PROGRAMME STRUCTURE

SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY

Department of Computer Science & Applications

Bachelor of Computer Application
(Specilization in Artificial Intelligence & Machine Learning)

Programme Code: SET0103

Batch: 2023-26

Programme Structure									
Sharda School of Engineering & Technology									
Computer Science & Applications									
BCA (Artificial Intelligence- Machine Learning)									
Batch: 2023-26							SEMESTER: I		
S. No.	Course Code	Paper ID	Course	Teaching Load			Credits		Type of Course
									1. CC
									2. OE
									3. SEC
									4. AECC
				L	T	P			5. VAC-II
THEORY SUBJECTS									
1	BCA283		Artificial Intelligence	5	0	0	5		CC
2	BCA187		Fundamentals of Computer and Programming in C	3	0	0	3		DSC
	BCA041		Introduction to IoT	2	0	0	2		SEC
3	BCA176		Open Elective-I Introduction to Computers & Technology	3	0	0	3		OE
	BCA189		Introduction to Entrepreneurship Development						
4	ARP103		Communicative English-1	2	0	0	2		AECC
5	BCA173		Ethics and Social Implications of AI	3	0	0	3		VAC-1
Practical/Viva-Voce/Jury									
7	BCP187		Data Structures Using C-Lab	0	0	2	1		CC
8	BCP041		Probability and Statistics-Lab	0	0	2	1		CC
TOTAL CREDITS							20		

Programme Structure									
Sharda School of Engineering & Technology									
Computer Science & Applications									
BCA (Artificial Intelligence- Machine Learning)									
Batch: 2023-26							SEMESTER: II		
S. No.	Course Code	Paper ID	Course	Teaching Load			Credits		Type of Course
									1. CC
									2. OE
									3. SEC
									4. AECC
				L	T	P			5. VAC-II
THEORY SUBJECTS									
1	BCA286		Data Structures Using C	4	0	0	4		CC
2	BCA287		Probability and Statistics	3	0	0	3		CC
3	BCA288		Open Elective II Web Analytics	3	0	0	3		OE
	BCA289		Mobile Application Development						
4	CSP395		Technical Writing and Communication	3	0	0	3		SEC
5	ARP105		Communicative English -2	2	0	0	2		AECC
6	EVS201		Environmental Studies	3	0	0	3		VAC-2
Practical/Viva-Voce/Jury									
7	BCP286		Data Structures Using C-Lab	0	0	2	1		CC
8	BCP287		Probability and Statistics-Lab	0	0	2	1		CC
TOTAL CREDITS							20		

Programme Structure									
Sharda School of Engineering & Technology									
Computer Science & Applications									
BCA (Artificial Intelligence- Machine Learning)									
Batch: 2023-26								SEMESTER: III	
S. No.	Course Code	Paper ID	Course	Teaching Load			Credits		Type of Course 1. CC 2. DSE 3. OE 4. SEC 5. AECC 6. Audit Course
				L	T	P			
THEORY SUBJECTS									
1	BCA368		Machine Learning	5	0	0	5		CC
2	BCA184		Principles of Data Base Management System	3	0	0	3		CC
3	BCA186		Object Oriented Programming Using Java	3	0	0	3		DSE
4	BCA369		Open Elective III Introduction to Blockchain Technology	3	0	0	3		OE
	BCA370		Cyber Analytics						
5	BCA382		Software Engineering and Quality Assurance	3	0	0	3		SEC
6	ARP209		Logical Skills Building and Soft Skills	2	0	0	2		AECC
Practical/Viva-Voce/Jury									
7	BCP184		Principles of Data Base Management System-Lab	0	0	2	1		CC
8	BCP186		Object Oriented Programming Using Java-Lab	0	0	2	1		DSE
9	RBL001		Research Based Learning-1	0	0	2	0		Audit Course
TOTAL CREDITS							21		

Programme Structure									
Sharda School of Engineering & Technology									
Computer Science & Applications									
BCA (Artificial Intelligence- Machine Learning)									
Batch: 2023-26							SEMESTER: IV		
S. No.	Course Code	Paper ID	Course	Teaching Load			Credits		Type of Course 1. CC 2. DSE 3. OE 4. AECC 5. Audit Course
				L	T	P			
THEORY SUBJECTS									
1	BCA401		Deep Learning	5	0	0	5		CC
2	BCA185		Operating System and Unix Shell Programming	3	0	0	3		CC
3	BCA281		Application based Programming in Python	4	0	0	4		DSE
4	BCA402		Open Elective-IV Data Warehousing and Data Mining	3	0	0	3		OE
	BCA403		Social Media Analytics						
5	ARP305		Personality Development and Decision making Skills	2	0	0	2		AECC
Practical/Viva-Voce/Jury									
6	BCP185		Operating System and Unix Shell Programming -Lab	0	0	2	1		
7	BCP281		Application based Programming in Python -Lab	0	0	2	1		DSE
8	RBL002		Research Based Learning-2	0	0	2	0		Audit Course
TOTAL CREDITS							19		

Programme Structure									
Sharda School of Engineering & Technology									
Computer Science & Applications									
BCA (Artificial Intelligence- Machine Learning)									
Batch: 2023-26							SEMESTER: V		
S. No.	Course Code	Paper ID	Course	Teaching Load			Credits		Type of Course 1. CC 2. DSE 3. INTERNSHIP
				L	T	P			
THEORY SUBJECTS									
1	BCA285		Introduction to R	4	0	0	4		CC
2	BCA282		Computer Networks and Data Communication	4	0	0	4		CC
3	BCA501		Natural Language Processing	5	0	0	5		CC
4	BRM002		Research Methodology	3	0	0	3		DSE
Practical/Viva-Voce/Jury									
5	BCP285		Introduction to R-Lab	0	0	2	1		CC
6	RBL003		Research Based Learning-3	0	0	4	2		RBL
7	INC003		Industry Connect	0	0	2	1		INTERNSHIP
TOTAL CREDITS							20		

Programme Structure									
Sharda School of Engineering & Technology									
Computer Science & Applications									
BCA (Artificial Intelligence- Machine Learning)									
Batch: 2023-26							SEMESTER: VI		
S. No.	Course Code	Paper ID	Course	Teaching Load			Credits		Type of Course 1. CC 2. OE 3. DSE 4. VAC
				L	T	P			
THEORY SUBJECTS									
1	BCA601		Artificial Neural Networks	4	0	0	4		CC
2	BCA602		Computer Vision	5	0	0	5		CC
3	BCA603		Predictive Analytics	5	0	0	5		CC
4	BCA604		Open Elective –V Information Security and Cyber Laws	3	0	0	3		OE
	BCA605		Big Data Analytics						
Practical/Viva-Voce/Jury									
5	RBL004		Research Based Learning-4	0	0	4	2		DSE
6	CCU108		Community Connect	0	0	2	1	Qualifying Course	VAC
TOTAL CREDITS							20		

Course Modules

TERM-I

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**I**	
1	**Course Code**	**BCA283**	
2	**Course Title**	**Artificial Intelligence**	
3	**Credits**	**5**	
4	**Contact Hours (L-T-P)**	**5-0-0**	
	Course Status	Core	
5	Course Objective	The objective of the course is to introduce basic fundamental concepts in Artificial Intelligence (AI) and Expert Systems, 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: **CO1:** ***Relate*** the goals of Artificial Intelligence and AI and non-AI solution. **CO2:** ***Analyze and*** various AI uninformed and informed search algorithms. **CO3:** ***Extend*** knowledge representation, reasoning, and theorem proving techniques to real-world problems. **CO4:** ***Make use of*** various learning techniques to understand AI problems. **CO5:** ***Explain*** about Expert system & discuss various case studies of it. **CO6:** ***Develop*** independent (or in a small group) research with help of AI techniques 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, The AI Problems, Importance of AI, AI and its related field, AI techniques, Criteria for success.	CO1
	B	Introduction to Intelligent Agents; Environment; Structure of Agent	CO1
	C	Problems, problem space and search: Defining the problem as a state space search, Production system and its characteristics, Issues in the design of the search problem.	CO1, CO2
	Unit 2	**SEARCH METHODS**	
	A	Problem Characteristics Searching strategies –Uninformed search and Informed search strategies. State space search, Uniformed search techniques: Depth first search, Breadth first search, Bidirectional Search,	CO1, CO2
	B	Informed search: Heuristic function, Hill climbing search, Best first search, A* & AO* Search, Generate and Test, Heuristic Search Techniques Hill climbing– issues in hill climbing. Problem solving using Search Techniques;	CO1, CO2
	C	Constraint satisfaction problem; Game tree, Evaluation function, Mini-Max search, Alpha-beta pruning, Games of chance.	CO1, CO2
	Unit 3	**KNOWLEDGE REPRESENTATION & REASONING**	
	A	Introduction to KR, Knowledge agent, Predicate logic, Inference rule & theorem proving forward chaining, backward chaining,	CO3
	B	Propositional knowledge, Boolean circuit agents; Rule Based Systems, Forward reasoning: Conflict resolution,	CO3
	C	Backward reasoning: Structured KR: Semantic Net - slots, inheritance	CO3
	Unit 4	**LEARNING**	
	A	Common Sense Vs Learning; Components; Representations; Feedback	CO3, CO4
	B	Learning Types: Supervised; Unsupervised; Reinforcement Learnings	CO3, CO4
	C	Rote learning, Learning by Taking Advice, Learning in Problem-solving, Learning from example: induction, Explanation-based learning.	CO3, CO4

	Unit 5	**EXPERT SYSTEM**			
	A	What is Expert system, Components of Expert System, Representing and using Domain Knowledge, Reasoning with knowledge, Expert System Shells, Knowledge acquisition examples			CO5, CO6
	B	Robotics – Hardware; Vision; Navigation based case studies;			CO5, CO6
	C	Case studies on Expert System			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	• **Rich E** & Knight K, **Artificial Intelligence,** Tata McGraw Hill, Edition 3.			
	Reference Books	• Russell S & Norvig P, *Artificial Intelligence: A Modern Approach*, Prentice Hall. • Dan W. Patterson, Artificial Intelligence & Expert Systems, Pearson Education with Prentice Hall India. Indian Edition. • Artificial Intelligence and Intelligent Systems by Padhy, Oxforfd University Press,			

CO and PO Mapping

Sl. No.	Course Outcome (CO)	
1.	***Relate*** the goals of Artificial Intelligence and AI & non-AI solution.	PO1, PO2, PO3, PO4, PO5, PO10, PSO1, PSO2,
2.	***Analyze and*** various AI uninformed and informed search algorithms.	PO1, PO2, PO3, PO4, PO5, PO10, PSO1, PSO2
3.	***Extend*** knowledge representation, reasoning, and theorem proving techniques to real-world problems	PO1, PO2, PO3, PO4, PO5, PO6, PO7,PO10,PSO1, PSO2
4.	***Make use of*** various learning techniques to understand AI problems.	PO1, PO2, PO3, PO4, PO5, PO6, PO7,PSO1, PSO2,
5.	***Explain*** about Expert system & discuss various case studies of it.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2
6.	***Develop*** independent (or in a small group) research with help of AI techniques and communicate it effectively.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name Artificial Intelligence (BCA283)

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

Course Code/ Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2
BCA283/ Artificial Intelligence	2.2	2.8	3.0	2.7	2.5	1.8	1.5	2.0	3.0	1.8	3.0	2.5

Strength of Correlation 1. Addressed to Slight (Low=1) extent 2. Addressed to Moderate (Medium=2) extent3. Addressed to Substantial (High=3) extent

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**I**	
1	Course Code	**BCA187**	
2	Course Title	Fundamentals of Computers and Programming in C	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Program Core	
5	Course Objective	To learn computer fundamentals and basic computer organization. Along with that the objective is to learn basic programming constructs –data types, decision structures, and control structures in C to apply knowledge in real life software building.	
6	Course Outcomes	Students will be able to: CO1: Enumerate core concept of C Programming CO2: Discuss programs using Array and String CO3: Develop Functions for any problem CO4: Classify Union and Structure to write any program CO5: Implement concept of Pointers CO6**:** Predict 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	**Computer Fundamentals and Basic Computer Organization**	**CO1, CO6**
	A	Computer Fundamentals: Introduction to Computers: Characteristics of Computers, Uses of computers, Types and generations of Computers, introduction to operating systems, Types of Software; Application software and system software.	
	B	Units of a computer, CPU, ALU, memory hierarchy, registers, I/O devices, number system.	
	C	Techniques of Problem Solving: Flowchart, decision table, algorithms, Structured programming concepts, Programming methodologies viz. top-down and bottom-up programming.	
	Unit 2	**Introduction to C Programming**	**CO2, CO6**
	A	Introduction to C programming language, Data types, Variables, Constants, Identifiers and keywords, Storage classes	
	B	Operators and expressions, Types of Statements: Assignment, Control, jumping, Control statements: Decisions, Loops, break, continue	
	C	Dynamic memory allocation (malloc, calloc, realloc, free), recursion-definition, Example-Tower of Hanoi problem, Tail Recursion.	
	Unit 3	**Arrays and Functions**	**CO3, CO6**
	A	Arrays: One dimensional and multidimensional arrays: Declaration, Initialization and array manipulation	
	B	Functions: Definition, Declaration/Prototyping and Calling,	

		Types of functions, Parameter passing: Call by value, Call by reference.	
	C	Passing and Returning Arrays from Functions, Recursive Functions.	
	Unit 4	**Pre-processors and Pointers**	**CO4, CO6**
	A	Pre-processors: Types, Directives, Pre-processors Operators (#,##,\)	
	B	Pointer: Introduction, declaration of pointer variables, Operations on pointers: Pointer arithmetic, Arrays and pointers, Dynamic memory allocation.	
	C	String: Introduction, predefined string functions, Manipulation of text data, Command Line Arguments.	
	Unit 5	**User Defined Data Types and File Handling**	**CO5, CO6**
	A	Structure and Unions: Introduction, Declaration, Difference, Application, Nested structure, self-referential structure, Array of structures, Passing structure in function.	
	B	Files: Introduction, concept of record, I/O Streaming and Buffering, Types of Files: Indexed file, sequential file and random file, 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.	
	C	Industry oriented Question solving, Expert talk on Coding challenges.	
	Mode of examination	Theory	
	Weightage Distribution	CA / MTE / ETE	
		25% / 25% / 50%	
	Textbook/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	

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	**CO1:** Enumerate core concept of C Programming	**PO1,PO2,PO3, PO9, PSO1,PSO2**
2.	**CO2:** Discuss programs using Array and String. .	**PO1,PO3, PO4, PO5, PO9, PO11,PSO1,PSO2**
3.	**CO3:** Develop Functions for any problem	**PO1,PO3,PO4, PO9, PSO2**
4.	**CO4:** Classify Union and Structure to write any program	**PO1,PO3,PO4, PO9, PSO2**
5.	**CO5:** Implement concept of Pointers	**PO1,PO3,PSO2**
6	**CO6: Predict** a realworld problem with the help of c programming	**PO1,PO2,PO3,PO4,PO9, PO11,PSO1 PSO2,PSO3**

PO and PSO mapping with level of strength for Course Name- Fundamentals of Computers and Programming in C

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
BCA187 Fundamentals of Computers and Programming in C	CO1	2	2	3	2	2	2	-	-	2	-	3	2
	CO2	3	2	3	2	2	2	-	-	3	-	3	3
	CO3	2	2	3	2	2	3	-	-	2	2	2	3
	CO4	1	1	2	1	1	2	-	2	2	1	2	2
	CO5	2	3	3	2	2	2	-	2	3	2	3	2
	CO6	3	2	3	3	1	3	-	3	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**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PSO 1**	**PSO 2**
BCA187	Fundamentals of Computers and Programming in C	2.17	2	2.83	2	1.67	2.33	-	2.33	2.33	1.75	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***

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**I**	
1	Course Code	BCA041	
2	Course Title	Introduction to IoT	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status		
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. In the end they will also be able to identify the challenges in IoT and its various areas of application. SENSEnuts platform can be used to test newly developed routing and application layer algorithms.	
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 SENSEnut platform CO4: Explain basic sensor functions available with SENSEnuts devices CO5: Explain 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	**Sensor Functions**	
	A	Phy Layer Functions, Routing Functions	CO1, CO4, CO5
	B	Sensor Functions: Light Sensor Functions, Temperature Sensor Functions, Humidity Sensor Functions	CO1, CO4, CO5
	C	Pressure and Temperature sensor Functions, GPS Functions, Passive Infrared Functions	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*	• The Internet of Things: Connecting Objects to the Web edited by Hakima Chaouchi, Reference for Unit-1. • Introduction to Internet of Things, Prof. SudipMisra, NPTEL Lectures Notes, Department of Computer Science and Engineering, Indian Institute of Technology Kharagpur, Reference for Unit 2, 3 (c), 4. • Internet of Things, Rajkumar Buyya, Reference for Unit 3 (c) • Arshdeep Bahga and Vijay Madisetti, "Internet of Things – A Hand-on Approach", Universities press, 2015, Reference for Unit 3 (B) • API REFERENCE GUIDE: SENSEnuts WSN sensation			
	Other References	• Charalampos Doukas , "Building Internet of Things with the Arduino", Create space, April 2002 • Dr.OvidiuVermesan and Dr. Peter Friess, "Internet of Things: From research and innovation to market deployment", River Publishers 2014. • Contiki : The open source for IOT, www.contiki-os.org			

CO and PO Mapping

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

PO and PSO mapping with level of strength for Course Name Introduction to IoT

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
BCA041 Introduction to IoT	CO1	3	1	1	-	-	2	1	-	-	-	-	3
	CO2	2	2	1	-	-	1	3	-	-	-	-	3
	CO3	2	2	2	2	3	2	2	-	2	2	-	3
	CO4	2	3	2	2	3	2	2	-	2	2	-	3
	CO5	3	3	3	3	3	2	3	-	-	-	-	3

	CO6	2	2	2	2	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**	**PSO 1**	**PSO 2**
BCA041	**Introduction to IoT**	2.3	2.2	1.8	2.3	3.0	1.8	2.3	0.0	2.0	2.0	0.0	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		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**I**	
1	**Course Code**	**BCA188**	
2	**Course Title**	**Ethics and Social Implications of AI**	
3	**Credits**	**3**	
4	**Contact Hours (L-T-P)**	**3-0-0**	
	Course Status		
5	Course Objective	The objective of the course "Ethics and Social Implications of AI" is to provide students with a comprehensive understanding of the ethical considerations and broader societal implications associated with artificial intelligence (AI) technologies	
6	Course Outcomes	After the completion of this course, students will be able to: **CO1:** ***Relate*** and explain the ethical considerations in the development and deployment of AI. **CO2:** ***Analyze*** and evaluate the social and ethical impacts of AI on various stakeholders and society as a whole. **CO3:** ***Extend*** propose ethical decision-making models relevant to AI applications. **CO4:** ***Make use of*** the implications of AI on privacy, data protection, bias, fairness, transparency, and accountability. **CO5:** ***Explain*** and address ethical challenges in AI research, development, and governance. **CO6:** ***Develop*** and discuss the ethical responsibilities of AI practitioners, policymakers, and organizations.	
7	Course Description	The course "Ethics and Social Implications of AI" is designed to explore the ethical dimensions and social implications of AI technologies. It provides an in-depth examination of the ethical considerations that arise in the development, deployment, and use of AI systems.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Ethics and Social Implications of AI**	
	A	Introduction to Ethics and AI, Historical and philosophical foundations of ethics, Ethical theories and frameworks ,Ethical decision-making models	CO1
	B	Impact of AI on society Ethical considerations in AI development and deployment Privacy and data protection in AI,	CO1
	C	Bias ,fairness, and accountability in AI Transparency and explainability in AI systems Ethical challenges in AI research	CO1, CO2
	Unit 2	**Ethical Issues in AI Governance and Policy**	
	A	AI governance frameworks and initiatives, Ethical considerations in AI regulation and policy-making, Intellectual property and AI, Ethical implications of AI patents	CO1, CO2
	B	Ethical issues in AI transparency and auditability, Algorithmic accountability and responsibility, Ethical considerations in AI procurement and use by governments	CO1, CO2
	C	AI ethics committees and their role, Ethical challenges in AI governance and policy, International perspectives on AI ethics and regulation	CO1, CO2
	Unit 3	**AI and Human Rights**	
	A	AI and privacy rights, Ethical considerations in AI surveillance technologies, AI and freedom of expression	CO3
	B	Ethical implications of AI in law enforcement and criminal justice, AI and discrimination in employment and hiring, AI and social inequality	CO3
	C	Ethical issues in AI-powered decision-making systems, AI and the right to access information, Ethical considerations in AI-mediated communication,AI and the right to a fair trial	CO3
	Unit 4	**AI and Workforce Ethics**	
	A	AI and the future of work, Ethical implications of AI in job displacement and automation, AI and job creation	CO3, CO4

	B	Ethical considerations in AI-based hiring and recruitment, AI and workplace surveillance, Bias and discrimination in AI-based employment systems			CO3, CO4
	C	Ethical challenges in AI-driven skill assessment and training, AI and worker well-being, AI and ethical implications for professional responsibilities, AI and labor rights			CO3, CO4
	Unit 5	**Ethical AI Development and Deployment**			
	A	Ethical considerations in AI system design and development, Ethical use of data in AI, responsible AI research and innovation			CO5, CO6
	B	Ethical implications of AI in healthcare, AI and autonomous systems ethics, AI and environmental sustainability, Ethical considerations in AI for social good			CO5, CO6
	C	AI and the ethical challenges in autonomous vehicles, AI and ethical implications in education, AI and the future of humanity			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	• Paula Boddington, ―Towards a Code of Ethics for Artificial Intelligence‖, Springer, 2017 • Markus D. Dubber, Frank Pasquale, Sunit Das, ―The Oxford Handbook of Ethics of AI‖, Oxford University Press Edited book, 2020.			
	Reference Books	• Wallach, W., & Allen, C, ―Moral machines: ceaching robots right from wrong‖, Oxford University Press, 2008. • Bostrom and E. Yudkowsky. ―The ethics of artificial intelligence‖. In W. M. Ramsey and K. Frankish, editors, The Cambridge Handbook of Artificial Intelligence, Cambridge University Press, Cambridge, 2014.			

