (High=3)*** ***extent***

IMPLEMENTING BLOCK CHAIN ON CLOUD

School:		**Sharda School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B.Tech - CSE**		
Branch:		**Blockchain**		
1	Course Code	BCC021	Semester- 5	
2	Course Title	**IMPLEMENTING BLOCK CHAIN ON CLOUD**		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Elective		
5	Course Objective	The objective of the course is a short, concise introduction and implementation of block chain techniques over cloud system.		
6	Course Outcomes	On successful completion of this module students will be able to 1. synthesize the basic concepts and principles of blockchain 2. analyze the concept of secure service container and IBM cloud private cluster. 3. synthesize the planning and installation of the secure service container 4. develop and install the secure service container architecture 5. identify the application client, Smart contract programming language, Endorsement policy, Orderer block configuration 6. design and develop GO language program		
7	Course Description	The fundamental concepts in Smart Contracts using Eherium with a practical approach in understanding them have been discussed.		
8	Outline syllabus		CO Mapping	
	Unit 1	**INTRODUCTION**		
	A	Why Blockchain?, IBM blockchain platform introduction, benefits and differentiators of deploying and using a blockchain environment of LinuxONE	CO1, CO2	
	B	LinuxONE, Kubernetes(K8s), IBM cloud private, Gluster FS, IBM secure service container, IBM blockchain platform,	CO1, CO2	
	C	Secure service container partition, IBM cloud private cluster.	CO1, CO2	
	Unit 2	**PLANNING FOR INSTALLATION**		
	A	Why secure service container? Persistant storage provider, setting up file storage system	CO1, CO2, CO3	

	B	IBM blockchain platform console, Minimum network , Pilot network, Production network, Component containers, Resource reallocation			CO1, CO2, CO3
	C	Consideration for specific use cases			CO1, CO2, CO3
	Unit 3	**SECURE SERVICE CONTAINER INSTALLATION AND CONFIGURATION**			
	A	Secure service container architecture, SSC bootleader overview, download the image			CO1, CO2, CO3, CO4
	B	Hardware requirement for SSC partition, Networking, Supported operating system and platform, software requirement, supported docker version, Supported IBM Cloud Private Versions, required ports,			CO1, CO2, CO3, CO4
	C	Creating SSC partitions, Installing IBM cloud private cluster, Deploying IBM cloud private, Uninstalling ICP and SSC, Updating cluster resource dynamically			CO1, CO2, CO3, CO4
	Unit 4	**IBM BLOCKCHAIN PLATFORM INSTALLATIONS AND CONFIGURATIONS**			
	A	Loading Helm chart, setting up role based access control (RBAC) rules, scripted console installation, manual console installation			CO3, CO4, CO5
	B	Creating peer organization, creating a peer, creating the ordering service, Open shift support			CO3, CO4, CO5
	C	Troubleshooting the installation			CO3, CO4, CO5
	Unit 5	**PERFORMANCE AND CONSIDERATIONS**			
	A	Application client, Smart contract programming language, Endorsement policy, Orderer block configuration, Peer container resource allocation			CO4,CO5, CO6
	B	Hiper sockets, Hiper socket benefits			CO4,CO5, CO6
	C	Cryptography importance in block chain, CPACF's role in acceleration and protection			CO4,CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	● 1. Serious Cryptography: A Practical Introduction to Modern Encryption By Jean-Philippe Aumasson ● 2. Handbook of Research on Blockchain Technology by Saravanan Krishnan, Valentina Emilia Balas, Julie Golden, Y. Harold Robinson, S. Balaji, Raghvendra Kumar			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	synthesize the basic concepts and principles of blockchain	PO1, PO2, PO3,PO6, PO7, PO8, PO11, PO12,PSO1, PSO2, PSO3
2.	analyze the concept of secure service container and IBM cloud private cluster.	PO1, PO2, PO3, PO4, PO5, PO10, PO12, PSO1, PSO2, PSO3
3.	synthesize the planning and installation of the secure service container	PO1, PO2, PO3, PO4, PO5, PO7,PO8, PO10,PO12, PSO1, PSO2, PSO3
4.	develop and install the secure service container architecture	PO1, PO2, PO3, PO4, PO7, PO8, PO9, PO10, PSO1, PSO2, PSO3
5.	identify the application client, Smart contract programming language, Endorsement policy, Orderer block configuration	PO1, PO2, PO3, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	design and develop GO language program	PO1, PO2,PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO11,PSO1, PSO2, PSO3

PO and PSO mapping with level of strength

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	2	1	2	-	-	3	3	2	-	-	3	1	2	2	3
CO 2	2	2	1	2	2	-	-	-	-	2	-	2	1	2	2
CO 3	3	2	2	2	2	-	1	2	-	2	-	2	1	2	1
CO 4	2	1	2	2	-	-	2	2	1	1	-	-	1	3	2
CO 5	3	2	3	-	-	-	-	-	2	2	1	2	1	1	1
CO 6	2	3	2	1	2	2	1	1	2	-	2	-	2	1	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BCC021	IMPLEMENTING BLOCK CHAIN ON CLOUD	2.3	1.8	2.0	1.2	1.0	0.8	1.2	1.2	0.8	1.2	1.0	1.2	1.3	1.8	1.8

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***

3. Addressed to ***Substantial (High=3) extent***

Cryptocurrency with Ethereum

School:		**Sharda School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B.Tech - CSE**		
Branch:		**Blockchain**		
1	Course Code	BCC031	Semester- 6	
2	Course Title	**Cryptocurrency with Ethereum**		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Program Elective		
5	Course Objective	By the end of the course, students will be able to 1. Understand how blockchain systems (Ethereum) work, 2. To securely interact with them, 3. Design, build, and deploy smart contracts and distributed applications, 4. Integrate ideas from blockchain technology into their own projects.		
6	Course Outcomes	On completion of this course the student should be able to: 7. understanding of the realities of Cryptocurrency 8. Explain design principles of Ethereum 9. Design, build, and deploy smart contracts 10. The student will be able to use cryptocurrency exchanges and wallets safely 11. To learn concept of Decentralized and Distributed Ledger. 12. Evaluate security, privacy, and efficiency of a given blockchain system.		
7	Course Description	**Cryptocurrency with Ethereum**		
8	Outline syllabus			CO Mapping
	Unit 1	**Introduction to cryptocurrency**		
	A	What is Cryptocurrency? History of Cryptocurrency Cryptocurrency vs. Traditional Currency, Understanding Blockchain Technology		CO1
	B	Major global market cryptocurrencies; Compares the potential benefits and problems of cryptocurrency to other currencies. Virtual currency, Centralize and decentralize currency		CO1
	C	Where to store your cryptocurrency - Wallets & Cold Storage Paper Wallets: Hardware Wallets, How to Buy Cryptocurrency, Things to Consider Before Investing in Cryptocurrency		CO1, CO4

	Unit 2	**Introduction to Ethereum**	
	A	What is Ethereum? Ethereum Virtual Machine (EVM) , Mining in Ethereum, private and public Blockchain, Platform Functions used in Ethereum, Technologies that support Ethereum	CO2
	B	Introducing Smart Contracts Cryptocurrency in Ethereum, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts	CO2, CO3
	C	Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts	CO2, CO3
	Unit 3	**DECENTRALIZED APPLICATIONS (DAPPS)**	
	A	Decentralized Application Types, Components for development of Ethereum DApps, Ethereum Platform – Transactions in Ethereum – Ether wallet, Ether Accounts, Ether Gas, Gas Price, Gas Limit,	CO2, CO4, CO5
	B	Ether Tokens – ERC20 ethereum stands for Tokens,	CO2, CO4, CO5
	C	Hyperledger Platform – Hyperledger Fabric Architecture, Hyperledger Fabric and Smart Contract – Chain Code and Go Language. Hyperledger fabric, the plug and play platform and mechanisms in permissioned blockchain	CO2, CO4, CO5
	Unit 4	**Cryptocurrency Investing Mindset**	
	A	**Security:** Privacy, Security issues in Blockchain,Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation,	CO6
	B	Hash Codes, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.	CO6
	C	**Planning:** Short term gain vs. Long term investment, Paper proft vs. Actual Profit	CO6
	Unit 5	**Cryptocurrency Regulation**	
	A	Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.	CO4, CO6
	B	Identify major research challenges and technical gaps existing between theory and practice in cryptocurrency domain	CO4, CO6

	C	Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain			CO1
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).			
	Other References	3. Stephen Satoshi - Cryptocurrency_ Ultimate Beginners Guide to Making Money with Cryptocurrency like Bitcoin, Ethereum and altcoins-CreateSpace Independent Publishing Platform (2017) 4. Draft version of "S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Blockchain Technology: Cryptocurrency and Applications', Oxford University Press, 2019			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1	understanding of the realities of Cryptocurrency	PO1,PO2,PO3,PO4,PO5,PO6,PO8, PSO1, PSO2
2	Explain design principles of Ethereum	PO1,PO2,PO3,PO4,PO5, PO6,PO8,PO12,, PSO1, PSO2,PSO3
3	Design, build, and deploy smart contracts	PO1, PO2,PO3,PO4,PO5, PO6,PO9,PO11,PO12, PSO2
4	The student will be able to use cryptocurrency exchanges and wallets safely	PO1, PO2,PO4,PO5,PO6,PO8, PO10,PO11, PSO2,PSO3
5	To learn concept of Decentralized and Distributed Ledger.	PO1, PO2,PO3,PO6,PO8,PO10,PSO1, PSO2,PSO3
6	Evaluate security, privacy, and efficiency of a given blockchain system.	PO1, PO2,PO3,PO5, PO6,PO8, PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Cryptocurrency and Ethereum

S.No	Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO1	1	3	1	1	2	2	-	2	-	-	-	-	-	2	-
2	CO2	1	3	1	1	2	2	-	2	-	-	-	1	1	2	1
3	CO3	2	2	3	2	3	2	-	-	1	-	1	1	-	2	-
4	CO4	1	1	-	3	3	3	--	2	-	1	1	-	-	3	1
5	CO5	3	3	3	-	-	3	--	2	-	2	-	-	3	2	2
6	CO6	3	3	3	-	2	3	-	3	-	-	-	-	-	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O 1**	**PS O 2**	**PS O 3**
BCC031	**Cryptocurrency with Ethereum**	1.8	2.5	1.8	1.2	2.0	2.5	0.0	1.8	0.2	0.5	0.3	0.3	0.7	2.3	1.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

OPEN SOURCE FOR BLOCKCHAIN USING HYPERLEDGER

School:		**Sharda School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B.Tech - CSE**		
Branch:		**Blockchain**		
1	Course Code	BCC041	Semester- 6	
2	Course Title	OPEN SOURCE FOR BLOCKCHAIN USING HYPERLEDGER		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Program Elective		

5	Course Objective	The objective of the course is to introduce basic fundamental concepts in Open source for blockchain using hyperledger, with a practical approach in understanding them. To visualize the scope of blockchain and hyperledger, and its role in futuristic development.	
6	Course Outcomes	On successful completion of this module students will be able to CO1: Explain Hyperledger and blockchain technologies. CO2: Discover bitcoin mechanism and network. CO3: Interpret hyperledger ecosystem and blockchain for business. CO4: Compare different hyperledger frameworks and networks. CO5: Design applications using hyperledger tools such as sawtooth, Iroha etc. CO6: Discuss Hyperledger leverages open standards and open governance to support business solutions.	
7	Course Description	The fundamental concepts in Open source for blockchain using hyperledger, with a practical approach in understanding them have been discussed.	
8	Outline syllabus		CO Mapping
	Unit 1	**Blockchain Technologies**	
	A	Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism,	CO1,CO2
	B	Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy	CO1, CO2
	C	Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain	CO1, CO2
	Unit 2	**Introduction to Hyperledger**	
	A	What is Hyperledger? Why we need Hyperledger? How Hyperledger Works? The Birth of Hyperledger	CO1, CO2
	B	Different types of Hyperledger frameworks. Comparing Hyperledger with Bitcoin and Ethereum	CO1, CO2, CO3
	C	Hyperledger Goals	CO2, CO3, CO4
	Unit 3	**Hyperledger Frameworks**	
	A	blockchain networks: public blockchains, consortiums, and private, Components of Hyperledger Frameworks	CO1, CO2, CO4
	B	key elements of a typical Hyperledger network,	CO1,CO2, CO4

	C	Hyperledger fabric transaction flow, Hyperledger Composer	CO1, CO2
	Unit 4	**Hyperledger Tools**	
	A	Open Standards, The Importance of Open Source, Open Source and Open Governance	CO1, CO2, CO5
	B	Software Governance of the Hyperledger Projects, Unique Characteristics of Hyperledger Sawtooth	CO1, CO4, CO5
	C	Hyperledger Sawtooth v1.0, Hyperledger Iroha v0.95,	CO1, CO4, CO5
	Unit 5	**Hyperledger Ecosystem**	
	A	Interest of developers in Open Source Software? Hyperledger vs. Apache	CO2, CO3, CO6
	B	Blockchain for Business, Why Businesses Choose to Use Hyperledger?	CO2, CO3, CO6
	C	Hyperledger Modules, Hyperledger Cello, Interoperability between Hyperledger Frameworks	CO2, CO3, CO6
	Mode of examination	Theory	
	Weightage Distribution	CA 25% / MTE 25% / ETE 50%	
	Text book/s*	• Gaur Nitin et. al. (2018), Hands-On Blockchain with Hyperledger: Building decentralized applications with Hyperledger Fabric and Composer, Packt Publishing • Anotnopoulous AM. and Wood M.,(2018) Mastering Ethereum: Building Smart Contracts and DApps. O'Reilly Media	
	Other References	• Wattenhofer, The Science of the Blockchain • Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Explain Hyperledger and blockchain technologies.	PO1, PO2, PO4, PO6, PO10, PO11, PO12, PSO1, PSO2, PSO3
2.	CO2: Discover bitcoin mechanism and network.	PO1, PO2, PO3, PO4, PO5, PO7, PO8, PO11, PO12, PSO1, PSO2, PSO3
3.	CO3: Interpret hyperledger ecosystem and blockchain for business.	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO11, PO12, PSO1, PSO2, PSO3
4.	CO4: Compare different hyperledger frameworks and networks.	PO1, PO2, PO4, PO8, PO9, PO12, PSO1, PSO2
5	CO5: Design applications using hyperledger tools such as sawtooth, Iroha etc.	PO1, PO2, PO3, PO5, PO9, PO11, PSO1, PSO2, PSO3
6	CO6: Discuss Hyperledger leverages open standards and open governance to support business solutions.	PO1, PO2, PO3, PO4, PO5,PO6, PO7, PO8, PO10, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO 12	PSO 1	PSO 2	PSO 3

CO1	2	2	-	1	-	2	-	-		2	2	2	3	2	2
CO2	1	3	3	2	2	-	1	2	-	-	2	3	2	1	1
CO3	2	1	2	1	1	3	-	1	-	-	1	1	2	1	2
CO4	1	2	-	3	-	-	-	2	2	-	-	2	2	3	-
CO5	2	2	2	-	1	-	-	-	1	-	2	-	1	2	2
CO6	2	3	2	3	2	2	2	2	-	2	-	-	1	1	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O 1**	**PS O 2**	**PS O 3**
BCC041	**OPEN SOURCE FOR BLOCKCHAIN USING HYPERLEDGER**	1.7	2.2	1.5	1.7	1.0	1.2	0.5	1.2	0.6	0.7	1.2	1.3	1.8	1.7	1.5

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Disaster Recovery Management using Blockchain Technology

School:		**Sharda School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B.Tech-CSE**		
Branch:		**Blockchain**		
1	Course Code	BCC051	Semester : 7	
2	Course Title	**Disaster Recovery Management using Blockchain Technology**		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	ELECTIVE		
5	Course Objective	It aims to explores the application of blockchain in disaster management to address the prevalant issues, and in turn, reduce the loss of time, money, and human life. Disaster management is a unique form of operations management in which emergency service providers and humanitarian agencies provide resources (e.g., medical services, logistical services, food, shelter, etc.) to support the public before, during, and after disasters.		
6	Course Outcomes	CO1. Explore the application of blockchain in disaster management CO2. Interpret various blockchain functionalities to extend existing disaster solution models. CO 3. Apply Blockchain technology for humanitarian agencies CO 4. Highlight the role of blockchain to support public healthcare services CO 5. Recommend new disaster management application for the Blockchain CO 6. Understand the current issues of blockchain and propose potential solutions to support emergency service providers		
7	Course Description	Blockchain can be used as an application during emergencies. Because, there is no integrated information system so far developed for disaster management and control for effective decision making, there is a need for development of conceptual model. It is necessary to address and collaborate the stakeholders to a common platform where the storing and information sharing is consistent and reliable. Unfolding of disaster management produces massive amount of data that can help in restoring and supporting the society. The adoption of blockchain in this regard mitigates corruption, accelerates partnerships between various relief agencies, and improves resource allocation. In this course you will learn how blockchain framework will be useful for disaster management and how it facilitates the governments, residents, medical service providers, shelter providers, food service providers, transporters, and non-government relief organizations.		
8	Outline syllabus			CO Mapping
	Unit 1	**Introduction to Blockchain**		

	A	Evolution of blockchain, Types: Public, Private, Consortium, Decentralization, Consensus protocols			CO2
	B	Working of Blockchain, Hashing, Blockchain disruption and Smart Contract, Cryptocurrencies			CO2
	C	Brief history of blockchain in healthcare, supply chain management and other disaster related services.			CO1,CO2
	Unit 2	**Integration of Blockchain and Disaster Management**			
	A	Hazard Monitoring, Transcription and management on blockchain of disaster related data.			CO2,CO3
	B	Humanitarian aid and emergency relief; smart contracts for the management of aid requests and relief deliveries			CO3
	C	Blockchain governance for disaster management, Integration of blockchain and IoT for hazard surveillance and monitoring			C03,CO2,CO5
	Unit 3	**Operations management**			
	A	Emergency service providers and humanitarian agencies, Disaster response, Disaster Recovery			CO3,CO4
	B	Allocation of vital resources, Operations management, Government issues in blockchain based disaster management.			CO3,CO4
	C	Design stakeholders: Governments, food service providers, transportation providers, residents, government relief organizations, telecommunication providers.			CO3
	Unit 4	**Multiagent collaborative emergency management mechanism**			
	A	Emergency management system, Smart contract for management of aid requests and relief deliveries.			CO5,CO6
	B	Connotation and dilemma of Multiagent collaborative emergency management mechanism			CO5,CO6
	C	Application of blockchain to Multiagent collaborative emergency management mechanism			CO5,CO6
	Unit 5	**Current issues and challenges**			
	A	Blockchain for supply chain and logistics leading to resilient infrastructure, Perceived trust in blockchain, Perceived security issues in blockchain			CO5,CO6
	B	Preventing cyber risks and their cascading impacts with blockchain, Implementing blockchain inside a Business Models to face a crisis, Crisis management and blockchain			CO5,CO6
	C	War, guerrilla, counter-insurgency, and blockchain, Applied case studies, Acceptance and adoption of blockchain in a turbulent context			CO5,CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	

	Text book/s*	1. Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World, Book by Alex Tapscott and Don Tapscott. 2. Blockchain-EnabledResilience: An Integrated Approach for Disaster Supply Chain and Logistics Management. By Polinpapilinho F. Katina, Adrian V. Gheorghe, CRC Press, ISBN 9781032371504, 2023. 3. Disaster ManagementByR N Misra, ISBN: 9789388854047,2019. https://g.co/kgs/HzDnXR	
	Other References	1. Hunt, K., Zhuang, J. (2022). Blockchain for Disaster Management. In: Emrouznejad, A., Charles, V. (eds) Big Data and Blockchain for Service Operations Management. Studies in Big Data, vol 98. Springer, Cham. https://doi.org/10.1007/978-3-030-87304-2_10 2. Babich, V., & Hilary, G. (2020). OM Forum—Distributed ledgers and operations: What operations management researchers should know about blockchain technology. Manufacturing & Service Operations Management, 22(2), 223–240.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
CO1	Explore the application of blockchain in disaster management	PO1,PO2,PO3,PO8,PO11, PSO1,PSO3
CO2	Interpret various blockchain functionalities to extend existing disaster solution models.	PO1,PO3,PO5,PO8,PO11, PSO1,PSO2
CO3	Apply Blockchain technology for humanitarian agencies	PO1,PO2,PO8,PSO2,PSO3

CO4	Highlight the role of blockchain to support public healthcare services	PO1,PO2,PO3,O4,PO7,PO8, PSO2
CO5	Recommend new disaster management application for the Blockchain	PO3,PO4,PO5,PO8,PSO2, PSO1
CO6	Understand the current issues of blockchain and propose potential solutions to support emergency service providers	PO1,PO2,,PO5,PO6,PO8,PO11,PSO1,PSO2

PO and PSO mapping with level of strength for Course Name Disaster Recovery Management using Blockchain Technology

Course Code_ Course Name	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Disaster Recovery Management using Blockchain Technology	**CO1**	2	1	2	-	-	-	-	2	-	-	1	-	1	-	1
	CO2	2	-	1	-	1	-	-	2	-	-	2	-	1	1	-
	CO3	1	2	-	-	-	-	-	3	-	-	-	-	-	1	1
	CO4	2	2	2	3	-	-	2	2	-	-	-	-	-	3	-
	CO5	-	-	1	1	2	-	-	1	-	-	-	-	2	1	-
	CO6	1	1	1	-	2	2	-	1	-	-	1	-	1	1	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	Disaster Recovery Management using Blockchain Technology	1.3	1.1	1	0.6	0.8	0.3	0.3	2	0	0	0.6	0	0.8	1.1	0.3

Strength of Correlation

1. Addressed to ***Slight (Low=1)*** ***extent*** ***2.*** Addressed to ***Moderate (Medium=2)*** ***extent***

3. Addressed to ***Substantial (High=3)*** ***extent***

-

Blockchain Risk Management

School:		**Sharda School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B.Tech - CSE**		
Branch:		**Blockchain**		
1	Course Code	BCC061	Semester- 7	
2	Course Title	Blockchain Risk Management		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core		

5	Course Objective	By the end of the course, students will be able to: 1 Understand how blockchain systems work, 2 To securely interact with them, 3 Design, build, and deploy smart contracts and distributed applications, 4 Integrate ideas from blockchain technology into their own projects	
6	Course Outcomes	1 Define the basic concept of blockchain risk, types, and prediction of risk. 2 Control and opportunity risk. 3 Summarizing the benefits of cryptographic basics for cryptocurrency in case of various attacks 4 Better understand blockchain risk assessment or the risks of blockchain 5 Common blockchain business risks is business continuity risk. 6 Explain use cases of blockchain in security	
7	Course Description	Blockchain, essentially an encrypted, distributed ledger, may fundamentally change financial services, the internet, international development, the sharing economy and everything in between. It will enable organisations to lower costs, decrease interaction or settlement times and improve transparency. It will revolutionise the way we interact with companies and transform peer to peer transactions.Beyond financial services, some analysts suggest blockchain will become the foundational technology for the future of risk management.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	

	A	Blockchain Enterprise Risk Assessment and Management Framework			CO1 , CO2
	B	Types of Blockchain and the risks, Privacy and chain management			CO1 , CO2
	C	Smart Contracts and their role in risk, Mitigate risk			CO1 , CO2
	Unit 2	**Basics Risk Considerations**			
	A	Standard risk considerations, Smart contract risk considerations			CO1, CO3
	B	Security Related Blockchain Risks,Risks with Private and Public Key, Human-Related Risks			CO1, CO3
	C	Value transfer risk considerations, Regulatory Risks, Vendor Risks			CO1, CO3
	Unit 3	**Consensus Methods Risk**			
	A	Cryptographic Protocol, Data confidentiality risk			CO3, CO4
	B	Transaction Verifiability - Anonymity - Forks - Double Spending			CO3, CO4
	C	Faux Consensus, Consensus Decisions Appropriate			CO3, CO4
	Unit 4	**Business/Regulatory Risks, Smart Contract Risk**			
	A	Information security risks, Legal Risks			CO4,CO5
	B	Smart Contracts - some attacks on smart contracts			CO3,CO5
	C	Vulnerability, Attacks, Sidechain			CO3,CO5
	Unit 5	**Web Application Security Risks**			
	A	Improper Logging & Monitoring, Insecure Deserialization			CO5, CO6
	B	Cross-Site Scripting(XSS), Injection			CO5, CO6
	C	Broken Access Control, Broken Authentication			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Block Chain”, Packt Publishing			
	Other References	1 Imran Bashir, “Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Packt Publishing 2 J.A.Garay et al, The bitcoin backbone protocol - analysis and applications EUROCRYPT 2015 LNCS VOl 9057, (VOLII), pp 281-310. (Also available at eprint.iacr.org/2016/1048) . (serious beginning of			

		discussions related to formal models for bitcoin protocols). 3 Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Block Chain", Packt Publishing 4 R.Pass et al, Fruitchain, a fair blockchain, PODC 2017 (eprint.iacr.org/2016/916).