CO and PO Mapping

Sl. No.	Course Outcome (CO)	
1.	***Relate*** the goals of Artificial Intelligence and AI & non-AI solution.	PO1, PO2, PO3, PO4, PO5, PO10, PSO1, PSO2,
2.	***Analyze and*** various AI uninformed and informed search algorithms.	PO1, PO2, PO3, PO4, PO5, PO10, PSO1, PSO2
3.	***Extend*** knowledge representation, reasoning, and theorem proving techniques to real-world problems	PO1, PO2, PO3, PO4, PO5, PO6, PO7,PO10,PSO1, PSO2
4.	***Make use of* v**arious learning techniques to understand AI problems.	PO1, PO2, PO3, PO4, PO5, PO6, PO7,PSO1, PSO2,
5.	***Explain*** about Expert system & discuss various case studies of it.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2
6.	***Develop*** independent (or in a small group) research with help of AI techniques and communicate it effectively.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name Ethics and Social Implications of AI

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

CO5	2	3	3	3	3	2	2	2	3	2	3	3
CO6	2	3	3	3	3	2	2	2	3	2	3	3

Course Code/ Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2
BCA188 Ethics and Social Implications of AI	2.2	2.8	3.0	2.7	2.5	1.8	1.5	2.0	3.0	1.8	3.0	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		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**I**	
1	Course Code	**BCA189**	
2	Course Title	Introduction of Entrepreneurship Development	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	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 instill 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 1	**Introduction to Entrepreneurship**	**CO1**
	A	Meaning, Definition and concept of Enterprise, Entrepreneurship and Entrepreneurship Development, Evolution of Entrepreneurship	CO1
	B	Theories of Entrepreneurship. Characteristics of Entrepreneurship, Concepts of Intrapreneurship, Entrepreneur v/s Intrapreneur, Entrepreneur Vs. Entrepreneurship, Entrepreneur Vs. Manager	CO1
	C	Role of Entrepreneurship in Economic Development, Factors affecting Entrepreneurship, Problems of Entrepreneurship	CO1
	Unit 2	**Entrepreneurship Journey as Innovator**	**CO2**
	A	Idea generation, Feasibility Study and opportunity assessment	CO2
	B	Business Plan: meaning, purpose and elements, Execution of Business Plan	CO2
	C	Entrepreneurs as problem solvers, Innovations and Entrepreneurial Ventures – Global and Indian,	CO2, CO6
	Unit 3	**Setting Up Small Business Enterprises**	**CO3**
	A	Identifying the business Opportunity – Business opportunity in various Sectors – Formalities for setting up a small Business Enterprise	CO3
	B	Benefits to Small Scale Enterprises: Tax Holiday, Rehabitation Allowance, Investment Allowance,	CO3
	C	Government policy for Small Scale Enterprises: New Small Enterprise Policy 1991, Micro Small & Medium Enterprises Development (MSMED) Act 2006	CO3, CO6
	Unit 4	**Role of Government in promoting Entrepreneurship**	**CO4**
	A	MSME policy in India, Agencies for Policy Formulation and Implementation: District Industries Centres (DIC), Entrepreneurship	CO4, CO6

		Development Institute of India (EDII),			
	B	National Institute of Entrepreneurship & Small Business Development (NIESBUD), National Entrepreneurship Development Board (NEDB),			CO4, CO6
	C	Financial Support System: long term and short-term financial support, Investment Institutions.			CO4, CO6
	Unit 5	**IPM & Institutional support for small businesses in India**			**CO5**
	A	Intellectual Property Management, Importance of innovation, patents & trademarks in small businesses,			CO5
	B	Introduction to laws relating to IPR in India, Support in areas of entrepreneurship development			CO5
	B	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	MTE	ESE	
		25%	25%	50%	
	Text book/s*	• Udyamita by Dr. MMP. Akhouri and S.P Mishra, By National Institute for Entrepreneurship and Small Business Development (NIESBUD), NSIC-PATC Campus, Okhla • Entrepreneurial Development by Dr S S Khanka, S Chand & Company Ltd • Entrepreneurship Development & Small Business Enterprises by Poornima M Charantimath, Pearson. • Lall & Sahai: Entreprenurship (Excel Books 2 edition) Couger, C-Creativity and Innovation (IPP, 1999) • Kakkar D N - Enterpreneurship Development (Wiley Dreamtech)			

CO and PO Mapping

S. No.	Course Outcome	Programme 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_ Course Name	**CO's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
BCA189 Introduction of	CO 1	-	-	-	-	1	-	-	-	2	-	2	3	-	-	-

Entrepreneurship Development	CO 2	1	1	2	3	3	3	-	-	-	-	-	-	-	-	-
	CO 3	-	-	-	-	-	-	-	-	-	3	2	3	-	-	-
	CO 4	-	-	-	-	-	-	-	-	-	1	3	1	-	-	-
	CO 5	-	-	-	1	-	-	3	-	-	-	-	2	-	-	-
	CO 6	-	1	3	2	1	-	-	-	-	-	1	2	-	-	-

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

Course Name	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO1 2**	**PS O1**	**PS O2**	**PSO 3**
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***

Schools: SSET | SOL | SMFE | SBS-BBA | SBSR | SOE | SAP		**Batch :** 2023-2026	
		Academic Year: 2022-2023	
		Semester: I	
1	Course Code	**ARP103**	
2	Course Title	Communicative English-1	
3	Credits	2	
4	Contact Hours (L-T-P)	1-0-2	
5	Course Objective	To minimize the linguistic barriers that emerges in varied socio-linguistic environments through the use of English. Help students to understand different accents and standardize their existing English. Guide the students to hone the basic communication skills - listening, speaking, reading and writing while also uplifting their perception of themselves, giving them self-confidence and building positive attitude.	
6	Course Outcomes	After completion of this course, students will be able to: CO1 Develop a better understanding of advanced grammar rules and write grammatically correct sentences CO2 Acquire wide vocabulary and punctuation rules and learn strategies for error-free communication. CO3 Interpret texts, pictures and improve both reading and writing skills which would help them in their academic as well as professional career CO4 Comprehend language and improve speaking skills in academic and social contexts CO5 Develop, share and maximize new ideas with the concept of brainstorming and the documentation of key critical thoughts articulated towards preparing for a career based on their potentials and availability of opportunities. CO6 Function effectively in multi-disciplinary teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality	
7	Course Description	The course is designed to equip students, who are at a very basic level of language comprehension, to communicate and work with ease in varied workplace environment. The course begins with basic grammar structure and pronunciation patterns, leading up to apprehension of oneself through written and verbal expression as a first step towards greater employability.	
8		Outline syllabus – ARP 103	
	Unit A	**Sentence Structure**	**CO Mapping**
	Topic 1	Subject Verb Agreement	CO1
	Topic 2	Parts of speech	
	Topic 3	Writing well-formed sentences	
	Unit B	**Vocabulary Building & Punctuation**	
	Topic 1	Homonyms/ homophones, Synonyms/Antonyms	CO1, CO2
	Topic 2	Punctuation/ Spellings (Prefixes-suffixes/Unjumbled Words)	CO1, CO2
	Topic 3	Conjunctions/Compound Sentences	CO1, CO2
	Unit C	**Writing Skills**	
	Topic 1	Picture Description – Student Group Activity	CO3
	Topic 2	Positive Thinking - Dead Poets Society-Full-length feature film - Paragraph Writing inculcating the positive attitude of a learner through the movie | SWOT Analysis – Know yourself	CO3, CO2, CO3
	Topic 3	Story Completion Exercise –Building positive attitude - The Man from Earth (Watching a Full length Feature Film)	CO2, CO3

	Topic 4	Digital Literacy | Effective Use of Social Media	CO3
	Unit D	**Speaking Skill**	
	Topic 1	Self-introduction/Greeting/Meeting people – Self branding	CO4
	Topic 2	Describing people and situations - To Sir With Love (Watching a Full length Feature Film)	CO4
	Topic 3	Dialogues/conversations (Situation based Role Plays)	CO4
	Unit E	**Professional Skills | Career Skills**	
	Topic 1	Exploring Career Opportunities	CO4, CO5
	Topic 2	Brainstorming Techniques & Models	CO4, CO5
	Topic 3	Social and Cultural Etiquettes	CO4, CO5
	Topic 4	Internal Communication	CO4, CO5
	Unit F	**Leadership and Management Skills**	
	Topic 1	Managerial Skills	CO6
	Topic 2	Entrepreneurial Skills	CO6
9	Evaluations	*Class Assignments/Free Speech Exercises / JAM Group Presentations/Problem Solving Scenarios/GD/Simulations (25% CA MTE-25% ETE- 50%*	*N/A*
10	Texts & References | Library Links	• Blum, M. Rosen. *How to Build Better Vocabulary*. London: Bloomsbury Publication • Comfort, Jeremy (et.al). *Speaking Effectively*. Cambridge University Press	

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

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**			
Batch:		**2023-26**			
Department		**Computer Science & Applications**			
Programme		**BCA. (AI-ML), Academic Year: 2023-24**			
Semester		**I**			
1	**Course Code**	**BCP187**			
2	**Course Title**	**Fundamentals of Computers and Programming in C -Lab**			
3	**Credits**	**1**			
4	**Contact Hours (L-T-P)**	**0-0-2**			
	Course Status	Core			
5	Course Objective	• To learn computer fundamentals and basic computer organization. Along with that the objective is to learn basic programming constructs –data types, decision structures, control structures in C to apply knowledge in real life software building.			
6	Course Outcomes	Upon completion of this course, the students will be able to: CO1: Enumerate core concept of C Programming CO2: Discuss programs using Array and String CO3: Develop Functions for any problem CO4: Classify Union and Structure to write any program CO5: Implement concept of Pointers CO6: Predict 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				
	A	Write a program to find out the largest of three numbers by using if-else.			CO1,CO6
	B	2. Write a program to find out the largest of three numbers by using the logical Operators.			CO1,CO6
	Unit 2				
	A	Write a program to find the roots of a quadratic equation using function and switch statements.			CO2,CO6
	B	Write a program to multiply two matrices.			CO2,CO6
	Unit 3				
	A	Write a program to find out the sum of digit of a number.			CO3,CO6
	B	Write a program to find out whether the entered no is Armstrong or not.			CO3,CO6
	Unit 4				
	A	Write a program in which if and else both blocks get their execution.			CO4,CO6
	B	Write a program which takes the input as an integer no. from the user and display its factorial by using recursion.			CO4,CO6
	Unit 5				
	A	Write a program to concatenate the two strings of different length.			CO5,CO6
	B	Write a program to find out the largest and second largest no out of given 50 no. using array. descriptive statistics: mean, median, mode, variance, standard deviation			CO5,CO6
	Mode of examination	Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	

CO and PO Mapping

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

1.	**CO1:** Enumerate core concept of C Programming	**PO1,PO2,PO3, PO9, PSO1,PSO2**
2.	**CO2:** Discuss programs using Array and String. .	**PO1,PO3, PO4, PO5, PO9,PSO1,PSO2**
3.	**CO3:** Develop Functions for any problem	**PO1,PO3,PO4, PO9, PSO2**
4.	**CO4:** Classify Union and Structure to write any program	**PO1,PO3,PO4, PO9, PSO2**
5.	**CO5:** Implement concept of Pointers	**PO1,PO3,PSO2**
6	**CO6: Predict** a real world problem with the help of c programming	**PO1,PO2,PO3,PO4,PO9,PSO1 PSO2**

PO and PSO mapping with level of strength for Course Name- Fundamentals of Computers and Programming in C -Lab

Course Code_ Course Name	COs	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO2
BCP187 Fundamentals of Computers and Programming in C - Lab	CO1	2	2	3	2	2	2	-	-	2	-	3	2
	CO2	3	2	3	2	2	2	-	-	3	-	3	3
	CO3	2	2	3	2	2	3	-	-	2	2	2	3
	CO4	1	1	2	1	1	2	-	2	2	1	2	2
	CO5	2	3	3	2	2	2	-	2	3	2	3	2
	CO6	3	2	3	3	1	3	-	3	2	2	2	3

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

Course Name	**PO1**	**PO2**	**PO3**	**PO 4**	**PO 5**	**PO6**	**PO 7**	**PO 8**	**PO9**	**PO 10**	**PSO 1**	**PSO 2**
Fundamentals of Computers and Programming in C -Lab	2.17	2	2.83	2	1.67	2.33	-	2.33	2.33	1.75	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***

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**I**	
1	Course Code	BCP041	
2	Course Title	Introduction to IoT with hands-on Lab implementation	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status		
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: Understand the working of IoT Platforms. CO2:Recognize the various sensors and actuators. CO3: Outline the concepts of SENSEnut platform CO4: Demonstrate Blink application using SENSEnuts devices CO5: Experiment with environment sensors on SENSEnuts GUI. CO6: Design embedded applications using SENSEnut Platform	
7	Course Description	SENSEnuts platform can be used to test newly developed routing and application layeralgorithms. It provides a flexible mac with around 9 parameters that can be controlled at mac and4 at physical giving user the kind of flexibility to control their network environment.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to IoT Platforms**	
		Demonstrate Arduino and its pins.(Students have to prepare the Report for the same)	**CO1**
		Demonstration of Setup & Working of Raspberry Pi. (Students have to prepare the Report for the same)	CO1,CO2
	Unit 2	**Study of Sensors and Actuators**	
		PIR Motion Sensor, Moisture Sensor, Temperature Sensor, Touch Sensor	**CO2**
		Infrared Sensor, Servo Motor, RFID Sensor	CO2
	Unit 3	**Sensenut Platform**	
		Introduction to SENSEnuts Platform, the components that make up an SENSEnuts board and their functions.	**CO3**
		Installing and working with SENSEnuts.	CO3
	Unit 4	**Working with SENSEnuts device**	
		To develop a code for LED blinks operation for SENSEnuts device.	**CO3, CO4**
		To develop a code for RGB blinks operation for SENSEnuts device.	CO3,CO4
	Unit 5	**Working with Environment Sensors**	
		To develop a code to read temperature and light sensor data from sensor module attached	**CO2,CO4**

		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.			CO2, CO5
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	• The Internet of Things: Connecting Objects to the Web edited by Hakima Chaouchi, Reference for Unit-1. • Introduction to Internet of Things, Prof. Sudip Misra, NPTEL Lectures Notes, Department of Computer Science and Engineering, Indian Institute of Technology Kharagpur, Reference for Unit 2, 3 (c), 4. • Internet of Things, Rajkumar Buyya, Reference for Unit 3 (c) • Arshdeep Bahga and Vijay Madisetti, "Internet of Things – A Hand-on Approach", Universities press, 2015, Reference for Unit 3 (B) • API REFERENCE GUIDE: SENSEnuts WSN sensation			
	Other References	• CharalamposDoukas , "Building Internet of Things with the Arduino", Create space, April 2002 • Dr.OvidiuVermesan and Dr. Peter Friess, "Internet of Things: From research and innovation to market deployment", River Publishers 2014. • Contiki : The open source for IOT, www.contiki-os.org			

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1: Understand the working of IoT Platforms.	PO1,PO2,PO3, PO9, PSO1,PSO2
2.	CO2: Recognize the various sensors and actuators.	PO1,PO3, PO4, PO5, PO9,PSO1,PSO2
3.	CO3: Outline the concepts of SENSEnut platform	PO1,PO3,PO4, PO9, PSO2
4.	CO4: Demonstrate Blink application using SENSEnuts devices	PO1,PO3,PO4, PO9, PSO2
5.	CO5: Experiment with environment sensors on SENSEnuts GUI.	PO1,PO3,PSO2
6	CO6: Design embedded applications using SENSEnut Platform	PO1,PO2,PO3,PO4,PO9,PSO1 PSO2

PO and PSO mapping with level of strength for Course Name: Introduction to IoT with hands-on Lab implementation

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	PSO 1	PSO 2
BCP041 Introduction to IoT with hands-on Lab implementation	CO1	2	2	2	-	3	1	1	-	2	2	-	1
	CO2	2	2	2	1	3	2	2	2	1	1	-	2
	CO3	2	2	2	1	3	2	2	2	3	3	-	2
	CO4	2	2	2	2	3	2	2	2	3	3	-	2
	CO5	3	2	2	3	3	2	2	2	3	3	-	2

	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 Name	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO7**	**PO 8**	**PO 9**	**PO1 0**	**PSO 1**	**PSO 2**
BCP041 Introduction to IoT with hands-on Lab implementation	2.3	2.2	2.2	2.0	3.0	2.0	2.0	2.2	2.5	2.5	0.0	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***

TERM-II

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**II**	
1	Course Code	BCA286	Course Name: Data Structures Using C
2	Course Title	Data Structures Using C	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	This course provides programming concepts for subsequent study in Computer Science, as well as developing the skills necessary to solve practical problems.	
6	Course Outcomes	After the completion of this course, students will be able to: CO-1. Apply the basic operations on arrays. CO-2. Construct complex programs like matrix implementations on arrays. CO-3. Apply the concept of stacks and queues in real life problem solving. CO-4. Apply the concepts of data structure, like linked list to solve complex problems. CO-5. Solving the real-life problems based on trees. CO-6 Implementing the graphs and apply graph concept in computer networks.	
7	Course Description	The purpose of this course is to understand and use data structures that are backbone of computer science. A basic understanding of data structure topics is fundamental for work in computer science. In this course we will discover taking form arrays to stacks, queues, linked list, trees and graphs including searching and sorting.	
8	Outline syllabus		CO Mapping
	Unit 1	**Arrays and Strings**	
	A	Arrays: Initialization – Declaration – One dimensional Simple program.	CO1, CO6
	B	and two-dimensional arrays. String-: String operations – String Arrays.	CO1, CO6
	C	sorting- searching – matrix operations like matrix addition, subtraction and multiplication	CO1, CO6
	Unit 2	**Stacks and Queues**	
	A	Abstract data Types, Data Structure and Structured Types, Difference between Abstract Data Types, Data Types and Data Structures.	CO2, CO6
	B	Data Types, Linear data type, Non-Linear data type, Primitive data type, non-primitive data type, Introduction to Complexity, Big OH notation, Time and Space trade-offs.	CO2, CO6
	C	Representation of stacks & queues using linked, sequential and their applications. Making a program that implement Stack and Queue.	CO2, CO6
	Unit 3	**Linked list sorting and searching**	
	A	Linked list, singly linked list and doubly linked list, representation of linked list in memory	CO1,CO3, CO6
	B	Algorithms like insertion, deletion at beginning, middle and at the end of the linked list	CO1,CO3, CO6

	C	Various types of sorting like bubble sort, selection sort, insertion sort, heap sort, quick sort and searching like linear and binary search algorithms			CO1,CO3, CO6
	Unit 4	**Introduction to Trees**			
	A	Trees: Definition, Binary tree, Binary tree traversal: pre-order, in-order and post-order, Binary search tree.			CO4,CO5
	B	Binary search trees and operation like insertion deletion on binary search trees, AVL search trees with insertion deletion and rotation.			CO4,CO5
	C	M-way search trees, B-Trees and B+ Trees			CO4,CO5
	Unit 5	**Trees and Graph Theory.**			
	A	Graphs: Definition and terminology, Representation of graphs			CO4,CO5
	B	Minimum spanning trees by Prims Algorithms and Krushkal's Algorithm			CO4,CO5
	C	Multi graphs, Bipartite graphs, Planar graphs, Isomorphism and Homeomorphism of graphs, Euler and Hamiltonian paths, Graph coloring.			CO4,CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	• A Common-Sense Guide to Data Structures and Algorithms, Second Edition: Level Up Your Core Programming Skills 2nd Edition • Data Structures Through C (A Practical Approach) Paperback – 1 January 2016 ○ by G.S. Baluja			
	Other References	• Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein "Data Structures Using C and C++" , PHI • Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication			

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO)
1.	CO-1. Apply the basic operations on arrays.	**PO1,PO2,PO3,PO4,PO7,PO10,PSO1,PSO2**
2.	CO-2. Construct complex programs like matrix implementations on arrays.	**PO1,PO2,PO3,PO4,PO7,PO10,PSO1,PSO2**
3.	CO-3. Apply the concept of stacks and queues in real life problem solving.	**PO1,PO2,PO3,PO4,PO7,PO10,PSO1,PSO2**
4.	CO-4. Apply the concepts of data structure, like linked list to solve complex problems.	**PO1,PO2,PO3,PO4,PO5,PO7,PO10,PSO1,PSO2**
5.	CO-5. Solving the real-life problems based on trees.	**PO1,PO2,PO3,PO4,PO5,PO7,PO10,PSO1,PSO2**
6.	CO-6. Implementing the graphs and apply graph concept in computer networks.	**PO1,PO2,PO3,PO4,PO5,PO7,PO10,PSO1,PSO2**

PO and PSO mapping with level of strength for Course Name: Data Structures Using C

COs	PO1	PO 2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO1	PSO2
CO1	2	1	1	1	-	-	2		-	1	1	1
CO2	2	2	2	1	-	-	2	-	-	1	1	2
CO3	2	2	2	1	-	-	2	-	-	1	2	2
CO4	2	1	2	3	2	-	2	-	-	1	1	1
CO5	2	2	3	2	2	-	2	-	-	1	2	2
CO6	3	3	3	2	2	-	2	-	-	1	2	2
Avg. PO attained	2.16	1.8	2.16	1.67	2	-	2	-	-	1	1.5	1.67

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**		
Batch:		**2023-26**		
Department		**Computer Science & Applications**		
Programme		**BCA. (AI-ML), Academic Year: 2023-24**		
Semester		**II**		
1	**Course Code**	**BCA287**		
2	**Course Title**	**Probability and Statistics**		
3	**Credits**	**3**		
4	**Contact Hours (L-T-P)**	**3-0-0**		
	Course Status	**Core**		
5	Course Objective	● To introduce students to the basic principles and concepts of probability theory and statistics. ● To introduce the applications in artificial intelligence and machine learning. ● To enable students to analyze and interpret data using descriptive statistical techniques, such as measures of central tendency and dispersion, probability distributions, and data transformations. ● To teach students inferential statistical techniques, such as hypothesis testing, confidence intervals, and regression analysis, to make decisions based on data. ● To familiarize students with statistical learning techniques, such as linear regression		
6	Course Outcomes	CO1: **Understand** the basic principles and concepts of probability theory and statistics, and their applications in artificial intelligence and machine learning. CO2: **Understand** the applications of probability theory and statistics in artificial intelligence and machine learning. CO3: **Analyze** and interpret data using descriptive statistical techniques, such as measures of central tendency and dispersion, probability distributions, and data transformations. CO4: **Apply** inferential statistical techniques, such as hypothesis testing, confidence intervals, and regression analysis, to make decisions based on data. CO5: **Use** statistical learning techniques, such as linear regression, logistic regression. CO6: **Demonstrate** critical thinking and apply statistical reasoning to solve real-world problems in various domains, such as finance, healthcare, marketing, and social sciences.		
7	Course Description	This course starts with an introduction to Probability and Statistics designed to equip students with a strong understanding of probability theory and statistical analysis, and how they are applied in artificial intelligence and machine learning. The course is divided into five units, each covering various topics related to probability and statistics.		
8	Outline syllabus			CO Mapping
	Unit 1	**Introduction to Probability Theory**		
	A	Basic Concepts of Probability, Conditional Probability and Bayes' Theorem, Random Variables and Probability Distributions		**CO1, CO6**
	B	Discrete Probability Distributions: Bernoulli, Binomial, and Poisson Distributions, Continuous Probability Distributions: Uniform, Normal, and Exponential Distributions		**CO1, CO6**
	C	Joint Probability Distributions, Independence and Covariance, Expected Value and Variance, Moment Generating Functions, Central Limit Theorem		**CO1, CO6**
	Unit 2	**Descriptive Statistics**		
	A	Measures of Central Tendency: Mean, Median, Mode, Measures of Dispersion: Variance, Standard Deviation, Skewness and Kurtosis		**CO2, CO6**
	B	Probability Distributions: Normal, Poisson, and Binomial Distributions, Chebyshev's Theorem and Empirical Rule, Z-scores and Percentiles		**CO2, CO6**
	C	Box and Whisker Plot, Scatter Plots and Correlation, Outliers and Influential Observations, Data Transformations		**CO2, CO6**
	Unit 3	**Inferential Statistics**		
	A	Sampling Techniques, Estimation of Population Parameters: Point Estimation and Interval Estimation, Sampling Distribution of the Sample Mean and the Sample Proportion		**CO3, CO6**

	B	Hypothesis Testing: Null and Alternative Hypotheses, Type I and Type II Errors, p-values and Significance Level, One-Sample and Two-Sample Tests for Means and Proportions			**CO3, CO6**
	C	Chi-Square Tests, ANOVA and Post Hoc Tests, Correlation and Regression Analysis, Non-Parametric Tests			**CO3, CO6**
	Unit 4	**Statistical Learning Techniques**			
	A	Linear Regression, Logistic Regression, Decision Trees, Random Forests			**CO4, CO5, CO6**
	B	k-Nearest Neighbors Algorithm, Naive Bayes Classifier, Support Vector Machines, Principal Component Analysis			**CO4, CO5, CO6**
	C	Clustering Techniques: K-Means and Hierarchical Clustering, Artificial Neural Networks			**CO4, CO5, CO6**
	Unit 5	**Applications of Probability and Statistics in AI/ ML**			
	A	Image and Signal Processing, Natural Language Processing, Speech Recognition, Computer Vision			**CO4, CO5**
	B	Recommender Systems, Fraud Detection, Sentiment Analysis			**CO4, CO5**
	C	Time Series Analysis, Survival Analysis, Bayesian Networks			**CO4, CO5**
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	• Richard I. Levin, David S. Rubin(2017) ,Statistics for Management, Pearson • Education Prentice -Hall 8thEdition. • T. Veerarajan(2009), Probability, Statistics and Random Processes– McGraw hill,Third Edition.			
	Other References	• C Fernandez Granda(2017)-Probability and Statistics for Data Science-NewYork.			

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1: **Understand** the basic principles and concepts of probability theory and statistics, and their applications in artificial intelligence and machine learning.	**PO1,PO2,PO3, PO9, PSO1,PSO2**
2.	CO2: **Understand** the applications of probability theory and statistics in artificial intelligence and machine learning.	**PO1,PO3, PO4, PO5, PO9, PO11,PSO1,PSO2**
3.	CO3: **Analyze** and interpret data using descriptive statistical techniques, such as measures of central tendency and dispersion, probability distributions, and data transformations.	**PO1,PO3,PO4, PO9, PSO2**
4.	CO4: **Apply** inferential statistical techniques, such as hypothesis testing, confidence intervals, and regression analysis, to make decisions based on data.	**PO1,PO3,PO4, PO9, PSO2**
5.	CO5: **Use** statistical learning techniques, such as linear regression, logistic regression.	**PO1,PO3,PSO2**
6	CO6: **Demonstrate** critical thinking and apply statistical reasoning to solve real-world problems in various domains, such as finance, healthcare, marketing, and social sciences.	**PO1,PO2,PO3,PO4,PO9, PO11,PSO1 PSO2,PSO3**

PO and PSO mapping with level of strength for Course Name- Probability and Statistics

Course Code_ Course Name-	COs	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO2
BCA287 Probability and Statistics	CO1	2	2	3	2	2	2	-	-	2	-	3	2
	CO2	3	2	3	2	2	2	-	-	3	-	3	3
	CO3	2	2	3	2	2	3	-	-	2	2	2	3
	CO4	1	1	2	1	1	2	-	2	2	1	2	2
	CO5	2	3	3	2	2	2	-	2	3	2	3	2
	CO6	3	2	3	3	1	3	-	3	2	2	2	3

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

Course Name	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
Probability and Statistics	2.17	2	2.83	2	1.67	2.33	-	2.33	2.33	1.75	2.50	2.50

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**
Batch:		**2023-26**
Department		**Computer Science & Applications**
Programme		**BCA. (AI-ML), Academic Year: 2023-24**
Semester		**II**
1	Course Code	ARP-105
2	Course Title	Communicative English -2
3	Credits	2
4	Contact Hours (L-T-P)	2-0-0
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 learning 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	

Unit A	**Acquiring Vision, Goals and Strategies through Audio-visual Language Texts**	**CO Mapping**
Topic 1	Pursuit of Happiness / Goal Setting & Value Proposition in life	CO1
Topic 2	12 Angry Men / Ethics & Principles	
Topic 3	The King's Speech / Mission statement in life | strategies & Action Plans in Life	
Unit B	**Creative Writing**	
Topic 1	Story Reconstruction - Positive Thinking	CO2
Topic 2	Theme based Story Writing - Positive attitude	
Topic 3	Learning Diary Learning Log – Self-introspection	
Unit C	**Writing Skills 1**	
Topic 1	Precis	CO2
Topic 2	Paraphrasing	
Topic 3	Essays (Simple essays)	
Unit D	**MTI Reduction/Neutral Accent through Classroom Sessions & Practice**	
Topic 1	Vowel, Consonant, sound correction, speech sounds, Monothongs, Dipthongs and Tripthongs	CO3
Topic 2	Vowel Sound drills , Consonant Sound drills, Affricates and Fricative Sounds	
Topic 3	Speech Sounds | Speech Music| Tone | Volume| Diction |Syntax |Intonation | Syllable Stress |	

Unit E	**Gauging MTI Reduction Effectiveness through Free Speech**	
Topic 1	Jam sessions	CO3
Topic 2	Extempore	
Topic 3	Situation-based Role Play	
Unit F	**Leadership and Management Skills**	
Topic 1	Innovative Leadership and Design Thinking	CO4
Topic 2	Ethics and Integrity	CO4
Unit F	**Universal Human Values**	
Topic 1	Love & Compassion, Non-Violence & Truth	CO5
Topic 2	Righteousness, Peace	CO5
Topic 3	Service, Renunciation (Sacrifice)	CO5
Unit G	**Introduction to Quantitative aptitude & Logical Reasoning**	
Topic 1	Analytical Reasoning & Puzzle Solving	CO6
Topic 2	Number Systems and its Application in Solving Problems	CO6
Evaluations	*Practical Basis - Class Assignments/Free Speech Exercises / JAM Group Presentations/Problem Solving Scenarios/GD/Simulations (CA,CE and ESE component) and NO MSE* CA-25%; CE-25%; ESE-50%	*N/A*
Texts & References | Library Links	• 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. The Luncheon by W. Somerset Maugham - http://mistera.co.nf/files/sm_luncheon.pdf	

CO and PO Mapping

Sl. No.	Course Outcome (CO)	
1.	CO1 Acquire Vision, Goals and Strategies through Audio-visual Language Texts	PO1, PO2
2.	CO2 Synthesize complex concepts and present them in creative writing	PO1, PO2, PO4
3.	CO3 Develop MTI Reduction/Neutral Accent through Classroom Sessions & Practice	P01, PO2, PO3, PO4, PO10, PSO1
4.	CO4 Determine their role in achieving team success through defining strategies for effective communication with different people	PO1, PO2, PO3, PO10
5.	CO5 Realize their potentials as human beings and conduct themselves properly in the ways of world.	PO2, PO3, PO4, PO10
6.	CO6 Acquire satisfactory competency in use of Quantitative aptitude and Logical Reasoning	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO10, PSO1, PSO2

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO 2
CO1	-	-	-	-	-	-	-	-	1	3	1	2	-
CO2	-	-	-	-	-	-	-	-	1	3	1	2	-

CO3	-	-	-	-	-	-	-	-	1	3	1	2	-
CO4	-	-	-	-	-	-	-	-	1	2	1	2	-
CO5	-	-	-	-	-	-	-	-	1	2	1	2	-
CO6	1	-	-	-	-	-	-	-	1	2	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	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
ARP105	Communicative English -2	1	0	0	0	0	0	0	0	1	2.5	2	0

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**			
Batch:		**2023-26**			
Department		**Computer Science & Applications**			
Programme		**BCA. (AI-ML), Academic Year: 2023-24**			
Semester		**II**			
1	**Course Code**	**BCA288**			
2	**Course Title**	**Web Analytics**			
3	**Credits**	**3**			
4	**Contact Hours (L-T-P)**	**3-0-0**			
	Course Status	Core			
5	Course Objective	This course provides the critical elements of web and search engine content analytics so that one can optimize the organization's capacity to make highly-informed business decisions			
6	Course Outcomes	After the completion of this course, students will be able to: **CO1:** ***Relate*** and understand the fundamental concepts and principles of web analytics. **CO2:** ***Analyze the*** proficiency in using web analytics tools to collect and analyze website data. **CO3:** ***Extend*** the key metrics and performance indicators to evaluate website effectiveness and user behavior. **CO4:** ***Make use of*** data-driven insights to optimize website performance, user experience, and conversion rates. **CO5:** ***Explain*** Develop skills in data visualization and reporting to effectively communicate web analytics findings. **CO6:** ***Develop*** and Utilize web analytics data to inform and support strategic decision-making in online marketing campaigns.			
7	Course Description	The Web Analytics course introduces students to the fundamental concepts and techniques used to analyze and interpret website data. Students will learn how to track website visitors, measure user behavior, and assess website performance using various web analytics tools and platforms.			
8	Outline syllabus				CO Mapping
	Unit 1	**INTRODUCTION**			
	A	Introduction- A brief history of web analytics, current landscape and challenges			CO1
	B	Traditional web analytics, measuring both what and the why			CO1
	C	Data Collection-clickstream data, Outcomes data, research data.			CO1, CO2
	Unit 2	**OVERVIEW OF QUALITATIVE ANALYSIS**			
	A	The Essence of Customer centricity -Lab usability testing-Heuristic			CO1, CO2
	B	Evaluations-Site visits-surveys- critical components of a successful			CO1, CO2
	C	web analytics -Focus on customer centricity- Solve for business questions- Follow the 10/90 rule			CO1, CO2
	Unit 3	**WEB ANALYTICS FUNDAMENTALS**			
	A	Capturing data-Selecting your optimal web analytics tools			CO3
	B	Understanding clickstream data quality- Implementing best practices			CO3
	C	Implementing best practices			CO3
	Unit 4	**CORE WEB ANALYTICS CONCEPTS**			
	A	Preparing to understand the basics-revisiting foundational metrics understanding			CO3, CO4
	B	standard reports-using website content quality			CO3, CO4
	C	Preparing navigation report			CO3, CO4
	Unit 5	**SEARCH ANALYTICS**			
	A	Performing internal site search analytics-search engine optimization measuring			CO5, CO6
	B	SEO efforts-Analyzing pay per click effectiveness -competitive			CO5, CO6
	C	intelligence analytics -competitive traffic reports-search engine reports			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	

	Text book/s*	1. Avinash Kaushik(2009), Web Analytics, Wiley Publisher	
	Reference Books	2. Brian Clifton(2012), Advanced Web Metrics with Google Analytics, 3rd Edition,Wiley publisher	

CO and PO Mapping

Sl. No.	Course Outcome (CO)	
1.	**CO1:** ***Relate*** and understand the fundamental concepts and principles of web analytics.	PO1, PO2
2.	**CO2:** ***Analyze the*** proficiency in using web analytics tools to collect and analyze website data.	PO1, PO2, PO4
3.	**CO3:** ***Extend*** the key metrics and performance indicators to evaluate website effectiveness and user behavior.	P01, PO2, PO3, PO4, PO10, PSO1
4.	**CO4:** ***Make use of*** data-driven insights to optimize	PO1, PO2, PO3, PO10
5.	**CO5:** ***Explain*** Develop skills in data visualization and reporting to effectively communicate web analytics findings.	PO2, PO3, PO4, PO10
6.	**CO6:** ***Develop*** and Utilize web analytics data to inform and support strategic decision-making in online marketing campaigns.	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name Web Analytics

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	PSO 1	PSO 2
BCA288 Web Analytics	**CO1**	**3**	**2**	-	-	-	-	-	-	-	**2**	-	-
	CO2	2	3	-	2	-	-	-	-	-	-	-	-
	CO3	**2**	**3**	**2**	**3**	-	-	-	-	-	**2**	2	-
	CO4	2	3	**2**	-	-	-	-	-	-	**2**	-	-
	CO5	-	2	**2**	3	-	-	-	-	-	**2**	**2**	**1**
	CO6	**2**	**3**	**2**	**3**	**3**	**2**	-	**2**	-	**2**	**2**	**2**

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

Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO10	PSO1	PSO2
Web Analytics	2.2	2.67	2	2.75	3	2	0	2	0	2	2	1.5

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**				
Batch:		**2023-26**				
Department		**Computer Science & Applications**				
Programme		**BCA. (AI-ML), Academic Year: 2023-24**				
Semester		**II**				
1	Course Code	BCP286				
2	Course Title	Data Structure Using C Lab				
3	Credits	1				
4	Contact Hours (L-T-P)	0-0-2				
	Course Status	Compulsory				
5	Course Objective	• To Develop arrays-based program to implement matrix • To write program to implement stacks and queues • Perform operation on various data structures like trees and graphs				
6	Course Outcomes	By the end of this course, the student will be able to: CO-1 Apply the basic operations on arrays (K2) CO-2 Construct complex programs like matrix implementations on arrays (K2) CO-3 Apply the concept of stacks and queues in real life problem solving (K3) CO-4. Apply the concepts of data structure, like linked list to solve complex problems (K4) CO-5. Solving the real-life problems based on trees (K5) CO-6 Implementing the graphs and apply graph concept in computer networks (K6)				
7	Course Description	An introduction design and implement data structures. Design and develop various program in lab like programs on stacks and queues, program on linked list like singly linked list and doubly linked list, program on trees and graphs.				
8	Outline syllabus				CO Mapping	
	Unit 1	**Programs based on arrays**				
		Write programs to implement the matrix operations			CO1, CO6	
	Unit 2	**Programs based on stacks and queues**				
		Programs to implement the stacks and queues operations			CO2, CO6	
	Unit 3	**Programs based on linked list, searching and sorting**				
		Programs to implement the linked list, searching and sorting			CO3, CO6	
	Unit 4	**Programs based on Trees**				
		Program to implement the trees like insertion, deletion of a node including tree traversal			CO4, CO6	
	Unit 5	**Programs based on Graphs**				
		Program to implement the graphs like Dijkstra algorithm, Prims algorithm and Kruskal's algorithm			CO5, CO6	
	Mode of examination	Jury/Practical/Viva				
	Weightage Distribution	CA	CE (Viva)	ESE		
		25%	25%	50%		
	Text book/s*	1. A Common-Sense Guide to Data Structures and Algorithms, Second Edition: Level Up Your Core Programming Skills 2nd Edition 2. Data Structures Through C (A Practical Approach) Paperback – 1 January 2016 by G.S. Baluja				
	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				

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO-1 Apply the basic operations on arrays (K2)	PO1, PO3, PO4, PO8, PO9, PO10, PSO1
2.	CO-2 Construct complex programs like matrix implementations on arrays (K2)	PO1, PO2, PO3, PO4, PO8, PO9, PO10
3.	CO-3 Apply the concept of stacks and queues in real life problem solving (K3)	PO1, PO2, PO3, PO4, PO8, PO9, PO10
4.	CO-4. Apply the concepts of data structure, like linked list to solve complex problems (K4)	PO1, PO2, PO3, PO4, PO8, PO9, PO10, PSO1
5	CO-5. Solving the real-life problems based on trees (K5)	PO1, PO2, PO3, PO4, PO8, PO9, PO10, PSO1
6	CO-6 Implementing the graphs and apply graph concept in computer networks (K6)	PO1, PO2, PO3, PO4, PO5, PO7, PO8, PO9, PO10, PSO1

PO and PSO mapping with level of strength for Course Name: Data Structure Using C Lab

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

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**	**PSO1**	**PSO2**
BCP286/Data Structure Using C Lab	3	3	3	2.2	2	-	2	2.8	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:		**Sharda School of Engineering and Technology**			
Department		**Department of Computer Science and Applications**			
Program:		**BCA. (AI-ML)**			
Semester:		**Semester: II**			
1	**Course Code**	**BCP287**			
2	**Course Title**	**Probability and Statistics-Lab**			
3	**Credits**	**1**			
4	**Contact Hours (L-T-P)**	**0-0-2**			
	Course Status	Core			
5	Course Objective	• To introduce students to the basic principles and concepts of probability theory and statistics. • To introduce the applications in artificial intelligence and machine learning. • To enable students to analyze and interpret data using descriptive statistical techniques, such as measures of central tendency and dispersion, probability distributions, and data transformations. • To teach students inferential statistical techniques, such as hypothesis testing, confidence intervals, and regression analysis, to make decisions based on data. • To familiarize students with statistical learning techniques, such as linear regression			
6	Course Outcomes	Upon completion of this course, the students will be able to: CO1: **Understand** the basic principles and concepts of probability theory and statistics, and their applications in artificial intelligence and machine learning. CO2: **Understand** the applications of probability theory and statistics in artificial intelligence and machine learning. CO3: **Analyze** and interpret data using descriptive statistical techniques, such as measures of central tendency and dispersion, probability distributions, and data transformations. CO4: **Apply** inferential statistical techniques, such as hypothesis testing, confidence intervals, and regression analysis, to make decisions based on data. CO5: **Use** statistical learning techniques, such as linear regression, logistic regression. CO6: **Demonstrate** critical thinking and apply statistical reasoning to solve real-world problems in various domains, such as finance, healthcare, marketing, and social sciences.			
7	Course Description	This course starts with an introduction to Probability and Statistics designed to equip students with a strong understanding of probability theory and statistical analysis, and how they are applied in artificial intelligence and machine learning. The course is divided into five units, each covering various topics related to probability and statistics.			
8	Outline syllabus				CO Mapping
	Unit 1	**Descriptive Statistics**			
	A	Measures of central tendency: mean, median, mode			CO1,CO6
	B	Measures of dispersion: range, variance, standard deviation			CO1,CO6
	Unit 2	**Graphical representation of data**			
	A	Graphical representation of data: histograms, bar charts, box plots			CO2,CO6
	B	Introduction to data analysis using statistical software			CO2,CO6
	Unit 3	**Probability Theory**			
	A	Basic concepts of probability: sample space, events, probability axioms			CO3,CO6
	B	Conditional probability and independence, Probability axioms			CO3,CO6
	Unit 4	**Data visualization**			
	A	Data visualization using tools like matplotlib, seaborn, or ggplot			CO4,CO6
	B	Exploratory data analysis: scatter plots, heatmaps, correlation matrices			CO4,CO6
	Unit 5	**Descriptive Statistics in SPSS**			
	A	Data entry and management in SPSS			CO5,CO6
	B	Computing descriptive statistics: mean, median, mode, variance, standard deviation, Generating frequency distributions and histograms, Computing descriptive statistics: mean, median, mode, variance, standard deviation			CO5,CO6
	Mode of examination				
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO-1: **Understand** the basic principles and concepts of probability theory and statistics, and their applications in artificial intelligence and machine learning.	PO1, PO3, PO4, PO8, PO9, PO10, PSO1
2.	CO-2: **Understand** the applications of probability theory and statistics in artificial intelligence and machine learning.	PO1, PO2, PO3, PO4, PO8, PO9, PO10
3.	CO-3: **Analyze** and interpret data using descriptive statistical techniques, such as measures of central tendency and dispersion, probability distributions, and data transformations.	PO1, PO2, PO3, PO4, PO8, PO9, PO10
4.	CO-4: **Apply** inferential statistical techniques, such as hypothesis testing, confidence intervals, and regression analysis, to make decisions based on data.	PO1, PO2, PO3, PO4, PO8, PO9, PO10, PSO1
5	CO-5: **Use** statistical learning techniques, such as linear regression, logistic regression.	PO1, PO2, PO3, PO4, PO8, PO9, PO10, PSO1
6	CO-6: **Demonstrate** critical thinking and apply statistical reasoning to solve real-world problems in various domains, such as finance, healthcare, marketing, and social sciences.	PO1, PO2, PO3, PO4, PO5, PO7, PO8, PO9, PO10, PSO1

PO and PSO mapping with level of strength for Course Name: Probability and Statistics-Lab

COs	PO 1	PO2	PO3	PO4	P O 5	PO 6	PO 7	PO8	PO9	PO1 0	PSO 1	PSO 2
CO1	3	-	3	2	-	-	-	2	2	2	1	-
CO2	3	3	3	2	-	-	-	3	2	2	-	-
CO3	3	3	3	2	-	-	-	3	2	2	-	-
CO4	3	3	3	3	-	-	-	3	2	2	2	-
CO5	3	3	3	2	-	-	-	3	2	2	2	-
CO6	3	3	3	2	2	-	2	3	2	2	3	-

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

Course Code/ Name	PO 1	PO2	PO 3	PO 4	PO5	PO 6	PO7	PO8	PO9	PO1 0	PSO 1	PSO 2
BCP287 Probability and Statistics-Lab	3	3	3	2.2	2	-	2	2.8	2	2	2	-

TERM-III

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**III**	
1	**Course Code**	**BCA368**	
2	**Course Title**	**Machine Learning**	
3	**Credits**	**5**	
4	**Contact Hours (L-T-P)**	**5-0-0**	
	Course Status	Core	
5	Course Objective	The objective of this course is to introduce the fundamental concepts of machine learning and its applications and to learn the classification, clustering and regression-based machine learning algorithms	
6	Course Outcomes	After the completion of this course, students will be able to: **CO1:** ***Understand*** the basic concepts of Bayesian theory and normal densities. **CO2:** ***Implement*** different classification algorithms used in machine learning. **CO3:** ***Implement*** clustering and component analysis techniques. **CO4:** ***Design*** and implement deep learning architectures for solving real life problems. **CO5:** ***Combine*** the evidence from two or more models/methods for designing a system. **CO6:** ***Develop*** and Utilize data to inform and support strategic decision-making in online marketing campaigns.	
7	Course Description	The course "Machine Learning: Principles and Practices" provides students with a comprehensive understanding of the fundamental concepts, methodologies, and practical applications of machine learning.	
8	Outline syllabus		CO Mapping
	Unit 1	**BAYESIAN DECISION THEORY AND NORMAL DISTRIBUTION**	
	A	Machine perception -feature extraction -classification, clustering,	CO1
	B	linear and logistic regression -Types of learning -Bayesian decision theory -classifiers	CO1
	C	Discriminant functions, and decision surfaces -univariate and multivariate normal densities -Bayesian belief networks	CO1, CO2
	Unit 2	**CLASSIFICATION ALGORITHMS**	
	A	Perceptron and backpropagation neural network -k-nearest-neighbor rule.	CO1, CO2
	B	Support vector machine: multicategory generalizations -Regression.	CO1, CO2
	C	Decision trees: classification and regression tree -random forest.	CO1, CO2
	Unit 3	**COMPONENT ANALYSIS AND CLUSTERING ALGORITHMS**	
	A	Principal component analysis -Linear discriminant analysis -Independent component analysis.	CO3
	B	k-means clustering -fuzzy k-means clustering -Expectation-maximization algorithm	CO3
	C	Gaussian mixture models -auto associative neural network.	CO3
	Unit 4	**DEEP LEARNING ARCHITECTURES AND APPLICATIONS**	
	A	Convolution neural network (CNN) -Layers in CNN -CNN architectures.	CO3, CO4
	B	Recurrent Neural Network -Applications: Speech-to-text conversion	CO3, CO4
	C	Image classification-time series prediction.	CO3, CO4
	Unit 5	**COMBINING MULTIPLE LEARNERS**	
	A	Generating diverse learners -model combination schemes -voting	CO5, CO6
	B	Error-correcting output codes -bagging -boosting	CO5, CO6
	C	Mixture of experts revisited -stacked generalization -fine-tuning an ensemble – cascading.	CO5, CO6

	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. W.A.Coklin, G.White(2016) Principles of Computer Security: Fourth Edition, McGrawHill			
	Reference Books	1. Thomas Halt, Adam M. Bossler and Kathryn C.SeigfriedSpellar(2017), Cybercrime and Digital Forensics: An Introduction‖, Routledge Taylor and Francis Group. 2. William, Stallings. (2018). Effective Cyber security: A Guide to Using Best Practices and Standards, Addison - Wesley Professional Publishers, 1st Edition.			