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1	Explain Abstract model of blockchain and consensus problem.	PO1, PO2,PO3,PO4,PO5,PO6,PO11,PSO1, PSO2,PSO3
2	List and describe differences between proof-of-work and proof-of-stake consensus.	PO1, PO2,PO3,PO4,PO5,PO7,PO10,PO12 PSO2,PSO3
3	Summarizing the benefits of cryptographic basics for cryptocurrency in case of various attacks	PO1, PO2,PO3,PO4,PO5,PO8,PO9,PSO1, PSO2,PSO3
4	Analyzing properties of Bitcoin and Ethereum	PO1, PO2,PO3,PO4,PO5, PO8,PO9,PO12,PSO1, PSO2
5	List Ethereum Virtual Machine (EVM) and its benefits	PO1, PO2,PO3,PO4,PO5, PO7,PO10,PSO1, PSO2,PSO3
6	List topics like SNARK and zcash along with various applications of blockcahin technology	PO1, PO2,PO3,PO4,PO5, PO6, PO11,PO12,PSO1, PSO2,PSO3

PO and PSO mapping with level of strength

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BCC061_Blockchain Risk Management	CO 1	3	2	2	2	2	1	-	-	-	-	1	-	1	3	1
	CO 2	3	3	2	2	2	-	1	-	-	1	-	1	-	3	2
	CO 3	3	3	3	2	2	-	-	1	1	-	-	-	1	3	1
	CO 4	2	3	2	2	2	-	-	1	1	-	-	1	1	3	-
	CO 5	2	2	2	3	2	-	1	-	-	1	-	-	2	3	1
	CO 6	2	3	2	2	3	1	-	-	-	-	1	1	1	3	1

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BCC061	Blockchain Risk Management	2.5	2.7	2.2	2.2	2.2	0.3	0.3	0.3	0.3	0.3	0.3	0.5	1.0	3.0	1.0

Strength of Correlation

1. Addressed to***Slight (Low=1)extent2.*** Addressed to***Moderate (Medium=2) extent***

3. Addressed to***Substantial (High=3) extent***

Blockchain Opportunity Analysis

School:		**Sharda School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B.Tech - CSE**		
Branch:		**Blockchain**		
1	Course Code		Semester- 7	
2	Course Title	Blockchain Opportunity Analysis		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core		

5	Course Objective	In this course we will study the business are of blockchain. Students are expected to be capable of understanding the implementation blockchain in industry, their advantages and drawbacks, how to implement them in network, how their drawbacks can be overcome and what the applications are and where they can be used.	
6	Course Outcomes	1 Students would be able to analyses opportunity in blockchain properly. 2 Students would be able to implement any problem by writing their own business idea. 3 By analyzing the logic of transaction, students would be able to write efficient business proposal in blockchain. 4 To become an efficient blockchain administrator. 5 To be aware with blockchain governance 6 To become a blockchain practitioner	
7	Course Description	This course examines Blockchain Transformations for Every Industry. The Topics to be covered (tentatively) include: Industry Transformations, Introduction to the Blockchain Case Commons, Problem Solving with Blockchain, Decision Matrix, Statement of Benefit.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Blockchain Transformations for Every Industry, Practitioner Perspective: Rob Carter CIO at FedEx, How to Use the Blockchain Case Commons	CO1
	B	Decentralizing the Enterprise, Blockchain & ConsenSys, Transaction Costs and the Structure of the Firm, Opportunity Search	CO1
	C	Opportunity Contracting, Opportunity Coordination, Opportunity, Building Trust	CO1

<table>
<tr><td></td><td>Unit 2</td><td colspan="3">Introduction to the Blockchain Case Commons</td><td></td></tr>
<tr><td></td><td>A</td><td colspan="3">Determining Corporate Boundaries, Hacking Your Future: Boundary Decisions, Decentralizing the Enterprise, Transaction Costs and the Structure of the Firm</td><td>CO2</td></tr>
<tr><td></td><td>B</td><td colspan="3">Industry Transformations, Introduction to the Blockchain Case Commons, Exploratory, Market Research</td><td>CO2</td></tr>
<tr><td></td><td>C</td><td colspan="3">Conducting Preliminary Market Research, How to Perform a Competitive Analysis</td><td>CO2</td></tr>
<tr><td></td><td>Unit 3</td><td colspan="3">Problems That Blockchain Can and Cannot Solve</td><td></td></tr>
<tr><td></td><td>A</td><td colspan="3">Intellectual Property, Payments, Attribution, and Licensing, Distributed Ownership</td><td>CO3</td></tr>
<tr><td></td><td>B</td><td colspan="3">APAC Business Development & Strategic Relations, Use a Decision Matrix, Problems, That Blockchain Can and Cannot Solve, Blockchain Opportunity Brainstorm,</td><td>CO3</td></tr>
<tr><td></td><td>C</td><td colspan="3">Problem Solving With Blockchain, Decision Matrix, Statement of Benefit</td><td>CO3</td></tr>
<tr><td></td><td>Unit 4</td><td colspan="3">Regulatory Principles</td><td></td></tr>
<tr><td></td><td>A</td><td colspan="3">Keyless Technologies, Strategic Positioning of Your Organization, Regulatory Principles, Regulation,</td><td>CO4</td></tr>
<tr><td></td><td>B</td><td colspan="3">Regulation vs. Governance, Regulation & Governance, The Blockchain Stack, Multiple Layers of Blockchain Governance,</td><td>CO4</td></tr>
<tr><td></td><td>C</td><td colspan="3">A New Framework for Blockchain Governance, Practitioner Perspective - Rob Carter: Governance, Profile of a Blockchain Hotbed</td><td>CO4</td></tr>
<tr><td></td><td>Unit 5</td><td colspan="3"></td><td></td></tr>
<tr><td></td><td>A</td><td colspan="3">How to Store and Use Bitcoins, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees</td><td>CO5, CO6</td></tr>
<tr><td></td><td>B</td><td colspan="3">Currency Exchange Markets, Building the Blockchain, Crypto Finance, Business Use Cases, Blockchain in Gaming</td><td>CO5, CO6</td></tr>
<tr><td></td><td>C</td><td colspan="3">Investing in Blockchain, Government and Regulation, Media and Advocacy1m, Creating the New Frontier of FinTech.</td><td>CO5, CO6</td></tr>
<tr><td></td><td>Mode of examination</td><td colspan="3">Theory</td><td></td></tr>
<tr><td rowspan="2"></td><td rowspan="2">Weightage Distribution</td><td>CA</td><td>MTE</td><td>ETE</td><td></td></tr>
<tr><td>25%</td><td>25%</td><td>50%</td><td></td></tr>
</table>

	Text book/s*	Blockchain: Blueprint for a New Economy Kindle Edition, by Melanie Swan
	Other References	1 The Internet of Money Kindle Edition, by Andreas M. Antonopoulos 2 Bitcoin Billionaires: A True Story of Genius, Betrayal, and Redemption, by Ben Mezrich

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1	Students would be able to analyses opportunity in blockchain properly.	PO1, PO2,PO3,PO4,PO5,PO6,PO11,PSO1, PSO2,PSO3
2	Students would be able to implement any problem by writing their own business idea.	PO1, PO2,PO3,PO4,PO5,PO7,PO10,PO12 PSO2,PSO3
3	By analyzing the logic of transaction, students would be able to write efficient business proposal in blockchain.	PO1, PO2,PO3,PO4,PO5,PO8,PO9,PSO1, PSO2,PSO3
4	To become an efficient blockchain administrator.	PO1, PO2,PO3,PO4,PO5, PO8,PO9,PO12,PSO1, PSO2
5	To be aware with blockchain governance	PO1, PO2,PO3,PO4,PO5, PO7,PO10,PSO1, PSO2,PSO3
6	To become a blockchain practitioner	PO1, PO2,PO3,PO4,PO5, PO6, PO11,PO12,PSO1, PSO2,PSO3

PO and PSO mapping with level of strength

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BLOCKCHAIN OPPORTUNITY ANALYSIS	CO 1	3	2	2	2	2	1	-	-	-	-	1	-	1	3	1
	CO 2	3	3	2	2	2	-	1	-	-	1	-	1	-	3	2
	CO 3	3	3	3	2	2	-	-	1	1	-	-	-	1	3	1
	CO 4	2	3	2	2	2	-	-	1	1	-	-	1	1	3	-
	CO 5	2	2	2	3	2	-	1	-	-	1	-	-	2	3	1
	CO 6	2	3	2	2	3	1	-	-	-	-	1	1	1	3	1

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	BLOCKCHAIN OPPORTUNITY ANALYSIS	2.5	2.7	2.2	2.2	2.2	0.3	0.3	0.3	0.3	0.3	0.3	0.5	1.0	3.0	1.0

Strength of Correlation

1. Addressed to***Slight (Low=1)extent2.*** Addressed to***Moderate (Medium=2) extent***

3. Addressed to***Substantial (High=3) extent***

B.Tech. (CSE) with Specialization in Cloud Technology and Virtualization with AWS

School:		School of Engineering & Technology		
Department		**Computer Science & Engineering**		
Program:		**B. Tech**		
Branch:		**CSE with Specialization in CTV**		
1	**Course Code**			
2	**Course Title**	**Fundamentals of Linux System and cloud**		
3	Credits	1-0-0		
4	Contact Hours (L-T-P)	1	0	0
	Course Status	Specialized Subject 1		
5	Course Objective	Introduces the Linux operating system, including: task scheduling and management, memory management, input/output processing, internal and external commands, shell configuration, and shell customization. Explores the use of operating system utilities such as text editors, electronic mail, file management and scripting.		
6	Course Outcomes	CO-1. Identify and use Linux utilities to create and manage simple file processing operations, organize directory structures with appropriate security, and develop shell scripts to perform more complex tasks. CO-2. Effectively use the Linux system to accomplish typical personal, office, technical, and software development tasks. CO-3. Monitor system performance and network activities. Effectively use software development tools including libraries, preprocessors, compilers, linkers, and make files. CO-4. Comprehend technical documentation, prepare simple readable user documentation and adhere to style guidelines. CO-5. Analyze the use of cloud in different editors in Linux environment. CO-6. Introduce the domain of cloud.		
7	Course Description			

8	**Outline syllabus**		CO Mapping
	Unit 1	**Introduction**	
	A	Introduction to Unix, Unix architecture, Features of Unix, Internal & External Commands, Basic unix commands:	CO1
	Unit 2	**Introduction to shell**	
	B	Shell & types of shell(Bourne family & its derivatives, c shell & its derivative tcsh), shell's interpretive cycle, wild cards, meta characters, escaping & quoting.	CO2
	Unit 3	**Graphical Interface**	
	A	Session Management, Basic Operations, Graphical Desktop,	CO3, CO6
	Unit 4	**Filters**	
	A	Piping, Simple filters: pr, head, tail, cut, paste, sort, nl, tr	CO4, CO6
	Unit 5	**Introduction to Cloud**	

	A	Public ,private and hybrid cloud, Access of private and public cloud, Introduction to EC2, Use of keys.			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Unix and shell programming by Richard F. Gilberg and Behrouz A. forouzan			
	Other References	1. Unix Shell programming by Stephen G. Kochan and Patric Wood 2. Sumitabha Das, "Unix Concepts and Applications", Tata McGraw Hill. 3. Internet as a resource for reference			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Identify and use Linux utilities to create and manage simple file processing operations, organize directory structures with appropriate security, and develop shell scripts to perform more complex tasks.	PO1, PO2, PO4, PSO1, PSO3
2.	Effectively use the Linux system to accomplish typical personal, office, technical, and software development tasks.	PO1, PO3, PO5, PSO1, PSO3
3.	Monitor system performance and network activities. Effectively use software development tools including libraries, preprocessors, compilers, linkers, and make files.	PO1,PO3,PO4,PSO1,PSO3
4.	Comprehend technical documentation, prepare simple readable user documentation and adhere to style guidelines.	PO2,PO3,PO4,PSO1,PSO2
5.	Analyze the use of different editors in Linux environment.	PO1,PO2,PO4,PSO2,PSO3
6.	Introduce the domain of cloud.	PO1,PO3,PO5,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Introduction to Artificial Intelligence & Machine Learning **(Course Code)**

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Fundamentals of Linux System and cloud	CO1	2	3		3									3		2
	CO2	3		1		2								3		2
	CO3		2	3	1									2		2
	CO4		2	1	3									1	2	
	CO5	2	1		2										2	1
	CO6	2		2		1									2	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	Fundamentals of Linux System and cloud	1.5	1.1	1.1	1.5	0.5	-	-	-	-	-	-	-	1.5	1	1.7

***Total*—1.23**

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B. Tech**	
Branch:		**CSE with Specialization in CTV**	
1	**Course Code**		
2	**Course Title**	**Fundamentals of Linux System and cloud**	
3	Credits	0-0-2	
4	Contact Hours (L-T-P)	0 | 0 | 2	
	Course Status	Specialized Subject 1	
5	Course Objective	Introduces the Linux operating system, including: task scheduling and management, memory management, input/output processing, internal and external commands, shell configuration, and shell customization. Explores the use of operating system utilities such as text editors, electronic mail, file management and scripting.	
6	Course Outcomes	CO-1. Identify and use Linux utilities to create and manage simple file processing operations, organize directory structures with appropriate security, and develop shell scripts to perform more complex tasks. CO-2. Effectively use the Linux system to accomplish typical personal, office, technical, and software development tasks. CO-3. Monitor system performance and network activities. Effectively use software development tools including libraries, preprocessors, compilers, linkers, and make files. CO-4. Comprehend technical documentation, prepare simple readable user documentation and adhere to style guidelines. CO-5. Analyze the use of different editors in Linux environment. CO-6. Explore the application domain of Linux environment in AWS cloud.	
7	Course Description		
8	**Outline syllabus**		CO Mapping
	Unit 1	**Introduction**	
	A	Setup Linux Environment	CO1
	B	Install Linux in System	CO1
	Unit 2	**Introduction to shell**	
	A	Implement c shell & its derivative tcsh ,	CO2
	B	shell's interpretive cycle, wild cards, meta characters, escaping & quoting.	CO2
	Unit 3	**Graphical Interface**	
	A	Setup Session in Linux	CO3
	B	Create Graphical Desktop in Linux	CO3
	Unit 4	**Filters**	
	A	Implement Piping with Simple filters in commands such as pr, head, tail, cut, paste, sort, nl, tr	CO4

	B	Create conditional statement in Linux shell.			CO4
	Unit 5	**Linux in AWS**			
	A	Setup Linux Machine in EC2			CO5,CO6
	B	Deploy Linux based editor in EC2 environment.			CO5,CO6
	Mode of examination	Practical			
	Weightage Distribution	CA	ETE	MTE	
		25%	25%	50%	
	Text book/s*	1. Unix and shell programming by Richard F. Gilberg and Behrouz A. forouzan			
	Other References	1. Unix Shell programming by Stephen G. Kochan and Patric Wood 2. Sumitabha Das, “Unix Concepts and Applications”, Tata McGraw Hill. 3. Internet as a resource for reference			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Identify and use Linux utilities to create and manage simple file processing operations, organize directory structures with appropriate security, and develop shell scripts to perform more complex tasks.	PO1,PO2,PO4,PSO1,PSO3
2.	Effectively use the Linux system to accomplish typical personal, office, technical, and software development tasks.	PO1,PO3,PO5,PSO1,PSO3
3.	Monitor system performance and network activities. Effectively use software development tools including libraries, preprocessors, compilers, linkers, and make files.	PO1,PO3,PO4,PSO1,PSO3
4.	Comprehend technical documentation, prepare simple readable user documentation and adhere to style guidelines.	PO2,PO3,PO4,PSO1,PSO2,PSO3
5.	Analyze the use of different editors in Linux environment.	PO1,PO2,PO4,PSO2,PSO3
6.	Explore the application domain of Linux environment in AWS cloud.	PO1,PO3,PO5,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Fundamentals of Linux System and cloud

Course Code_ Course Name	CO 's	P O 1	P O 2	P O 3	P O4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 1 0	P O 1 1	P O 1 2	PS O 1	PS O2	PS O3
Fundamentals of Linux System and cloud	CO 1	2	3		3									3		2
	CO 2	3		1		2								3		2
	CO 3		2	3	1									2		2
	CO 4		2	1	3									1	2	3
	CO 5	2	1		2										2	1
	CO 6	2		2		1									2	3

Average of non-zeros entry in following table (should be auto calculated).

Cours e Code	Course Name	P O 1	PO 2	PO 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	P O 11	P O 12	PS O 1	PS O 2	PS O 3
	Fundamentals of Linux System and cloud	1. 5	1.1	1. 1	1. 5	0. 5	-	-	-	-	-	-	-	1.5	1	1.7

***Total*—1.23**

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent*** ***3.*** Addressed to ***Substantial (High=3) extent***

B.Tech. (CSE) with Specialization in Augmented and Virtual Reality

The Mathematics and Science of Virtual Reality

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech CSE (Specialization in Augmented and Virtual Reality)**	
Branch:		**CSE**	
1	Course Code		
2	Course Title	**The Mathematics and Science of Virtual Reality**	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status		
5	Course Objective	To understand the fundamentals of virtual reality systems, including geometric modeling, transformations, graphical rendering, optics, the human vision, auditory, and vestibular systems, interface design, human factors, developer recommendations, and technological issues.	
6	Course Outcomes	after studying this course student will be able to: CO1: *Describe* the components of VR and differentiate between VR, AR, MR. CO2: *Explain* current trends in VR systems and Geometry of VR World CO3: *Apply* the concept of geometry of virtual worlds and effect of light & camera. CO4: *Compare* and understand the perception of color, depth, and motion in Virtual Reality. CO5: *Assess* different VR techniques to create motion and tracking in the real and virtual world. CO6: *Plan* future challenge and opportunity of virtual reality.	
7	Course Description	In this course, students will learn the fundamentals of virtual reality technology and its components.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Immersive Technologies:**	
	A	A Brief History of Virtual Reality, The Five Classic Components of a VR System, Modern VR Experiences. VR, AR, MR, XR: similarities and differences	CO1
	B	Current trends and state of the art in immersive technologies, developing platforms and consumer devices, The future of human experience.	CO2
	Unit 2	**Bird's-Eye View: Math's and Physics of VR**	

	A	Hardware, Software, Human Physiology and Perception. The Geometry of Virtual Worlds: Geometric Models, Changing Position and Orientation,	CO2
	B	Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations.	CO2
	Unit 3	**Light and Optics:**	
	A	Basic Behaviour of Light, Lenses, Optical Aberrations, the Human Eye, Cameras, and Displays.	CO3
	B	The Physiology of Human Vision: From the Cornea to Photoreceptors, From Photoreceptors to the Visual Cortex, Eye Movements, and Implications for VR.	CO3
	Unit 4	**Visual Perception:**	
	A	Perception of Depth: Monocular depth cues, Stereo depth cues, Implications for VR. Perception of Motion: Detection mechanisms, stroboscopic apparent motion, Perception of color, combining sources of information.	CO4, CO5
	B	Visual Rendering: Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates, Immersive Photos and Videos.	CO4, CO5
	Unit 5	**Motion in real and virtual worlds:**	
	A	Velocities and Accelerations, the Vestibular System, physics in the virtual world, mismatched motion and Vection.	CO5, CO6
	B	Tracking: Tracking in 2D and 3D Orientation. Tracking position and orientation. Tracking attached bodies. 3D Scanning of the Environment.	CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	CA / MTE / ETE 25% / 25% / 50%	
	Textbook/s*	Virtual reality, Steven M. Lavelle. Cambridge University Press. K.S. Hale and K. M. Stanney, Handbook on Virtual Environments, 2nd edition, CRC Press, 2015.	
	Other References	Virtual Reality, IIT Madras, Prof Steven LaValle https://nptel.ac.in/courses/106106138	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: *Describe* the components of VR and differentiate between VR, AR, MR.	PO1, PO3, PO5, PO12, PSO2, PSO3

2.	CO2: *Explain* current trends in VR systems and Geometry of VR World	PO1, PO2, PO3, PO5, PO12, PSO1, PSO2, PSO3
3.	CO3: *Apply* the concept of geometry of virtual worlds and effect of light & camera.	PO1, PO3, PO5, PO12, PSO1, PSO2, PSO3
4.	CO4: *Compare* and understand the perception of color, depth, and motion in Virtual Reality.	PO1, PO5, PO12, PSO1, PSO2, PSO3
5.	CO5: *Assess* different VR techniques to create motion and tracking in the real and virtual world.	PO1, PO5, PO12, PSO1, PSO2
6.	CO6: *Plan* future challenge and opportunity of virtual reality.	PO1, PO2, PO3, PO4, PO5, PO9, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength

CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	-	2	-	-	-	-	-	-	-	-	2	3	-	3	-
CO2	2	-	2	2	3	-	-	-	-	-	2	3		3	-
CO3	3	2	-	2	-	2	-	-	-	-	-	-	2	-	2
CO4	-	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO5	2	2	2	2	-	-	-	-	-	-	-	-	-	2	-
CO6	2	-	-	2	-	-	-	2	-	-	2	-	-	2	-

Course Code/Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2	PSO3
The Mathematics and Science of Virtual Reality	1.5	1.33	1	1.33	0.5	0.33	-	0.33	-	-	1	1	0.33	2	0.67

Strength of Correlation

1. Addressed to Slight (Low=1) extent ***2. Addressed to Moderate (Medium=2) extent***
3. Addressed to Substantial (High=3) extent

Programming in C# using Unity

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech CSE (Specialization in Augmented and Virtual Reality)**	
Branch:		**CSE**	
1	Course Code		
2	Course Title	Programming in C# using Unity	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status		
5	Course Objective	The objective of this course is to equip students with C# programming concepts.	
6	Course Outcomes	After studying this course student will be able to: CO1: *Describe* the basic concepts of C# programming and implement knowledge of object-oriented concepts. CO2: *Explain* the concepts of code development using C#. CO3: *Apply* the concept of C# to implement object-oriented concepts such as inheritance. CO4: *Compare* different tools and techniques in product development using Unity. CO5: *Assess* different features of C# & tools of Unity for product development. CO6: *Plan* the opportunities of product development using Unity and C#.	
7	Course Description	To understand the basic concepts of C# programming and implement knowledge of object-oriented concepts like classes, methods, and accessors, instantiate objects and understand the basic components of Game development using unity.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Unity Environment**	
	A	Unity IDE, Different windows: Hierarchy, Project, Scene Game, Inspector, Console.	CO1
	B	Primitive Shapes, Game Object, Different Asset, and Layout of Unity.	CO1
	Unit 2	**Programming with C#**	
	A	Tokens, Variables, Statement and Expression, Keywords, Classes, Type Casting.	CO2
	B	Creating classes, functions, scope, this, logical Operators, Loops	CO2
	Unit 3	**Inheritance**	
	A	Inheritance, Instancing, Static, Jump Statement	CO3
	B	Arrays, Array List, Strings.	CO3
	Unit 4		
	A	Constructor, Enum, Switch, Structs	CO4
	B	Vectors, Boxing and Unboxing and Operator overloading	CO4

	Unit 5				
	A	Delegates, Interfaces, Exception, Destructor			CO5,CO6
	B	Source Version Control, Setting up Repository.			CO5,CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	● Learning C# Programming with Unity 3D, Alex Okita, CRC Press. ● C# Game Programming Cookbook for Unity 3D, Jeff W. Murray, CRC Press.			
	Other References				