CO and PO Mapping

Course Outcome	**Programme Outcomes (PO) & Programme Specific Outcomes (PSO)**
CO1: Understand the basic concepts of Bayesian theory and normal densities.	PO1, PO2, PO3, PO4, PO5, PO10, PSO1, PSO2,
CO2: Implement different classification algorithms used in machine learning.	PO1, PO2, PO3, PO4, PO5, PO10, PSO1, PSO2
CO3: Implement clustering and component analysis techniques.	PO1, PO2, PO3, PO4, PO5, PO6, PO7,PO10,PSO1, PSO2
CO4: Design and implement deep learning architectures for solving real life problems.	PO1, PO2, PO3, PO4, PO5, PO6, PO7,PSO1, PSO2,
CO5: Combine the evidence from two or more models/methods for designing a system.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2
CO6: Develop and Utilize data to inform and support strategic decision-making in online marketing campaigns.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name: Machine Learning

Course Code_ Course Name	**COs**	**PO1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PSO 1**	**PSO 2**
BCA368 Machine Learning	**CO1**	1	2	3	2	2	-	-	-	-	2	3	2
	CO2	2	3	3	2	3	-	-	-	-	2	3	3
	CO3	3	3	3	3	2	1	1	-	-	1	3	2
	CO4	3	3	3	3	2	2	1	-	-	2	3	2
	CO5	2	3	3	3	3	2	2	2	3	2	3	3
	CO6	2	3	3	3	3	2	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**	**PSO 1**	**PSO 2**

BCA368	**Machine Learning**	2.2	2.8	3.0	2.7	2.5	1.8	1.5	2.0	3.0	1.8	3.0	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		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**III**	
1	Course Code	**BCA184**	
2	Course Title	Principles of Database Management Systems	
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:** 1. To learn about basic concepts of databases, terms, **2.** Introduce students to build database management systems **3.** Apply DBMS concepts to various examples and real life applications	
6	Course Outcomes	**At the end of the course student will be able to:** **CO1:** Explain the basics concepts of database & design an ER model for a given example from real world description.(K2,K6) **CO2:** Design & Solve the given problem using Relational Algebra, Relational Calculus, SQL and PL/SQL.(K6,K3) **CO3:** Apply normalization techniques to reduce redundancy from the database.(K3) **CO4: A**ppraise the basic issues of Transaction processing, Serializability & deadlock.(K5) **CO5:** Determine the roles of concurrency control techniques in database design.(K5) **CO6:** Design & develop database system for real life problems.(k6)	
7	Course Description	This course introduces developing and managing efficient and effective database applications that requires understanding the fundamentals of database management systems, techniques for the design of databases, and principles of database administration.	
8	Outline syllabus		**CO Mapping**
	Unit 1	**INTRODUCTION TO DATABASES & ENTITY–RELATIONSHIP (ER) MODEL**	
	A	Overview of DBMS, Database System vs File System, Data Independence Database languages: DDL, DML, Database Users, Database Administrator	CO1, CO6
	B	Data Models, Hierarchical, Network Data Modeling, Database System Architecture, Overall Database Structure, Relational data model concepts, ER Model Concepts, Notation for ER Diagram	CO1, CO6
	C	Keys, Concept of keys, Weak Entity Types, Generalization, Aggregation, Converting ER diagrams to relational tables.	CO1, CO6
	Unit 2	**RELATIONAL DATA MODEL & CONCEPTS OF SQL**	
	A	Relational Data Model Concepts, Integrity Constraints, Entity Integrity, Referential Integrity, Keys Constraints, Domain Constraints	CO1, CO2, CO6
	B	Relational Algebra, Relational Calculus, Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION	CO1, CO2, CO6
	C	Introduction on SQL: Characteristics of SQL, Advantage of SQL, Views and Indexes. Queries and Subqueries, Joins, Cursors, Triggers, Procedures in SQL/PL SQL	CO1, CO2, CO6
	Unit 3	**RELATIONAL DATABASE DESIGN & NORMALIZATION**	
	A	Functional Dependency, Different anomalies in designing a Database, loss less join decompositions	CO3, CO6
	B	Normal Forms: First, Second, Third normal forms and Boyce Codd normal form (BCNF), Multivalued dependencies, fourth normal forms	CO3, CO6
	C	Case Study based on Relational Database Design & Normalization	CO3, CO6
	Unit 4	**TRANSACTION PROCESSING CONCEPTS**	

	A	Introduction to Transaction processing; ACID property, Testing of Serializability, Serializability of Schedules,		CO4
	B	Conflict & View Serializable, Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Checkpoints, Deadlock,		CO4
	C	Case Study based on Transaction Processing System		CO4
	Unit 5	**CONCURRENCY CONTROL TECHNIQUES**		
	A	Concurrency Control, Two-Phase Locking Techniques for Concurrency Control, Time Stamping Protocols for Concurrency Control,		CO5
	B	Validation Based Protocol, Multiple Granularity, Multi Version Schemes,		CO5
	C	Case Study based on Oracle		CO5
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		25%	25%	50%
	Text book/s*	• Korth , Silberschatz& Sudarshan, Data base Concepts, Tata McGraw-Hill • Elmasri, Navathe, Fundamentals of Database Systems, Pearson Education Inc.		
	Other References	• Thomas Connolly, Carolyn Begg, Database Systems: A Practical Approach to design, Implementation and Management, Pearson Education, Latest Edition. • Jeffrey D. Ullman, Jennifer Windon, A first course in Database Systems, Pearson Education. • Date C.J., An Introduction to Database Systems, Addison Wesley. • Richard T. Watson, Data Management: databases and organization, Wiley.		

CO and PO Mapping

S. No.	Course Outcome (CO)	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Explain the basics concepts of database & design an ER model for a given example from real world description.	PO1, PO4, PO8, PO9, PO10
2.	CO2: Design & Solve the given problem using Relational Algebra, Relational Calculus, SQL and PL/SQL.	PO1, PO2, PO4, PO8, PO10
3.	CO3: Apply normalization techniques to reduce redundancy from the database.	PO1, PO2, PO3, PO4, PO8, PO10
4.	CO4: Appraise the basic issues of Transaction processing, Serializability & deadlock.	PO1, PO2, PO3, PO4, PO8
5	CO5: Determine the roles of concurrency control techniques in database design.	PO1, PO2, PO3, PO4, PO10
6	CO6: Design & develop database system for real life problems	PO1, PO2, PO3, PO4, PO5, PO6, PO9, PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name: Principles of Database Management Systems

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

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	PO1 0	PSO 1	PSO 2
BCA184/ **DBMS**	2.5	2.6	2.5	3	2	2	2	2.6	2.5	2.4	2	2

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

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**III**	
1	**Course Code**	**BCA186**	
2	**Course Title**	**Object Oriented Programming Using Java**	
3	**Credits**	**3**	
4	**Contact Hours (L-T-P)**	**3-0-0**	
	Course Status	Core	
5	Course Objective	Understand the fundamentals of object-oriented concept in Java, defining classes, objects, invoking methods inheritance, interfaces and exception handling mechanisms. To develop skills in analyzing the usability of a web and understand the fundamentals of web design and its technologies.	
6	Course Outcomes	**After successfully completion of this course students will be able to:** CO1: Compare and contrast different features of java with other programming paradigms. CO2: Describe the fundamental of object-oriented concepts in java. CO3: Explain the concept of inheritance, polymorphism, interfaces and multithreading. CO4: Analyze Exception and Error in java programs. CO5: Design web pages by using HTML & CSS. CO6: Develop real world related problems using object-oriented concepts of java.	
7	Course Description	Basic Object-Oriented Programming (OOP) concepts, including objects, classes, methods, parameter passing, information hiding, inheritance and polymorphism are introduced and their implementations using Java are discussed. HTML and CSS are discussed to give basic understanding and its implementation to design the web pages.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Object-Oriented Paradigm**	
	A	Procedural Languages, object-based languages, object-oriented languages, difference between programming paradigms, advantages of OOPs.	CO1, CO2
	B	Object-oriented programming features: Abstraction, class, object, Encapsulation, data hiding, polymorphism, inheritance.	CO1, CO2
	C	Java virtual machine, Byte Code, Architecture of JVM, Class Loader, Execution Engine, Garbage collection.	CO1, CO2
	Unit 2	**Introduction to Java with class and object**	
	A	Java development Kit (JDK), Introduction to IDE for java development, setting java environment (steps for path and CLASSPATH setting)	CO1, CO2
	B	Constants, Variables, Data Types, Type conversion & casting, Operators, Expressions, Decision Making, Branching, Loops, command line argument, Input from keyboard.	CO1, CO2
	C	Classes, Objects, Methods, Constructors, Constructor's overloading, static keyword, Introducing Access Control.	CO2, CO6
	Unit 3	**Inheritance, Polymorphism, Interface, Array & String**	
	A	Types of inheritance, Concept of multiple inheritances, use of this and super, Implementing Interface	CO3, CO6
	B	Polymorphism, Compile Time Polymorphism, Run Time Polymorphism, Method overloading, Overriding methods	CO3, CO6
	C	Final class, method and variable, Abstract class and method, Introduction to, Arrays and String handling.	CO3, CO6
	Unit 4	**Exception and Multithreading**	
	A	Exception Handling, Introduction to try, catch, throw and throws.	CO4, CO6
	B	Checked and Unchecked exceptions, User define exception,	CO4, CO6
	C	Introduction to Multithreading: multithreading advantages and issues, creating thread using Runnable interface and Thread class, Thread life cycle.	CO3, CO6

	Unit 5	**Html & Style sheets**			
	A	forms, XHTML			CO5, CO6
	B	frames and frame sets			CO5, CO6
	C	Overview and features of HTML 5			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1.Schildt H, "The Complete Reference JAVA2", TMH 2. Douglas Comer "The Internet Book - Pearson Education", Asia			
	Reference Books	1. Balagurusamy E, "Programming in JAVA", TMH 2. Professional Java Programming: BrettSpell, WROX Publication 3. Douglas E. Comer "Internetworking with TCP/IP", Volume-I, PHI 4. HTML 5, Black Book, Dreamtech Press			

CO and PO Mapping

Sl. No.	Course Outcome (CO)	
1.	CO1: Compare and contrast different features of java with other programming paradigms.	PO1, PO2
2.	CO2: Describe the fundamental of object-oriented concepts in java.	PO1, PO2, PO4
3.	CO3: Explain the concept of inheritance, polymorphism, interfaces and multithreading.	P01, PO2, PO3, PO4, PO10, PSO1
4.	CO4: Analyze Exception and Error in java programs.	PO1, PO2, PO3, PO10
5.	CO5: Design web pages by using HTML & CSS.	PO2, PO3, PO4, PO10
6.	CO6: Develop real world related problems using object-oriented concepts of java.	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name Object Oriented Programming Using Java

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
BCA186 Object Oriented Programming Using Java	**CO1**	**3**	**2**	**-**	-	-	-	-	-	-	**2**	-	-
	CO2	2	3	-	2	-	-	-	-	-	-	-	-
	CO3	**2**	**3**	**2**	**3**	-	-	-	-	-	**2**	2	-
	CO4	2	3	**2**	-	-	-	-	-	-	**2**	-	-
	CO5	-	2	**2**	3	-	-	-	-	-	**2**	**2**	**1**
	CO6	**2**	**3**	**2**	**3**	**3**	**2**	-	**2**	-	**2**	**2**	**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	PSO 1	PSO 2
BCA 186	**Object Oriented Programming Using Java**	**2.2**	**2.67**	**2**	**2.75**	**3**	**2**	**0**	**2**	**0**	**2**	**2**	**1.5**

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**		
Batch:		**2023-26**		
Department		**Computer Science & Applications**		
Programme		**BCA. (AI-ML), Academic Year: 2023-24**		
Semester		**III**		
1	Course Code	**BCA382**		
2	Course Title	**Software Engineering and Quality Assurance**		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Core Course		
5	Course Objective	The objective of this course is to provide 1. Fundamental knowledge of software engineering. 2. To make student aware of best software engineering practices. 3. Inculcate ability in students to work as an effective member or leader in software engineering teams. 4. To help students to develop skills that will enable them to develop software of high quality.		
6	Course Outcomes	CO1: Illustrate and compare an effective software engineering process, based on knowledge of widely used development lifecycle model. CO2: Apply effective requirement elicitation techniques to develop SRS for a project. CO3: Construct design documents with the help of designing tools. CO4: Analyze testing strategies for a software system. CO5: Develop and deliver quality software as an individual or as part of a multidisciplinary team. CO6: Adapt techniques and tools necessary for software engineering practices.		
7	Course Description	This course provides knowledge of software engineering. It introduces concepts such as software processes and agile methods and essential software development activities, from initial specification to system maintenance. Formalisms and tools to assist in software development are also presented, including common design patterns and UML notation. Course focuses on all levels of testing.		
8	Outline syllabus			CO Mapping
	Unit 1	**Introduction to Software Engineering and Process Models**		
	A	Significance, challenges and Software Myths in software engineering, Software Characteristics		CO1
	B	Software Development Methodologies: Waterfall model, prototyping model, Incremental model, Spiral model, V model		CO1
	C	Agility, Agile Process models: Extreme Programming (XP), Adaptive Software Development (ASD), Scrum		CO1
	Unit 2	**Requirement Engineering**		
	A	Types of Requirements, Feasibility study		CO2
	B	Requirement Engineering process, Elicitation techniques		CO2
	C	Requirement Documentation: Document SRS according to IEEE standards, Characteristics of SRS		CO2
	Unit 3	**Software Design**		
	A	Design Concepts, Design Strategies: Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design		CO3, CO6
	B	Effective modular design: Cohesion, Coupling		CO3, CO6
	C	UML Diagrams and Tools: Introduction to UML Diagrams, Use Case, Object and Class, Interaction diagrams: Sequence & Collaboration		CO3, CO6
	Unit 4	**Software Implementation and Testing**		
	A	Fundamental of testing: Objectives, principles, myths and facts,		CO4

		limitations of testing			
	B	Levels of testing, Acceptance Testing and its types, Integration techniques			CO4, CO6
	C	White Box Testing, Black Box Testing, Verification and Validation, Test case designing, Debugging			CO4, CO6
	Unit 5	**Maintenance & Quality Management**			
	A	Introduction to Maintenance, Need for Maintenance, Categories of Maintenance, Cost of Maintenance			CO5, CO6
	B	Quality Concepts: Quality, Quality Control, Cost of Quality, Software Quality Assurance, SQA Plan			CO5, CO6
	C	Statistical Software Quality Assurance: Six Sigma, The ISO 9000 Quality Standards, Capability Maturity Model			CO5, CO6
	Mode of examination	Theory/Jury/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Pressman R S, Software Engineering: A Practitioners Approach, McGraw Hill.			
	Other References	1. Datta S, Software Engineering: Concepts and Applications, Oxford University Press, 2010. 2. K.K. Aggrawal and Yogesh Singh, "Software Engineering", New Age International Publication 3. Sommerville, Ian. "Software Engineering", Pearson(Latest Ed).			

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1: Illustrate and compare an effective software engineering process, based on knowledge of widely used development lifecycle model	PO1,PO3,PO8,PO9,PO10,PSO1,PSO2
2.	CO2: Apply effective requirement elicitation techniques to develop SRS for a project	PO1,PO2,PO3,PO4,PO5,PO8,PO9,PO10, PSO1,PSO2
3.	CO3: Construct design documents with the help of designing tools	PO1,PO2,PO3,PO4,PO5, PO8,PO9,PO10, PSO1,PSO2
4.	CO4:Analyze testing strategies for a software system	PO1,PO2,PO4,PO5,PO6,PO7,PO8,PO9,PO10, PSO1,PSO2
5.	CO5: Develop and deliver quality software as an individual or as part of a multidisciplinary team.	PO1,PO2,PO3,PO4,PO5, PO6,PO7, PO8,PO9,PO10, PSO1,PSO2
6.	CO6: Adapt techniques and tools necessary for software engineering practices .	PO1,PO4,PO5,PO8,PO9,PO10, PSO2

PO and PSO mapping with level of strength for Course Name Software Engineering and Quality Assurance (BCA382)

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO2
BCA 382 Software Engineering and Quality Assurance	CO1	3	-	2	-	-	-	-	1	2	3	1	2
	CO2	3	3	2	3	3	-	-	1	2	3	2	3
	CO3	3	2	3	3	3	-	-	1	2	3	2	3
	CO4	3	1	-	1	3	2	2	2	3	3	1	3
	CO5	3	1	3	3	3	3	3	2	3	3	1	3
	CO6	2	-	-	1	3	-	-	1	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	PSO 1	PSO 2
BCA382	Software Engineering and Quality Assurance	2.8	1.75	2.5	2.2	3	2.5	2.5	1.3	2.3	2.8	1.4	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		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**		
Batch:		**2023-26**		
Department		**Computer Science & Applications**		
Programme		**BCA. (AI-ML), Academic Year: 2023-24**		
Semester		**III**		
1	Course Code	BCA369		
2	Course Title	Introduction to 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. 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	At the end of this course, students will be able to: CO1: Define principles of Blockchain networks, distributed ledger, and the layered architecture of blockchain CO2: Demonstrate an understanding of key terms related to cryptocurrencies CO3: Evaluate the differences among key consensus algorithms CO4: Evaluate the Ethereum and Hyperledger Fabric blockchain frameworks and their applications in enterprise contexts CO5: Apply the knowledge of smart contracts to design and develop simple programs using the Solidity programming language and Remix IDE CO6: Evaluate the benefits and challenges of using blockchain technology in various domains and identify potential use cases		
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	Introduction to Blockchain networks, distributed ledger, layered architecture of blockchain		CO1 , CO2
	B	Blockchain principles: Decentralization, immutability, transparency, hashing and digital signature		CO1 , CO2
	C	Types of Blockchain: Public, private and consortium. Permission less and permissioned		CO1 , CO2
	Unit 2	**Cryptocurrency**		
	A	Definition, Types, Benefits, Limitations		CO1, CO3
	B	Different Cryptocurrencies: Bitcoin, Ethereum, Altcoins.		CO1, CO3
	C	Crypto Wallets, Mining, Initial Coin Offering, Merkle Tree		CO1, CO3
	Unit 3	**Consensus Algorithms**		
	A	Proof of Work(PoW), Proof of Stake(PoS), Proof of Elapsed Time (PoET)		CO3, CO4
	B	Practical Byzantine Fault Tolerance: Definition, Working, Limitations		CO3, CO4
	C	Delegated Byzantine Fault Tolerance, Directed Acyclic Graphs,		CO3, CO4

	Unit 4	**Ethereum and Hyperledger**			
	A	Ethereum blockchain, Ethereum Virtual Machine (EVM), Ether and Gas			CO4,CO5
	B	Smart Contracts: Definition, Features, Working of Smart Contracts, Benefits and Limitations, Basic programming concepts of Solidity, Introduction to Remix IDE			CO3,CO5
	C	Hyperledger Project, Hyperledger Fabric, Working and Consensus algorithm			CO3,CO5
	Unit 5	**Application and future of Blockchain**			
	A	Blockchain in Finance, Blockchain in Governance, Blockchain in smart energy			CO5, CO6
	B	Blockchain in supply chain management, Blockchain and Artificial Intelligence, Blockchain and Internet of Things			CO5, CO6
	C	Applications: Electronic Health Record Management System, Land Record Management, Blockchain based traceability systems, Hash graphs			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Blockchain Technology and Applications, Manoj Kumar M. V., Likewin Thomas, Sourav Kanti Addya, Niranjana Murthy M., Annappa B. CRC Press, 2022			
	Other References	• 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}. • 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). • 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).			