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Describe the basic concepts of C# programming and implement knowledge of object-oriented concepts.	PO1, PO3,PO5, PO11,PO12,PSO1,PSO23
2.	CO2: Explain the concepts of code development using C#.	PO1,PO3,PO4,PO5,PO11PO12,PSO2
3.	CO3: Apply the concept of C# to implement object-oriented concepts such as inheritance.	PO1,PO2,PO4,PO11, PO12, PSO1, PSO2, PSO3
4.	CO4: Compare different tools and techniques in product development using Unity.	PO1, PO2, PO4, PO5, PO12, PSO2,PSO3
5.	CO5: Assess different features of C# & tools of Unity for product development.	PO1, PO2,PO3, PO4, PO12, PSO1, PSO2
6.	CO6: Plan the opportunities of product development using Unity and C#.	PO1, PO2, PO4,PO8 PO11, PSO2

PO and PSO mapping with level of strength

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO 1	PSO2	PSO3
CO1	3	-	3	-	2	-	-	-	-	-	-	2	2	-	2
CO2	2	-	2	2	2	-	-	-	-	-	2	2	-	3	-
CO3	2	3	-	2	-	-	-	-	-	-	2	2	2	3	3
CO4	2	-	2	3	3	-	-	-	-	-	-	2	-	2	3
CO5	2	2	2	2	-	-	-	-	-	-	-	2	3	2	-
CO6	2	2	-	3	-	-	-	-	2	-	2	2	-	2	-

Course Code	**Course Name**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
		2.2	2.33	2.25	2.4	-	-	-	-	2	-	2	2	2.33	2.4	2.6

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Programming in C# using Unity Lab

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**BTech.**	
Branch:		**CSE**	
1	Course Code		
2	Course Title	**Programming in C# using Unity Lab**	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-4	
	Course Status		
5	Course Objective	The objective of this course is to equip students with C# programming concepts.	
6	Course Outcomes	After studying this course student will be able to: CO1: *Describe* the basic concepts of C# programming and implement knowledge of object-oriented concepts. CO2: *Explain* the concepts of code development using C#. CO3: *Apply* the concept of C# to implement object-oriented concepts such as inheritance. CO4: *Compare* different tools and techniques in product development using Unity. CO5: *Assess* different features of C# & tools of Unity for product development. CO6: *Plan* the opportunities of product development using Unity and C#.	
7	Course Description	To understand the basic concepts of C# programming and implement knowledge of object-oriented concepts like classes, methods, and accessors, instantiate objects and understand the basic components of Game development using unity	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Unity and C#**	
	1	Introduction to Unity IDE, installation and setting up the environment	CO1
	2	In C# suppose you're making a RPG (Role Playing Game). Now in this RPG, your Player Character will have Stats, like Name, Strength, Endurance, Mana, Charm etc that will be used by you to display and calculate various things in your game. Create that player character's data using data types	CO1
			CO2
	Unit 2	**Conditional and looping**	
	3	Write a program in C# utilizing logical operators and conditional statements. In the ongoing RPG project, limit the time for the player to enter the shop after 11 am and before 7pm	CO2

	4	Create C# program to model a restaurant menu where players can choose a food of the day from the menu	CO2
	Unit 3	**Arrays and Methods**	
	5	Create a scenario for a team game, which stores the data of all different players using arrays	CO3
	6	Write a program in C# to design a player bag. Create a system to manage the inventory of the bag using looping fundamentals	CO3
	Unit 4	**Advanced C# techniques**	
	7	Write a program in C# to demonstrate difference between Boxing and Unboxing	CO4, CO5
	8	Write a program in C# to demonstrate vector3 and vector2 and use it to create a game environment and interaction	CO4, CO5
	Unit 5		
	9	Write a program in C# to demonstrate interfaces and delegates	CO5, CO6
	10	Write a program in C# using inheritance to emulate RPG (Role Playing Game) that has a lot of different types of weapons like Swords, Spears, Guns, Axes, Bows and Arrows. Now all these weapons will have stats like Piercing Damage, Slashing Damage, Bleeding Damage, Weapon HP.	CO5, CO6
	Mode of examination	Lab/ Practical	
	Weightage Distribution	CA: 25% / CE(VIVA): 25% / ETE: 50%	
	Text book/s*	● Learning C# Programming with Unity 3D, Alex Okita, CRC Press. ● C# Game Programming Cookbook for Unity 3D, Jeff W. Murray, CRC Press.	
	Other References		

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Describe the basic concepts of C# programming and implement knowledge of object-oriented concepts.	PO1, PO2, PO5, PO8, PSO1, POS2
2.	CO2: Explain the concepts of code development using C#.	PO1, PO2, PO3, PO4, PO8, PSO1, PSO2
3.	CO3: Apply the concept of C# to implement object-oriented concepts such as inheritance.	PO1, PO3, PO4, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2

4.	CO4: Compare different tools and techniques in product development using Unity.	PO1, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PSO1, PSO2
5.	CO5: Assess different features of C# & tools of Unity for product development.	PO1, PO2, PO3, PO4, PO5, PO6, PO10, PSO1, PSO2
6.	CO6: Plan the opportunities of product development using Unity and C#.	PO1,PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2

PO and PSO mapping with level of strength

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO 3
Programming in C# using Unity Lab	CO1	3	3	2	2						3	3	3	3	3	3
	CO2	3	3	2	2						3	3	3	3	3	3
	CO3	3	3	3	3	3					2	3	3	3	3	3
	CO4	3	3	2	2	2					2	3	3	2	2	2
	CO5	3	2	2	2	2					2	3	3	2	2	2
	CO6	3	3	2	2	2					2	3	3	2	2	2

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO 1	PSO 2	PSO 3
	Programming in C# using Unity Lab	3.00	2.83	2.17	2.17	2.25	-	-	-	-	2.33	3.00	3.00	2.50	2.50	2.50

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

3D Modeling Using Blender

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech CSE (Specialization in Augmented and Virtual Reality)**	
Branch:		**CSE**	
1	Course Code		
2	Course Title	**3D Modeling Using Blender**	
3	Credits	2	
4	Contact Hour (L-T-P)	2-0-0	
	Course Status		
5	Course Objective	The objective of this course is to develop the skill & knowledge in 3D Modeling & Animation.	
6	Course Outcomes	After studying this course student will be able to: CO1: *Describe* the basic concepts of blender for 3D modeling. CO2: *Utilize* materials and textures for creating 3D game assets. CO3: *Apply* the principles of animation. CO4: *Create* and animate 3D Text using blender. CO5: *Develop* character rigging object armatures. CO6: *Design* 3D game environments using blender.	
7	Course Description	This course introduces the concept of 3D Modeling & Animation and blender with its usage in 3 D game development. Students will understand multimedia and the animation industry, video studios, edit set-up.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Definition of Computer-based Animation, Basic Types of Animation, Definition of Modeling, Application using 3D skills. Blender Editor panels, The 3D View Editor, the Outliner Editor, the Properties Editor, and the Timeline Editor	CO1
	B	Meshes, Mesh types, Scaling and Rotating Objects, Precision Manipulation, Transformation, Vertex Editing, Center Points, Shading, Edge Loop Selection, Knife and Sculpt Tool.	CO1
	Unit 2	**Materials and Textures**	
	A	Introduction to materials, Button, Colors, Shaders, Transparency, Vertex Painting, Application of Materials.	CO2
	B	Texture Mapping & Displacement Mapping, UV Texture Mapping, Unwrapping with seams, Texture Paint.	CO2
	Unit 3	**Animation**	
	A	Lighting and Camera, Rendering and Ray tracing.	CO3
	B	Animation Basics: Introduction, Moving, Rotating and Scaling, Types of curves, Automatic key framing.	CO3
	Unit 4	**3D character**	

	A	3D Text: Creating 3D Text, Create Text on Curve, Convert text to mesh object, curve, and NURBS & Meta shapes.	CO4
	B	Modifiers and Particles system, Armatures.	CO4, CO5
	Unit 5	**Rigging**	
	A	Basic Rigging and Animation: Keyframing with the Timeline, The Dopesheet, Parenting, Graph Editor	CO5, CO6
	B	Pivot Point: The Center of Rotation, Basic Tracking: Eyes That Follow, Rigging with Bones, Rigging a Simple Character	CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	CA / 25% | MTE / 25% | ETE / 50%	
	Textbook/s*	• John M. Blain, The Complete Guide to Blender Graphics Computer Modeling and Animation, CRC Press	
	Other References	• Gordon Fisher, Blender 3D Basics, 2nd Edition_ A quick and easy-to-use guide to create 3D modeling and animation using Blender, PACKT Publishing. • Michael G. Strintzis, 3D Modeling and Animation, Igi Publishing. • Lance Flavell, Beginning Blender: Open-Source 3D Modeling, Animation, and Game Design, Apress.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: *Describe* the basic concepts of blender for 3D modeling.	PO1,PO2,PO3,PO4,PO5,PO11,PO12,PSO2,
2.	CO2: *Utilize* materials and textures for creating 3D game assets.	PO1,PO2,PO3,PO4,PO5,PO11,PO12,PSO2
3.	CO3: *Apply* the principles of animation.	PO1,PO2,PO3,PO5, PO9,PO11,PO12
4.	CO4: *Create* and animate 3D Text using blender.	PO1,PO2,PO3,PO4,PO5,PO09,PO10,PO11,PO12,PSO3
5.	CO5: *Develop* character rigging object armatures.	PO1,PO2,PO3,PO4,PO5,PO10,PO11,PO12,PSO1,PSO2,PSO3
6.	CO6: Design 3D game environments using blender	PO1,PO2,PO3,PO4,PO5,PO10,PO11,PO12,PSO1,PSO2,PSO3

PO and PSO mapping with level of strength

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
3D Modeling Using Blender	CO1	3	3	2	-	2	-	-	-	-	-	2	2	-	3	-
	CO2	3	3	2	2	2	-	-	-	-	-	2	2	-	3	-
	CO3	3	3	3	3	-	-	-	-	3	-	2	3	-	-	-
	CO4	3	3	3	3	-	-	-	-	3	2	2	3	-	-	3
	CO5	3	3	3	2	2	-	-	-	-	2	2	3	3	3	3
	CO6	3	3	2	2	2	-	-	-	-	2	2	2	3	3	3

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO 1	PSO 2	PSO 3
	3D Modeling Using Blender	3	3	2.33	2.4	2	-	-	-	3	2	2	2.33	3	3	3

Strength of Correlation

1. Addressed to ***Slight (Low=1)*** ***extent*** ***2.*** Addressed to ***Moderate (Medium=2)*** ***extent***
3. Addressed to ***Substantial (High=3)*** ***extent***

3D Modeling using Blender Lab

School:		**School of Engineering & Technology**			
Department		**Computer Science & Engineering**			
Program:		**B.Tech CSE (Specialization in Augmented and Virtual Reality)**			
Branch:		**CSE**			
1	Course Code				
2	Course Title	3D Modeling using Blender Lab			
3	Credits	1			
4	Contact Hours (L-T-P)	0-0-2			
	Course Status				
5	Course Objective	The objective of this course is to impart practical knowledge in 3D modelling & Animation.			
6	Course Outcomes	After studying this course student will be able to: CO1: *Describe* the basic concepts of blender for 3D modeling. CO2: *Utilize* materials and textures for creating 3D game assets. CO3: *Apply* the principles of animation. CO4: *Create* and animate 3D Text using blender. CO5: *Develop* character rigging object armatures. CO6: *Design* 3D game environments using blender.			
7	Course Description	This course introduces the concept of 3D Modeling & Animation and blender with its usage in 3 D game development.			
8	Outline syllabus				CO Mapping
	Unit 1	**Introduction**			
	1	Learn Blender from Absolute Basics, Add Materials To 3D Models, Learn Modifiers in Blender			CO1
	2	Design poly rocks, trees, mountains to create jungle scene.			CO1
	Unit 2	**Materials and Textures**			
	3	Design the donut with a glass containing water.			CO2
	4	Design the Teddy Bear and place it on chair			CO2
	Unit 3	**Animation**			
	5	Create animation of interior design of a cinema hall			CO3
	6	Create an animation of a car running on road			CO3
	Unit 4	**3D character**			
	7	Create a 3D Text, Create Text on Curve, Convert text to mesh object and curve			CO4
	8	Create a 3D character using sculpting feature			CO4
	Unit 5	**Rigging**			
	9	Create the cartoon character and render it as a movie file.			CO5,CO6
	10	Create a Castle/City in blender			CO5,CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	CE(VIVA)	ETE	
		25%	25%	50%	

	Text book/s*	• John M. Blain, The Complete Guide to Blender Graphics Computer Modeling and Animation, CRC Press.	
	Other References	• Gordon Fisher, Blender 3D Basics, 2nd Edition_ A quick and easy-to-use guide to create 3D modeling and animation using Blender, PACKT Publishing. • Michael G. Strintzis, 3D Modeling and Animation, Igi Publishing. • Lance Flavell, Beginning Blender: Open-Source 3D Modeling, Animation, and Game Design, Apress.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: *Describe* the basic concepts of blender for 3D modeling.	PO1,PO2,PO3,PO4, PO5,PO11,PO12,PSO2,
2.	CO2: *Utilize* materials and textures for creating 3D game assets.	PO1,PO2,PO3,PO4, PO5,PO11,PO12,PSO2
3.	CO3: *Apply* the principles of animation.	PO1,PO2,PO3,PO5, PO9,PO11,PO12
4.	CO4: *Create* and animate 3D Text using blender.	PO1,PO2,PO3,PO4, PO5,PO09,PO10,PO11,PO12,PSO3
5.	CO5: *Develop* character rigging object armatures.	PO1,PO2,PO3,PO4, PO5,PO10,PO11,PO12,PSO1,PSO2,PSO3
6.	CO6: *Design* 3D game environments using blender.	PO1,PO2,PO3,PO4, PO5,PO10,PO11,PO12,PSO1,PSO2,PSO3

PO and PSO mapping with level of strength

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
3D Modeling Using Blender	CO1	3	3	2	-	2	-	-	-	-	-	2	2	-	3	-
	CO2	3	3	2	2	2	-	-	-	-	-	2	2	-	3	-
	CO3	3	3	3	3	-	-	-	-	3	-	2	3	-	-	-
	CO4	3	3	3	3	-	-	-	-	3	2	2	3	-	-	3
	CO5	3	3	3	2	2	-	-	-	-	2	2	3	3	3	3
	CO6	3	3	2	2	2	-	-	-	-	2	2	2	3	3	3

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO 1	PSO 2	PSO 3
	3D Modeling Using Blender	3	3	2.33	2.4	2	-	-	-	3	2	2	2.33	3	3	3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

2D and 3D Game Development in Unity

School:		**School of Engineering & Technology**
Department		**Computer Science & Engineering**
Program:		**BTech.**
Branch:		**CSE**
1	Course Code	
2	Course Title	**2D and 3D Game Development in Unity**
3	Credits	2
4	Contact Hours (L-T-P)	2-0-0
	Course Status	
5	Course Objective	This course introduces game development using Unity, a powerful game engine widely used in the industry. Students will learn how to create 2D and 3D games using Unity's scripting language, C#. By the end of the course, students will have developed a solid foundation in game development that they can use to create their own games.
6	Course Outcomes	after studying this course student will be able to: CO1: *Recall* fundamental game development concepts and terminology. CO2: *Explain* the components and stages of game development. CO3: *Develop* 2D and 3D games in Unity using pre-built assets and game mechanics and modify existing scripts. CO4: *Analyze* and troubleshoot code and game design problems. CO5: *Evaluate* game design choices and their impact on gameplay experience. CO6: *Create* original game mechanics, player controls, user interfaces, and graphics using Unity and C# programming.
7	Course Description	This course explores basic and advanced techniques for developing 2D and 3D games using Unity. Students will learn about fundamental concepts in game development, including the history and evolution of games, game types and genres, and game design principles. Additionally, they will gain hands-on experience creating game mechanics, player controls, graphics, sound effects, and user interfaces using Unity's features and C# scripting language.

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Game Development**	
	A	Overview of game development process and stages. Technological advancements and their impact on video games. Overview of different types of games.	CO1
	B	Elements of game design, level design, storytelling, and player experience.	CO2
	Unit 2	**Hands on to Unity**	
	A	Sprites: Introduction to Scripting, C# Language Concepts, Game Loops and Functions, Simple and Input Movement, Simple Rotation and Scaling.	CO2, CO4
	B	2D and 3D Physics Concepts: Rigid body Components, Unity Colliders, Physics Materials, Scripting Collision Events.	CO2, CO4
	Unit 3	**Game Development Fundamentals**	
	A	Techniques for importing and exporting game assets in Unity, Introduction to physics engines. Overview of graphics and animation and their applications in game development, Animation techniques, Optimization techniques.	CO3
	B	Implementation of core gameplay mechanics, Creation of gameplay systems, Techniques for balancing gameplay systems.	CO3
	Unit 4	**Advanced Game Development Techniques**	
	A	Developing complex game systems, Multiplayer game development: Client-server architecture, Network synchronization. Procedural generation of game content: Perlin noise, Cellular automata, L-systems,	CO5
	B	Generating terrain, levels, and enemies Shader programming for advanced graphics. Optimization techniques for improving game performance: Reducing draw calls, Asset size and loading optimization, Object pooling, Unity's built-in profiling tools	CO4, CO5
	Unit 5	**Game Development Project**	
	A	Applying the principles and techniques learned in previous units to develop a complete game project using Unity.	CO6

	B	Developing the game mechanics, graphics, sound effects, and user interface elements. Game performance.			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	• Unity Game Development Cookbook: Essentials for Every Game, by Paris Buttfield-Addison, Jon Manning, and Tim Nugent. • Unity in Action by Joe Hocking.			
	Other References	• Learning C# by Developing Games with Unity by Harrison Ferrone. • Introduction to Game Design, Prototyping, and Development by Jeremy Gibson Bond.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: *Recall* fundamental game development concepts and terminology.	PO1, PO2, PO12
2.	CO2: *Explain* the components and stages of game development.	PO2, PO3, PO5, PO6
3.	CO3: *Develop* 2D and 3D games in Unity using pre-built assets and game mechanics and modify existing scripts.	PO3, PO5, PO9, PO10
4.	CO4: *Analyze* and troubleshoot code and game design problems.	PO2, PO4, PO6, PO9, PO10
5.	CO5: *Evaluate* game design choices and their impact on gameplay experience.	PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO10
6.	CO6: *Create* original game mechanics, player controls, user interfaces, and graphics using Unity and C# programming.	PO3, PO5, PO9, PO10

PO and PSO mapping with level of strength

Course Code_ Course Name	**CO's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
2D and 3D Game Development in Unity	**CO1**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**
	CO2	**-**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**
	CO3	**-**	**-**	**3**	**-**	**2**	**-**	**-**	**-**	**3**	**3**	**-**	**3**	**-**	**-**	**-**
	CO4	**-**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**3**	**2**	**-**	**2**
	CO5	**-**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**3**	**2**	**2**	**2**
	CO6	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**3**	**-**	**2**	**2**

Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
2D and 3D Game Development in Unity	1.5	3	3	3	2	-	-	-	3	3	-	3	2	2	2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***

3. Addressed to ***Substantial (High=3) extent***

2D and 3D Game Development in Unity Lab

School:		**School of Engineering & Technology**
Department		**Computer Science & Engineering**
Program:		**BTech.**
Branch:		**CSE**
1	Course Code	
2	Course Title	**2D and 3D Game Development in Unity**
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	
5	Course Objective	This course introduces game development using Unity, a powerful game engine widely used in the industry. Students will learn how to create 2D and 3D games using Unity's scripting language, C#. By the end of the course, students will have developed a solid foundation in game development that they can use to create their own games.
6	Course Outcomes	after studying this course student will be able to: CO1: *Recall* fundamental game development concepts and terminology. CO2: *Explain* the components and stages of game development. CO3: *Develop* 2D and 3D games in Unity using pre-built assets and game mechanics and modify existing scripts. CO4: *Analyze* and troubleshoot code and game design problems. CO5: *Evaluate* game design choices and their impact on gameplay experience. CO6: *Create* original game mechanics, player controls, user interfaces, and graphics using Unity and C# programming.
7	Course Description	This course explores basic and advanced techniques for developing 2D and 3D games using Unity. Students will learn about fundamental concepts in game development, including the history and evolution of games, game types and genres, and game design principles. Additionally, they will gain hands-on experience creating game mechanics, player controls, graphics, sound effects, and user interfaces using Unity's features and C# scripting language.

8	Outline syllabus		CO Mapping
	Unit 1		

	A	Create a new project through Unity Hub, Navigate 3D space and the Unity Editor comfortably, Add and manipulate objects in the scene to position, Position a camera in an ideal spot for your game. Create C# scripts and apply them to objects. Utilize fundamental C# methods and classes like transform.Translate and Vector3, Add Rigidbody and Collider components to allow objects to collide realistically	CO1
	Unit 2		
	A	Create an if-then statement to implement basic logic in your project, including the use of greater than (>) and less than (<) operators. Get user input with GetKey and KeyCode to test for specific keyboard presses. Apply components to multiple objects at once to work as efficiently as possible. Detect collisions and destroy objects that collide with each other	CO2, CO4
	Unit 3		
	A	Influence physics of game objects with ForceMode.Impulse. Tweak the gravity of your project with Physics.gravity. Utilize new operators and variables like &&. Constrain the RigidBody component to halt movement on certain axe. Use script communication to access the methods and variables of other scripts. Stop and play particle effects to correspond with character animation states. Work with Audio Sources and Listeners to play background music.Add sound effects to add polish to your project	CO3
	Unit 4		
	A	Apply Texture wraps to objects. Attach a camera to its focal point using parent-child relationships. Transform objects based on local XYZ values. Write informative debug messages with Concatenation and variables. Repeat functions with the power of IEnumerator and Coroutines. Use SetActive to make game objects appear and disappear from the scene	CO5
	Unit 5		
	A	Add torque to the force of an object. Create a Game Manager object that controls game states as well as spawning. Create a List of objects and return their length with Count.	CO6

		Use OnMouseDown to enable the player to click on things. Create UI Elements in the Canvas. Lock elements and objects into place with Anchors			
	Mode of examination	Theory			
	Weightage Distribution	CA	CE(VIVA)	ETE	
		25%	25%	50%	
	Textbook/s*	• Unity Game Development Cookbook: Essentials for Every Game, by Paris Buttfield-Addison, Jon Manning, and Tim Nugent. • Unity in Action by Joe Hocking.			
	Other References	• Learning C# by Developing Games with Unity by Harrison Ferrone. • Introduction to Game Design, Prototyping, and Development by Jeremy Gibson Bond.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: *Recall* fundamental game development concepts and terminology.	PO1, PO2, PO12
2.	CO2: *Explain* the components and stages of game development.	PO2, PO3, PO5, PO6
3.	CO3: *Develop* 2D and 3D games in Unity using pre-built assets and game mechanics and modify existing scripts.	PO3, PO5, PO9, PO10
4.	CO4: *Analyze* and troubleshoot code and game design problems.	PO2, PO4, PO6, PO9, PO10
5.	CO5: *Evaluate* game design choices and their impact on gameplay experience.	PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO10
6.	CO6: *Create* original game mechanics, player controls, user interfaces, and graphics using Unity and C# programming.	PO3, PO5, PO9, PO10

PO and PSO mapping with level of strength

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO 3
2D and 3D Game Development in Unity	CO1	3	3	-	-	-	-	-	-	-	-	-	3	-	-	-
	CO2	-	3	3	-	2	-	-	-	-	-	-	3	-	-	-
	CO3	-	-	3	-	2	-	-	-	3	3	-	3	-	-	-
	CO4	-	3	-	3	-	-	-	-	3	-	-	3	2	-	2
	CO5	-	3	3	3	-	-	-	-	3	3	-	3	2	2	2
	CO6	-	-	3	-	-	-	-	-	3	3	-	3	-	2	2

Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO 2	PSO3
2D and 3D Game Development in Unity	3	3	3	3	2	-	-	-	3	3	-	3	2	2	2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Augmented Reality Application Development

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**BTech.**	
Branch:		**CSE**	
1	Course Code		
2	Course Title	**Augmented Reality Application Development**	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status		
5	Course Objective	The objective of this course is to provide a foundation to the fast-growing field of AR and make the students aware of the various AR devices	
6	Course Outcomes	after studying this course student will be able to: CO1: *Describe* the basic concepts and different applications of Augmented Reality. CO2: *Explain* how AR systems work and list the applications of AR. CO3: *Apply* the concept of AR in unity game engine to develop various applications. CO4: *Compare* and understand the working of various state of the art AR devices. CO5: *Assess* different AR techniques for application development. CO6: *Plan* for future challenge and opportunity of augmented reality.	
7	Course Description	This Course introduces the concept of augmented reality and its utilization to develop various applications using unity engine. The future utilization of this course will be to merge with computer vision.	
8	Outline syllabus		CO Mapping
	Unit 1	**Augmented Reality: Introduction**	
	A	What Is Augmented Reality, Applications of Augmented Reality, Components of Augmented Reality, History of AR,	CO1
	B	Concept of Displays and Tracking (Tracking, Calibration and Registration), AR architecture	CO2
	C	How Does Augmented Reality Work, Trends in Augmented Reality, Mobile Augmented Reality	CO2
	Unit 2	**Augmented Reality Hardware**	

	A	Augmented Reality Hardware – Displays – Audio Displays, Haptic Displays, Visual Displays	CO2, CO4
	B	Visual Perception, Requirements and Characteristics, Spatial Display Model.	CO2, CO4
	C	Tracking & Sensors - Tracking, Calibration, and Registration, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors, Optical Tracking	CO2, CO4
	Unit 3	**Augmented Reality in Unity**	
	A	Game Loops and Functions, Simple Movement, and Input: Simple Movement, Simple Rotation and Scaling, Easy Input Handling in Unity	CO3
	B	2D and 3D Physics Concepts: Rigidbody Components, Unity Colliders, Physics Materials, Scripting Collision Events,	CO3
	C	Organizing Game Objects, Parent-Child Objects, Sorting Layers, Tagging Game Objects, Collision Layers	CO3
	Unit 4	**AR Techniques- Marker based & Marker less tracking**	
	A	Marker-based approach- Introduction to marker-based tracking, types of markers, marker camera pose and identification, visual tracking	CO5
	B	mathematical representation of matrix multiplication Marker types- Template markers, 2D barcode markers, imperceptible markers.	CO4, CO5
	C	Marker-less approach- Localization based augmentation, real world examples Tracking methods- Visual tracking, feature based tracking, hybrid tracking, and initialization and recovery	CO5
	Unit 5	**Augmented Reality Challenges and Future**	
	A	Human Factor Consideration in AR – What are Human Factors, Physical Side Effects, Visual Side Effects,	CO6
	B	Legal and Social Considerations in AR – Legal Considerations, Moral and Ethical Considerations,	CO6
	C	Today's challenges for AR, Current State of Augmented Reality, Future of Augmented Reality	CO6
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	CA: 25% / MTE: 25% / ETE: 50%	
	Text book/s*	Augmented Reality for Developers by Jonathan Linowes, Krystian Babilinski, Released October 2017 Publisher(s): Packt Publishing,ISBN: 9781787286436	

	Other References	• Augmented Reality with Unity AR Foundation: A practical guide to cross-platform AR development with Unity 2020 and later versions, by Jonathan Linowes • Complete Virtual Reality and Augmented Reality Development with Unity: Leverage the power of Unity and become a pro at creating mixed reality applications by Jesse Glover, Jonathan Linowes	

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: *Describe* the basic concepts and different applications of Augmented Reality.	PO1, PO2, PO5, PO8, PSO1, POS2
2.	CO2: *Explain* how AR systems work and list the applications of AR.	PO1, PO2, PO3, PO4, PO8, PSO1, PSO2
3.	CO3: *Apply* the concept of AR in unity game engine to develop various applications.	PO1, PO3, PO4, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2
4.	CO4: *Compare* and understand the working of various state of the art AR devices.	PO1, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PSO1, PSO2,PSO3
5.	CO5: *Assess* different AR techniques for application development.	PO1, PO2, PO3, PO4, PO5, PO6, PO10, PO11,PO12, PSO1, PSO2,PSO3
6.	CO6: *Plan* for future challenge and opportunity of augmented reality.	PO1,PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11,PO12, PSO1, PSO2,PSO3

PO and PSO mapping with level of strength

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO 1	PSO 2	PSO 3
Augmented Reality Application Development	CO1	3	3			2			2					3	3	3
	CO2	3	3	2	2				2					3	3	3
	CO3	3		3	3		2	2	2		2	2	2	3	3	3
	CO4	2		2	2	1	1	1	2	2				2	2	2
	CO5	2	2	2	2	1	1				2	2	2	2	2	2
	CO6	3	3	2	2	2	2	1	1	1	1	1	2	2	2	2

Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO 2	PSO3
Augmented Reality Application Development	2.67	2.75	2.20	2.20	1.50	1.50	1.33	1.80	1.50	1.67	1.8	1.9	2.50	2.50	2.50

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***

3. Addressed to ***Substantial (High=3) extent***

Augmented Reality Application Development Lab

School:		**School of Engineering & Technology**
Department		**Computer Science & Engineering**
Program:		**B.Tech.**
Branch:		**CSE**
1	Course Code	
2	Course Title	**Augmented Reality Application Development Lab**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Status	
5	Course Objective	The objective of this course is to provide a foundation to the fast-growing field of AR and make the students aware of the various AR devices
6	Course Outcomes	after studying this course student will be able to: CO1: *Describe* the basic concepts and different applications of Augmented Reality. CO2: *Explain* how AR systems work and list the applications of AR. CO3: *Apply* the concept of AR in unity game engine to develop various applications. CO4: *Compare* and understand the working of various state of the art AR devices. CO5: *Assess* different AR techniques for application development. CO6: *Plan* for future challenge and opportunity of augmented reality.
7	Course Description	This Course introduce the concept of augmented reality and its utilization to develop various applications using unity engine. The future utilization of this course will be to merge with computer vision.

8	Outline syllabus		CO Mapping
	Unit 1	**Augmented Reality: Hardware**	
	A	Introduction to Augmented Reality Hardware – Displays – Audio Displays, Haptic Displays, Visual Displays, Other sensory displays	CO1
	B	Hands-on experience with HMDs (e.g. Microsoft HoloLens, Oculus Rift)	CO2
	C	Hands-on experience with mobile devices and smart glasses (e.g. Google Glass, Vuzix Blade)	CO2
	Unit 2	**Introduction to AR and ARCore**	

	A	Setting up ARCore environment and exploring its features.			CO2, CO4
	B	Creating a basic AR application to display a 3D object in the real world.			CO2, CO4
	C	Enhancing the AR application to display a virtual object based on the real-world location.			CO2, CO4
	Unit 3	**Introduction to Unity and AR**			
	A	Introduction to Unity and its AR features.			CO3
	B	Creating an AR application using Unity and ARCore to display a virtual object in the real world.			CO3
	C	Adding interactivity to the AR application using touch and gesture recognition.			CO3
	Unit 4	**AR Techniques- Marker based & Marker less tracking**			
	A	Marker-based Tracking Experiment: Create a simple 3D model using Unity. Print out a marker and place it on a table. Develop an AR application that detects the marker and overlays the 3D model on top of it. Add interactivity to the application by allowing the user to interact with the 3D model through touch or gestures.			CO4
	B	Markerless Tracking Experiment: Create a simple 3D model using Unity. Develop an AR application that uses image recognition to detect and track a real-world object. Overlay the 3D model on top of the real-world object in real-time. Add interactivity to the application by allowing the user to interact with the 3D model through touch or gestures.			CO4
	C	Hybrid Tracking Experiment: Create a simple 3D model using Unity. Print out a marker and place it on a table. Develop an AR application that uses marker-based tracking to detect the marker and display the 3D model on top of it. Use markerless tracking to detect and track a real-world object that is not related to the marker. Overlay the 3D model on top of the real-world object in real-time. Add interactivity to the application by allowing the user to interact with the 3D model through touch or gestures.			CO4
	Unit 5	**AR and Computer Vision**			
	A	Introduction to computer vision and its applications in AR.			CO6
	B	Building an AR application that recognizes real-world objects and overlays virtual information on them.			CO6
	C	Developing an AR application that tracks facial expressions and displays virtual objects based on them.			CO6
	Mode of examination	Practical/Viva			
	Weightage Distribution	CA	CE(VIVA)	ETE	
		25%	25%	50%	

	Text book/s*	• Augmented Reality for Developers by Jonathan Linowes, Krystian Babilinski, Released October 2017, Publisher(s): Packt Publishing ISBN: 9781787286436	
	Other References	• Augmented Reality with Unity AR Foundation: A practical guide to cross-platform AR development with Unity 2020 and later versions by Jonathan Linowes • Complete Virtual Reality and Augmented Reality Development with Unity: Leverage the power of Unity and become a pro at creating mixed reality applications by Jesse Glover, Jonathan Linowes	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: *Describe* the basic concepts and different applications of Augmented Reality.	PO1, PO2, PO5, PO8, PSO1, POS2
2.	CO2: *Explain* how AR systems work and list the applications of AR.	PO1, PO2, PO3, PO4, PO8, PSO1, PSO2
3.	CO3: *Apply* the concept of AR in unity game engine to develop various applications.	PO1, PO3, PO4, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2
4.	CO4: *Compare* and understand the working of various state of the art AR devices.	PO1, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PSO1, PSO2,PSO3
5.	CO5: *Assess* different AR techniques for application development.	PO1, PO2, PO3, PO4, PO5, PO6, PO10, PO11,PO12, PSO1, PSO2,PSO3
6.	CO6: *Plan* for future challenge and opportunity of augmented reality.	PO1,PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11,PO12, PSO1, PSO2,PSO3

PO and PSO mapping with level of strength

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO 1	PSO 2	PSO 3
Augmented Reality Application Development	CO1	3	3			2			2					3	3	3
	CO2	3	3	2	2				2					3	3	3
	CO3	3		3	3		2	2	2		2	2	2	3	3	3
	CO4	2		2	2	1	1	1	2	2				2	2	2
	CO5	2	2	2	2	1	1				2	2	2	2	2	2
	CO6	3	3	2	2	2	2	1	1	1	1	1	2	2	2	2

Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO 2	PSO3
Augmented Reality Application Development	2.67	2.75	2.20	2.20	1.50	1.50	1.33	1.80	1.50	1.67	1.8	1.9	2.50	2.50	2.50

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Virtual Reality Application Development

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech CSE (Specialization in Augmented and Virtual Reality)**	
Branch:		**CSE**	
1	Course Code		
2	Course Title	Virtual Reality Application Development	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status		
5	Course Objective	The objective of this course is to introduce the principles of Virtual Reality and learn the concepts of Development of Application in Virtual Reality.	
6	Course Outcomes	After studying this course student will be able to: CO1: *Describe* the basic concepts of virtual reality and learn about the technology and psychology of VR and differentiate between VR and AR systems. CO2: *Explain* the concepts of content creation, interaction, and iterative design. CO3: *Apply* the concept of 3D scenes with Unity and experiment with various user interface (UI) techniques that are used in VR applications. CO4: *Analyze* the different event and its corresponding actions of virtual reality objects. CO5: *Assess* the effect of VR systems on the health of individuals. CO6: *Plan* the opportunities of virtual reality application creation.	
7	Course Description	This course will help students learn the basic principles of virtual reality applications and get them to know how games differ from desktop apps. It will help students build various types of VR experiences and use Unity to develop VR applications.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to virtual reality**	
	A	What is virtual reality? Types of head-mounted displays, The difference between virtual 6reality and augmented reality,	CO1
	B	Applications versus games, how virtual reality really works, Types of VR experiences, technical skills that are important to VR	CO1

	Unit 2	**Virtual Reality System**		
	A	High-Level Concepts of Content Creation, Environmental Design, Affecting Behavior, Transitioning to VR Content Creation, Content Creation: Design Guidelines		CO2
	B	Human-Centered Interaction, VR Interaction Concepts, Input Devices, Interaction Patterns and Techniques, Interaction: Design Guidelines		CO2
	Unit 3	**Iterative Design and Game Development**		
	A	Philosophy of Iterative Design, The Define Stage, The Make Stage, The Learn Stage, Iterative Design: Design Guidelines		CO3
	B	Overview, Building Your Project and Character, Getting Animated, The Town View, Working with Unity's UI System, NPCs and Interactions, The World Map, Encountering Enemies and Running Away.		CO3
	Unit 4	**Game Development in Unity - Part II**		
	A	Getting Ready to Fight, The Battle Begins, Shopping for Items, Sound and Music, Putting a Bow on It, Deployment and Beyond		CO4
	B	Keyboard Input as Action, Controller Button Inputs as Actions, Creating Proxy Actions and Chaining Actions.		CO4
	Unit 5	**Adverse Health Effects**		
	A	Motion Sickness, Eye Strain, Seizures, and Aftereffects, Hardware Challenges, Latency, Measuring Sickness,		CO5,CO6
	B	Summary of Factors That Contribute to Adverse Effects, Examples of Reducing Adverse Effects, Adverse Health Effects: Design Guidelines		CO5,CO6
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	CA / 25%	MTE / 25%	ETE / 50%
	Text book/s*	• Jason Jerald- The VR Book: Human- Centered Design for Virtual Reality, Association for Computing Machinery and Morgan & Claypool Publishers (Aug. 5 2016), ISBN-B01JV1LAZW • Jonathan Linowes – Unity Virtual Reality Projects: Explore the world of virtual reality by building immersive and fun VR projects using Unity 3D Paperback‖, 1st Edition, Packt Publications, 2015, ISBN 978-1783988556		
	Other References	• Tony Parsi, Learning Virtual Reality Developing Immersive Experiences and Applications for Desktop, Web and Mobile • Rakesh Baruah, Virtual Reality with VRTK4 _ Create Immersive VR Experiences Leveraging Unity3D and Virtual Reality Toolkit, 2020, Apress		

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Describe the basic concepts of virtual reality and learn about the technology and psychology of VR and differentiate between VR and AR systems.	PO1,PO3,PO5,PO12, PSO1,PSO3
2.	CO2: Explain the concepts of content creation, interaction, and iterative design.	PO1,PO5,PO12, PSO1,PSO2,PSO3
3.	CO3: Apply the concept of 3D scenes with Unity and experiment with various user interface (UI) techniques that are used in VR applications.	PO1, PO3, PO5, PO12, PSO1,PSO2,PSO3
4.	CO4: Analyze the different event and its corresponding actions of virtual reality objects.	PO1, PO5, PO12, PSO1, PSO2,PSO3
5.	CO5: Assess the effect of VR systems on the health of individuals.	PO1, PO5, PO12, PSO1, PSO2
6.	CO6: Plan the opportunities of virtual reality application creation.	PO1, PO2, PO3, PO5, PO9, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO 1	PSO 2	PSO 3
Virtual Reality Application Development	CO1	3	-	3	-	2	-	-	-	-	-	-	2	2	-	2
	CO2	2	-	-	-	2	-	-	-	-	-	-	2	2	3	3
	CO3	2	-	3	-	2	-	-	-	-	-	-	2	2	3	3
	CO4	2	-	-	-	3	-	-	-	-	-	-	2	3	2	3
	CO5	2	-	-	-	2	-	-	-	-	-	-	2	3	2	-
	CO6	2	2	3	-	3	-	-	-	2	-	-	2	3	2	2

Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO 2	PSO3
Virtual Reality Application Development	2.1	2	3	-	2.3	-	-	-	2	-	-	2	2.5	2.4	2.6

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Virtual Reality Application Development Lab

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech CSE (Specialization in Augmented and Virtual Reality)**	
Branch:		**CSE**	
1	Course Code		
2	Course Title	Virtual Reality Application Development Lab	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-4	
	Course Status		
5	Course Objective	The objective of this course is to learn and develop the different VR applications based on different concepts of Virtual Reality.	
6	Course Outcomes	After studying this course student will be able to: CO1: *Describe* the basic concepts of virtual reality and learn about the technology and psychology of VR and differentiate between VR and AR systems. CO2: *Explain* the concepts of content creation, interaction, and iterative design. CO3: *Apply* the concept of 3D scenes with Unity and experiment with various user interface (UI) techniques that are used in VR applications. CO4: *Analyze* the different event and its corresponding actions of virtual reality objects. CO5: *Assess* the effect of VR systems on the health of individuals. CO6: *Plan* the opportunities of virtual reality application creation.	
7	Course Description	This course will help students learn the basic principles of virtual reality applications and get them to know how games differ from desktop apps. It will help students build various types of VR experiences and use Unity to develop VR applications.	
8	Outline syllabus		CO Mapping
	Unit 1		
		Develop a VR Ball Game. The scene should contain a play area surrounded by four walls and a ball that acts as a player. The objective of the game is to keep the ball rolling without colliding with the walls. If it collides with either of the walls, the wall color should change, and a text should display on the screen indicating the collision.	CO1
	Unit 2		

		Develop a VR Golf Game. The scene should contain a play area (golf course), which consists of a series of cups/holes each having different scores. Display the score card.			CO2
	Unit 3				
		Develop a VR game in Unity such that on each gun trigger click, destroy the cubes placed on the plane and gain a score point. Make a score UI and display it on the screen			CO3
	Unit 4				
		Develop a VR Basketball Game. The scene should contain a basketball court. The developed game should be a single player game. The objective of the game is to let the player put the ball in the basket maximum number of times. Display the score card.			CO4
	Unit 5				
		Develop an VR bowling game with one image target. The image target should include 3d models as per requirement. Write a c# program to develop score point system for bowling game. Build an apk. (Note: Vuforia plugin should be installed in unity.)			CO5 and CO6
		Develop a VR environment for flying helicopter/moving car simulation.			CO5 and CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	CE(VIVA)	ETE	
		25%	25%	50%	
	Text book/s*	Jonathan Linowes – Unity Virtual Reality Projects: Explore the world of virtual reality by building immersive and fun VR projects using Unity 3D Paperback‖, 1st Edition, Packt Publications, 2015, ISBN 978-1783988556			
	Other References	Rakesh Baruah, Virtual Reality with VRTK4 _ Create Immersive VR Experiences Leveraging Unity3D and Virtual Reality Toolkit, 2020, Apress			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: *Describe* the basic concepts of virtual reality and learn about the technology and psychology of VR and differentiate between VR and AR systems.	PO1, PO3, PO5, PO12, PSO1, PSO3
2.	CO2: *Explain* the concepts of content creation, interaction, and iterative design.	PO1, PO5, PO12, PSO1, PSO2, PSO3
3.	CO3: *Apply* the concept of 3D scenes with Unity and experiment with various user interface (UI) techniques that are used in VR applications.	PO1, PO3, PO5, PO12, PSO1, PSO2, PSO3
4.	CO4: *Analyze* the different event and its corresponding actions of virtual reality objects.	PO1, PO5, PO12, PSO1, PSO2, PSO3
5.	CO5: *Assess* the effect of VR systems on the health of individuals.	PO1, PO5, PO12, PSO1, PSO2
6.	CO6: *Plan* the opportunities of virtual reality application creation.	PO1, PO2, PO3, PO5, PO9, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
Virtual Reality Application Development Lab	CO1	3	-	3	-	2	-	-	-	-	-	-	2	2	-	2
	CO2	2	-	-	-	2	-	-	-	-	-	-	2	2	3	3
	CO3	2	-	3	-	2	-	-	-	-	-	-	2	2	3	3
	CO4	2	-	-	-	3	-	-	-	-	-	-	2	3	2	3
	CO5	2	-	-	-	2	-	-	-	-	-	-	2	3	2	-
	CO6	2	2	3	-	3	-	-	-	2	-	-	2	3	2	2

Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO 2	PSO3
Virtual Reality Application Development	2.1	2	3	-	2.3	-	-	-	2	-	-	2	2.5	2.4	2.6

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***

3. Addressed to ***Substantial (High=3) extent***

Game Development using Unreal Engine

School:		**School of Engineering & Technology**
Department		**Computer Science & Engineering**
Program:		**B.tech CSE (Specialization in Augmented and Virtual Reality)**
Branch:		**CSE**
1	Course Code	
2	Course Title	**Game Development using Unreal Engine**
3	Credits	1
4	Contact Hours (L-T-P)	0-1-0
	Course Status	
5	Course Objective	To learn different concepts of Unreal Engine.
6	Course Outcomes	after studying this course student will be able to: **CO1:** *Describe* the basics of game development in Unreal Engine **CO2:** *Explain* the knowledge of models, terrains, environment effects, etc. **CO3:** *Apply* the concept of code development in Unreal Engine **CO4:** *Compare* User interface principles in game development. **CO5:** *Assess* different techniques and tools of Unreal engine for Game Development **CO6:** *Plan* the opportunities of game development using Unreal Engine
7	Course Description	This course basically deals with the theoretical concepts of unreal engine for game development.

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Unreal:**	
	A	Introduction to Ureal: Installing, Getting to Know the Unreal, Project Type Selection and Start-Up, Exploring the Unreal Launcher, Choosing a Project Type and Location.	CO1
	B	An Overview of the Unreal Engine 4's User Interface, A Look at the Tab System, An Overview of the Level Design Process, The Conceptual Design of Levels.	CO2
	Unit 2	**Blocking:**	
	A	Blocking: Blocking Your First Level, Introduction, Exploring the Modes Panel Focusing on BSPs, Using BSPs to Build the Foundation, Continuing to Block Out Your Level, Play-Testing the Level, Using Geometry Editing Mode, Finishing the Blocking.	CO2

	B	Importing Assets into Unreal, Creating Your First Blueprint, Exploring the Swapping Process, Creating Your Initial Materials, Adding Your First Point Light,			CO2
	Unit 3	**Exploring Blueprints:**			
	A	Exploring Blueprints: Introduction, Creating the Hallway Blueprints, Adding Hallway Blueprints to the Level, Using Layers to Group Objects			CO3
	B	Correcting Collisions, Materials: Introduction, Textures versus Materials, Material Types, Input Types, Adding Textures.			CO3
	Unit 4	**Lighting Concepts:**			
	A	Lighting Concepts: Introduction, Common Lighting Techniques.			CO4, CO5
	B	Blueprint Animation: Introduction, Creating Automatic Doors, Matinee, Populating Your Level: Introduction, Time-Based Materials, Adding Actors, Adding Physics to an Actor.			CO4, CO5
	Unit 5	**Particle Systems:**			
	A	Particle Systems: Introduction, Overview of Cascade, Emitters, Curve Editor, Advanced Blueprint Techniques: Introduction, Using Blueprints.			CO5, CO6
	B	Working with Landscapes: Introduction, Creating and Working with Landscapes			CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. "Unreal Engine 4 Game Development in 24 Hours" by Aram Cookson, Publisher: Sams Publishing 2. "Mastering Unreal Engine 4.X" by Simon Manning, Matt Edmonds, and Zak Parrish, Publisher: Packt Publishing 3. "Learning C++ by Creating Games with UE4" by William Sherif, Publisher: Packt Publishing			
	Other References	"An Introduction to Unreal Engine 4" by Andrew Sanders, Publisher: CRS Press, Taylor & Francis Group			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:** *Describe* the basics of game development in Unreal Engine.	PO1, PO5, PO8, PO12

2.	**CO2***: Explain* the knowledge of models, terrains, environment effects, etc.	PO1, PO2, PO3, PO4, PO5, PO6, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
3.	**CO3***: Apply* the concept of code development in Unreal Engine	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, PO12, PSO1, PSO2
4.	**CO4***: Compare* User interface principles in game development.	PO1, PO2, PO3, PO4, PO5, PO9, PO10, PO12, PSO1, PSO2, PSO3
5.	**CO5:** *Assess* different techniques and tools of Unreal engine for Game Development	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, PO12, PSO1, PSO2, PSO3
6.	**CO6***: Plan* the opportunities of game development using Unreal Engine	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength

CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	-	-	2	-	-	-	3	-	2	-
CO2	3	2	2	2	3	2	-	-	2	2	2	3	2	2	3
CO3	3	2	2	2	3	2	-	2	2	2	-	3	-	2	-
CO4	3	3	3	3	3	-	-	-	2	2	-	3	-	2	3
CO5	3	3	3	3	3	3	-	2	2	2	2	3	-	3	3
CO6	3	3	3	3	3	3	3	2	3	3	-	3	3	3	3

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO 1	PSO 2	PSO 3
	Game Development using Unreal Engine	3.0	2.6	2.6	2.6	2.8	2.5	3.0	2.0	2.2	2.2	2	3	2.5	2.3	3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Game Development using Unreal Engine Lab