CO and PO Mapping

Course Outcome	Programme Outcomes (PO) & Program Specific Outcomes (PSO)
CO1:Define principles of Blockchain networks, distributed ledger, and the layered architecture of blockchain	PO1,PO2,PO3, PO4, PO10, PSO1, PSO2
CO2:Demonstrate an understanding of key terms related to cryptocurrencies	PO1,PO2,PO3, PO4, PO10, PSO1, PSO2
CO3:Evaluate the differences among key consensus algorithms	PO1,PO2,PO3, PO4, PO10, PSO1, PSO2
CO4:Evaluate the Ethereum and Hyperledger Fabric blockchain frameworks and their applications in enterprise contexts	PO1,PO2,PO3, PO4, PO10, PSO1, PSO2
CO5:Apply the knowledge of smart contracts to design and develop simple programs using the Solidity programming language and Remix IDE	PO1,PO2,PO3, PO4, PO8, PO10, PSO1, PSO2
CO6:Evaluate the benefits and challenges of using blockchain technology in various domains and identify	PO1,PO2,PO3, PO4, PO5, PO6, PO7, PO8, PO10, PSO1, PSO2

potential use cases	

PO and PSO mapping with level of strength

Course Name	COs	PO 1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PSO1	PSO2
BCA369 Introduction to Blockchain Technology	**CO1**	3	3	2	2	-	-	-	-	-	3	2	3
	CO2	3	3	2	2	-	-	-	-	-	3	2	3
	CO3	3	3	2	2	-	-	-	-	-	3	2	3
	CO4	3	3	3	3	-	-	-	-	-	3	3	3
	CO5	3	3	3	3	-	-	-	2	-	3	3	3
	CO6	3	2	3	2	2	2	2	2	-	3	3	3
	AVG	3.00	2.83	2.50	2.33	2.00	2.00	2.00	2.00	0	3.00	2.50	3.00

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		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**			
Batch:		**2023-26**			
Department		**Computer Science & Applications**			
Programme		**BCA. (AI-ML), Academic Year: 2023-24**			
Semester		**III**			
1	**Course Code**	**BCA370**			
2	**Course Title**	**Cyber Analytics**			
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 to provide knowledge to secure corrupted systems, protect personal data, and secure computer networks in an organization. Additionally, to practice with an expertise in academics to design and implement security solutions.			
6	Course Outcomes	After the completion of this course, students will be able to: ***CO1: Explain*** the broad set of technical, social & political aspects of Computer Security. ***CO2: Describe*** the operational and psychology security Aspects. ***CO3: Explain*** Authentication Methods and Intrusion detection system. ***CO4: Describe*** the Cyber Crime Strategy analysis. ***CO5: Apply*** the Concepts of Cyber Crime and Digital Forensics in Real Time Scenarios. **CO6: *Develop*** and Utilize cyber analytics data to inform and support strategic decision-making in online marketing campaigns.			
7	Course Description	The course 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.			
8	Outline syllabus				CO Mapping
	Unit 1	**INTRODUCTION TO CYBER FORENSICS**			
	A	Introduction to Cyber Forensics - Cyber Threats and Vulnerabilities			CO1
	B	Concept of Cyber Security, Cyber Crimes and Cyber-attack.			CO1
	C	Current Threats and Trends – Confidentiality – Cyber Hate Crimes.			CO1, CO2
	Unit 2	**CYBER CRIME**			
	A	National Security Strategy – Organized Crime Strategy – Cyber Crime Strategy			CO1, CO2
	B	Policy Cyber Crime – International Response – National Cyber Security Structure			CO1, CO2
	C	Strategic Policy Requirements – Police and Crime Commissioners.			CO1, CO2
	Unit 3	**CYBER SECURITY AND THREATS**			
	A	User, Group, and Role Management - Password Policies - Single Sign-On -			CO3
	B	Security Controls and Permissions - Preventing Data Loss or Theft			CO3
	C	The Remote Access Process - Remote Access Methods. - Network-Based IDSs -			CO3
	Unit 4	**CYBER SECURITY**			
	A	Security Policies, Security Procedures, Standards, and Guidelines			CO3, CO4
	B	Security Awareness and Training - Interoperability Agreements - The Security Perimeter, Physical Security			CO3, CO4
	C	Environmental Issues - Wireless - Electromagnetic Eavesdropping - People—A Security Problem - People as			CO3, CO4
	Unit 5	**SECURITY SPACE**			
	A	Intrusion Detection System (IDS) and Intrusion Protection System (IPS).			CO5, CO6
	B	Web Based Automated System for Cyber Analytics			CO5, CO6
	C	Collection of Links, Scraping of Information, Structuring Information, Analysis of Data.			CO5, CO6
	Mode of examination	Theory			
	Weightage	CA	MTE	ETE	

	Distribution	25%	25%	50%	
	Text book/s*	1. Francois Chollet, Deep Learning with Python, Manning publications, Shelter Island, New York, 2018. 2. Tom M. Mitchell, ―Machine Learning‖, McGraw-Hill Education (India) Private Limited, 2013.			
	Reference Books	1. Navin Kumar Manaswi, Deep Learning with Applications using Python, Apress, New York, 2018. 2. Ethem Alpaydin, Introduction to Machine Learning, 3rd Edition, MIT Press, 2014.			

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	***CO1: Explain*** the broad set of technical, social & political aspects of Computer Security.	PO1,PO2,PO3,PO7,PO10,PSO1
2.	***CO2: Describe*** the operational and psychology security Aspects.	PO1,PO2,PO6,PO7,PO8,PO10, PSO1, PSO2
3	***CO3: Explain*** Authentication Methods and Intrusion detection system.	PO1, PO2, PO6, PO7, PO8, PO10, PSO1, PSO2
4	***CO4: Describe*** the Cyber Crime Strategy analysis.	PO1, PO2, PO3, PO4, PO5, PO10, PSO1
5	***CO5: Apply*** the Concepts of Cyber Crime and Digital Forensics in Real Time Scenarios.	PO1, PO2, PO3,PO4, PO5,PO6,PO7, PO9,PO10, PSO1, PSO2
6	**CO6: *Develop*** and Utilize cyber analytics data to inform and support strategic decision-making in online marketing campaigns.	PO1, PO2,PO3,PO4,PO5,PO7 ,PO9,PO10, PSO1

PO and PSO mapping with level of strength for Course Name Cyber Analytics

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO1 0	PSO1	PSO2
BCA370 Cyber Analytics	**CO1**	2	2	3	-	-	-	3	-	-	3	2	-
	CO2	3	3	-	-	-	2	2	3	-	3	3	2
	CO3	2	2	-	-	-	2	2	2	-	2	3	3
	CO4	2	2	2	3	3	-	-	-	-	3	2	-
	CO5	2	2	2	2	2	2	2	-	2	2	2	3
	CO6	3	2	-	2	2	-	3	-	3	2	2	-

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	PSO1	PSO2
BCA370	**Cyber Analytics**	2.3	2.1	2.3	2.3	2.3	2	2.4	2.5	2.5	2.4	2.3	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***

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**III**	
1	Course Code	**ARP207**	
2	Course Title	**Logical Skills Building and Soft Skills**	
3	Credits	2	
4	Contact Hours (L-T-P)	1-0-2	
	Course Status	Active	
5	Course Objective	To enhance holistic development of students and improve their employability skills. To provide a 360 degree exposure to learning elements of Business English readiness program, behavioural traits, achieve softer communication levels and a positive self-branding along with augmenting numerical and altitudinal abilities. To step up skill and upgrade students' across varied industry needs to enhance employability skills. By the end of this semester, a student will have entered the threshold of his/her 1st phase of employability enhancement and skill building activity exercise.	
6	Course Outcomes	After completion of this course, students will be able to: CO1: Ascertain a competency level through Building Essential Language and Life Skills CO2: Build positive emotional competence in self and learn GOAL Setting and SMART Goals techniques CO3: Apply positive thinking, goal setting and success-focused attitudes, time Management, which would help them in their academic as well as professional career CO4: Acquire satisfactory competency in use of aptitude, logical and analytical reasoning CO5: Develop strategic thinking and diverse mathematical concepts through building number puzzles CO6: Demonstrate an ability to apply various quantitative aptitude tools for making business decisions	
7	Course Description	This Level 1 blended training approach equips the students for Industry employment readiness and combines elements of soft skills and numerical abilities to achieve this purpose.	
8	Outline syllabus – ARP 207		
	Unit 1	**BELLS (Building Essential Language and Life Skills)**	**CO Mapping**
	A	*Know Yourself*: Core Competence. A very unique and interactive approach through an engaging questionnaire to ascertain a student's current skill level to design, architect and expose a student to the right syllabus as also to identify the correct TNI/TNA levels of the student.	CO1
	B	Techniques of Self Awareness | Self Esteem & Effectiveness| Building Positive Attitude | Building Emotional Competence	CO1, CO2
	C	Positive Thinking & Attitude Building | Goal Setting and SMART Goals – Milestone Mapping | Enhancing L S R W G and P (Listening Speaking Reading Writing Grammar and Pronunciation) |	CO1, CO2,CO3
	Unit 2	**Introduction to APTITUDE TRAINING- Reasoning- Logical/ Analytical**	
	A	Syllogism | Letter Series | Coding, Decoding , Ranking & Their Comparison Level-1	CO4

	B	Number Puzzles	CO5
	C	Selection Based On Given Conditions	CO5
	Unit 3	**Quantitative Aptitude**	
	A	Number Systems Level 1 | Vedic Maths Level-1	CO6
	B	Percentage ,Ratio & Proportion | Mensuration - Area & Volume |Algebra	CO6
	Unit 4	**Verbal Abilities – 1**	
	A	Reading Comprehension	CO1
	B	Spotting the Errors	CO2
	Unit 5	**Time & Priority Management**	
	A	Steven Covey Time Management Matrix	CO3
	B	Creating Self Time Management Tracker	CO3
	Weightage Distribution	*Class Assignment/Free Speech Exercises / JAM – 60% | Group Presentations/Mock Interviews/GD/ Reasoning, Quant & Aptitude – 40%*	
	Text book/s*	*Wiley's Quantitative Aptitude-P Anand |* ***Quantum CAT – Arihant Publications | Quicker Maths- M. Tyra |*** *Power of Positive Action (English, Paperback, Napoleon Hill) | Streets of Attitude (English, Paperback, Cary Fagan, Elizabeth Wilson) The 6 Pillars of self-esteem and awareness – Nathaniel Brandon | Goal Setting (English, Paperback, Wilson Dobson*	

PO and PSO mapping with level of strength for Course Name: Logical Skills Building and Soft Skills

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

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**			
Batch:		**2023-26**			
Department		**Computer Science & Applications**			
Programme		**BCA. (AI-ML), Academic Year: 2023-24**			
Semester		**III**			
1	Course Code	BCP184			
2	Course Title	Principles of 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, the student will be able to: CO1: Understand the basic concept of SQL commands in DBMS. (K2) CO2: Demonstrate various DDL Commands used to create and alter a table. (K2) CO3: Experiment with operations using Data Manipulation Language statements like Insert, Update and Delete. (K3) CO4: Examine data to apply various grouping clauses and aggregate functions. (K4) CO5: Evaluate the queries using the concepts like sub-queries, JOINS, Views, Cursors, Triggers. (K5) CO6: Develop project based on various SQL commands. (K6)			
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/Oracles			CO1, CO6
	Unit 2	**Practical based on DDL commands**			
		Create table, Alter table and Drop table			CO2, CO6
	Unit 3	**DML commands**			
		Introduction about the INSERT, SELECT, UPDATE & DELETE commands.			CO3, CO6
	Unit 4	**Practical based on Grouping Clauses GROUP BY, ORDER BY, HAVING & Aggregate Functions**			
		Briefly explain Group by, order by, having clauses with examples. Aggregate function: sum, avg, count, max, min			CO4, CO6
	Unit 5	**Practical based on Sub- queries, JOINS, Views**			
		Related example of Sub- queries, Joins and related examples, Views, Cursors, Trigger, PL/SQL			CO5, CO6
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	CE (Viva)	ESE	
		25%	25%	50%	
	Text book/s*	● Korth, Silberschatz & Sudarshan, Database Concepts, Tata McGraw-Hill			
	Other References	● Elmasri, Navathe, Fundamentals of Database Systems, Pearson Education Inc. ● Thomas Connolly, Carolyn Begg, Database Systems: A Practical Approach to design, Implementation and Management, Pearson Education, Latest Edition.			

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1: Understand the basic concept of SQL commands in DBMS.	PO1, PO3, PO4, PO8, PO9, PO10, PSO1
2.	CO2: Demonstrate various DDL Commands used to create and alter a table.	PO1, PO2, PO3, PO4, PO8, PO9, PO10
3.	CO3: Experiment with operations using Data Manipulation Language statements like Insert, Update and Delete.	PO1, PO2, PO3, PO4, PO8, PO9, PO10
4.	CO4: Examine data to apply various grouping clauses and aggregate functions.	PO1, PO2, PO3, PO4, PO8, PO9, PO10, PSO1
5	CO5: Evaluate the queries using the concepts like sub- queries, JOINS, Views, Cursors, Triggers.	PO1, PO2, PO3, PO4, PO8, PO9, PO10, PSO1
6	CO6: Develop project based on various SQL commands.	PO1, PO2, PO3, PO4, PO5, PO7, PO8, PO9, PO10, PSO1

PO and PSO mapping with level of strength for Course Name Principles of Database Management System Lab (BCP 184)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	-	3	2	-	-	-	2	2	2	1	-
CO2	3	3	3	2	-	-	-	3	2	2	-	-
CO3	3	3	3	2	-	-	-	3	2	2	-	-
CO4	3	3	3	3	-	-	-	3	2	2	2	-
CO5	3	3	3	2	-	-	-	3	2	2	2	-
CO6	3	3	3	2	2	-	2	3	2	2	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	PO1 0	PSO 1	PSO 2
BCP184: Principles of Database Management System Lab	3	3	3	2.2	2	-	2	2.8	2	2	2	-

Strength of Correlation

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

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**			
Batch:		**2023-26**			
Department		**Computer Science & Applications**			
Programme		**BCA. (AI-ML), Academic Year: 2023-24**			
Semester		**III**			
1	Course Code	BCP186			
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 implement Java language syntax and semantics and concepts such as classes, objects, inheritance, polymorphism, packages and multithreading.			
6	Course Outcomes (must be 6 COs, following verbs given in Bloom's Taxonomy)	CO1: Demonstrate Java environment and executing Java Programs CO2: Understand and formulate the problems in basic programming constructs CO3: Applying OOP concepts to solve real world problems CO4: Implement inheritance and polymorphism features of Java CO5: Implementing multithreading to enhance efficiency and handle run time errors CO6: Develop Java programs for software development			
7	Course Description	Apply features of OOPS and Java Programming including objects, classes, methods, parameter passing, information hiding, inheritance and polymorphism are discussed.			
8	Outline syllabus				CO Mapping
	Unit 1	**Jdk, IDE installation and program execution**			
		Installing jdk, setting path,Installation and uses of IDE, Writing Java programs, program execution,JVM, JVM for other operating systems, .class files			CO1
	Unit 2	**Programming revisited**			
		Programs on different data types, promotion rules in expressions, narrowing & type casting, logical-bit wise-arithmetic operators,Programs using if .. else, switch .. case statements, for, while, do .. while loop control structures, break and continue Programs using command line arguments, taking input from keyboard, Arrays in Java, nested control structures			CO2, CO3
	Unit 3	**class , object and constructor**			
		Programs to define classes, defining data members & member function, create objects, accessing members of a class through objects, Programs to define constructors, initializing instance variables, method overloading, constructor overloading.			CO2, CO3, CO6
	Unit 4	**Inheritance, package and Interface**			
		Programs on different types of inheritance, method overriding, achieving multiple inheritance through interfaces, inheritance in interfaces, private, protected and public mode			CO3, CO4, CO6
	Unit 5	**I/O, Exception and Multithreading**			
		Programs to use try.. catch.. finally for exception handling, throw user defined exceptions, uses of throws, nested try catch, rethrowing exceptions, Programs to define Thread, run and synchronize multiple threads by extending Thread class and implementing Runnable interface.			CO3, CO5, 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	1. Balagurusamy E, "Programming in JAVA", TMH Professional Java Programming: BrettSpell, WROX Publication			

PO and PSO mapping with level of strength for Course Name Object Oriented Programming Using Java LAB

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1: Demonstrate Java environment and executing Java Programs	PO1,PO2,PO3,PO7,PO10,PSO1
2.	CO2: Understand and formulate the problems in basic programming constructs	PO1,PO2,PO6,PO7,PO8,PO10, PSO1, PSO2
3	CO3: Applying OOP concepts to solve real world problems	PO1, PO2, PO6, PO7, PO8, PO10, PSO1, PSO2
4	CO4: Implement inheritance and polymorphism features of Java	PO1, PO2, PO3, PO4, PO5, PO10, PSO1
5	CO5: Implementing multithreading to enhance efficiency and handle run time errors	PO1, PO2, PO3,PO4, PO5,PO6,PO7, PO9,PO10, PSO1, PSO2
6	CO6: Develop Java programs for software development	PO1, PO2,PO3,PO4,PO5,PO7 ,PO9,PO10, PSO1

	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
BCP 186 Object Oriented Programming Using Java LAB	**CO1**	**1**	-	-	**2**	**2**	-	-	-	-	**2**	**1**	**1**
	CO2	**2**	-	-	**2**	**2**	-	-	-	-	**2**	**2**	**2**
	CO3	**2**	**3**	**3**	**3**	**2**	-	-	-	-	**2**	**2**	**3**
	CO4	**3**	-	-	**3**	**2**	-	-	-	-	**2**	**2**	**2**
	CO5	**3**	-	-	**3**	**2**	-	-	-	-	**2**	**2**	**2**
	CO6	**3**	**3**	**3**	**3**	**2**	-	-	-	-	**2**	**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	PO6	PO 7	PO 8	PO 9	PO1 0	PSO 1	PSO 2
BCP 186	Object Oriented Programming Using Java LAB	2.3	3	3	2.5	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***

List of Experiments

1. WAP in Java to print Hello and explore the difference between print() and println()
2. WAP in Java with two classes create an object of first class and call into another class (having main method)
3. WAP in Java to find product of two numbers.
4. WAP in Java product of two numbers (Input by the user)
5. WAP in Java to illustrate the concept of local, instance and static variable
6. WAP in Java to count the total number of vowels and consonants in a string.
7. WAP in Java input a string and check whether it is palindrome or not.
8. WAP in Java to implement implicit and explicit type casting
9. WAP in Java to implement various operators in java
10. WAP in Java to check whether the given number is prime or not.
11. WAP in Java for constructor overloading
12. WAP in Java for method overloading
13. WAP in Java for method overriding
14. WAP in Java to find the factorial of a given number.
15. WAP in Java to show run time polymorphism (up casting)
16. WAP in Java for access specifiers (all four)
17. WAP in Java to implement the single dimension array
18. WAP in Java to copy the elements from one array to another array
19. WAP in Java to perform the addition and multiplication in 2-D array
20. WAP in Java to print the duplicate elements of an array.
21. WAP in Java to find the sum of each row and each column of a matrix
22. WAP in Java to sort the elements of an array in ascending/ descending order using Bubble Sort and Insertion sort.
23. WAP in Java for simple inheritance
24. WAP in Java for Final keyword
25. WAP in Java for super keyword
26. WAP in Java to create package (user defined)
27. WAP in Java for abstract method, class
28. WAP in Java for interface
29. WAP in Java multiple inheritance
30. WAP in Java for exception handling by using try, catch and finally
31. WAP in Java for throw and throws exception
32. WAP in Java to throw your own exceptions
33. WAP in Java to reading and writing through console class.
34. WAP in Java how to create thread using Thread Class.
35. WAP in Java how to create thread using runnable interface.
36. WAP in Java to implement the multithreading.