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.tech CSE (Specialization in Augmented and Virtual Reality)**	
Branch:		**CSE**	
1	Course Code		
2	Course Title	**Game Development using Unreal Engine Lab**	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-4	
	Course Status	Compulsory/Elective	
5	Course Objective	The objective of this course is to inculcate among students' different concepts of Unreal Engine and development of game in unreal engine	
6	Course Outcomes	after studying this course student will be able to: **CO1:** *Describe* the basics of game development in Unreal Engine **CO2:** *Explain* the knowledge of models, terrains, environment effects, etc. **CO3:** *Apply* the concept of code development in Unreal Engine **CO4:** *Compare* User interface principles in game development. **CO5:** *Assess* different techniques and tools of Unreal engine for Game Development **CO6:** *Plan* the opportunities of game development using Unreal Engine.	
7	Course Description	The course basically deals with the concepts of unreal engine for the game development	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Unreal Engine, Getting Started with Unreal Engine**	
		1.1 Overview of Unreal Engine 1.2 Installing Unreal Engine 1.3 Introduction to Blueprint Visual Scripting 1.4 Creating a New Project 1.5 Unreal Engine Editor Interface 1.6 Asset Management and Content Browser 1.7 Working with Levels and Actors	**CO1, CO2, CO3**
	Unit 2	**Building Game Environments, Creating Player Characters and NPCs**	
		2.1 Creating Landscapes and Terrain 2.2 Adding Static Meshes and Props 2.3 Working with Materials and Textures 2.4 Lighting and Post-Processing Effects 2.5 Introduction to Characters and Pawns 2.6 Implementing Player Input 2.7 Creating Non-Player Characters (NPCs) 2.8 AI Behavior and Navigation	**CO1, CO2, CO4**

	Unit 3	**Implementing Gameplay Mechanics, User Interface and HUD**			
		3.1 Physics and Collision Detection 3.2 Implementing Character Movement 3.3 Interactable Objects and Triggers 3.4 Game Modes and Game Rules 3.5 Creating HUD Elements 3.6 Health Bars and Status Indicators 3.7 Inventory and Item Management 3.8 Menu Systems and User Input			**CO1, CO2, CO5**
	Unit 4	**Sound Design and Music, Polishing and Optimization**			
		4.1 Adding Sound Effects 4.2 Implementing Background Music 4.3 Spatial Audio and Attenuation 4.4 Dynamic Audio and Triggered Events 4.5 Performance Optimization Techniques 4.6 Debugging and Testing 4.7 Playtesting and Feedback Iteration 4.8 Finalizing and Packaging the Game			**CO1, CO2, CO6**
	Unit 5	**Additional Resources and Next Steps**			
		5.1 Unreal Engine Documentation and Tutorials 5.2 Community Resources and Forums 5.3 Further Learning and Game Development Tips			**CO1, CO2, CO6**
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	CE(viva)	ESE	
		25%	25%	50%	
	Text book/s*	• "Unreal Engine 4 Game Development in 24 Hours" by Aram Cookson, Publisher: Sams Publishing • "Mastering Unreal Engine 4.X" by Simon Manning, Matt Edmonds, and Zak Parrish Publisher: Packt Publishing. • "Learning C++ by Creating Games with UE4" by William Sherif, Publisher: Packt Publishing			
	Other References	• "An Introduction to Unreal Engine 4" by Andrew Sanders, Publisher: CRS Press, Taylor & Francis Group			

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	*Describe* the basics of game development in Unreal Engine	PO1,PO2,PO3,PO10
2.	*Explain* the knowledge of models, terrains, environment effects, etc.	PO1, PO5, PO8, PO12
3.	*Apply* the concept of code development in Unreal Engine	PO1, PO2, PO3, PO4, PO5, PO6, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
4.	*Compare* User interface principles in game development.	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, PO12, PSO1, PSO2
5.	*Assess* different techniques and tools of Unreal engine for Game Development	PO1, PO2, PO3, PO4, PO5, PO9, PO10, PO12, PSO1, PSO2, PSO3
6.	*Plan* the opportunities of game development using Unreal Engine.	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength

CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	-	-	2	-	-	-	3	-	2	-
CO2	3	2	2	2	3	2	-	-	2	2	2	3	2	2	3
CO3	3	2	2	2	3	2	-	2	2	2	-	3	-	2	-
CO4	3	3	3	3	3	-	-	-	2	2	-	3	-	2	3
CO5	3	3	3	3	3	3	-	2	2	2	2	3	-	3	3
CO6	3	3	3	3	3	3	3	2	3	3	-	3	3	3	3

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
	Game Development using Unreal Engine	3.0	2.6	2.6	2.6	2.8	2.5	3.0	2.0	2.2	2.2	2	3	2.5	2.3	3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***

3. Addressed to ***Substantial (High=3) extent***

Introduction to Artificial Intelligence & Machine Learning

School:		**School of Engineering & Technology**		
Department		**Computer Science & Engineering**		
Program:		**B. Tech**		
Branch:		**CSE**		
1	**Course Code**	**CSA102**		
2	**Course Title**	**Introduction to Artificial Intelligence & Machine Learning**		
3	Credits	2		
4	Contact Hours (L-T-P)	2	0	0
	Course Status	Core		
5	Course Objective	The objective of the course is to introduce basic fundamental concepts in Artificial Intelligence (AI) and Machine Learning (ML) as well as to give a strong foundation od AI Techniques.		
6	Course Outcomes	CO-1. Define the requirement of Artificial Intelligence CO-2. Classify the functionality of agents along with acting environment of Intelligence in Artificial Intelligence. CO-3. Apply the concepts of Propositional Logic for real-world AI based problems. CO-4. Analyse the various ML techniques and apply them to solve the real world societal problems. CO-5. Explain the Use Cases of AIML in real world societal problems. CO-6. Discuss the applicability of Artificial Intelligence and Machine learning Approaches to develop sustainable solutions using professional ethics.		
7	Course Description	Artificial Intelligence (AI) and Machine Learning (ML) are increasingly necessary to translate today's data into direct business value. This course introduces learners to the basic concepts of AI and ML, and covers how learning algorithms work. It illustrates how AI and ML fit in the data science ecosystem, and presents several real-world use cases that show how companies are implementing.		
8	**Outline syllabus**			CO Mapping
	Unit 1	**Introduction of Artificial Intelligence**		
	A	Introduction to Artificial Intelligence, Foundation of Artificial Intelligence: Acting humanly: The Turing Test approach , Thinking humanly: The cognitive modeling approach ,		CO1

		Thinking rationally: The laws of thought approach , Acting rationally: The rational agent approach	
	B	History of Artificial Intelligence, Applications of AI in Pattern Recognition, Autonomous planning and scheduling, Game playing, Spam filtering, Logistics planning , and Machine Translation.	CO1, CO6
	C	Case Study on AI Solutions Vs. Conventional Solutions, Google Duplex, Do you think AI is good or evil?	CO1, CO6
	Unit 2	**Introduction to Intelligent Agents**	
	A	Introduction to Intelligent Agents, How Agents Should Act, The ideal mapping from percept sequences to actions, Properties of Agents: Intelligence, Autonomy, Ability to Learn, Cooperation.	CO2
	B	Classification of Agents: Reactive Agents, Collaborative Agents, Interface Agents, Mobile Agents, Information gathering Agents	CO2
	C	The nature of Environments: Specifying the task environment, Properties of task environments, Applications of Intelligent agents: Robotic vehicles, driver less cars	CO2
	Unit 3	**Introduction to Propositional Logic**	
	A	Introduction, What Is Logic? Why Logic is used in Artificial Intelligence, Logical Operators, Translating between English and Logic Notation, Truth Tables.	CO3
	B	Complex Truth Tables, Tautology, Equivalence	CO3
	C	Propositional Logic, Syntax, Semantics, Deduction, The Deduction Theorem	CO3
	Unit 4	**Introduction to Machine Learning**	
	A	Introduction, Training, Rote Learning , Learning Concepts, A Simple Learning Algorithm, Supervised Learning, Unsupervised Learning, Reinforcement Learning	CO4, CO6
	B	Introduction to Linear Regression, Application of Linear Regression in various application domains through case study.	CO4, CO6
	C	Introduction, Neurons, Artificial Neurons, Perceptron, Neural Networks Architecture, Feed forward Neural Networks, Applications of Neural Networks	CO4, CO6
	Unit 5	**Applications of AIML**	
	A	Case Study on applications of AI ML in Human Resource: Screening Tons Of Resumes, Attracting Talent, Schedule Management Case Study on applications of AI ML in Health Care: Virtual assistance in healthcare, Diagnostics assistance and medical imaging	CO5, CO6

	B	Use Cases on applications of AI ML in Banking, Use Cases on applications of AI ML in insurance,			CO5, CO6
	C	Use Cases on applications of AI ML in cyber security Use Cases on applications of AI ML in weather forecasting			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Coppin Ben, Artificial Intelligence Illuminated, Jones and Bartlett Publishers			
	Other References	1) Russell S & Norvig P, Artificial Intelligence: A Modern Approach, Prentice Hall 2) Rich E & Knight K, Artificial Intelligence, Tata McGraw Hill, Edition 3 3) Dan W. Patterson, Artificial Intelligence & Expert Systems, Pearson Education with Prentice Hall India. Indian Edition.			
		https://analyticsindiamag.com/top-use-cases-ai-human-resources/			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO-1. Define the requirement of Artificial Intelligence	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	CO-2. Classify the functionality of agents along with acting environment of Intelligence in Artificial Intelligence.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	CO-3. Apply the concepts of Propositional Logic for real-world AI based problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	CO-4. Analyse the various ML techniques and apply them to solve the real world societal problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	CO-5. Explain the Use Cases of AIML in real world societal problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	CO-6. Discuss the applicability of Artificial Intelligence and Machine learning Approaches to develop sustainable solutions using professional ethics.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Introduction to Artificial Intelligence & Machine Learning **(Course Code** CSA-102**)**

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO3
Introduction to Artificial Intelligence & Machine Learning (CSA-102)	CO1	3	3	3	1	2	1	1	1	2	3	1	3	2	3	1
	CO2	3	3	3	1	2	3	3	1	2	3	1	3	2	3	2
	CO3	3	3	3	1	2	3	3	1	3	3	3	3	3	3	3
	CO4	3	3	3	1	2	3	3	1	3	3	3	3	3	3	3
	CO5	3	3	3	1	2	3	3	1	3	3	3	3	3	3	3
	CO6	3	3	3	1	2	3	3	3	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA-102	Introduction to Artificial Intelligence & Machine Learning	3.00	3.00	3.00	1.00	2.00	2.67	2.67	1.33	2.67	3.00	2.33	3.00	2.67	3.00	2.50

***Total*--37.83**

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE**	
1	Course Code	CSI011	
2	Course Title	Android with IoT	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Elective	
5	Course Objective	This course aim to give an overview of Android with IoT, its architecture, challenges and applications in different context.	
6	Course Outcomes	CO1: Define the basics of Android platform CO2: Outline the Components of Android CO3: Identify IoT ecosystem and role of the Android Things CO4: Analyze Android Things with IoT cloud platforms CO5: Evaluate Android Things in IoT projects CO6: Develop an Android App with IoT	
7	Course Description	The course is intended to know fundamentals of Android Platform, Android application components; integration of Android with IoT, The main focus is on implementing IoT projects using Android Things.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Android Platform**	
	A	Features of Android, Architecture of Android	CO1
	B	Configuration of android SDK	CO1
	C	Android application structure, Generation of APK Files for Android Projects	CO1
	Unit 2	**Components of Android**	
	A	Components of Android architecture	CO1, CO2
	B	Activity, Activity life cycle	CO1, CO2
	C	Service, Service life cycle, Concept of Intent	CO1, CO2
	Unit 3	**Android and IoT**	
	A	Internet of Things overview & its components	CO3
	B	Android Things overview, Android Things board compatibility	CO3
	C	Installation of Android Things	CO3
	Unit 4	**Integrate Android Things with IoT Cloud Platforms**	
	A	IoT cloud architecture & IoT cloud platform overview	CO3, CO4
	B	IoT cloud architecture overview	CO3, CO4
	C	Android with Android Things	CO3, CO4
	Unit 5	**Android Things**	
	A	Creating the first Android Things project	CO5, CO6
	B	Streaming data to the IoT cloud platform	CO5, CO6

	C	Developing an Android app to retrieves data from Android Things			CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	CE (Viva)	ESE	
		25%	25%	50%	
	Text book/s*	3. Android Things Projects by Francesco Azzola Publisher: Packt Publishing 4. Anubhav Pradhan and Anil V. Deshpande , Composing Mobile Apps: Learn, Explore, Apply Using Android , 1st Edition, Wiley India.			
	Other References				

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the basics of Android platform	PO1, PO5, PO10, PO11, PO12
2.	CO2: Outline the Components of Android	PO1, PO5, PO11, PO12
3.	CO3: Identify IoT ecosystem and role of the Android Things	PO1, PO2, PO4, PO5, PO6, PO7, PO9, PO10, PO11, PO12, PSO3
4.	CO4: Analyze Android Things with IoT cloud platforms	PO1, PO2, PO4, PO5, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5.	CO5: Evaluate Android Things in IoT projects	PO1, PO2, PO3,PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	CO6: Develop an Android App with IoT	PO1, PO2, PO3,PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Android with IoT CSI011)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CSI011 _Android with IoT	CO1	2	-	-	-	2	-	-	-	-	1	2	2	-	-	-
	CO2	2	-	-	-	2	-	-	-	-	-	2	2	-	-	1
	CO3	2	2	-	2	2	2	3	-	2	2	2	3	-	-	-
	CO4	2	2	-	2	2	-	-	-	2	2	2	3	1	1	3
	CO5	2	2	2	3	2	3	2	2	3	3	2	3	3	3	3
	CO6	2	3	3	3	2	3	2	2	3	3	2	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI011	**Android with IoT**	2.0	2.3	2.5	2.5	2.0	2.7	2.3	2.0	2.5	2.2	2.0	2.7	2.3	2.3	2.5

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***

3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE**	
1	Course Code	CSI032	
2	Course Title	Data Analytics for IoT	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective	
5	Course Objective	The objective of this course is to learn techniques to solve unique problems associated with IoT and examine and analyze data from your IoT devices	
6	Course Outcomes	CO1: Identify the main challenges of IoT analytics systems development and deployment. CO2: Utilize IoT, Cloud and BigData Integration for IoT Analytics CO3: Evaluate the development tools for real-life applications using IoT analytics CO4: Explain the paradigm for on-demand IoT analytics as a service based on the open source framework. CO5: Analyze the data in smart buildings, including data stemming from sensors and IoT devices. CO6: Assess the popular tools for IoT data analytics, along with their use in practical projects and applications.	
7	Course Description	Data Analytics has a significant role to play in the growth and success of IoT applications and investments. There are different types of data analytics that can be used and applied in the IoT investments to gain advantages.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introducing IoT Analytics**	
	A	Defining IoT analytics and IoT, The concept of constrained	
	B	IoT Data and BigData, Challenges of IoT Analytics Applications	
	C	IoT Analytics Lifecycle and Techniques	
	Unit 2	**IoT, Cloud and BigData Integration for IoT Analytics**	
	A	Cloud-based IoT Platform, Data Analytics for the IoT, Data Collection Using Low-power, Long-range Radios	
	B	WAZIUP Software Platform	
	C	iKaaS Software Platform	
	Unit 3	**Development Tools for IoT Analytics Applications**	
	A	Introduction, The VITAL Architecture for IoT Analytics Applications	

	B	VITAL Development Environment: Overview, VITAL Nodes			
	C	IoT Analytics Applications			
	Unit 4	**An Open Source Framework for IoT Analytics as a Service**			
	A	Architecture for IoT Analytics-as-a-Service, Sensing-as-a-Service Infrastructure Anatomy			
	B	Scheduling, Metering and Service Delivery			
	C	From Sensing-as-a-Service to IoT-Analytics- as-a-Service			
	Unit 5	**Data Analytics in Smart Buildings**			
	A	Addressing Energy Efficiency in Smart Buildings			
	B	General Architecture for Management Systems of Smart Buildings			
	C	IoT-based Information Management System for Energy Efficiency in Smart Buildings			
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MSE	ESE	
		25%	25%	50%	
	Text book/s*				
	Other References				

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Identify the main challenges of IoT analytics systems development and deployment.	PO1, PO2, PO4, PO12, PSO2
2.	CO2: Utilize IoT, Cloud and BigData Integration for IoT Analytics	PO1, PO4, PO5, PO11, PO12, PSO1, PSO2
3.	CO3: Evaluate the development tools for real-life applications using IoT analytics	PO1, PO2, PO3, PO4, PO5, PO10, PO11, PO12, PSO1, PSO2
4.	CO4: Explain the paradigm for on-demand IoT analytics as a service based on the open source framework.	PO1, PO4, PO10, PO11, PO12, PSO2
5.	CO5: Analyze the data in smart buildings, including data stemming from sensors and IoT devices.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2
6.	CO6: Assess the popular tools for IoT data analytics, along with their use in practical projects and applications.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name Data Analytics for IoT (Course Code CSI032)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CSI032_ Data Analytics for IoT	CO1	2	3	-	2	-	-	-	-	-	-	-	2	-	1	-
	CO2	3	-	-	2	2	-	-	-	-	-	2	2	2	1	-
	CO3	3	2	3	2	2	-	-	-	-	2	2	2	2	1	-
	CO4	2	-	-	2	-	-	-	-	-	2	2	2	-	1	-
	CO5	3	3	3	2	2	3	2	-	2	2	2	2	2	2	-
	CO6	3	3	3	2	3	3	2	2	2	2	2	2	3	2	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	P O 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PSO 3
CSI032	Data Analytics for IoT	2.7	2.8	3.0	2.0	2. 3	3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.3	1.3	0.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE**	
1	Course Code	CSI202	
2	Course Title	IoT: Architecture and Programming	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Core	
5	Course Objective	This course provides a preliminary view on Logical and Physical Design of IoT systems and gives an overview of Data analytics for IoT.	
6	Course Outcomes	CO1: Recall the basic concepts of Internet of Things CO2: Explain the concepts of logical design of IoT System using Python. CO3: Demonstrate the Raspberry Pi interfaces with Python CO4: Interpret the IoT Physical Servers and Cloud Offerings CO5: Make use of data analytics for IoT using Apache Hadoop CO6: Utilize the IoT reference architecture required in building IoT based solutions.	
7	Course Description	The course focuses on understanding the vision of IoT from a global perspective, understand its applications, and determine its market perspective, using gateways, devices and data management, building a state of art architecture in IoT and its applications in commercial building automation and real world design constraints.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to IoT**	
	A	Introduction, Physical Design of IOT, Logical design of IoT, IoT Levels & Development Templates	CO1
	B	Difference between IoT and M2M, SDN and NFV for IoT, Need for IoT systems management, Simple Network Management Protocol (SNMP)	CO1
	C	Network operator requirements, NETCONF, YANG, IoT systems Management with NETCONF, YANG	CO1
	Unit 2	**IoT Systems- Logical Design using Python**	
	A	Language features of Python, Data types, data structures, Control of flow	CO1, CO2
	B	Functions, modules, packaging, file handling, data/time operations, classes	CO1, CO2
	C	Python packages for Internet of Things	CO1, CO2
	Unit 3	**IoT Physical Devices and Endpoints**	
	A	Basic building blocks of an IoT device, Exemplary Device: Raspberry Pi	CO1, CO2, CO3
	B	About the board, Raspberry Pi interfaces	CO1, CO2, CO3
	C	Programming Raspberry Pi with Python	CO1, CO2, CO3

	Unit 4	**IoT Physical Servers and Cloud Offerings**			
	A	Introduction to Cloud Storage models and communication APIs			CO1, CO2, CO4
	B	Webserver – Web server for IoT, Cloud for IoT			CO1, CO2, CO4
	C	Python web application framework, Amazon Web services for IoT			CO1, CO2, CO4
	Unit 5	**Data analytics for IoT**			
	A	Introduction, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis			CO5, CO6
	B	Apache Oozie, Apache Spark, Apache Storm			CO5, CO6
	C	Using Apache Storm for Real-time Data Analysis			CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MSE	ESE	
		25%	25%	50%	
	Text book/s*	1. Arshdeep Bahga and Vijai Madisetti : A Hands-on Approach "Internet of Things", Universities Press 2015. 2. "Internet of Things with Python" Gastón C. Hillar,Published by Packt Publishing Ltd. Livery Place 35 Livery Street Birmingham B3 2PB, UK. ISBN 978-1-78588-138-1			
	Other References	1. Kamal, R., (2017), Internet of Things - Architecture and Design Principles, 1st Edition, Mcgraw Hill. 2. Misra, S., Introduction to Internet of Things, NPTEL Course Material, Department of Computer Science & Engineering, Indian Institute of Technology Kharagpur, https://nptel.ac.in/courses/106105166/ 3. Samuel Greengard, " The Internet of Things", The MIT press, 2015. 4. Adrian McEwen and Hakim Cassimally "Designing the Internet of Things "Wiley,2014.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Recall the basic concepts of Internet of Things	PO1, PO9, PO12, PSO2
2.	CO2: Explain the concepts of logical design of IoT System using Python.	PO1, PO9, PO12, PSO1, PSO2
3.	CO3: Demonstrate the Raspberry Pi interfaces with Python	PO1, PO2, PO3, PO4, PO5, PO7, PO8, PO9, PO10, PO12, PSO1, PSO2
4.	CO4: Interpret the IoT Physical Servers and Cloud Offerings	PO1, PO4, PO5, PO7, PO9, PO10, PO12, PSO2
5.	CO5: Make use of data analytics for IoT using Apache Hadoop	PO1, PO2, PO5, PO9, PO10, PO12, PSO2, PSO3
6.	CO6: Utilize the IoT reference architecture required in building IoT based solutions.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name IoT: Architecture and Programming (Course Code CSI202)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CSI202_IoT: Architecture and Programming	CO1	2	-	-	-	-	-	-	-	1	-	-	2	-	2	-
	CO2	2	-	-	-	-	-	-	-	2	-	-	2	2	2	-
	CO3	2	3	2	3	3	-	2	1	2	3	-	2	3	2	-
	CO4	2	-	-	2	2	-	2	-	2	2	-	2	-	2	-
	CO5	2	2	-	-	3	-	-	-	2	3	-	2	-	2	2
	CO6	3	3	3	3	3	2	3	3	3	3	2	2	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI202	IoT: Architecture and Programming	2.2	2.7	2.5	2.7	2.8	2.0	2.3	2.0	2.0	2.8	2.0	2.0	2.7	2.2	2.5

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Object Oriented Programming Using C++ Lab

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.tech CSE (Specialization in Augmented and Virtual Reality)**	
Branch:		**CSE**	
1	Course Code		
2	Course Title	**Object Oriented Programming Using C++ Lab**	
3	Credits	3	
4	Contact Hours (L-T-P)	2-0-2	
	Course Status	Elective	
5	Course Objective	*The objective of this course is to learn C++ for the implementation of Unreal Engine.*	
6	Course Outcomes	after studying this course student will be able to: **CO1:** Describe the basics of Object-Oriented Programming concepts. **CO2:** Explain the object initialization and destroy concept using constructors and destructors. **CO3**: Apply the concept of polymorphism to implement compile time polymorphism in programs by using overloading methods and operators. **CO4**: Examine the concept of inheritance to reduce the length of code and evaluate its usefulness. **CO5**: Asses the concept of run time polymorphism by using virtual functions, overriding functions and abstract class in programs. **CO6**: Plan to Use I/O operations and file streams in programs.	
7	Course Description	To introduce the principles and paradigms of OOPS for design and implementation of Object-Oriented System.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to C++:**	
	A	1. Calculator Program: A simple calculator that can perform basic arithmetic operations like addition, subtraction, multiplication, and division. 2. Gradebook Program: A program that reads in student grades from a file and calculates their average grade, highest grade, lowest grade, and overall class average.	CO1
	Unit 2		

	A	3. Tic Tac Toe Game: A game where two players take turns placing X's and O's on a 3x3 grid, with the objective of getting three in a row. 4. Hangman Game: A game where the user tries to guess a random word by guessing one letter at a time. For every incorrect guess, a part of a hangman figure is drawn until the user runs out of guesses.	
	Unit 3		
	A	5. Bank Account Program: A program that allows the user to create and manage bank accounts, deposit and withdraw money, and view account balances. 6. Binary Search Algorithm: A program that searches for a value in a sorted array using the binary search algorithm.	CO3
	Unit 4		
	A	7. Fibonacci Sequence: A program that generates the Fibonacci sequence up to a certain number of terms. 8. Sorting Algorithm: A program that implements a sorting algorithm such as bubble sort, selection sort, or insertion sort.	CO4
	Unit 5		
	A	9. Text Adventure Game: A game where the player navigates through a story by making choices that affect the outcome. 10. Encryption/Decryption Program: A program that can encrypt and decrypt messages using a symmetric encryption algorithm such as AES or DES.	CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva	
	Text book/s*	Deitel , "C++ How to Program" , Prentice Hall Robert Lafore, "Object Oriented Programming in Turbo C++" , The Waite Group Press. Ravichandran, "Programming with C++" , 2003, TMH Balagurusamy , "Object oriented Programming with C++", Tata McGraw-Hill	
	Other References	Unreal Engine C++ the Ultimate Developer's Handbook by Stephen Seth Ulibarri	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:** Describe the basics of Object-Oriented Programming concepts.	**PO1,PO2,PO3, PO9, PSO1,PSO2**
2.	**CO2:** Explain the object initialization and destroy concept using constructors and destructors.	**PO1,PO3, PO4, PO5, PO9, PO11,PSO1,PSO2**
3.	**CO3**: Apply the concept of polymorphism to implement compile time polymorphism in programs by using overloading methods and operators.	**PO1,PO3,PO4, PO9, PSO2**
4.	**CO4**: Examine the concept of inheritance to reduce the length of code and evaluate its usefulness.	**PO1,PO3,PO4, PO9, PSO2**
5.	**CO5**: Asses the concept of run time polymorphism by using virtual functions, overriding functions and abstract class in programs.	**PO1,PO3,PSO2**
6.	**CO6**: Plan to Use I/O operations and file streams in programs.	**PO1,PO2,PO3,PO4,PO9, PO11,PSO1 PSO2,PSO3**

PO and PSO mapping with level of strength

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	1	2	2	_	_	-	_	_	2	_	_	_	1	2	_
CO2	2	_	3	2	2	-	_	_	1	_	1	_	2	2	_
CO3	3	_	2	1	_	_	_	_	3	_	_	_	_	2	_
CO4	1	_	2	1	_	_	_	_	1	_	_	_	_	3	_
CO5	1	_	1	_	_	_	_	_	_	_	_	_	_	1	_
CO6	3	3	3	2	-	-	_	_	2	_	2	_	2	3	1

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	Object Oriented Programming Using C++	1.83	2.50	2.17	1.50	2.00	-	-	-	1.80	-	1.50	-	1.67	2.17	1.00

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Object Oriented Programming Using C++

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.tech CSE (Specialization in Augmented and Virtual Reality)**	
Branch:		**CSE**	
1	Course Code		
2	Course Title	**Object Oriented Programming Using C++**	
3	Credits	3	
4	Contact Hours (L-T-P)	2-0-2	
	Course Status	Elective	
5	Course Objective	*The objective of this course is to learn C++ for the implementation of Unreal Engine.*	
6	Course Outcomes	after studying this course student will be able to: **CO1:** Describe the basics of Object-Oriented Programming concepts. **CO2:** Explain the object initialization and destroy concept using constructors and destructors. **CO3**: Apply the concept of polymorphism to implement compile time polymorphism in programs by using overloading methods and operators. **CO4**: Examine the concept of inheritance to reduce the length of code and evaluate its usefulness. **CO5**: Asses the concept of run time polymorphism by using virtual functions, overriding functions and abstract class in programs. **CO6**: Plan to Use I/O operations and file streams in programs.	
7	Course Description	To introduce the principles and paradigms of OOPS for design and implementation of Object-Oriented System.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to C++:**	
	A	**Object Oriented Concepts:** Introduction to Objects and Object Oriented Programming, Encapsulation (Information Hiding), Access Modifiers: Controlling access to a class, method, or variable(public, protected, private, package), Other Modifiers, Polymorphism: Overloading, Inheritance, Overriding Methods, Abstract Classes, Reusability, Class's Behaviors.	CO1
	B	**Classes and Data Abstraction:** Introduction, Structure Definitions, Accessing Members of Structures, Class Scope and Accessing Class Members, Separating Interface from	CO1

		Implementation, Controlling Access Function and Utility Functions,	
	Unit 2		
	A	Initializing Class Objects: Constructors, Using Default Arguments with Constructors, Using Destructors, Classes: Constructor (Constant) Object and Constructor Member Functions, Object as Member of Classes, Friend Function and Friend Classes, Using This Pointer, Dynamic Memory Allocation with New and Delete, Static Class Members, Container Classes And Integrators, Proxy Classes, Function overloading.	
	B	**Operator Overloading:** Introduction, Fundamentals of Operator Overloading, Restrictions on Operators Overloading, Operator Functions as Class Members vs. as Friend Functions, Overloading, <<, >> Overloading Unary Operators, Overloading Binary Operators.	CO2
	Unit 3		
	A	**Inheritance:** Introduction, Inheritance: Base Classes and Derived Classes, Protected Members, Casting Base- Class Pointers to Derived- Class Pointers, Using Member Functions, Overriding Base –Class Members in a Derived Class, Public, Protected and Private Inheritance, Using Constructors and Destructors in derived Classes, Implicit Derived –Class Object To Base- Class Object Conversion, Composition Vs. Inheritance.	CO3
	B	**Virtual Functions and Polymorphism:** Introduction to Virtual Functions, Abstract Base Classes And Concrete Classes, Polymorphism, New Classes And Dynamic Binding, Virtual Destructors, Polymorphism, Dynamic Binding.	CO3
	Unit 4		
	A	**Files and I/O Streams:** Files and Streams, creating a Sequential Access File, Reading Data From A Sequential Access File, Updating Sequential Access Files, Random Access Files,	CO4
	B	Creating A Random-Access File, Writing Data Randomly To a Random Access File, Reading Data Sequentially from a Random Access File. Stream Input/Output Classes and Objects, Stream Output, Stream Input, Unformatted I/O (with read and write).	CO4
	Unit 5		
	A	**Templates:** Function Templates, Overloading Template Functions, Class Template, Class Templates and Non-Type Parameters, Templates and Inheritance, Templates and Friends, Templates and Static Members,	CO5, CO6

	B	Basics of C++ Exception Handling: Try Throw, Catch, Throwing an Exception, Catching an Exception, Re-throwing an Exception, Exception specifications, Processing Unexpected Exceptions, Constructors, Destructors and Exception Handling, Exceptions and Inheritance.	
	Mode of examination	Theory/Jury/Practical/Viva	
	Text book/s*	Deitel , “C++ How to Program” , Prentice Hall Robert Lafore, “Object Oriented Programming in Turbo C++” , The Waite Group Press. Ravichandran, “Programming with C++” , 2003, TMH Balagurusamy , “Object oriented Programming with C++”, Tata McGraw-Hill	
	Other References	Unreal Engine C++ the Ultimate Developer’s Handbook by Stephen Seth Ulibarri	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:** Describe the basics of Object-Oriented Programming concepts.	**PO1,PO2,PO3, PO9, PSO1,PSO2**
2.	**CO2:** Explain the object initialization and destroy concept using constructors and destructors.	**PO1,PO3, PO4, PO5, PO9, PO11,PSO1,PSO2**
3.	**CO3**: Apply the concept of polymorphism to implement compile time polymorphism in programs by using overloading methods and operators.	**PO1,PO3,PO4, PO9, PSO2**
4.	**CO4**: Examine the concept of inheritance to reduce the length of code and evaluate its usefulness.	**PO1,PO3,PO4, PO9, PSO2**
5.	**CO5**: Asses the concept of run time polymorphism by using virtual functions, overriding functions and abstract class in programs.	**PO1,PO3,PSO2**
6.	**CO6**: Plan to Use I/O operations and file streams in programs.	**PO1,PO2,PO3,PO4,PO9, PO11,PSO1 PSO2,PSO3**

PO and PSO mapping with level of strength

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	**1**	**2**	**2**	_	_	-	_	_	**2**	_	_	_	**1**	**2**	_
CO2	**2**	_	**3**	**2**	**2**	-	_	_	**1**	_	**1**	_	**2**	**2**	_
CO3	**3**	_	**2**	**1**	_	_	_	_	**3**	_	_	_	_	**2**	_
CO4	**1**	_	**2**	**1**	_	_	_	_	**1**	_	_	_	_	**3**	_
CO5	**1**	_	**1**	_	_	_	_	_	_	_	_	_	_	**1**	_

CO6	3	3	3	2	-	-	_	_	2	_	2	_	2	3	1

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	Object Oriented Programming Using C++	1.83	2.50	2.17	1.50	2.00	-	-	-	1.80	-	1.50	-	1.67	2.17	1.00

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School: SET		**Batch : 2023-27**	
Program: B.Tech		**Current Academic Year: 2023-24**	
Branch: ALL		**Semester: VII**	
1	**Course Code**	**CSA401**	**Course Name: Computer Vision**
2	**Course Title**	**Computer Vision**	
3	**Credits**	**3**	
4	**Contact Hours (L-T-P)**	**3-0-0**	
	Course Status	**Program Elective**	
5	Course Objective	21. To implement fundamental image processing techniques required for computer vision 22. To develop applications using computer vision techniques	
6	Course Outcomes	Students will be able to have thorough Understanding of: CO-1 Define the Fundamentals of Computer Vision and Computer Graphics and relate them with real world applications CO-2 Explain Image formation models and Foundations for Mathematical basis for various Projection Systems CO- 3 Apply Image processing techniques such as Segmentation and Edge Detection for real time and real world applications. CO- 4 Analyze various feature extraction techniques for different problem domain. CO-5 Evaluate Pattern Recognition Using Clustering, Classification, Supervised Learning and Unsupervised Learning Techniques CO-6 Build computer vision applications for real world Applications.	
7	Course Description	In this course students will learn basic principles of image formation, image processing algorithms, extracting the features and then analyzing the underlying patterns.	

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Computer Vision**	
	A	Computer Vision and Computer Graphics , What is Computer Vision - Low-level, Mid-level, High-level	CO1
	B	Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis	CO1

	C	Face detection, Face recognition, Eigen faces, Active appearance and 3D shape models of faces, Surveillance, foreground-background separation, vehicle vision system: locating roadway, road markings, identifying road signs, locating pedestrians	CO1
	Unit 2	**Image Formation Models**	
	A	Monocular imaging system , Radiosity: The 'Physics' of Image Formation, Radiance, Irradiance, Brightness, color etc,	CO2
	B	Orthographic & Perspective Projection ,Camera model and Camera calibration, Binocular imaging systems	CO2
	C	Multiple views geometry, Structure determination, shape from shading, Weak perspective projection and orthographic projection, Concept of image coordinate system and camera coordinate system;	CO2
	Unit 3	**Image Processing**	
	A	Image preprocessing: The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Discrete Cosine Transform (DCT)	CO3, CO6
	B	Wavelet Transforms in One Dimension-The Discrete Wavelet Transform (DWT) and The Continuous Wavelet Transform. Wavelet Decomposition,	CO3, CO6
	C	Orthogonal, Euclidean, Affine, Projective, etc; Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.	CO3, CO6
	Unit 4	**Image Processing Operations**	
	A	Image Filtering (spatial domain), Mask-based (e.g., correlation, convolution), Smoothing (e.g., Gaussian), Sharpening (e.g., gradient)	CO4
	B	Segmentation : Edge-based (e.g., voting, optimization, perceptual grouping), Pixel-based (e.g., clustering)	CO4
	C	Colour fundamentals, Colour models, Colour transformation, Smoothing and Sharpening, Colour segmentation	CO4
	Unit 5	**Feature Extraction**	
	A	Edge detection: Canny, Laplacian of Gaussian; Line detectors (Hough Transform)	CO5, CO6
	B	Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH	CO5, CO6
	C	Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters	CO5, CO6

	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Digital Image Processing and Computer Vision"Cengage Learning, 1st Edition, 2008 2. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.			
	Reference Books	1, Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall. 2. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992. 3. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO-1 Define the Fundamentals of Computer Vision and Computer Graphics and relate them with real world applications	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	CO-2 Explain Image formation models and Foundations for Mathematical basis for various Projection Systems	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	CO- 3 Apply Image processing techniques such as Segmentation and Edge Detection for real time and real world applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	CO- 4 Analyze various feature extraction techniques for different problem domain.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	CO-5 Evaluate Pattern Recognition Using Clustering, Classification, Supervised Learning and Unsupervised Learning Techniques	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	CO-6 Build computer vision applications for real world applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Computer Vision **(Course Code** CSA-401**)**

Subject	PO's / PSO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Computer Vision CSA-401	CO1	3	3	3	3	1	1	1	1	1	2	1	3	2	3	1
	CO2	3	3	3	3	2	1	1	1	1	2	1	3	2	3	2
	CO3	3	3	3	3	2	1	1	1	1	2	1	3	3	3	2
	CO4	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
	CO5	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
	CO6	3	3	3	3	2	3	3	1	3	2	1	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA-401	Computer Vision	3.00	3.00	3.00	3.00	1.83	1.67	1.33	1.00	1.33	2.00	1.00	3.00	2.67	3.00	2.00

Total- 32.83
Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School: SET		**Batch : 2023-27**		
Program:B.Tech		**Current Academic Year: 2023-24**		
Branch: ALL		**Semester: VII**		
1	**Course Code**	**CAL401**	**Course Name: Computer Vision Lab**	
2	**Course Title**	**Computer Vision Lab**		
3	**Credits**	**1**		
4	**Contact Hours (L-T-P)**	**0-0-2**		
	Course Status	**Core**		
5	Course Objective	To implement fundamental image processing techniques required for computer vision To develop applications using computer vision techniques		
6	Course Outcomes	Students will be able to have thorough Understanding of: CO-1 Define and show the Fundamentals of Computer Vision techniques on images CO-2 Show the Image filtering and opening / closing operations on Color images CO- 3 Apply Image transformation techniques such as for real time and real world applications. CO- 4 Analyze various feature extraction techniques for different Problem domains. CO-5 Evaluate Pattern Recognition Using Clustering, Classification Techniques CO-6 Build computer vision applications for real world Problems.		
7	Course Description	In this course students will learn basic principles of image formation, image processing algorithms, extracting the features and then analyzing the underlying patterns.		
8	Outline syllabus			CO Mapping
	Unit 1	**Introduction to Computer Vision**		
	A	To create a program to display grayscale image using read and write operation.		CO1
	B	To create a vision program to find histogram value and display histograph of a grayscale and color image.		CO1
	C	Write a program for color image processing		
	Unit 2	**Image Formation Models**		
	A	To Implement smoothing or averaging filter in spatial domain		CO2
	B	Program for opening and closing of the image.		CO2

	C	To fill the region of interest for the image			CO2
	Unit 3	**Image Processing**			
	A	To create a vision program for Non-Linear Filtering technique using edge detection			CO3, CO6
	B	To create a program to discretize an image using Fourier transformation.			CO3, CO6
	C	To create a vision program to determine the edge detection of an image using different operators.			CO3, CO6
	Unit 4	**Feature Extraction**			
	A	Program of sharpen image using gradient mask.			CO4
	B	Program for morphological operation: erosion and dilation.			CO4
	C	Write a program for image segmentation using local and global thresholding			CO4
	Unit 5	**Pattern Analysis**			
	A	Write a program to implement image classification.			CO5, CO6
	B	Write a program to implement image clustering.			CO5, CO6
	C	Lab			
	Weightage Distribution	CA	CE	ETE	
		25%	25%	50%	
	Text book/s*	1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Digital Image Processing and Computer Vision"Cengage Learning, 1st Edition, 2008 2. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.			
	Reference Books	1, Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall. 2. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992. 3. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO-1 Define and show the Fundamentals of Computer Vision techniques on images	PO1,PO2,PO3,PO4, PO5,PSO1,PSO2
2.	CO-2 Show the Image filtering and opening / closing operations on Color images	PO1,PO2,PO3,PO4, PO5,PSO1,PSO2
3.	CO- 3 Apply Image transformation techniques such as for real time and real world applications.	PO1,PO2,PO3,PO4, PO5,PO12,PSO1,PSO2, PSO3
4.	CO- 4 Analyze various feature extraction techniques for different problem domains.	PO1,PO2,PO3,PO4, PO5,PSO1,PSO2
5.	CO-5 Evaluate Pattern Recognition Using Clustering, Classification Techniques	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	CO-6 Build computer vision applications for real world Problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Computer Vision **(Course Code** CSA-301**)**

Subject	**PO's / PSO's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
Computer Vision CAL-401	CO1	3	2	1	1	1	-	-	-	-	-	-	-	2	2	-
	CO2	3	2	1	1	2	-	-	-	-	-	-	-	2	2	-
	CO3	3	2	1	1	2	-	-	-	-	-	-	1	2	2	1
	CO4	3	3	1	1	1	-	-	-	-	-	-	-	2	2	-
	CO5	3	3	2	2	2	-	-	-	-	-	-	-	2	2	-
	CO6	3	2	2	2	2	-	-	-	-	-	-	1	2	2	1

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O 1**	**PS O 2**	**PS O 3**
CAL-401	**Computer Vision**	3.00	2.33	1.33	1.33	1.67	0.00	0.00	0.00	0.00	0.00	0.00	1.00	2.00	2.00	1.00

Total- 32.83
Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School:		**School of Engineering & Technology**			
Department		**Computer Science & Engineering**			
Program:		**B.Tech. DS**			
Branch:		**CSE**			
1	Course Code				
2	Course Title	Data Exploration and Visualization			
3	Credits	3			
4	Contact Hours (L-T-P)	2	0	2	
	Course Status	Core /Elective/Open Elective			
5	Course Objective	• To understand what is in a dataset and the characteristics of the data • To design and create data visualizations based on data available and tasks to be achieved. • To evaluate the effectiveness of visualization designs, and think critically about each design decision, such as choice of color and choice of visual encoding. • Students will create their own data visualizations, and learn to use Open Source data visualization tools, especially D3.js.			
6	Course Outcomes	CO1: Design an approach to leverage data using the steps in the machine learning process. CO2: Design and create data visualizations. CO3: Craft visual presentations of data for effective communication. CO4: Design and evaluate color palettes for visualization based on principles of perception. CO5: Apply data transformations such as aggregation and filtering for visualization. CO6: Use JavaScript with D3.js to develop interactive visualizations for the Web.			
7	Course Description	This course uses ecological datasets to discuss data exploration and visualization tools. It also explains how to visualize the results of statistical models. The course also includes the JavaScript with D3.js needed to construct, visualize, and explore the main features of the data step by step.			
8	Outline syllabus				CO Mapping
	Unit 1	**INTRODUCTION**			
	A	Introduction to data exploration, Data Terminology,			CO1

	B	Data Exploration through summary statistics, Exploring data with KNIME plots, Data Exploration in Spark	CO 2, CO3
	C	Classification Techniques, Clustering Techniques, Regression Methods,	CO 1, CO2
	Unit 2	**OVERVIEW OF DATA VISUALIZATION, INTRODUCTION TO WEB TECHNOLOGIES**	
	A	Why Visualize Data?, Introduction to SVG and CSS, Introduction to JavaScript, Introduction to VizHub, Making a Face with D3.js	CO3
	B	Input for Visualization: Data and Tasks, Loading and Parsing Data with D3.js	CO2. CO3, CO4
	C	Encoding Data with Marks and Channels, Rendering Marks and Channels with D3.js and SVG, Introduction to D3 Scales, Creating a Scatter Plot with D3.js	CO3, CO4
	Unit 3	**DATA MANAGEMENT ISSUES**	
	A	Integrity and Quality of Data - Data type issues, Exploratory data analysis, simple viz.	CO1, CO4,CO5
	B	Handling missing data, Handling outliers, Attribute creation, modification conversion: categorical – numeric.	CO4, CO5
	C	Understanding and naming the attributes and files, Replicability	CO3, CO4
	Unit 4	**VISUALIZATION OF SPATIAL DATA, NETWORKS, AND TREES**	
	A	Reusable Dynamic Components using the General Update Pattern:-Reusable Scatter Plot Common Visualization Idioms with D3.js:- Bar Chart, Vertical & Horizontal, Pie Chart and Coxcomb Plot, Line Chart, Area Chart	CO2, CO3
	B	Making Maps, Visualizing Trees and Networks	CO3, CO4
	C	Encoding Data using Color, Encoding Data using Size, Stacked & Grouped Bar Chart, Stacked Area Chart & Streamgraph, Line Chart with Multiple Lines	CO4, CO5
	Unit 5	**INTERACTION TECHNIQUES**	
	A	Adding interaction with Unidirectional Data Flow, Using UI elements to control a scatter plot, Panning and Zooming on a Globe, Adding tooltips	CO1,CO2, CO3, CO5
	B	Small Multiples, Linked Highlighting with Brushing, Linked Navigation: Bird's Eye Map	CO4, CO5, CO6

	C	Case Study: Covid19 Dashboard by joining interactive techniques and spatial data networks and trees			CO4, CO5, CO6
	Mode of examination				
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Advanced Methods of Data Exploration and Modelling by Brian Everitt, Graham Dunn 2. Interactive Data Visualization for the Web by Scott Murray 2nd Edition (2017)			
	Other References	1. Visualizing Data: Exploring and Explaining Data with the Processing Environment by Ben Fry 2. Visualization Analysis and Design by Tamara Munzner			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Design an approach to leverage data using the steps in the machine learning process.	PO 1, PO2
2.	CO2: Design and create data visualizations	PO1, PSO2, PSO3
3.	CO3: Craft visual presentations of data for effective communication.	PO1, PO2, PO3, PSO2
4.	CO4: Design and evaluate color palettes for visualization based on principles of perception.	PO4, PO5, PO6
5.	CO5: Apply data transformations such as aggregation and filtering for visualization.	PO1, PO2, PSO2,PSO3
6.	CO6: Use JavaScript with D3.js to develop interactive visualizations for the Web.	PO2, PO3, PO5, PSO2, PSO3

PO and PSO mapping with level of strength for Data Exploration and Visualization

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Data Exploration and Visualization	CO1	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	CO2	2	0	0	0	0	0	0	0	0	0	0	0	0	3	2
	CO3	3	2	3	0	0	0	0	0	0	0	0	0	0	3	0
	CO4	0	0	0	3	2	3	0	0	0	0	0	0	0	0	0
	CO5	2	3	0	0	0	0	0	0	0	0	0	0	0	2	3
	CO6	0	2	3	0	3	0	0	0	0	0	0	0	0	3	2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***

3. Addressed to ***Substantial (High=3) extent***

INT248: Human Computer interaction

School:		**School of Engineering & Technology**			
Department		**Computer Science & Engineering**			
Program:		**B.Tech**			
Branch:		**CSE**			
1	Course Code	INT249			
2	Course Title	Human Computer Interaction			
3	Credits	3			
4	Contact Hours (L-T-P)	3-0-0			
	Course Status	Core /Elective/Open Elective			
5	Course Objective	The main objective is to make student think constructively and analytically about how to design and evaluate interactive technologies.			
6	Course Outcomes	CO1: Define the capabilities of both humans and computers from the viewpoint of HCI. CO2: Explain different types of User interfaces. CO3: Describe and use HCI design principles, standards and guidelines. CO4: Understand the fundamental aspects of designing and evaluating interfaces. CO5: Analyse and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems. CO6: Adapt methodologies to design, implement and evaluate a user interface for a project			
7	Course Description	HCI is an interdisciplinary field that integrates theories and methodologies from computer science, cognitive psychology, design, and many other areas. This course is an introduction to the fundamentals of human-computer interaction, user interface design, and usability analysis. Students will learn principles and guidelines for usability and apply them through critiques of existing interfaces and development of new ones.			
8	Outline syllabus				CO Mapping
	Unit 1	**Introduction**			
	A	Introduction to HCI, CHI, MMI, Human System Interaction, Importance of User Interface, Importance of Good Design, Benefits of Good Design, Principles of User Interface Design			CO1
	B	Techniques and Tasks, Basic Interaction Tasks, Composite Interaction Task, Interaction Styles, Speech			CO1