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**			
Batch:		**2023-26**			
Department		**Computer Science & Applications**			
Programme		**BCA. (AI-ML), Academic Year: 2023-24**			
Semester		**III**			
1	Course Code	**RBL001**	Course Name: Research Based Learning -1		
2	Course Title	Research Based Learning -1			
3	Credits	0 (Audit Course)			
4	Contact Hours (L-T-P)	0-0-2			
	Course Status	Compulsory (Audit Course)			
5	Course Objective	1. To align student's skill and interests with a realistic Problem or Research Gap 2. To understand the significance of problem and its scope 3. Students will find the rational solution with correct methodology			
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 perform literature review with others. CO3: Plan the solution of problem as per the problem statement framed. CO4: Classify and understand basic methodology for hypothesis verification and validation of Research successfully. CO5: Implement the solution by using different aspects of programming language/other tools and techniques. CO6: Develop a glory of the need to engage in life-long learning.			
7	Course Description	In RBL-1, the students will learn how to define the problem for developing Research scope, identifying the skills required for developing the Research based on given a set of specifications and all subjects of that Semester.			
	Mode of examination	Practical /Viva			
	Weight age Distribution	CA	CE (Viva)	ETE	
		25%	25%	50%	

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO)
1.	CO1: Identify and formulate problem statement with systematic approach.	PO1, PO2,
2.	CO2: Develop teamwork and problem-solving skills, along with the ability to perform literature review with others.	PO2,PO8,PO10
3.	CO3: Plan the solution of problem as per the problem statement framed.	PO3,PO4
4.	CO4: Classify and understand basic methodology for hypothesis verification and validation of Research Successfully.	PO2,PO3,PO7,
5.	CO5: Implement the solution by using different aspects of programming language/other tools and techniques.	PO2,PO4
6.	CO6: Develop a glory of the need to engage in life- long learning	PO10

PO and PSO mapping with level of strength for Course Name Research Based Learning -1 (Course Code RBL001)

CO/PO Mapping (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Low												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	-	2	-	-	-	-	-	3	-	2	-	-
CO3	-		2	2	-	-	-	-	-	-	-	-
CO4	-	2	2	-	-	-	2	-	-	-	-	-
CO5	-	2		2	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	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	PSO 1	PSO 2
RBL001	Research Based Learning I	3	2	2	-	-	-	2	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***

TERM-IV

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**IV**	
1	**Course Code**	**BCA401**	
2	**Course Title**	**Deep Learning**	
3	**Credits**	**5**	
4	**Contact Hours (L-T-P)**	**5-0-0**	
	Course Status	Core	
5	Course Objective	The course "Principles of Deep Learning" aims to provide students with a comprehensive understanding of deep learning principles, architectures, and applications. Through theoretical knowledge and practical hands-on experience, students will gain the necessary skills to design, implement, and evaluate deep learning models for various AI and ML tasks.	
6	Course Outcomes	After the completion of this course, students will be able to: **CO1:** ***Understand*** the foundational concepts and principles of deep learning. **CO2:** ***Apply*** deep learning techniques to solve real-world problems in AI and ML. **CO3:** ***Design*** and implement deep neural network architectures for different tasks. **CO4:** ***Evaluate*** and fine-tune deep learning models for optimal performance. **CO5:** ***Analyze*** and interpret the results of deep learning experiments. **CO6:** ***Apply*** ethical considerations and best practices in deep learning applications.	
7	Course Description	The course will introduce students to the science and social science of network analysis. Through real world examples, including analysis of their own social networks, students will develop skills for describing and understanding the patterns and usage of services like Facebook, Twitter, YouTube, and others.	
8	Outline syllabus		CO Mapping
	Unit 1	**INTRODUCTION TO DEEP LEARNING**	
	A	Overview of deep learning and its significance in AI and ML, History and evolution of deep learning	CO1
	B	Deep learning applications in image recognition, natural language processing, and speech recognition	CO1
	C	Deep learning frameworks and tools (e.g., TensorFlow, Keras, PyTorch)	CO1, CO2
	Unit 2	**NEURAL NETWORKS AND ACTIVATION FUNCTIONS**	
	A	Fundamentals of artificial neural networks Activation functions and their properties (e.g., sigmoid, ReLU, softmax)	CO1, CO2
	B	Feedforward neural networks and backpropagation algorithm	CO1, CO2
	C	Optimization algorithms for training neural networks (e.g., gradient descent, stochastic gradient descent)	CO1, CO2
	Unit 3	**CONVOLUTIONAL NEURAL NETWORKS (CNNS)**	
	A	Convolutional layers and filters,Pooling and stride operations in CNNs	CO3
	B	Popular CNN architectures (e.g., LeNet, AlexNet, VGG, ResNet)	CO3
	C	Transfer learning and fine-tuning pre-trained CNN models	CO3
	Unit 4	**RECURRENT NEURAL NETWORKS (RNNS) AND SEQUENCE MODELS**	
	A	Introduction to recurrent neural networks	CO3, CO4
	B	Long Short-Term Memory (LSTM) networks, Gated Recurrent Units (GRUs)	CO3, CO4
	C	Applications of RNNs in sequence generation and natural language processing	CO3, CO4

	Unit 5	**ADVANCED DEEP LEARNING TOPICS**			
	A	Generative Adversarial Networks (GANs), Autoencoders and dimensionality reduction			CO5, CO6
	B	Attention mechanisms in deep learning			
	C	Reinforcement learning with deep neural networks			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville.			
	Reference Books	1. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems" by Aurélien Géron.			

CO and PO Mapping

S.No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	**CO1:** ***Understand*** the foundational concepts and principles of deep learning.	PO1, PO2, PO3, PO4, PO9, PSO1, PSO2
2.	**CO2:** ***Apply*** deep learning techniques to solve real-world problems in AI and ML.	PO1, PO2, PO3, PO4, PO9, PSO1, PSO2
3.	**CO3:** ***Design*** and implement deep neural network architectures for different tasks.	PO1, PO2, PO3, PO9, PSO1, PSO2
4.	**CO4:** ***Evaluate*** and fine-tune deep learning models for optimal performance.	PO1, PO2, PO3, PO4, PO9, PSO1, PSO2
5.	**CO5:** ***Analyze*** and interpret the results of deep learning experiments.	PO1, PO2, PO3, PO4, PO9, PSO1, PSO2
6	**CO6:** ***Apply*** ethical considerations and best practices in deep learning applications.	PO1, PO2, PO3, PO4, PO5, PO9, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name: Deep Learning

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

BCA401	**Deep Learning**	2	2.17	1.83	2.4	2	-	-	-	2.2	-	2.5	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		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**IV**	
1	Course Code	BCA185	
2	Course Title	Operating Systems and Unix shell Programming	
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 operating systems. 2. Includes different design principles and algorithms. 3. Evaluation of algorithms proposed. 4. Implementation of algorithms and utilities.	
6	Course Outcomes	CO1: Define role, responsibilities, features, and design of operating system. CO2: Demonstrate the Process Management and Scheduling techniques CO3: Implement tools and utility of operating systems. CO4: Apply various memory management techniques to understand file and disk management and analyze it. CO5: Understand the concepts of Unix and shell programming. CO6: Design and develop solutions to real world problem using Unix	
7	Course Description	This course introduces the design principles of operating systems, resource management, identifying challenges and applying respective algorithms. This course will also provide the basics of unix and shell programming.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Operating System Concepts**	
	A	Operating System Concepts and functions, Components of Computer System, Need of Operating system,	CO1, CO2
	B	Types of Operating Systems- Batch, Multiprogramming, Multi-Tasking, Multiprocessing, Distributed, Clustered, Embedded and Real Time Operating System.	CO1, CO2
	C	User Mode Vs Kernel Mode, Threading, Comparison between Process and Thread	CO1, CO2
	Unit 2	**Process Management and Scheduling**	
	A	Process Concepts- PCB, Process States, Process Operations.	CO1, CO2
	B	CPU Scheduling: Concept , Types of schedulers- (Short term, Long term, Middle term), Dispatcher,	CO1, CO2, CO4
	C	Performance Criteria CPU Scheduling Algorithms (FCFS, SJF, Priority, Round Robin, Multilevel Queue, Multilevel feedback Queue)	CO1,CO2,CO4
	Unit 3	**Deadlock Handling**	
	A	Race condition, Critical sections, Mutual exclusion,	CO1,CO2
	B	Deadlock concepts & Handling Techniques: Avoidance, Prevention	CO1,CO3
	C	Deadlock Detection & Recovery	CO4
	Unit 4	**Memory Management and File Management**	
	A	Memory Hierarchy, Memory Management Unit, Paging, Segmentation	CO1, CO5
	B	Virtual memory concept, demand paging, Page replacement algorithms(FCFS, Optimal, LRU),	CO3, CO5
	C	File Concept ,File operations, File Directories, Case study of	CO2,CO3, CO5

		Windows Operating System, Disk structure , Disk scheduling(FCFS,SSTF, SCAN, LOOK,C-SCAN, C-LOOK)			
	Unit 5	**Unix and Shell Scripting**			
	A	Unix file system, Commands related to Process and File Handling.			CO1, CO2,CO3
	B	System Calls (File related, Device related, Information related, Process Control Related and Communication related)			CO1, CO4,CO6
	C	Fork System Call, Creating a Parent - Child Process			CO1, CO4,CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ESE	
		25%	25%	50%	
	Text book/s*	1. 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	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	**CO1: Define** role, responsibilities, features, and design of operating system.	PO1,PO2,PO3,PO4,PSO1
2.	**CO2: Demonstrate** the Process Management and Scheduling techniques	PO1, PO3, PO4, PSO2
3.	**CO3: Implement** tools and utility of operating systems.	PO1,PO2,PO3,PO4
4.	**CO4: Apply** various memory management techniques to understand file and disk management and analyze it.	PO9, PO10,PO11
5.	**CO5: Understand** the concepts of Unix and shell programming.	PO1,PO2,PO8,PO9,PO10,PSO1
6.	**CO6: Design and develop** solutions to real world problem using Unix.	PO1,PO2,PO10,PSO1,PSO2

PO and PSO mapping with level of strength for Course Name: Operating Systems and Unix shell Programming

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	PSO 1	PS O2
BCA185 Operating Systems and Unix shell Programming	**CO1**	3	3	3	3	--	--	--	2	2	1	3	2
	CO2	3	2	3	3	--	--	--	2	2	2	2	3
	CO3	3	3	3	3	--	--	--	1	1	1	3	2
	CO4	3	2	3	--	--	--	--	2	2	2	2	3
	CO5	3	3	3	3	--	2	--	2	1	1	3	2
	CO6	3	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	PSO 1	PSO 2
BCA185	Operating Systems and Unix shell Programming	2.83	2.67	1.67	1.67	1.00	1.00	1.00	2.00	1.00	2.67	2.88	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***

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**IV**	
1	Course Code	BCP185	
2	Course Title	Operating Systems and Unix shell Programming Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Core	
5	Course Objective	Introduces the UNIX 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, scripting, and C/C++ compilers	
6	Course Outcomes	On completion of this course the student should be able to: CO1: To Identify and use UNIX utilities to create and manage simple file processing operations, organize directory structures with appropriate security, and develop shell scripts to perform more complex tasks. CO2: To accomplish typical personal, office, technical, and software development tasks. CO3: To Analyze system performance and network activities. Effectively use software development tools including libraries, preprocessors, compilers, linkers, and make files. CO4: Comprehend technical documentation, prepare simple readable user documentation and adhere to style guidelines. CO5:Analyze various utilities to structure the Linux Program CO6:Implement the Unix utilities to successfully write a program	
7	Course Description	This courses introduces Unix Operating System	
8	Outline syllabus		CO Mapping
	Unit 1	**Practical based on Basic Unix Commands**	
	A	Introduction to Unix, Unix architecture	CO1, CO2, CO4
	B	Features of Unix, Internal & External Commands	CO1, CO2, CO4

	C	Basic unix commands: pwd, cd, mkdir, rmdir, ls, help, man, whatis			CO1, CO2, CO4	
	Unit 2	**Practical based on File Management**				
	A	Unix file system			CO1, CO2. CO3, CO4	
	B	File Permission			CO1, CO2. CO3, CO4	
	C	File Handling Commands			CO1, CO2. CO3, CO4	
	Unit 3	**Practical based on process Management**				
	A	Process basics			CO2, CO3, CO4	
	B	Process and Threads			CO2, CO3, CO4	
	C	Process States, PID,PPID and other commands			CO2, CO3, CO4	
	Unit 4	**Practical Based on Filters**				
	A	Simple filters			CO2, CO3, CO4	
	B	pr, head, tail, tr, grep commands			CO2, CO3, CO4	
	C	cut, paste, sort, nl commands			CO2, CO3, CO4	
	Unit 5	**Practical Based on Shell Scripting**				
	A	Shell script			CO1, CO2, CO3, CO4, CO6	
	B	Execution of shell scripts.			CO1, CO2, CO3, CO4, CO6	
	C	Using command line arguments, loops , condition			CO1, CO2, CO3, CO4, CO6	
	Mode of examination	Jury/Practical/Viva				
	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 Shell programming by Stephen G. Kochan and Patric Wood 2. Unix and shell programming by Richard F. Gilberg and Behrouz A. forouzan				

PO and PSO mapping with level of strength for Course Name Operating Systems and Unix shell Programming Lab **(Course Code: BCP185)**

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1: To Identify and use UNIX 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,PO3,PO4,PSO1
2.	CO2: To accomplish typical personal, office, technical, and software development tasks.	PO1, PO3, PO4, PSO2
3.	CO3: To Analyze system performance and network activities.	PO1,PO2,PO3,PO4
4.	CO4: Comprehend technical documentation, prepare simple readable user documentation and adhere to style guidelines.	PO9, PO10,PO11
5.	CO5:Analyze various utilities to structure the Linux Program	PO1,PO2,PO8,PO9,PO10,PSO1
6.	CO6:Implement the Unix utilities to successfully write a program	PO1,PO2,PO10,PSO1,PSO2

PO and PSO mapping with level of strength for Course Name: Operating Systems and Unix shell Programming

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	PSO 1	PS O2
BCP185 Operating Systems and Unix shell Programming Lab	**CO1**	3	3	3	3	--	--	--	2	2	1	3	2
	CO2	3	2	3	3	--	--	--	2	2	2	2	3
	CO3	3	3	3	3	--	--	--	1	1	1	3	2
	CO4	3	2	3	--	--	--	--	2	2	2	2	3
	CO5	3	3	3	3	--	2	--	2	1	1	3	2
	CO6	3	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	PS O 1	PS O 2
BCP185	Operating Systems and Unix shell Programming Lab	2.83	2.67	1.67	1.67	1.00	1.00	1.00	2.00	1.00	2.67	2.88	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***

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**IV**	
1	Course Code	**BCA281**	
2	Course Title	**Application based Programming in Python**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	Emphasis is placed on procedural programming and object oriented , algorithm design, and language constructs common to most high-level languages through Python Programming and Machine Learning.	
6	Course Outcomes	Upon successful completion of this course, the student will be able to: CO1. Apply the concepts of decision-making and looping structures in programming. CO2. Understanding Modular programming approach using methods and functions. CO3.Understand and Implement the use of Python lists, tuples and dictionaries. CO4. Incorporate object-oriented programming concept in programming. CO5: Creating python packages in Complex applications. CO6: Design real life Applications in python using Machine Learning	
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 and apply to basic concepts of Machine learning.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	**CO1**
	A	History, 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 , Dictionaries and Functions**	**CO2, CO3**
	A	**Lists and Nested List:** Introduction, Accessing list, Operations, Working with lists, Library Function And Methods with Lists.	
	B	**Tuple:** Introduction, Accessing tuples, Operations, Working, Library Functions and Methods with Tuples. **Dictionaries :**Introduction, Accessing values in dictionaries, Working with dictionaries, Library Functions	
	C	**Functions:** Defining a function, Calling a function, Types of functions, Function Arguments Anonymous functions, Global and local variables	
	Unit 3	**Exception Handling , OOP and File Handling**	**CO4**
	A	**Exception Handling**: Definition Exception, Exception handling Except clause, Try,finally clause	
	B	**OOPs concept** : Class and object, Attributes, Abstraction, Encapsulation, Polymorphism and Inheritance	
	C	Static and Final Keyword, Access Modifiers and specifiers, scope of a class User Defined Exceptions	
	Unit 4	**Module and Applications**	**CO5**
	A	**Modules:** Importing module, Math module, Random module	
	B	Matplotlib, Packages	
	C	Applications: Searching Linear Search, Binary Search. Sorting: Bubble Sort	

	Unit 5	**Introduction to python Applications**			**CO6**
	A	Introduction to machine learning, Problems under the category of machine learning, Basic algorithms of machine learning with labeled data, Naïve Bays classifiers concepts			
	B	,Confusion matrix, precision and Recall and other metrics			
	C	Django frameworks basics for web designing			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. The Complete Reference Python, Martin C. Brown, McGrwHill			
	Other References	1. Introduction to computing in problem solving using Python, E Balahurusamy, McGrwHill 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			

PO and PSO mapping with level of strength for Course Name Application based Programming in Python

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

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**
BCA281	**Application based Programming in Python**	3	3	3	3	1			1		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***

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**IV**	
1	Course Code	BCA402	
2	Course Title	Data Warehousing and Data Mining	
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 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 5. Enhance students communication and problem solving skills	
6	Course Outcomes	Students will be able to: CO1: To understand the basic concept of data mining CO2: Demonstrate the Data Pre-processing & transformation Techniques CO3: Explain Various Pattern Mining Methodology CO4: Compare & Contrast Classification& Prediction Mechanism CO5: Experiment with Clustering Algorithms CO6: Apply Data mining Techniques in real world Knowledge Discovery	
7	Course Description	This course introduces advanced aspects of data warehousing and data mining, encompassing the principles, analyse the data, identify the problems, and choose the relevant models and algorithms to apply.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Evolution of Data mining and introductory concepts, Kind of Data & issues in Data Mining	CO1
	B	Knowledge Discovery Process,	
	C	Introduction to outlier.	
	Unit 2	**Data Pre processing**	
	A	Descriptive Data Summarization, Data Cleaning,	CO1, CO2,CO6
	B	Integration and Transformation,	
	C	Data Reduction, Discretization and Concept Hierarchy Generation.	
	Unit 3	**Frequent Pattern Mining**	
	A	Efficient and Scalable Frequent Item set Mining Methods: Apriori Algorithm	CO3, CO6
	B	FP -Growth, ECLAT Algorithm	
	C	correlation Analysis.	
	Unit 4	**Classification & Prediction**	
	A	What is classification, requirements of classification, Decision Tree-ID3 Algorithm, ,	CO4, CO6
	B	Naive Bayes Classifier, Rule Based classification, Backpropogation	
	C	Support Vector Machine for linearly separable data. Prediction: - Linear Regression.	
	Unit 5	**Clustering**	
	A	What is cluster analysis, requirements of cluster analysis, Applications of Cluster Analysis	CO5,CO6
	B	Partitioning methods-k-means and k-mediods,	
	C	Hierarchical Methods-Agglomerative and divisive, Density based methods-	

		DBSCAN			
	Mode of examination	Theory			
	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. VikramPudi& P. Radhakrishnan, "Data Mining", Oxford University Press			

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Program Specific Outcomes(PSO)
1.	CO1: To understand the basic concept of data mining	PO1,PO10
2.	CO2: Demonstrate the Data Preprocessing & transformation techniques	PO1, PO5, PO10
3.	CO3: Explain Various Pattern Mining Methodology	PO1 ,PO2, PO3,PO5
4.	CO4: Compare & Contrast Classification& Prediction Mechanism	PO1, PO2 PO3, PO4, PSO1, PSO2
5	CO5 :Experiment with Clustering Algorithms	PO1 ,PO2 PO3,PO4,PO5, PSO1, PSO2
6	CO6: Apply Data mining Techniques in real world Knowledge Discovery	PO2, PO3,PO4,PO5,PO6,PO7,PO8,PO9, PO10, PSO2

PO and PSO mapping with level of strength for Course Name Data Warehousing and Data Mining BCA402

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2
CO 1	3	-	-	-	-	-	-	-	-	3	-	-
CO 2	3	-	-	-	-	-	-	-	-	3	-	-
CO 3	2	2	2	-	2	-	-	-	-	-	-	-
CO 4	2	2	2	3		-	-	-	-	-	2	2
CO 5	2	3	3	3	3	-	-	-	-	-	2	2
CO 6	-	3	3	3	2	2	2	2	3	2	-	3

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

Course Code/ Name	**PO 1**	**PO2**	**PO 3**	**PO 4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO 2**
BCA 402 Data Warehousing and Data Mining-	2.5	2.5	2.5	3	2.3	2	2	2	3	2.6	2	2.3

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**IV**	
1	**Course Code**	**BCA403**	
2	**Course Title**	**Social Media Analytics**	
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 understand the role of social media data and analytics in helping organizations achieve their goals and understand their Publics and to identify and select key performance indicators to accurately measure the success of social media efforts;	
6	Course Outcomes	After the completion of this course, students will be able to: **CO1:** ***Explain*** the basic concepts of social network analysis **CO2:** ***Collaborative*** with peers to apply these methods to a variety of social media **CO3:** ***Describe*** the link between qualitative and quantitative methods of social network analysis **CO4:** ***Explain*** how these social technologies impact society and vice versa **CO5:** ***Examine*** the ethical and legal implications of leveraging social media data. **CO6:** ***Develop*** and Utilize SM analytics data to inform and support strategic decision-making in online marketing campaigns.	
7	Course Description	The course will introduce students to the science and social science of network analysis. Through real world examples, including analysis of their own social networks, students will develop skills for describing and understanding the patterns and usage of services like Facebook, Twitter, YouTube, and others.	
8	Outline syllabus		CO Mapping
	Unit 1	**INTRODUCTION TO SOCIAL MEDIA ANALYTICS**	
	A	Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas	CO1
	B	Network fundamentals and models: The social networks perspective - nodes, ties and influencers, social network and web data and methods	CO1
	C	Graphs and Matrices- Basic measures for individuals and networks. Information visualization	CO1, CO2
	Unit 2	**CONNECTIONS & WEB ANALYTICS TOOLS**	
	A	Making connections: Link analysis. Random graphs and network evolution.	CO1, CO2
	B	Social contexts: Affiliation and identity, Web analytics tools: Clickstream analysis, A/B testing, online surveys, Web crawling and Indexing.	CO1, CO2
	C	Natural Language Processing Techniques for Micro-Text Analysis	CO1, CO2
	Unit 3	**SOCIAL ANALYTICS (FACEBOOK, INSTAGRAM, TWITTER)**	
	A	Facebook Analytics: Introduction, parameters, demographics, Analyzing page audience.	CO3
	B	Reach and Engagement analysis. Post- performance on FB, Social campaigns. Measuring and analyzing social campaigns	CO3
	C	Defining goals and evaluating outcomes, Network Analysis. 9 (LinkedIn, Instagram, YouTube Twitter etc. Google analytics).	CO3
	Unit 4	**PROCESSING AND VISUALIZING DATA**	
	A	Processing and Visualizing Data, Influence Maximization, Link Prediction,	CO3, CO4
	B	Collective Classification, Applications in Advertising and Game Analytics.	CO3, CO4
	C	Introduction to Python Programming, Collecting and analyzing social media data;	CO3, CO4

		visualization and exploration			
	Unit 5	**CASE STUDY IMPLEMENTATION**			
	A	Practical component: CASE STUDY Students should analyze the social media of any ongoing campaigns and present the findings			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Marshall Sponder(2017), Social Media Analytics, McGraw Hill, Latest edition			
	Reference Books	2. Jim Sterne(2021), Social Media Metrics: How to Measure and Optimize Your Marketing Investment, Wiley Latest Edition.			

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	**CO1:** ***Explain*** the basic concepts of social network analysis	PO1, PO2, PO3, PO4, PO9, PSO1, PSO2
2.	**CO2:** ***Collaborative*** with peers to apply these methods to a variety of social media	PO1, PO2, PO3, PO4, PO9, PSO1, PSO2
3.	**CO3:** ***Describe*** the link between qualitative and quantitative methods of social network analysis	PO1, PO2, PO3, PO9, PSO1, PSO2
4.	CO4: Explain how these social technologies impact society and vice versa	PO1, PO2, PO3, PO4, PO9, PSO1, PSO2
5.	CO5: Examine the ethical and legal implications of leveraging social media data.	PO1, PO2, PO3, PO4, PO9, PSO1, PSO2
6	CO6: Develop and Utilize SM analytics data to inform and support strategic decision-making in online marketing campaigns.	PO1, PO2, PO3, PO4, PO5, PO9, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name: Social Media Analytics

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	2	3	1	2	-	--	--	-	2	-	3	2
CO2	2	2	2	2	-	--	--	-	3	-	2	3
CO3	2	1	2	-	-	--	--	-	1	-	3	2
CO4	1	2	2	3	-	--	--	-	2	-	2	2
CO5	3	3	1	3	-	-	-	-	3	-	2	1
CO6	2	2	3	2	2	-	-	--	2	-	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	PSO 1	PSO 2
BCA403	Social media Analytics	2	2.17	1.83	2.4	2	-	-	-	2.2	-	2.5	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		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**IV**	
1	Course Code	**ARP 305**	
2	Course Title	**Personality Development and Decision making Skills**	
3	Credits	2	
4	Contact Hours (L-T-P)	1-0-2	
	Course Status	Active	
5	Course Objective	To enhance holistic development of students and improve their employability skills. Provide a 360 degree exposure to learning elements of Business English readiness program, behavioural traits, achieve softer communication levels and a positive self-branding along with augmenting numerical and altitudinal abilities. To up skill and upgrade students' across varied industry needs to enhance employability skills. By the end of this semester, a will have entered the threshold of his/her 3rd phase of employability enhancement and skill building activity exercise.	
6	Course Outcomes	After completion of this course, students will be able to: CO1: Apply skills of personality development which will help a student groom to meet the needed social strata for establishing themselves in the society CO2: Build a positive behavioural attitude and attributes developing interpersonal skills for building positive and meaningful social and professional relationships CO3: Review and revise development plans to adapt to changing aspirations, circumstances and working environments CO4: Acquire higher level competency in use of numbers and digits, logical and analytical reasoning CO5: Develop higher level strategic thinking and diverse mathematical concepts through building cubes and cuboids. CO6: Demonstrate higher level quantitative aptitude such as analytical and statistical tools for making business decisions.	
7	Course Description	This bundles Training approach attempts to explore the personality, character, and the natural style of the student. This helps to develop character, personality, confidence and interpersonal abilities within the student along with level 3 readiness in quant, aptitude and reasoning skills	
8			

	Unit 1	**Impress to Impact**	**CO MAPPING**
	A	What is Personality?| Creating a positive impression – The 3 V's of Impression | Individual Differences and Personalities	CO1
	B	Personality Development and Transformation | Building Self Confidence | Behavioural and Interpersonal Skills	CO2
	C	Avoiding Arguments | The Art of Assertiveness | Constructive Criticism | The Personal Effectiveness Grid | Assessing our Strengths & Limitations and Creating an Action Plan for Learning with the 4M Model	CO3
	Unit 2	**Introduction to APTITUDE TRAINING- Reasoning- Logical/ Analytical**	
	A	Numbers & Digits , Mathematical Operations | Analytical Reasoning	CO4
	B	Cubes & Cuboids | Statement & Assumptions	CO5
	C	Strong & Weak Argument	CO5
	Unit 3	**Quantitative Aptitude**	
	A	Work & Time ,Pipes & Cistern	CO6
	B	Time ,Speed & Distance, Quadratic & Linear Equations, Logs & Inequalities	CO6
	C	Sequence & Series, Logarithms, Data Interpretation | Data sufficiency - Level 1	CO6
	Unit 4	**Verbal Abilities-3**	
	A	Cloze Test	CO3
	B	Sentence Rearrangement	CO3
	Unit 5	**Charisma Building**	

	A	How to Build Charisma	CO2
	B	Steps Towards Building a Charisma	CO2
	C		
	Weightage Distribution	*(CA)Class Assignment/Free Speech Exercises / JAM – 60% | (ETE) Group Presentations/Mock Interviews/GD/ Reasoning, Quant & Aptitude – 40%*	
	Text book/s*	*Wiley's Quantitative Aptitude-P Anand* | ***Quantum CAT – Arihant Publications*** | ***Quicker Maths- M. Tyra*** | *Power of Positive Action (English, Paperback, Napoleon Hill) | Streets of Attitude (English, Paperback, Cary Fagan, Elizabeth Wilson) The 6 Pillars of self-esteem and awareness – Nathaniel Brandon | Goal Setting (English, Paperback, Wilson Dobson*	

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

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**IV**	
1	Course Code	**BCP281**	
2	Course Title	**Application based Programming in Python lab**	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-4	
	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 and Machine Learning.	
6	Course Outcomes	Upon successful completion of this course, the student will be able to: CO1. Apply the concepts of decision-making and looping structures in programming. CO2. Understanding Modular programming approach using methods and functions. CO3.Understand and Implement the use of Python lists, tuples and dictionaries. CO4. Incorporate object-oriented programming concept in programming. CO5: Creating python packages in Complex applications. CO6: Design real life Applications in python using Machine Learning	
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 and apply to basic concepts of Machine learning.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	**CO1,CO2**
	A	1. Getting started with python environment like Jupyter, Spyder, Pycharm 2. Demonstrate basic data type in python. Demonstrate the working of 'id' and 'type'	
	B	3. Demonstration of type casting. 4. Demonstrate different in-built string functions. 5. Program to implement all conditional statements	
	C	6. Program to implement different control structures	
	Unit 2	**List, Tuple , Dictionaries and Functions**	**CO3**
	A	1. Program to implement operations on lists 2. Program to implement operations on Dictionaries.	
	B	3. Program to implement operations on Tuple 4. Program to implement Exception Handling	
	C	5. Program to use different functions 6. Write a python program to find the factorial of a given number using functions. 7. Write a function ball_collide that takes two balls as parameters and computes if they are colliding. Your function should return a Boolean representing whether or not the balls are colliding. Hint: Represent a ball on a plane as a tuple of (x, y, r), r being the radius If (distance between two balls centers) <= (sum of their radii) then (they are colliding) Write a python to print Fibonacci series using functions.	

	Unit 3	**Exception Handling , OOP and File Handling**			**CO4**
	A	1. Program to use object oriented concepts like inheritance, overloading polymorphism etc. 2. Program for file handling			
	B	3. Write a Python program to demonstrate working of classes and objects. Write a Python program to demonstrate class method & static method			
	C	4. Write a Python program to demonstrate constructors. 5. Write a program to perform division by handling exceptions. Demonstrate a python code to print try, except and finally block statements.			
	Unit 4	**Module and Applications**			**CO5**
	A	1. Program to use modules and package 2. Program to implement searching and sorting			
	B	3. Write a python program to create a package (Engg), sub -package(years),modules (sem) and create staff and student function to module.			
	C	Write a python program to create a package (college),sub - package (alldept),modules(it,cse) and create admin and cabin function to the module.			
	Unit 5	**Machine Learning Application**			**CO6**
	A	Wap to understand the concept of data, labeled data, supervised techniques for a machine learning application. Implementation of SVM, Naïve Bayes classifier			
	B	○ WAP to implement unsupervised machine learning algorithms such as K-means clustering ○ KNN (k-nearest neighbors) ○ Hierarchal clustering			
	C	Create a website using Djengo framework.			
	Mode of examination	Practical/Viva			
	Weightage Distribution	CA	CE (Viva)	ESE	
		25%	25%	50%	
	Text book/s*	1. The Complete Reference Python, Martin C. Brown, McGrwHill			
	Other References	1. Introduction to computing in problem solving using Python, E Balahurusamy, McGrwHill 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	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1. Apply the concepts of decision-making and looping structures in programming.	PO1,PO2,PO3,PO4,PO8,PO10, PSO1,PSO2
2.	CO2. Understanding Modular programming approach using methods and functions.	PO1,PO2,PO3,PO4,PO8,PO10, PSO1,PSO2
3.	CO3.Understand and Implement the use of Python lists, tuples and dictionaries.	PO1,PO2,PO3,PO4,PO8,PO10, PSO1,PSO2
4.	CO4. Incorporate object-oriented programming concept in programming.	PO1,PO2,PO3,PO4,PO5,PO8,PO10, PSO1,PSO2
5.	CO5: Creating python packages in Complex applications.	PO1,PO2,PO3,PO4,PO5,PO8,PO10, PSO1,PSO2
6.	CO6: Design real life Applications in python using Machine Learning	PO1,PO2,PO3,PO4,PO5,PO8,PO10, PSO1,PSO2,

PO and PSO mapping with level of strength for Course Name Application based Programming in Python and Machine Learning

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

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
BCP281	**Application based Programming in Python and Machine Learning**	3	3	3	3	1			1		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***

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**			
Batch:		**2023-26**			
Department		**Computer Science & Applications**			
Programme		**BCA. (AI-ML), Academic Year: 2023-24**			
Semester		**IV**			
1	Course Code	RBL002	Course Name: Research Based Learning -2		
2	Course Title	Research Based Learning -2			
3	Credits	0			
4	Contact Hours (L-T-P)	0-0-2			
	Course Status	Compulsory (Audit Course)			
5	Course Objective	1. To align student's skill and interests with a realistic research 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 perform literature review with others. CO3: Plan the solution of problem as per the problem statement framed. CO4: Classify and understand basic methodology for hypothesis verification and validation of Research successfully. CO5: Implement the solution by using different aspects of programming language/other tools and techniques. CO6: Develop a glory of the need to engage in life-long learning.			
7	Course Description	In RBL-2, the students will learn how to define the problem for developing Research scope, identifying the skills required for developing the Research based on given a set of specifications and all subjects of that Semester.			
	Mode of examination	Practical /Viva			
	Weight age Distribution	CA	CE (Viva)	ETE	
		25%	25%	50%	

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO)
1.	CO1: Identify and formulate problem statement with systematic approach.	PO1,PO2,PO5,PO6
2.	CO2: Develop teamwork and problem-solving skills, along with the ability to perform literature review with others.	PO2,PO3,PO4,PO8
3.	CO3: Plan the solution of problem as per the problem statement framed.	PO2,PO3,PO4
4.	CO4: Classify and understand basic methodology for hypothesis verification and validation of Research successfully.	PO3,PO4
5.	CO5: Implement the solution by using different aspects of programming language/other tools and techniques.	PO3,PO4,PO10,PSO1,PSO2
6.	CO6: Develop a glory of the need to engage in life- long learning.	PO8,PO9, PO10

PO and PSO mapping with level of strength for Course Name Research Based Learning 2 (Course Code RBL002)

CO/PO Mapping												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	3	-	-	2	2	-	-	-	-	-	-
CO2	-	3	2	3	-	-	-	2	-	-	-	-
CO3	-	3	2	3	-	-	-	-	-	-	-	-
CO4	-	-	2	2	-	-	-	-	-	-	-	-
CO5	-	-	3	2	-	-	-	-	-	2	2	2
CO6	-	-	-	-	-	-	-	3	3	3		-

TERM V

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**V**	
1	Course Code.	BCA285	
2	Course Title	Introduction to R	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course status	Compulsory	
5	Course Objectives	To familiarize the students with the basics of programming in R language, and its applications in data analysis.	
	Course Outcomes	Upon successful completion of this course, student will be able to: CO1: Demonstrate R programming using Decision statements, Loops and Functions. (K3) CO2: Apply functions to improve readability of programs. (K3) CO3: Select and construct programs using different data structures available in R. (K1, K3) CO4: Summarize data using descriptive statistics and perform distribution analysis. (K2, K4) CO5: Design visualizations of data using different types of graphs and plots. (K5) CO6: Estimate data using complex statistical testing. (K6)	
7	Course Description	R is a programming language and software environment for statistical analysis, graphics representation and reporting. This course provides an introduction to the basics of programming in R, and its applications in data analysis.	
8	**Outline syllabus:**		CO Mapping
	Unit 1	**Introduction to R Programming, Decisions, Loops and Functio**	
	A	Introduction to R Programming, R-Studio Installation (GUI): R Windows Environment, Simple Math in R	CO1
	B	Introduction to Data Types, Variables, Operators	CO1
	C	Decision Statements, R Loops, R Functions	CO2
	Unit 2	**Data Structures in R**	
	A	Introduction to Arrays, Working with Strings	CO3
	B	Data Structures/ Objects in R: Vector, List, Matrix, Factor, Data Frame	CO3, CO2, CO6
	C	Conversion of Data Objects: Matrix to Data frame, Data frame to Matrix, Data Frame to list, Matrix to list.	CO3, CO2
	UNIT 3	**Descriptive Statistics**	
	A	Reading Datasets, Working with different file types .txt, .csv etc., Combining Datasets	CO4
	B	Descriptive Statistics and Tabulation: Summarizing data with R, Contingency Tables	CO4
	C	Data Distribution Analysis: Shapiro Wilk Test, Kolmogorov	CO4

		Smirnov, Quantile Plots			
	Unit 4	**Data Visualization in R**			
	A	Load data in R environment and plotting a graph, histograms (equal class intervals and unequal class intervals), Bar Chart, Box plot,			CO5
	B	Stem-leaf plot, Scatter Plot, Line Chart, Pie chart,			CO5, CO6
	C	Customization of plot settings, adding text, saving plot to a file, adding legends.			CO5, CO6
	Unit 5	**Hypothesis Testing and Correlation Analysis**			
	A	Hypothesis Testing: Student t test, Mann Whitney Test			CO6
	B	Correlation Analysis, Random number generation and sampling procedures.			CO6
	C	Complex Statistics: One way and two-way ANOVA			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Gardener, M (2012): Beginning R: The Statistical Programming Language, Wiley Publications. 2. Braun W J, Murdoch D J (2007): A First Course in Statistical Programming with R. Cambridge University Press. New York			
	Other References	1. Crawley, M.J. (2015): Statistics: An Introduction Using R, 2nd Edition. Wiley. 2. Crawley, M.J. (2012): The R Book, 2nd Edition. Wiley.			

PO and PSO mapping with level of strength for Course Name Introduction to R (Course Code BCA285)

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
BCA285 Introduction to R	CO1	2	1	1	2	-	-	-	2	-	-	2	-
	CO2	2	2	2	2	-	-	-	2	-	-	2	-
	CO3	2	2	1	2	-	-	-	2	-	-	2	-
	CO4	2	2	2	2	-	-	-	2	-	-	2	-
	CO5	2	2	2	2	-	-	-	2	-	-	2	-
	CO6	3	3	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	PSO 1	PSO 2
BCA285	**Introduction to R**	**2.1**	**2**	**1.7**	**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		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**		
Batch:		**2023-26**		
Department		**Computer Science & Applications**		
Programme		**BCA. (AI-ML), Academic Year: 2023-24**		
Semester		**V**		
1	Course Code	**BCA282**		
2	Course Title	**Computer Networks and Data Communication**		
3	Credits	4		
4	Contact Hours (L-T-P)	4-0-0		
	Course Status	Compulsory		
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 OSI reference model.		
6	Course Outcomes	**Students will be able to:** **CO1:** Classify the basic network infrastructure to learn the overall function of networking systems and transmission mediums. **CO2:** Demonstrate analog and digital transmission techniques. **CO3:** Apply knowledge of switching and error detection and correction. **CO4:** Illustrate the network layer and transport layer including IP Addressing, routing, TCP and UDP services. **CO5:** Explain the functionality of application layer. **CO6:** Outline the cryptography and network security.		
7	Course Description	This course provides detailed concepts of computer networking. Familiarize the student with the basic taxonomy and terminology of the computer networking area.		
8	Outline syllabus		CO Mapping	
	Unit 1	**Introduction:**		
	A	Overview of networks in daily life, Network Topologies- Bus, Star, Ring, Mesh, Hybrid.	CO1	
	B	Connecting devices-Hub, Repeater, Router, Switch, Gateway, Modem, Multiplexers Transmission Media- Coaxial cables, twisted pair cables- Unshielded, shielded	CO1	
	C	Modes of Transmission-Simplex, half duplex and Full duplex, Network Architecture and structure, Types of networks- LAN, MAN, WAN, Broadcast, Point to Point, Peer to peer Networks	CO1, CO2	
	Unit 2	**Digital Transmission and Analog Transmission**		
	A	Digital Transmission: Digital-to-Digital Conversion, Analog-to-Digital Conversion	CO2, CO6	
	B	Analog Transmission: Digital-to-Analog Conversion, ASK,FSK,PSK, Analog-to-Analog Conversion,	CO2, CO6	
	C	Modulation Techniques, Pulse Code Modulation, Delta Modulation.	CO2, CO6	
	Unit 3	**Switching & Data Link Layer**		

	A	Switching: Circuit switched networks, Datagram networks, Virtual circuit networks, Dial up modems, DSL.	CO3, CO6	
	B	Framing , Errors in communication, Types of Error-Single Bit error, Burst error	CO3, CO6	
	C	Flow Control- simplex protocol and stop and Wait protocol, Random Access- Aloha, CSMA	CO3, CO6	
	Unit 4	**Network Layer & Transport Layer**		
	A	Network Layer Services. IPV4 addressing basics and Header format	CO4, CO6	
	B	IP Addressing: IPv4, IPv6 subnetting, super-netting, MASK. Routing Protocols: IP, ARP, RARP, ICMP, IGMP functionalities and characteristics.	CO4, CO6	
	C	Transport layer Basics, Process to Process delivery, TCP services and header format UDP: services, features, header format	CO4, CO6	
	Unit 5	**Application Layer**		
	A	DNS namespace, distribution of namespace, DNS in internet, resolution	CO5, CO6	
	B	Email Architecture, services and Features Network Security: Definition of -symmetric, Asymmetric Cryptography	CO5, CO6	
	C	Digital signature, Message Digest	CO5, CO6	
	Mode of examination	Theory		
	Weightage Distribution	CA / MTE / ETE		
		25% / 25% / 50%		
	Text book/s*	1. Forouzan, B.., "Communication Networks", TMH, Latest Edition		
	Other References	1. Tanenbaum, A.S." Computer Networks", 4th Edition, PHI 2. W. Stallings, "Data and Computer Communication" Macmillan Press		

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	**CO1:** Classify the basic network infrastructure to learn the overall function of networking systems and transmission mediums.	PO1, PO2, PO3,PO4 PSO2
2.	**CO2:** Demonstrate analog and digital transmission techniques.	PO1, PO2, PO3,PO4 PSO2
3.	**CO3:** Apply knowledge of switching and error detection and correction.	PO1, PO2, PO3,PO4 PSO2

4	**CO4:** Illustrate the network layer and transport layer including IP Addressing, routing, TCP and UDP services.	PO1, PO2, PO3,PO4 PSO2
5	**CO5:** Explain the functionality of application layer.	PO1, PO2, PO3,PO4 PSO2
6.	**CO6:** Outline the cryptography and network security.	PO1, PO2, PO3,PO4 PSO2

PO and PSO mapping with level of strength for Course Name Computer Networks and Data Communication (BCA282)

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**
CO1	3	2	2	2	-	--	--	--	--	--	--	2
CO2	3	2	2	2	-	---	--	---	-	---	-	2
CO3	3	2	2	2	-	---	--	---	-	---	-	2
CO4	3	2	2	2	-	---	--	---	-	---	-	2
CO5	3	2	2	2	-	--	--	--	-	--	-	2
CO6	3	2	2	2	-	--	--	--	-	--	-	2
AVG.	3	2	2	2	--	--	--	--	-	--	-	2

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**V**	
1	**Course Code**	**BCA501**	
2	**Course Title**	**Natural Language Processing**	
3	**Credits**	**5**	
4	**Contact Hours (L-T-P)**	**5-0-0**	
	Course Status	Core	
5	Course Objective	• To familiarize the concepts and techniques of Natural language Processing for analyzing words based on Morphology and CORPUS. • To Perform POS tagging for a given natural language using modeling technique based on the structure of the language. • To relate mathematical foundations, Probability theory with Linguistic essentials such as syntactic and semantic analysis of text. • To apply the Statistical learning methods and cutting-edge research models from deep learning. • To Check a current method for statistical approaches to machine translation	
6	Course Outcomes	Upon completion of this course, the students will be able to: **CO1:** Apply the principles and Process of Human Languages such as English and other Indian Languages using computers. **CO2:** Realize semantics and pragmatics of English language for text processing and Create CORPUS linguistics based on digestive approach (Text Corpus method) **CO3:** Perform POS tagging for a given natural language and select a suitable language modelling technique based on the structure of the language. **CO4:** Demonstrate the state-of-the-art algorithms and techniques for text-based processing of natural language with respect to morphology. **CO5:** Develop a Statistical Methods for Real World Applications and explore deep learning-based NLP and Check current methods for statistical approaches to machine translation. **CO6:** Apply ethical considerations and best practices in Natural Language Processing	
7	Course Description	This course explains the basic concepts of NLP, Morphological and semantical analysis techniques. It also describes context free grammars and word disambiguation methods.	
8	Outline syllabus		CO Mapping
	Unit 1	**NLP INTRODUCTION AND TEXT PREPROCESSING**	
	A	Introduction to NLP - Various stages of NLP –The Ambiguity of Language:Why NLP Is Difficult	**CO1, CO6**
	B	Parts of Speech: Nouns and Pronouns, Words:Determiners and adjectives, verbs, Phrase Structure.	**CO1, CO6**
	C	Statistics Essential Information Theory: Entropy, perplexity, the relation to language, Cross entropy. Character Encoding, Word Segmentation, Sentence Segmentation, Introduction to Corpora, Corpora Analysis.	**CO1, CO6**
	Unit 2	**MORPHOLOGY AND LANGUAGE MODELING**	
	A	Inflectional and Derivation Morphology, Morphological analysis and generation using Finite State Automata and Finite State transducer-	**CO2, CO6**
	B	Words: Collocations- Frequency-Mean and Variance –Hypothesis testing: The t test, Hypothesis testing of differences, Pearson's chi-square test, Likelihood ratios.	**CO2, CO6**
	C	Statistical Inference: n-gram Models over Sparse Data: Bins: Forming Equivalence Classes- N gram model - Statistical Estimators- Combining Estimators	**CO2, CO6**
	Unit 3	**WORD SENSE DISAMBIGUATION AND MARKOV MODEL**	
	A	Supervised Disambiguation: Bayesian classification, An information	**CO3, CO6**

		theoretic approach, Dictionary-Based Disambiguation: Disambiguation based on sense,	
	B	Thesaurus based disambiguation, Disambiguation based on translations in a second-language corpus. Hidden Markov model, Fundamentals, Probability of properties	**CO3, CO6**
	C	Parameter estimation, Variants, Multiple input observation- Applying HMMs to POS tagging, Applications of Tagging	**CO3, CO6**
	Unit 4	**CONTEXT FREE GRAMMARS AND DISCOURSE STRUCTURE ANALYSIS**	
	A	The Probability of a String, Problems with the Inside-Outside Algorithm, parsing for disambiguation, Tree banks, parsing models vs. language models,	**CO4, CO5, CO6**
	B	Phrase structure grammars and dependency, Lexicalized models using derivational histories,	**CO4, CO5, CO6**
	C	Dependency-based models- Discourse- Reference resolution, constraints on co-reference, algorithm for pronoun resolution,text coherence, discourse structure.	**CO4, CO5, CO6**
	Unit 5	**SYNTAX, SEMANTICS AND RECENT TRENDS**	
	A	Shallow Parsing and Chunking, Shallow Parsing with Conditional Random Fields (CRF), Lexical Semantics, WordNet, Thematic Roles, Semantic Role	**CO4, CO5**
	B	Labelling with CRFs. Statistical Alignment and Machine Translation, Text alignment, Word alignment, Information extraction, Text mining,	**CO4, CO5**
	C	Information Retrieval, NL interfaces, Sentimental Analysis, Question Answering Systems, and Social network analysis. Recent Trends in NLP	**CO4, CO5**
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	CA: 25% / MTE: 25% / ETE: 50%	
	Text book/s*	1. James Allen (2004)– "Natural Language Understanding ", Pearson Education, 2004. 2. Daniel Jurafsky and James H Martin (2018)" Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2nd Edition.	
	Other References	1. Nitin Indurkhya, Fred J. Damerau(2010) "Handbook of Natural Language Processing", Second Edition, CRC Press. 2. Hobson lane, Cole Howard, Hannes Hapke(2019), "Natural language processing in action" MANNING Publications.	