		Recognition, Natural Language Processing, Fields of HCI	
	C	The Contents of Human-Computer Interaction, Nature of Human-Computer Interaction, Applications , Goals and Aspects , HCI Groups	CO1
,	**Unit 2**	**Interfaces**	
	A	Term Interface, Good and Bad Interfaces, Features of a Good Interface,	CO2,CO6
	B	User interface, Quality of User Interface, Types of User Interfaces, Command Line Interface, Advantages of Command Line Interface, Graphical User Interface	CO2,CO6
	C	Document Interfaces and their types, Single Document Interface (SDI), Multiple Document Interface (MDI), Tabbed Document Interface.	CO2,CO6
	Unit 3	**User Interface Design & GUI**	
	A	Understanding How User Interact With Computers, User Interface Models, Design Methodologies, Designing an Interface, Process of Interaction Design.	CO3,CO6
	B	Human Interaction with Computers, Human Interaction Speeds, Human Characteristics in Design, Human Consideration in Design, Eight golden rules user interface design	CO3,CO6
	C	Popularity of Graphics, Characteristics of Graphical User Interface, Concepts of Direct Manipulation, Graphical System Advantages and Disadvantages, Web User Interface Characteristics and Popularity	CO3,CO6
	Unit 4	**Design Models and Ergonomics**	
	A	User interface models, User interface design methodologies, Efficacy of user interface design, Dialogue box design, Development and evaluation of user interface design, user centered design.	CO4,CO6
	B	Factors in user interface design, HCI design models, Process of interface analysis,	CO4,CO6
	C	User documentation, Ergonomics introduction, Human factors, Physical issues in ergonomics, cognitive issues in ergonomic	CO4,CO6
	Unit 5	**Usability**	
	A	Usability introduction & its need, usability acceptability,	CO5,CO6
	B	What to measure in Usability, Usability Engineering,	CO5,CO6
	C	Life cycle, how to achieve high usability, Usability evaluation and testing, Learnability, Flexibility.	CO5,CO6

	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Alan Dix, Janet Finlay, Gregory Abowd. Ruel Beale "Human Computer Interaction",PHI.			
	Other References	1. Kumar Rajendra, " Human Computer Interaction" Second Edition, Firewall Media New Delhi. 2. Ben Shneiderman, "Design the User Interface: Strategies for Effective Human-Computer Interaction" Pearson Education.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the capabilities of both humans and computers from the viewpoint of HCI.	PO1,PO4,PO5,PO6,PO7,PO8,PO9, PO10,PO12,PSO1
2.	CO2: Explain different types of User interfaces.	PO1,PO2,PO4,PO5,PO6,PO7,PO8,PO9, PO10,PO12,PSO1
3.	CO3: Describe and use HCI design principles, standards and guidelines.	PO1,PO2,PO4,PO5,PO6,PO7,PO8,PO9, PO10,PO12,PSO1
4.	CO4: Understand the fundamental aspects of designing and evaluating interfaces.	PO1,PO2,PO4,PO5,PO6,PO7,PO8,PO9, PO10,PO12,PSO1
5.	CO5: Analyze and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems.	PO1,PO2,PO3,PO4,PO5,PO6,PO7,PO8,PO9, PO10,PO11,PO12,PSO1
6.	CO6: Adapt methodologies to design, implement and evaluate a user interface for a project	PO1,PO2,PO3,PO4,PO5,PO6,PO7,PO8,PO9, PO10,PO11,PO12,PSO1,PSO2

PO and PSO mapping with level of strength for Course Name Human Computer Interaction(Course Code INT 249)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
INT249_Human Computer Interaction	CO1	1	-	-	1	1	1	2	1	2	3	-	3	1	-	-
	CO2	1	1	-	1	1	1	2	2	2	3	-	3	1	-	-
	CO3	1	1	-	1	1	1	2	2	2	3	-	3	2	-	-
	CO4	1	2	-	1	1	1	2	2	2	3	-	3	1	-	-
	CO5	3	3	3	3	2	1	2	2	2	3	3	3	1	-	-
	CO6	2	3	3	3	2	2	3	2	2	3	3	3	3	2	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PSO 3
INT249	Human Computer Interaction	1.5			1.6	1.3	1.1	2.1	1.8	2	3	3	3	1.5	2	-

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering & Technology**	
Department		**Computer Science & Engineering**	
Program:		**B.Tech**	
Branch:		**CSE**	
1	Course Code	CIP011	
2	Course Title	Android with IoT Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Elective	
5	Course Objective	This course aim to give an overview of Android with IoT, its architecture, challenges and applications in different context.	
6	Course Outcomes	CO1: Demonstrate the basics of Android Things on Raspberry CO2: Build the Android Things project CO3: Construction of connecting control peripherals with Android Things CO4: Experiment with GPIO pins and PIR sensors using Android Things CO5: Develop a small Android App with IoT CO6: Build IoT application using Android Things	
7	Course Description	The course is intended to know fundamentals of Android Platform, Android application components; integration of Android with IoT, The main focus is on implementing IoT projects using Android Things.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
		Install Android Things on Raspberry	CO1, CO6
		Testing the installation: Connect Raspberry Pi to a video using the HDMI, Connect Raspberry Pi to your network using the LAN connection, Connect Raspberry Pi to your Mac/PC using a USB cable	CO1, CO6
	Unit 2	**Android Things Project**	
		Creating the first Android Things project	CO2, CO6
		Cloning the template project, Create the project manually	CO2, CO6
	Unit 3	**Connecting Control peripherals with Android Things**	
		Study the Android Things and how it works	CO3, CO6
		Create your first Android Things app	CO3, CO6
	Unit 4	**Android Things with IoT-I**	
		Creating an Alarm System Using Android Things	CO4, CO6
		Use GPIO pins and PIR sensors, handle events from a GPIO pin	CO4, CO6
	Unit 5	**Android Things with IoT-II**	
		Build an app that is independent of the board	CO5, CO6

		Implementation of notifying events from Android Things to Android			CO5, CO6
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	CE (Viva)	ESE	
		25%	25%	50%	
	Text book/s*	5. Android Things Projects by Francesco Azzola Publisher: Packt Publishing 6. Anubhav Pradhan and Anil V. Deshpande , Composing Mobile Apps: Learn, Explore, Apply Using Android , 1st Edition, Wiley India.			
	Other References				

PO and PSO mapping with level of strength for Android with IoT Lab CIP011

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CIP011 _Android with IoT Lab	CO1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
	CO2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2
	CO3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
	CO4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
	CO5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PS O 3
CIP011	Android with IoT Lab	2.3	2.0	2.0	2.0	3.0	2.0	2.0	2.2	2.5	2.5	2.5	2.7	2.7	2.0	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1)*** ***extent*** ***2.*** Addressed to ***Moderate (Medium=2)*** ***extent***
3. Addressed to ***Substantial (High=3)*** ***extent***

School:		**School of Engineering & Technology**
Department		**Computer Science & Engineering**
Program:		**B.Tech**
Branch:		**CSE**
1	Course Code	CIP202
2	Course Title	IoT: Architecture and Programming Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Core
5	Course Objective	This course provides a preliminary view on Logical and Physical Design of IoT systems and gives an overview of Data analytics for IoT.
6	Course Outcomes	CO1: Demonstrate the concepts of IoT for home automation and security. CO2: Develop of logical design of IoT System using Python. CO3: Construct the Raspberry Pi interfaces with Python CO4: Interpret the IoT Physical Servers and Cloud Offerings CO5: Evaluate data analytics for IoT using Apache Hadoop CO6: Utilize the IoT reference architecture required in building IoT based solutions.
7	Course Description	The course focuses on understanding the vision of IoT from a global perspective, understand its applications, and determine its market perspective, using gateways, devices and data management, building a state of art architecture in IoT and its applications in commercial building automation and real world design constraints.

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to IoT**	
		Sending e-mail from IoT kit.	CO1
		Internet based home automation and home security system	CO1
	Unit 2	**IoT Systems- Logical Design using Python**	
		Python-Based Multicolored-LED control	CO1, CO2
		Water level monitoring using Python and Moisture sensing and logging using python.	CO1, CO2
	Unit 3	**IoT Physical Devices and Endpoints**	
		Touchscreen photo-booth with a Raspberry Pi	CO1, CO2, CO3
		Raspberry Pi weather forecast display and Programming Raspberry Pi for Home automation system.	CO1, CO2, CO3
	Unit 4	**IoT Physical Servers and Cloud Offerings**	
		Internet or intranet controlled motor	CO1, CO2, CO4
		Design IoT-Enabled Embedded Web Server and Server-less based web application.	CO1, CO2, CO4
	Unit 5	**Data analytics for IoT**	

		Improvement of smart city technologies to reduce pollution levels			CO5, CO6
		Enhance traffic conditions and Internet-based street light control			CO5, CO6
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Arshdeep Bahga and Vijai Madisetti : A Hands-on Approach "Internet of Things", Universities Press 2015. 2. "Internet of Things with Python" Gastón C. Hillar,Published by Packt Publishing Ltd. Livery Place 35 Livery Street Birmingham B3 2PB, UK. ISBN 978-1-78588-138-1			
	Other References	1. Kamal, R., (2017), Internet of Things - Architecture and Design Principles, 1st Edition, Mcgraw Hill. 2. Misra, S., Introduction to Internet of Things, NPTEL Course Material, Department of Computer Science & Engineering, Indian Institute of Technology Kharagpur, https://nptel.ac.in/courses/106105166/ 3. Samuel Greengard, " The Internet of Things", The MIT press, 2015. 4. Adrian McEwen and Hakim Cassimally "Designing the Internet of Things "Wiley,2014.			

PO and PSO mapping with level of strength for IoT: Architecture and Programming Lab CIP202)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CIP202 _IoT: Architecture and Programming Lab	CO1	2	2	1	2	2	2	2	-	2	1	3	3	2	2	-
	CO2	2	2	2	1	2	-	-	-	2	-	2	3	2	2	-
	CO3	2	2	2	1	2	-	-	-	2	-	3	3	2	2	-
	CO4	2	2	2	1	2	-	-	2	2	-	3	3	2	2	-
	CO5	2	2	2	2	2	-	-	2	2	-	3	3	3	3	-
	CO6	2	2	2	2	2	3	2	2	3	1	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PS O 3
CIP202	**IoT: Architecture and Programming Lab**	2.0	2.0	1.8	1.5	2.0	2.5	2.0	2.0	2.2	1.0	2.8	3.0	2.3	2.3	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

B.Tech (CSE) with Specialization in Full Stack Web Development in association with Xebia Academic Alliance

Syllabus: Fundamentals with craftsmanship

School: SET		**Batch: 2023-2027**
Program: B. Tech		**Current Academic Year: 2023-24**
Branch: CS		**Semester: 1**
1	Course Code	
2	Course Title	**Fundamentals with craftsmanship**
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Core/Compulsory
5	Course Objective	The course aims to provide an understanding of software craftsmanship principles and practices, code design, structure, formatting, documentation, testing, debugging, and refactoring techniques.
6	Course Outcomes	CO1: Recall and identify software development processes and paradigms, and recognize the principles of software craftsmanship to develop code. CO2: Understand the fundamental concepts of clean code design, software design considerations, and principles of software design to develop software systems. CO3: I Apply best practices for organizing code using classes, packages, and methods, and evaluate the quality of code based on characteristics such as size, cohesion, and coupling. CO4: Apply best practices for code formatting and documentation, including naming conventions, intention-revealing names, and appropriate use of comments, to ensure clear and maintainable code. CO5: Apply software testing and debugging techniques, including TDD, unit testing, and refactoring, to improve the quality and maintainability of code. CO6: Apply basic test-driven development (TDD) principles to write test cases before implementing code.
7	Course Description	This course covers the essential topics of software craftsmanship, including software design principles, code structure, formatting and documentation, and testing, debugging and refactoring techniques. Students will learn about the history and emergence of software craftsmanship, various programming paradigms, and best practices for writing well-crafted code. Additionally, the

		course will cover SOLID design principles, design patterns, and software metaphors. Students will gain practical experience with unit testing, refactoring, and using frameworks and tools. The course aims to develop students' ability to create high-quality, maintainable code that meets industry standards.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Software Craftsmanship**	
	A	Definition, History of the emergence of software craftsmanship, Software craftsmanship, Process versus paradigm, Software development processes, Software development models	CO1
	B	Software design paradigms, Software development paradigms, Major programming paradigms Procedural programming paradigm, Object-oriented programming paradigm, Functional programming paradigm,	CO1
	C	Dimensions of craftsmanship, Craftsmanship - Mastery of the paradigm Describing and defining well-crafted code, Becoming a craftsman, The programming process	CO1
	Unit 2	**Code Design**	
	A	Clean code and its fundamental concepts, Code Design, Software design considerations,	CO2
	B	Kent Beck's principle of simple design, Fundamental characteristics of good design,	CO2
	C	Design Patterns: Reusing best practices, SOLID design principles, Programming Principles	CO2
	Unit 3	**Code Structure**	
	A	Classes, packages and methods: building blocks of code, organizing code: the size of methods and classes,	CO3
	B	What makes methods and classes "good", Software metaphors,	CO3
	C	Objects and data structures, data transfer objects, Using libraries, Overview of the best practices in structure: Law of demeter and open close principle	CO3
	Unit 4	**Code Formatting & Documentation**	

	A	Introduction, Variants, Vertical Openness,Vertical Density, Distance and Ordering,	CO4
	B	Naming Best Practices, Intention-Revealing Names,Avoid Mental Mappings,	CO4
	C	Naming Classes, Methods and Functions, Comments, Writing Code Documentation	CO4
	Unit 5	**Testing Debugging & Refactoring-**	
	A	Testing and Debugging, Basic Test-driven Development (TDD), Categories of TDD and Unit tests, Unit Testing Techniques, Automating Testing Using Junit,	CO5, CO6
	B	Refactoring: Improving Structure, Refactoring: Changing Code Structure without Changing Functionality, The need for Refactoring, The Refactoring Process and the Different Levels of Refactoring, Refactoring Strategies,	CO5, CO6
	C	Code Smells: Symptoms of Poorly Designed Code, Categories of Code Smells, Code Base, Using Frameworks & Tools	CO5, CO6
	Mode of examination	Theory	
	Weightage Distribution	CA | MTE | ETE	
		25% | 25% | 50%	
	Text book/s*		
	Other References		

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Recall and identify software development processes and paradigms, and recognize the principles of software craftsmanship to develop code	PO1, PO2, PO3, PO4, PO5, PO10, PSO1, PSO2
2.	CO2: Understand the fundamental concepts of clean code design, software design considerations, and principles of software design to develop software systems	PO1, PO2, PO3, PO4, PO8, PO10, PSO1, PSO2
3.	CO3: I Apply best practices for organizing code using classes, packages, and methods, and evaluate the quality of code based on characteristics such as size, cohesion, and coupling	PO1, PO2, PO3, PO4, PO5, PO9, PSO1, PSO2
4	CO4: Apply best practices for code formatting and documentation, including naming conventions, intention-revealing names, and appropriate use of comments, to ensure clear and maintainable code	PO1, PO2, PO3, PO4, PO6, PO7, PSO1, PSO2
5	CO5: Apply software testing and debugging techniques, including TDD, unit testing, and refactoring, to improve the quality and maintainability of code.	PO1, PO2, PO3, PO4, PO5, PO8 PO10, PSO1, PSO2
6	CO6: Apply basic test-driven development (TDD) principles to write test cases before implementing code.	PO1, PO2, PO3, PO4, PO5, PO8 PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name Fundamentals with craftsmanship (Course Code)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	2	3	3	3	-	-	-	-	2	3	3
CO2	3	3	3	3	-	-	-	3	-	2	2	3
CO3	2	3	2	2	2	-	-	-	3	-	3	2
CO4	3	2	2	2	-	3	3	-	-	-	3	3
CO5	2	3	3	3	3	-	-	2	-	3	2	3
CO6	2	3	3	3	3	-	-	2	-	3	2	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
	Fundamentals with craftsmanship	2.5	2.7	2.7	2.7	2.7	3	3	2.3	3	2.5	2.5	2.8

Strength of Correlation:

1-**Slight (Low)**

2-**Moderate (Medium)**

3-**Substantial (High)**

Syllabus: UX Expert

School: SET		**Batch: 2023-27**
Program: B.Tech		**Current Academic Year: 2023-27**
Branch: CS		**Semester: II**
1	Course Code	
2	Course Title	UX Expert
3	Credits	3
4	Contact Hours (L-T-P)	3-0-1
	Course Status	Core/Compulsory
5	Course Objective	The course objective is to provide learners the skills to create dynamic and responsive web applications using various tools and technologies.
6	Course Outcomes	CO1: Identify key features of ES6 programming language. CO2: Understand React application using JSX syntax, components, and state, and apply validation to props using propTypes. CO3: Differentiate between functional and class components, explain React props and state, and utilize HTTP requests with Axios and FetchAPI in React applications. CO4: Develop a React application that incorporates event handling, conditional rendering, and forms with validation, and implement controlled and uncontrolled components using refs. CO5: Demonstrate the ability to utilizes routing and state management, including implementing routing and utilizing the Context API and Redux, while being able to explain the advantages and limitations of using Redux for state management. CO6: Analyze and evaluate the different routing mechanisms and strategies used in web applications.
7	Course Description	The course covers an introduction to Full Stack development, HTML, HTML5, CSS, JavaScript, and JavaScript functions, objects, and events. The purpose of this course is to give students the basic understanding of how things work in the Web world.
8	Outline syllabus	CO Mapping

	Unit 1	**Introduction to ES6**	
	A	Introduction to ES6, ECMA Script, The let and const	CO1
	B	The arrow functions, Interface, Classes, Inheritance using extends, Spread Operator	CO1
	C	Iterators and Generators, using extends, Default Parameter Values, Spread Operator	CO1
	Unit 2	**Introduction to React**	
	A	Introduction to React, Features of React, Why React?, Angular vs React, Installation and Setup	CO2
	B	Introduction to JSX, Why JSX, Why JSX, Embedding JavaScript, Expression in JSX, JSX as an Expression, Nested elements in JSX, JSX Attributes, JSX Comments, JSX Styling and representation as object	CO2
	C	The State of the Component, Defining State, Changing the State, Props, Validation, Validators	CO2
	Unit 3	**React Components**	
	A	Introduction to React Components, Components based Architecture, Type of Components, Functional vs Class Components	CO3
	B	React Props and State, Component Life Cycle, Error Boundaries, Introduction to List in React, why keys	CO3
	C	How to make HTTP Request, Introduction to Axios and FetchAPI, Styling in React, Different way of Styling components	CO3
	Unit 4	**Events & Forms in React**	
	A	Event Handling in React, Conditional Rendering, creating forms in React,	CO4
	B	How to add validation in forms, Introduction to Refs	CO4
	C	Controlled Components, Uncontrolled Components	CO4
	Unit 5	**Routing & State Management**	

	A	Introduction to Routing, How to implement Routing, What is State Management			CO5, CO6
	B	Introduction to Context API, Introduction to Redux			CO5, CO6
	C	Advantage of using Redux, Limitation of Redux, Redux Installation			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Mark Tielens Thomas, "React in Action", Manning Publications 2. Robin Wieruch "The Road to Learn React: Your Journey to Master Plain Yet Pragmatic React.Js", Zaccheus Entertainment			
	Other References	1. Jon Duckett "JavaScript and jQuery: Interactive Front-End Web Development" , Wiley			

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Identify key features of ES6 programming language.	PO1, PO2, PO3, PO5, PO10, PSO1
2.	CO2: Understand React application using JSX syntax, components, and state, and apply validation to props using propTypes.	PO1, PO2, PO3, PO4, PO8, PO10, PO12, PSO1, PSO2
3.	CO3: Differentiate between functional and class components, explain React props and state, and utilize HTTP requests with Axios and FetchAPI in React applications.	PO1, PO2, PO3, PO4, PO5, PO8, PO9, PO10, PSO1, PSO2
4	CO4: Develop a React application that incorporates event handling, conditional rendering, and forms with validation, and implement controlled and uncontrolled components using refs.	PO1, PO2, PO3, PO4, PO5, PO6, PSO1, PSO2

5	CO5: Demonstrate the ability to utilizes routing and state management, including implementing routing and utilizing the Context API and Redux, while being able to explain the advantages and limitations of using Redux for state management.	PO1, PO2, PO3, PO4, PO5, PO6, PO8 PO10, PSO1, PSO2
6	CO6: Analyze and evaluate the different routing mechanisms and strategies used in web applications.	PO1, PO2, PO3, PO4, PO5, PO6, PO8 PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name: UX Expert..(Course Code ……..)

Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	1	3	-	-	-	-	**2**	**-**	**2**	**3**	3
CO2	2	1	2	2	-	-	-	2	-	**2**		**2**	**2**	3
CO3	3	2	2	2	3	-	-	2	3	**2**		**2**	**3**	2
CO4	3	3	2	2	2	2	-	-	-	**1**		**2**	**3**	3
CO5	3	3	3	3	3	2	-	2	-	**3**		**2**	**2**	3
CO6	3	3	3	3	3	2	-	2	-	**3**		**2**	**2**	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**
		2.6	2.3	2.3	2.1	2.75	2		2	3	2.1		2	2.6	2.8

Strength of Correlation:

1-**Slight (Low)**

2-**Moderate (Medium)**

3-**Substantial (High)**

Syllabus: UI Specialist

School: SET		**Batch: 2023-27**	
Program: B.Tech		**Current Academic Year: 2023-27**	
Branch: CS		**Semester: II**	
1	Course Code		
2	Course Title	UI Specialist	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-1	
	Course Status	Core/Compulsory	
5	Course Objective	The course objective is to provide learners the skills to create dynamic and responsive web applications using various tools and technologies.	
6	Course Outcomes	CO1: Understand the basic concepts and components of Full Stack development and differentiate between Web development and Full Stack development. (L1) CO2: Identify and describe various HTML elements and attributes used to create structured and formatted web pages. (L2) CO3: Apply HTML5 and CSS3 techniques to design and develop responsive web pages with interactive features. (L3) CO4: Analyze and evaluate the use of JavaScript in developing interactive web applications. (L4) CO5: Demonstrate the ability to use JavaScript functions, objects, and events to manipulate and control data, elements, and events on a web page. (L3) CO6: Apply the JavaScript knowledge to implement Full Stack web application	
7	Course Description	The course covers an introduction to Full Stack development, HTML, HTML5, CSS, JavaScript, and JavaScript functions, objects, and events. The purpose of this course is to give students the basic understanding of how things work in the Web world.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	

	A	Introduction to Full Stack, Web development vs FullStack Development, Client-Server architecture	CO1
	B	MEAN, MERN, MEAN vs MERN stack	CO1
	C	Rails, Django Stack and LAMP, Front End Frameworks and Libraries	CO1
	Unit 2	**Introduction to HTML**	
	A	Intoduction, Need of HTMl, HTML Tags, HTML Elements, Formatting Text in HTML, Headings, HTML Paragraphs	CO2
	B	Identifying HTML Elements, HTML Basics & Attributes, HTML Links, Lists, Colors, Tables, Symbols	CO2
	C	Overview of Attributes, Core Attributes, Styles, Class Attribute, Generic Attributes	CO2
	Unit 3	**Creating web pages with HTML5 & CSS**	
	A	HTML5 introduced features, HTML5 form validate/no validate, HTML5 canvas, embedding audio, and video in a webpage, drag and drop, HTML5 Local Storage, HTML5 web workers and server sent events, HTML Attributes, Forms, Form Validation, Validation to HTML Page	CO2, CO3
	B	CSS Semantics, CSS Selectors CSS Styling, CSS Color, CSS Backgrounds, Borders, Margins, Padding, Box Model, Height width, Tables, Selectors, Display, CSS Buttons, CSS Animation, CSS Display, CSS Float & Clear, CSS Overflow	CO3
	C	CSS Align- Horizontal & Center Responsive Web Design, View Port, Grid View, Media Queries, Flex Box	CO3
	Unit 4	**JavaScript**	
	A	JavaScript, importance, What can JavaScript Do, Need of JavaScript, JavaScript with HTML Content, HTML Attributes, HTML DOM Elements Java script with CSS	CO4
	B	HTML Nodes, Syntax, Rules, Writing JavaScript, Tags, Programming Errors, Syntax Error, Runtime Error, Logical Errors, Data Types, Non-primitive, JavaScript Data Types,	CO4
	C	Objects in JavaScript, Events in JavaScript Objects, Changing HTML Styles, Events, Event Handler	CO4, CO6

		Attributes, Adding Event Handlers, Using Element Attribute directly, Using Event Attribute, Using HTML DOM, Reacting to Events			
	Unit 5	**JavaScript Functions, Objects & Events**			
	A	Introduction, Execution of Functions, Invoking Functions, As methods, As constructor, call (), arguments, apply (), bind (), Nesting Functions & Closure, Objects			CO5, CO6
	B	Primitive Values, Strings & Objects, Creating JS Object, Literal Syntax, New Keyword, Adding Methods to Objects, JavaScript			CO5, CO6
	C	Arrays Creating arrays, elements in array access, changing array elements, objects Arrays, recognizing Arrays, Looping Array, Array Methods, Adding Array Elements using Array Methods, Removing Last Array Elements, Converting Array into Strings, Converting and Joining Array into Strings with special separator, Array Methods & Manipulations, Sorting Array Methods, Iteration Methods, The Map ()			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Ivan Bayross, “HTML,DHTML, JavaScript, Perl & CGI”, BPB Publication 2. Rick Delorme,” Programming in HTML5 with JavaScript and CSS3”, Microsoft			
	Other References	1. POWELL and THOMAS “Html & CSS: The Complete Reference” , McGraw Hill			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Understand the basic concepts and components of Full Stack development and differentiate between Web development and Full Stack development.	PO1, PO2, PO3, PO5, PO10, PSO1
2.	CO2: Identify and describe various HTML elements and attributes used to create structured and formatted web pages.	PO1, PO2, PO3, PO4, PO8, PO10, PO12, PSO1, PSO2
3.	CO3: Apply HTML5 and CSS3 techniques to design and develop responsive web pages with interactive features.	PO1, PO2, PO3, PO4, PO5, PO8, PO9, PO10, PSO1, PSO2
4	CO4: Analyze and evaluate the use of JavaScript in developing interactive web applications.	PO1, PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
5	CO5: Demonstrate the ability to use JavaScript functions, objects, and events to manipulate and control data, elements, and events on a web page.	PO1, PO2, PO3, PO4, PO5, PO6, PO8 PO10, PSO1, PSO2
6	CO6: Apply the JavaScript knowledge to implement Full Stack web application	PO1, PO2, PO3, PO4, PO5, PO6, PO8 PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name: UI Specialist …..(Course Code ……..)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	3	-	-	-	-	**2**	**-**	**2**	**3**	3
CO2	2	1	2	2	-	-	-	2	-	**2**		**2**	**2**	3
CO3	3	2	2	2	3	-	-	2	3	**2**		**2**	**3**	2
CO4	3	3	2	2	2	2	-	-	-	**1**		**2**	**3**	3
CO5	3	3	3	3	3	2	-	2	-	**3**		**2**	**2**	3
CO6	3	3	3	3	3	2	-	2	-	**3**		**2**	**2**	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PSO 1	PSO 2
		2.6	2.3	2.3	2.1	2.8	2		2	3	2.1		2	2.5	2.8

Strength of Correlation:

1-**Slight (Low)**

2-**Moderate (Medium)**

3-**Substantial (High)**

Syllabus: Backend Development

School:		**School of Engineering & Technology**
Department		**Computer Science & Engineering**
Program:		**B.tech**
Branch:		**Semester: IV**
1	Course Code	
2	Course Title	**Backend Development**
3	Credits	4
4	Contact Hours (L-T-P)	3-0-2
	Course Status	
5	Course Objective	1- Understand fundamentals of Node.js open-source platform for web application development. 2- Demonstrate the knowledge of different techniques for the purpose of back-end development. 3- Apply theories and concepts associated with effective work design to real world applications.
6	Course Outcomes	after studying this course student will be able to: **CO1:** Describe fundamentals of Node.js and visual studio *for the purpose of web application development.* **CO2:** Analyse the working of file system and buffering modules of Node.js for the purpose of handling and designing files and streaming of binary data. **CO3:** Analyse asynchronous programming techniques in order to start a potentially long running task. **CO4:** Apply the concept of express node routing framework. **CO5:** Apply REST API for data accessing and manipulation**.** **CO6:** Develop various web application projects by using different mechanism of Node.js.
7	Course Description	Students will learn the fundamental concepts of Node.js, visual Studio, express node routing framework and other associated API through working in teams on web application projects, supported by lectures, discussions, and implementation. They will learn to evaluate and design usable and appropriate software based on technical analysis.

8	Outline syllabus		CO Mapping
	Unit 1		
	A	Introduction to Node.js-What is Node.js, History of Node.js, Why Node.js, Node.js Architecture, Working and Features.	CO1
	B	Installation and Setup, Installing Node.js, Launching REPL.	CO1
	C	Environment, Installing Visual Studio, Code Editor, Components of Node.js, Node.js success stories, Node.js architecture, Features, Nodejs Module.	CO1
	Unit 2		

	A	NPM- File Systems, Operating Systems.	CO2
	B	Writing to Buffers, Reading from Buffers, Concatenating Buffers, Copying Buffers, Slicing Buffers.	CO2
	C	The Stream Module, Reading from Stream, Writing to Stream, Pipes, Pipe Chaining.	CO2
	Unit 3		
	A	Asynchronous Programming in Node.js- Explain the Event Loops, Callback hell	CO3
	B	Promises, how to work with Promises, discuss about Async and Await, Error Handling	CO3
	Unit 4		
	A	Express Framework, Installing Express, Express Request.	CO4
	B	Request Properties, Express Response, Response Object Properties	CO4
	C	Response Object Methods, Routing, Routing Parameters, Middleware	CO4
	Unit 5		
	A	Node.js to Build REST APIs- BUILLDING A REST API, Request Object, Response Object.	CO5, CO6
	B	The GET, The GET with Parameter, The POST, create a REST API for User Management, creating a CRUD API using Express, GET Route, Using POSTMAN.	CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva	
	Text book/s*		
	Other References		

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:** Describe fundamentals of Node.js and visual studio *for the purpose of web application development*	PO1, PO2, PO3, PO5
2.	**CO2:** Analyse the working of file system and buffering modules of Node.js for the purpose of handling and designing files and streaming of binary data	PO1, PO2, PO3, PO5, PO9, PO10
3.	**CO3***:* Analyse asynchronous programming techniques in order to start a potentially long running task.	PO1, PO2, PO3, PO9
4.	**CO4***:* Apply the concept of express node routing framework	PO1, PO2, PO3, PO5, PO9, PO10
5.	**CO5:** Apply REST API for data accessing and manipulation	PO1, PO2, PO3, PO5, PO9, PO10
6.	**CO6:** Develop various web application projects by using different mechanism of Node.js.	PO1, PO2, PO3, PO5, PO9, PO10, PO11, PO12

PO and PSO mapping with level of strength

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O 1	PSO2
Backend Development	CO1	5	3	3		4							
	CO2	1	5	4		5				4	1		
	CO3	3	3	3						4			
	CO4	3	3	3		4				3	3		
	CO5	2	2	2		3				4	4		
	CO6	2	2	2		3				4	4	3	3

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
	Backend Development												

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Syllabus: Test Automation

School:		**School of Engineering & Technology**
Department		**Computer Science & Engineering**
Program:		**B.Tech**
Branch:		**Semester: V**
1	Course Code	
2	Course Title	**Test Automation**
3	Credits	3
4	Contact Hours (L-T-P)	2-0-2
	Course Status	
5	Course Objective	*1- Understand fundamentals and techniques of software testing for the purpose of UI testing.* *2- Analyse and apply different automated testing tools.* *3- Design and develop test suite for the purpose of application testing and perform comparative study on manual and automated testing.*
6	Course Outcomes	after studying this course student will be able to: **CO1:** Define fundamentals and technologies of software testing in order to test the different functionalities. **CO2:** Analyse the task of different automated testing tools for web applications. **CO3:** Apply the concept of selenium 3.x automated tool in order to perform automated testing. **CO4:** Contrast the working of manual testing with automated testing. **CO5:** Design test suite for platform testing. **CO6:** Develop real world web applications on the basis of technical analysis and perform automated testing by using different tools.
7	Course Description	Student will learn the basics of software testing including functional and GUI testing. They will perform comparative survey based on the automated and manual testing. Student will apply various modern tools for the purpose of automated testing by designing test cases.

8	Outline syllabus		CO Mapping
	Unit 1		
	A	Introduction to Software Testing- Seven principles of Software Testing, SDLC vs STLC, Testing Life Cycle.	CO1
	B	Usability Testing, why do we need Usability Testing, how to do Usability testing, Advantages & Disadvantages.	CO1

	C	Functional Testing, End to End Testing, Methods, Advantages & Disadvantages, Compatibility Testing, Types GUI testing, Techniques API testing, Advantages.	CO1
	Unit 2		
	A	Test Automation- Selenium, Selenium components, Selenium Architecture.	CO2
	B	TestNGInstalling TestNg in Eclipse, TestNG annotations – Understanding usage, setting priority of execution for test cases.	CO2
	C	Hard Assertion, Soft Assertion, TestNG Reports, ANT-Downloading & Configuring, XSLT report generation using TestNg and Ant, Creating Test Scripts using JavaScript	CO2
	Unit 3		
	A	Introduction to Selenium 3.x- Describe Selenium 3.x advantages and implementation, define drivers for Firefox, IE, chrome, iPhone, Android etc, Analyse first Selenium Code, differentiate between Close and Quit.	CO3
	B	Describe Firepath and firebug Add-ons installation in Mozilla, inspect elements in Mozilla, Chrome and IE, Identifying Web Elements using id, name, class, Generate own CSS Selectors. Differentiate between performance of CSS Selectors as compared to Xpaths	CO3
	C	Define class attribute, Handle Dynamic objects/ids on the page, Analyse whether object is present on page or not	
	Unit 4		
	A	Manual Testing- Manual Testing, Manual Testing – How to Approach? Manual Testing – Myth and fallacy, Defect Life Cycle, Qualities of a good Manual Tester.	CO4
	B	Manual Testing vs Automation Testing, Types, System Testing, Acceptance Testing, Unit Testing, Techniques, Integration Testing, Smoke- Sanity Testing.	CO4
	Unit 5		
	A	Introduction to Test Design-Test Scenario.	CO5, CO6
	B	Test Case Design, Test Basis Traceability Matrix.	CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva	
	Text book/s*		
	Other References		

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program

		Specific Outcomes (PSO)
1.	**CO1:** Define fundamentals and technologies of software testing in order to test the different functionalities.	PO1, PO2
2.	**CO2:** Analyse the task of different automated testing tools for web applications.	PO1, PO2, PO3, PO5
3.	**CO3:** Apply the concept of selenium 3.x automated tool in order to perform automated testing.	PO1, PO2, PO3, PO5, PO9, PO10
4.	**CO4:** Contrast the working of manual testing with automated testing.	PO1, PO2, PO3, PO4, PO10
5.	**CO5:** Design test suite for platform testing.	PO2, PO3, PO5, PO10
6.	**CO6:** Develop real world web applications on the basis of technical analysis and perform automated testing by using different tools.	PO1, PO2, PO3, PO4, PO5, PO6, PO9, PO10

PO and PSO mapping with level of strength

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO2
	CO1	3	3										
	CO2	3	3	3		3							
	CO3	3	3	3		5				2	2		
	CO4	3	3	3	3						3		
	CO5		3	3		5					4		
Test Automation	CO6	2	2	2	2	5	3			3	3		

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
	Test Automation												

Strength of Correlation

1. Addressed to ***Slight (Low=1)*** ***extent*** ***2.*** Addressed to ***Moderate (Medium=2)*** ***extent***

3. Addressed to ***Substantial (High=3)*** ***extent***

Syllabus: Database Engineering

School: SET		**Batch: 2023-2027**
Program: B. Sc.		**Current Academic Year: 2023-24**
Branch: CS		**Semester: VI**
1	Course Code	
2	Course Title	Database Engineering with MongoDB
3	Credits	4
4	Contact Hours (L-T-P)	3-0-2
	Course Status	Core/Compulsory
5	Course Objective	To develop skills in analyzing the knowledge of file system namespace, NoSQL database approach, sharding in NoSQL, MongoDB operations, and read and query operations.
6	Course Outcomes	CO1: Understand file system namespace, terminology, hierarchy, and limitations of traditional file systems. CO2: Recognize the benefits and types of NoSQL databases, including key-value, wide-column, document, and graph-based databases. CO3: Identify database scaling, replication, sharding, and its challenges, along with the scaling of NoSQL databases. CO4: Apply MongoDB principles, design goals, tools, CRUD operations, and basic commands to install, use features, and operate MongoDB. CO5: Demonstrate the application of MongoDB query operators, projections, and indexes to filter and sort data using nested documents and arrays, as well as querying on nested arrays with multiple conditions. CO6: Elaborate on MongoDB query operations' implementation with purpose, syntax, and examples on nested documents and arrays.
7	Course Description	The course explores a range of topics related to database engineering, including traditional storage devices, file systems, NoSQL databases, sharding, replication, and MongoDB, with a focus on practical application and analysis of these concepts.

8	Outline syllabus		CO Mapping
	Unit 1	**The File System Namespace**	
	A	Introduction to Data Storage, Types of Data Storage Media, Traditional Storage Devices.	CO1
	B	he File System Namespace – an Introduction, File Systems, File System Terminologies, Extents and Attributes, File Metadata, Directories, Some Basic Filesystem Operations.	CO1
	C	File System Hierarchy, Common File Systems, Limitations of Traditional File Systems	CO1
	Unit 2	**NoSQL Database Approach**	
	A	What is the NoSQL approach? Why Use the NoSQL	CO2

		Approach?, Benefits of NoSQL.	
	B	Types of Databases, Key-Value Stores, Wide-column Stores/Columnar Databases.	CO2, CO3
	C	Document/ Document-store/ Document oriented Databases, Graph based Databases.	CO2, CO3
	Unit 3	**Sharding in NoSQL**	
	A	Managing Database for Availability and Performance, Database Scaling, Database Distribution Models, Database Replication, Types of Database Replication, Master-Slave Replication, Peer-to-Peer Replication.	CO2, CO3
	B	Introduction to Sharding, Why Sharding, The Lookup Strategy, The Range Strategy, The Hash Strategy, When to Shard?, Sharding Challenges, Combining Sharding and Replication.	CO2, CO3
	C	Scaling of NoSQL Databases with Sharding, Algorithmic Sharding, Dynamic Sharding, Entity Groups, Hierarchical keys and Column-Oriented Databases.	CO2, CO3
	Unit 4	**Introduction to MongoDB & Its Operations**	
	A	Introduction to MongoDB, CAP Theorem, Collections & documents, understanding data types in MongoDB, Features of MongoDB Module.	CO4
	B	Overview of MongoDB, Principles & Design Goals for MongoDB Server and Database, MongoDB tools.	CO4
	C	MongoDB Installation on Windows, and Cloud, CRUD operations, Basic MongoDB Commands.	CO4
	Unit 5	**Read and Query Operations**	
	A	Importing data, Nested documents, Arrays in MongoDB, Sorting Documents, Mongo Shell / Driver, Query Comparison Operators, Nested Documents, Matching an embedded document.	CO5, CO6
	B	Query on Nested Field, Setting up filters using query operators, Arrays in MongoDB, Querying on Array, Querying the array for an Element, Querying for an Element, using operator, Querying to meet multiple criteria.	CO5, CO6
	C	Nested Arrays in MongoDB, Querying on Nested Arrays, Querying on Array of Embedded Documents, querying with multiple conditions on nested Fields, Projections Operations, Working with Indexes.	CO5, CO6

	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. "Database Systems: Design, Implementation, and Management" by Carlos Coronel, Steven Morris, and Peter Rob, published by Cengage Learning. 2. "MongoDB: The Definitive Guide" by Kristina Chodorow, published by O'Reilly Media. 3. "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence" by Pramod J. Sadalage and Martin Fowler, published by Addison-Wesley Professional.			
	Other References	1. "File System Forensic Analysis" by Brian Carrier, published by Addison-Wesley Professional.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Understand file system namespace, terminology, hierarchy, and limitations of traditional file systems	PO1, PO2, PO3, PO4, PO5, PO10, PSO1, PSO2
2.	CO2: Recognize the benefits and types of NoSQL databases, including key-value, wide-column, document, and graph-based databases.	PO1, PO2, PO3, PO4, PO8, PO10, PSO1, PSO2
3.	CO3: Identify database scaling, replication, sharding, and its challenges, along with the scaling of NoSQL databases	PO1, PO2, PO3, PO4, PO5, PO9, PSO1, PSO2
4	CO4: Apply MongoDB principles, design goals, tools, CRUD operations, and basic commands to install, use features, and operate MongoDB	PO1, PO2, PO3, PO4, PO6, PO7, PSO1, PSO2
5	CO5: Demonstrate the application of MongoDB query operators, projections, and indexes to filter and sort data using nested documents and arrays, as well as querying on nested arrays with multiple conditions	PO1, PO2, PO3, PO4, PO5, PO8 PO10, PSO1, PSO2
6	CO6: Elaborate on MongoDB query operations' implementation with purpose, syntax, and examples on nested documents and arrays	PO1, PO2, PO3, PO4, PO6, PO7, PO9, PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name Database Engineering with MongoDB **(Course Code:)**

Cos	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PSO 1	PSO2
CO1	3	2	3	3	3	-	-	-	-	2	3	3
CO2	3	3	3	3	-	-	-	3	-	2	2	3
CO3	2	3	2	2	2	-	-	-	3	-	3	2
CO4	3	2	2	2	-	3	3	-	-	-	3	3
CO5	2	3	3	3	3	-	-	2	-	3	2	3
CO6	3	3	3	3	-	2	2	-	2	2	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
		2.7	2.7	2.7	2.7	2.7	2.5	2.5	2.5	2.5	2.3	2.7	2.8

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Syllabus: Deployment with Development Operations

School: SET		**Batch: 2023-2027**	
Program: B. Sc.		**Current Academic Year: 2023-24**	
Branch: CS		**Semester: VI**	
1	Course Code		
2	Course Title	Deployment with Development Operations	
3	Credits	4	
4	Contact Hours (L-T-P)	3-0-2	
	Course Status	Core/Compulsory	
5	Course Objective	To develop a comprehensive understanding of DevOps principles, tools, and practices, enabling them to effectively implement and manage DevOps processes for efficient software development and deployment.	
6	Course Outcomes	CO1: Define DevOps principles, identify challenges in traditional IT systems, and understand the need for building a business case for DevOps. CO2: Utilize Linux, Git, Docker, Jenkins, and other tools to implement DevOps practices effectively. CO3: Apply version control systems, with a focus on Git, and understand the advantages of distributed version control. CO4: Analyze containerization concepts, Docker architecture, and deployment using Docker Swarm and Kubernetes. CO5: Design and implement advanced CI/CD processes, including code analysis, artifact management, and automated functional testing CO6: Elaborate the usage of different DevOps tool in real life.	
7	Course Description	This course is an overview of the modern Web technologies used for the Web development. The purpose of this course is to give students the basic understanding of how things work in the Web world.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to DevOps**	
	A	Definition of DevOps: Challenges of traditional IT systems & processes, History and emergence of DevOps, DevOps definition and principles governing DevOps.	CO1
	B	DevOps and Agile, the need for building a business use case for DevOps, Purpose of DevOps, Application Deployment, Automated Application Deployment.	CO1
	C	Application Release Automation (ARA), Components of Application Release Automation (ARA), Best Practices of CI, Benefits of CI, CAMS.	CO1
	Unit 2	**Introduction to DevOps Tools & Technologies**	

	A	Introduction to Linux (OS) & why it is important to know Linux while working with DevOps, Git & GitHub (SCM).	CO2
	B	Docker (Containerization), Jenkins (CI/CD Pipelines), Terraform (Provisioning), Maven (Build & Release Management), Ansible (Configuration Management).	CO2
	C	Selenium (Test Automation), AWS (Cloud Computing), SonarQube (Code Quality Checking), Prometheus/Nagios (Monitoring).	CO2
	Unit 3	**Source Code Management**	
	A	History of Version Control Systems (VCS), Basic operations in a VCS, Examples of version control systems, Subversion (SVN), Features and Limitations.	CO2, CO3
	B	Mercurial, Git, Overview, History - Linux and Git by Linus Torvalds, Advantages of Git, Explain how local version control works.	CO3
	C	Centralized Version Control Systems (CVCS), Distributed Version Control Systems (DVCS), advantages of DVCS, Private Workspace.	CO3
	Unit 4	**Application Containerization**	
	A	Understanding Containers: Transporting Goods Analogy, Problems in Shipping Industry before Containers, Shipping Industry Challenges, Container: Virtualization Introduction, Hypervisor, Scope of Virtualization, Containers vs Virtual Machines, Understanding Containers, Containerization.	CO4
	B	The Chroot System, FreeBSD Jails, Linux Containers (LXC), Docker, Introduction to Containerization Docker architecture, Docker Daemon (Container Platform), Docker Rest API , CLI Different environments.	CO4
	C	Development Environment Docker Swarm and Kubernetes, Jenkins Installation, Jenkins Dashboard & UI understanding, Jenkins Job, Jenkins Triggers, Jenkins Plugins, Multi Node cluster setup with architecture, Installing/Configuring Nexus Deploying the application to staging/prod environment, Docker integration with Jenkins, Static Pipeline.	CO4,CO6
	Unit 5	**Introduction to CI**	
	A	Continuous Integration Workflow, Benefits of Continuous Integration, How CI Benefits Distributed Teams, Continuous Delivery, Steps Involved in CICD,	CO5, CO6

		Pipelines, Prerequisites, Checklist, Business Drivers for Continuous Deployment, Benefits of Continuous Deployment.			
	B	The HP Laserjet Case Study, Automated code builds – Key metrics, Static Code Analysis, Snapshot, Sample Bug Report, Automated Unit Testing- JUNIT, Test Frameworks, Automated Unit Testing Process, Code Coverage analysis, Code Coverage Methods, Condition Coverage, Line Coverage, Publishing Code Coverage reports to Jenkins.			CO5, CO6
	C	Uploading build artifact to a repository, Advanced CI process, Automated Functional Testing, Publish Report to the Development Team, Google Canary release Case study.			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. "The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations" by Gene Kim, Jez Humble, Patrick Debois, and John Willis (Publisher: IT Revolution Press) 2. "DevOps for Dummies" by Emily Freeman (Publisher: For Dummies)			
	Other References	1. "Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation" by Jez Humble and David Farley (Publisher: Addison-Wesley Professional) 2. "Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale" by Jennifer Davis and Ryn Daniels (Publisher: O'Reilly Media)			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define DevOps principles, identify challenges in traditional IT systems, and understand the need for building a business case for DevOps.	PO1, PO2, PO3, PO4, PO5, PO10, PSO1, PSO2
2.	CO2: Utilize Linux, Git, Docker, Jenkins, and other tools to implement DevOps practices effectively.	PO1, PO2, PO3, PO4, PO8, PO10, PSO1, PSO2

3.	CO3: Apply version control systems, with a focus on Git, and understand the advantages of distributed version control.	PO1, PO2, PO3, PO4, PO5, PO9, PSO1, PSO2
4	CO4: Analyze containerization concepts, Docker architecture, and deployment using Docker Swarm and Kubernetes.	PO1, PO2, PO3, PO4, PO6, PO7, PSO1, PSO2
5	CO5: Design and implement advanced CI/CD processes, including code analysis, artifact management, and automated functional testing.	PO1, PO2, PO3, PO4, PO5, PO8 PO10, PSO1, PSO2
6	CO6: Elaborate the usage of different DevOps tool in real life.	PO1, PO2, PO3, PO4, PO6, PO7, PO9, PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name Deployment with Development Operations **(Course Code)**

Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**
CO1	3	2	3	3	3	-	-	-	-	2	3	3
CO2	3	3	3	3	-	-	-	3	-	2	2	3
CO3	2	3	2	2	2	-	-	-	3	-	3	2
CO4	3	2	2	2	-	3	3	-	-	-	3	3
CO5	2	3	3	3	3	-	-	2	-	3	2	3
CO6	3	3	3	3	-	2	2	-	2	2	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PSO 1**	**PSO 2**
	Deployment with Development Operations	2.7	2.7	2.7	2.7	2.7	2.5	2.5	2.5	2.5	2.3	2.7	2.8

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***