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	**CO1:** Apply the principles and Process of Human Languages such as English and other Indian Languages using computers.	PO1, PO2, PO3, PO4, PO5, PO10, PSO1, PSO2,
2.	**CO2:** Realize semantics and pragmatics of English language for text processing and Create CORPUS linguistics based on digestive approach (Text Corpus method)	PO1, PO2, PO3, PO4, PO5, PO10, PSO1, PSO2
3.	**CO3:** Perform POS tagging for a given natural language and select a suitable language modelling technique based on the structure of	PO1, PO2, PO3, PO4, PO5, PO6, PO7,PO10,PSO1, PSO2

	the language.	
4.	**CO4:** Demonstrate the state-of-the-art algorithms and techniques for text-based processing of natural language with respect to morphology.	PO1, PO2, PO3, PO4, PO5, PO6, PO7,PSO1, PSO2,
5.	**CO5:** Develop a Statistical Methods for Real World Applications and explore deep learning-based NLP and Check current methods for statistical approaches to machine translation.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2
6	**CO6:** Apply ethical considerations and best practices in Natural Language Processing	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name: Natural Language Processing

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	PSO 1	PSO 2
BCA501 Natural Language Processing	**CO1**	1	2	3	2	2	-	-	-	-	2	3	2
	CO2	2	3	3	2	3	-	-	-	-	2	3	3
	CO3	3	3	3	3	2	1	1	-	-	1	3	2
	CO4	3	3	3	3	2	2	1	-	-	2	3	2
	CO5	2	3	3	3	3	2	2	2	3	2	3	3
	CO6	2	3	3	3	3	2	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	PSO 1	PSO 2
BCA501	**Natural Language Processing**	2.2	2.8	3.0	2.7	2.5	1.8	1.5	2.0	3.0	1.8	3.0	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		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**V**	
1	Course Code	BRM002	
2	Course Title	Research Methodology	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	The primary objective of this course is to develop a research orientation among the scholars and to acquaint them with fundamentals of research methods. Specifically, the course aims at introducing them to the basic concepts used in research and to scientific social research methods and their approach. It includes discussions on sampling techniques, research designs and techniques of analysis.	
6	Course Outcomes	CO1: Understand the basic framework of research process CO2: Formulate hypotheses or suggested solutions CO3: Categorize various sources of research design, information for literature review and data collection CO4: Discuss the different sampling techniques CO5: Escalate the components of scholarly writing and evaluate its quality CO6: Conduct disciplined research under supervision in an area of their choosing	
7	Course Description	Research Methodology is a hands-on course designed to impart education in the foundational methods and techniques of academic research in social sciences and business management context. Research scholars would examine and be practically exposed to the main components of a research framework i.e., problem definition, research design, data collection, ethical issues in research, report writing, and presentation.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Research**	
	A	Meaning of Re-search, Retracing the path, Importance of re-search.	CO1
	B	Philosophies, and the language of research theory building Theoretical background of a research philosophy The meaning of methodology (structured definition and examples)	CO1
	C	Understanding research terminologies i.e., Concepts, Constructs, Variables, and Definitions etc.	CO1
	Unit 2	**Problems and Hypotheses**	
	A	Identifying research problem, State-of-the-Art, The problem definition lifecycle	CO1, CO2
	B	Meaning/Definition of a hypothesis. Real world examples.	CO1, CO2

	C	Testing and Verification of Hypothesis.			CO1, CO2
	Unit 3	**Research design**			
	A	Experimental and Non-experimental research design			CO1, CO3
	B	Field research, Survey Research, Survey outcomes			CO1, CO3
	C	Methods of data collection – Secondary data collection methods, qualitative methods of data collection, and Survey methods of data collection			CO1, CO3
	Unit 4	**Sampling Techniques**			
	A	Research Population and Sample. Target Population, Accessible Population			CO1, CO4, CO5
	B	Sampling techniques – The nature of sampling, Probability sampling design			CO1, CO4, CO5
	C	Nonprobability sampling design, Determination of sample size			CO1, CO4, CO5
	Unit 5	**Data Analysis & Report Generation**			
	A	Types of Data Sources, Web Data, Survey Data			CO1, CO3, CO6
	B	Data attributes, Discrete vs. Continuous Data attributes Mean, Median, Mode; Range, Quartile, Variance, SD, Interquartile Range			CO1, CO3, CO6
	C	Report generation, report writing, and APA format – Title page, Abstract, Introduction, Methodology, Results, Discussion, References, and Appendices			CO1, CO3, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	CE(Viva)	ESE	
		25%	25%	50%	
	Text book/s*	1. Bryman, Alan & Bell, Emma (2011). Business Research Methods (Third Edition), Oxford University Press. 2. Kerlinger, F.N., & Lee, H.B. (2000). Foundations of Behavioural Research (Fourth Edition), Harcourt Inc. 3. Rubin, Allen & Babbie, Earl (2009). Essential Research Methods for Social Work, Cengage Learning Inc., USA.			
	Other References	1. Chawla, Deepak & Sondhi, Neena (2011). Research methodology: Concepts and cases, Vikas Publishing House Pvt. Ltd. Delhi. 2. Pawar, B.S. (2009). Theory building for hypothesis specification in organizational studies, Response Books, New Delhi. 3. Neuman, W.L. (2008). Social research methods: Qualitative and			

		quantitative approaches, Pearson Education.	

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1: Understand the basic framework of research process	PO1, PO2, PO3, PO4, PO9, PO10, PSO1, PSO2
2.	CO2: Formulate hypotheses or suggested solutions	PO1, PO2, PO3, PO4, PO6, PSO1, PSO2
3.	CO3: Categorize various sources of research design, information for literature review and data collection	PO1, PO3, PO4, PO5, PO7, PO8, PO10, PSO1, PSO2
4	CO4: Discuss the different sampling techniques	PO1, PO2, PO3, PO4, PO6, PO9, PSO1, PSO2
5	CO5: Escalate the components of scholarly writing and evaluate its quality	PO1, PO3, PO4, PO5, PO7, PO8, PO9, PO10, PSO1, PSO2
6	CO6: Conduct disciplined research under supervision in an area of their choosing	PO1, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name Research Methodology (Course Code BRM002)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PSO1	PSO2
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

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
BRM002	Research Methodology	2.5	2.5	2.75	2.5	2.3	2.3	2.3	2.3	2.25	2.25	2.5	2.7

Strength of Correlation:
1- Slight (Low)
2- Moderate (Medium)
3- Substantial (High)

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**V**	
1	Course Code.	BCP285	
2	Course Title	Introduction to R Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course status	Compulsory	
5	Course Objectives	To familiarize the students with the basics of programming in R language, and its applications in data analysis.	
	Course Outcomes	Upon successful completion of this course, student will be able to: CO1: Demonstrate R programming using Decision statements, Loops and Functions. (K3) CO2: Apply functions to improve readability of programs. (K3) CO3: Select and construct programs using different data structures available in R. (K1, K3) CO4: Summarize data using descriptive statistics and perform distribution analysis. (K2, K4) CO5: Design visualizations of data using different types of graphs and plots. (K5) CO6: Estimate data using complex statistical testing. (K6)	
7	Course Description	R is a programming language and software environment for statistical analysis, graphics representation and reporting. This course provides an introduction to the basics of programming in R, and its applications in data analysis.	
8	**Outline syllabus:**		CO Mapping
	Unit 1	**Introduction to R Programming, Decisions, Loops and Functions**	
	A	P1. Write a R Program to make simple calculate. P2. Write a R program to demonstrate the usage of different types of operators. P3. Write a R program to find whether a given year is leap year or not. P4. Write a R program to calculate factorial of a given number.	CO1, CO2
	Unit 2	**Data Structures in R**	
	A	P5. Write R programs to create vector using c, rep, paste and seq functions. P6. Write a R program to find transpose of a given matrix. P7. Write R programs to create and manipulate data frames.	CO3, CO2, CO6
	UNIT 3	**Descriptive Statistics**	
	A	P8. Write a R Program to print summary statistics of a given dataset. P9. Write a R Program to perform Shapiro Wilk Test, Kolmogorov Smirnov test. P10. Write a R program to plot quantile quantile plots.	CO4
	Unit 4	**Data Visualization in R**	
	A	P11. Write R programs to create bar chart, histogram, pie chart, scatter plot, line chart, stem leaf plot.	CO5, CO6
	Unit 5	**Hypothesis Testing and Correlation Analysis**	
	A	P12. Write R programs to implement Student t and Mann Whitney Test. P13. Write a R program to perform correlation analysis of a given dataset. P14. Write a R program to implement ANOVA technique.	CO6
	Mode of examination	Practical/Viva	

	Weightage Distribution	CA	CE(Viva)	ETE	
		25%	25%	50%	
	Text book/s*	1. Gardener, M (2012): Beginning R: The Statistical Programming Language, Wiley Publications. 2. Braun W J, Murdoch D J (2007): A First Course in Statistical Programming with R. Cambridge University Press. New York			
	Other References	1. Crawley, M.J. (2015): Statistics: An Introduction Using R, 2nd Edition. Wiley. 2. Crawley, M.J. (2012): The R Book, 2nd Edition. Wiley.			

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1. Demonstrate R programming using Decision statements, Loops and Functions.	PO1, PO2, PO3, PO4, PO8, PO10, PSO1
2.	CO2. Apply functions to improve readability of programs	PO1, PO2, PO3, PO4, PO8, PO10, PSO1
3.	CO3. Select and construct programs using different data structures available in R.	PO1, PO2, PO3, PO4, PO8, PO10, PSO1
4.	CO4. Summarize data using descriptive statistics and perform distribution analysis.	PO1, PO2, PO3, PO4, PO8, PO10, PSO1
5.	CO5. Design visualizations of data using different types of graphs and plots.	PO1, PO2, PO3, PO4, PO8, PO10, PSO1
6.	CO6. Estimate data using complex statistical testing.	PO1, PO2, PO3, PO4, PO8, PO 10, PSO1

PO and PSO mapping with level of strength for Course Name Introduction to R Lab (Course Code: BCP185

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
BCP285 Introduction to R Lab	CO1	2	1	1	2	--	--	--	2	--	--	2	--
	CO2	2	2	2	2	--	--	--	2	--	--	2	--
	CO3	2	2	1	2	--	--	--	2	--	--	2	--
	CO4	2	2	2	2	--	--	--	2	--	--	2	--
	CO5	2	2	2	2	--	--	--	2	--	--	2	--
	CO6	3	3	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	PSO 1	PSO 2

BCP285	**Introduction to R lab**	**2.1**	**2**	**1.7**	**2**	-	-	-	**2**	-	-	2	

Strength of Correlation

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

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**			
Batch:		**2023-26**			
Department		**Computer Science & Applications**			
Programme		**BCA. (AI-ML), Academic Year: 2023-24**			
Semester		**V**			
1	Course Code	**RBL003**	Course Name: Research Based Learning -3		
2	Course Title	Research 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 Research. 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 a Hypothesis. CO3: Develop the solution by using different aspects of Research Methodology. CO4: Classify and understand various tools and techniques for verification and validation of Research. CO5: Analyze and make use of modern methods 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 RBL, the students will learn how to define the problem for developing Research, 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	Identify and formulate problem statement and Design a Hypothesis.			CO1,CO4
	Unit 2	Problem Definition and identification.			CO2,CO6
	Unit 3	Team/Group formation and Research Assignment. Finalizing the problem statement, resource requirement.			CO3
	Unit 4	Design; implement Research work in any programming language or research tool			CO4,CO5
	Unit 5	Use of various test tools and techniques for Hypothesis verification and validation of Research			CO6
	Mode of examination	Practical /Viva			
	Weight age Distribution	CA	CE(Viva)	ETE	
		25%	25%	50%	

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO)
1.	CO1: Identify and formulate problem statement.	PO1, PO2, PO4,PO6, PO8,PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
2.	CO2: Design a Hypothesis.	PO1, PO2, PO3,PO4,PO5, PO7, PO8, PO9, PO11, PO12 , PSO1,PSO2,PSO3
3.	CO3: Develop the solution by using different aspects of Research Methodology.	PO1, PO2, PO3,PO4,PO5, PO6, PO8, PO9, PO11, PO12, PSO1,PSO2
4.	CO4: Classify and understand various tools and techniques for verification and validation of Research.	PO1, PO2, PO3,PO4,PO5, PO8,PO9, PO10, PO11, PO12 ,PSO1,PSO2,PSO3

5.	CO5: Analyze and make use of modern methods 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 Research Based Learning -3 (Course Code RBL003)

CO/PO Mapping

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Low

COs	Programme Outcomes(POs)														
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO3
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

School	**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**				
Batch:	**2023-26**				
Department	**Computer Science & Applications**				
Programme	**BCA. (AI-ML), Academic Year: 2023-24**				
Semester	**V**				
1	Course Code	INC003			
2	Course Title	**Industry connect**			
3	Credits	2			
4	Contact Hours (L-T-P)	0-0-4			
	Course Status				
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	The opportunity to explore potential career paths while putting classroom knowledge and abilities into practise in a professional context is provided by an internship. Students also have the chance to network professionally and have a better understanding of what they still need to study thanks to the experience.			
8	Outline syllabus				CO Mapping
	Unit 1	Establish the internship's goals and requirements and make sure students understand how they relate to their University study plan.			**CO1,CO2**
	Unit 2	Definition and identification of the problem, creation of teams and groups, and project assignment. completing the problem definition and, if necessary, the resource requirements.			**CO2**
	Unit 3	The work plan for the internship is created by encouraging teamwork and using previously learned problem-solving skills.			**CO3**
	Unit 4	Execute the project with the team and demonstrate it. the intern's final report and assessment form must be submitted.			**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	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Scrum: The Art of Doing Twice the Work in Half the Time by Jeff Sutherland and J.J. Sutherlan			
	Other References	1. A Guide to the Project Management Body of Knowledge by Project Management Institute 2. Project Management for The Unofficial Project Manager by Kory Kogon, Suzette Blakemore, & James Wood 3. Project Management Absolute Beginner's Guide by Gregory M. Horine			

CO and PO Mapping

S. No.	Course Outcome	Programme 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,PSO 2
2.	CO2. Identify, formulate and model problems an find engineering solution based on a system approach.	PO1,PO2,PO3,PO4,PO5,PO7,PO8,PO9, PSO1,PSO2
3.	CO3. Develop teamwork and apply prior acquire knowledge in problem solving.	PO1,PO3,PO4,PO5, PO8,PO9, PSO1,PSO2
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.	PSO1,PSO2

PO and PSO mapping with level of strength for Course Name Industry connect

CO/PO Mapping (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Low												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	2	2	-	3	2	-	1	1	1	-	1	2
CO2	1	2	1	2	2	-	1	1	1	-	1	2
CO3	2	-	2	2	2	-	-	1	3	-	1	2
CO4	-	-	-	-	-	-	-	1	-	3	-	-
CO5	-	-	-	-	-	2	-	3	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	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**	**PSO 1**	**PSO 2**
INC003	**Industry connect**	1.6	2	1.5	2.3	**2**	**2.0**	1	1.4	1.7	3	1.25	2

Strength of Correlation:

1- Slight (Low)

2- Moderate (Medium)

Substantial (High)

TERM VI

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**		
Batch:		**2023-26**		
Department		**Computer Science & Applications**		
Programme		**BCA. (AI-ML), Academic Year: 2023-24**		
Semester		**VI**		
1	**Course Code**	**BCA601**		
2	**Course Title**	**Artificial Neural Networks**		
3	**Credits**	**4**		
4	**Contact Hours (L-T-P)**	**4-0-0**		
	Course Status	Core		
5	Course Objective	• To introduce the concepts of artificial neural networks and fuzzy systems • To explain the basic mathematical elements of the theory of fuzzy sets.		
6	Course Outcomes	Upon completion of this course, the students will be able to: **CO1:**Explain the concepts of neural networks and, fuzzy logic **CO2:** Understanding of the basic mathematical elements of the theory of fuzzy sets. **CO3:** Understanding the differences and similarities between fuzzy sets and classical sets theories **CO4:** Solve problems that are appropriately solved by neural networks and fuzzy logic **CO5:** Develop applications using Artificial Neural Networks **CO6:** Apply ethical considerations and best practices Artificial Neural Networks		
7	Course Description	This course introduces the fundamental concepts and principles of Artificial Neural Networks (ANNs), a subfield of machine learning inspired by the structure and function of the human brain. Students will gain a comprehensive understanding of ANNs and their applications in various domains, such as image and speech recognition, natural language processing, and predictive modeling.		
8	Outline syllabus			CO Mapping
	Unit 1	**INTRODUCTION**		
	A	Basic concepts-single layer perceptron-Multi layer perceptron, Adaline-Madaline		**CO1, CO6**
	B	Learning rules Supervised learning-Back propagation networks Training algorithm		**CO1, CO6**
	C	Advanced algorithms-Adaptive network, Radial basis network modular network, Applications		**CO1, CO6**
	Unit 2	**LEARNING**		
	A	Introduction, unsupervised learning -Competitive learning networks-Kohonen self organising networks, Learning vector quantisation, Hebbian learning, Hopfield network,		**CO2, CO6**
	B	Content addressable nature, Binary Hopfield network, Continuous Hopfield network Travelling Salesperson problem		**CO2, CO6**
	C	Adaptive resonance theory –Bidirectional Associative Memory-Principle component Analysis		**CO2, CO6**
	Unit 3	**FUZZY SETS**		
	A	Introduction to crisp sets an overview, the notion of fuzzy sets, Basic concepts of fuzzy sets,		**CO3, CO6**
	B	classical logic an overview Fuzzy logic, Operations on fuzzy sets, fuzzy complement		**CO3, CO6**
	C	fuzzy union, fuzzy intersection, combinations of operations, general aggregation operations		**CO3, CO6**
	Unit 4	**RELATIONS**		
	A	Crisp and fuzzy relations, binary relations, binary relations on a single set		**CO4, CO5, CO6**
	B	equivalence and similarity relations, Compatibility or tolerance relations orderings		**CO4, CO5, CO6**
	C	Membership functions, methods of generation, defuzzification methods		**CO4, CO5, CO6**

	Unit 5	**TREE LEARNING**			
	A	Adaptive Neuro Fuzzy based inference systems, classification and regression trees: decision tress, Cart algorithm – Data clustering algorithms: K means clustering,			**CO4, CO5**
	B	Fuzzy C means clustering, Mountain clustering, Subtractive clustering – rule base structure identification			**CO4, CO5**
	C	Neuro fuzzy control: Feedback Control Systems, Expert Control, Inverse Learning, Specialized Learning, Back propagation through Real –Time Recurrent Learning.			**CO4, CO5**
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Neuro Fuzzy and Soft computing‖, Jang J.S.R.,Sun C.T and Mizutani E – Pearson education, 2004 2. Fundamentals of Neural Networks‖, LaureneFauseett, Prentice Hall India, New Delhi,1994.			
	Other References	1. Fuzzy Logic Engineering Applications‖, Timothy J.Ross, McGrawHill,NewYork,1997.			

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1: Crisp and fuzzy relations, binary relations, binary relations on a single set	PO1, PO2, PO3, PO4, PO9, PO10, PSO1, PSO2
2.	CO2: Understanding of the basic mathematical elements of the theory of fuzzy sets.	PO1, PO2, PO3, PO4, PO6, PSO1, PSO2
3.	CO3: Understanding the differences and similarities between fuzzy sets and classical sets theories	PO1, PO3, PO4, PO5, PO7, PO8, PO10, PSO1, PSO2
4	CO4: Solve problems that are appropriately solved by neural networks and fuzzy logic	PO1, PO2, PO3, PO4, PO6, PO9, PSO1, PSO2
5	CO5: Develop applications using Artificial Neural Networks	PO1, PO3, PO4, PO5, PO7, PO8, PO9, PO10, PSO1, PSO2
6	CO6: Apply ethical considerations and best practices Artificial Neural Networks	PO1, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name Artificial Neural Networks (Course Code BCA601)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PSO1	PSO2
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

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
BCA601	**Artificial Neural Networks**	2.5	2.5	2.75	2.5	2.3	2.3	2.3	2.3	2.25	2.25	2.5	2.7

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**		
Batch:		**2023-26**		
Department		**Computer Science & Applications**		
Programme		**BCA. (AI-ML), Academic Year: 2023-24**		
Semester		**VI**		
1	**Course Code**	**BCA602**		
2	**Course Title**	**Computer Vision**		
3	**Credits**	**5**		
4	**Contact Hours (L-T-P)**	**5-0-0**		
	Course Status	Core		
5	Course Objective	• To introduce students the major ideas, methods, and techniques of computer vision. • To understand the basic principles of image formation, image processing algorithms • To develop your understanding of the basic principles and techniques of image processing and image understanding. • To understand the basic methods of computer vision related to multi-scale representation, edge, detection and detection of other primitives, stereo, motion		
6	Course Outcomes	Upon completion of this course, the students will be able to: **CO1:** Describe the fundamental image processing techniques required for computer vision **CO2:** Apply Image formation models and perform shape analysis **CO3:** Estimate motion and analysis of images **CO4:** Extract features form Images and do analysis of Images **CO5:** Develop applications using computer vision techniques **CO6:** Apply ethical considerations and best practices in Computer vision		
7	Course Description	This course provides an introduction to computer vision including fundamentals of image formation, camera imaging geometry, feature detection and matching. In this course students will learn basic principles of image formation, image processing algorithms and different algorithms for 3D reconstruction and recognition from single or multiple images (video).		
8	Outline syllabus			CO Mapping
	Unit 1	**INTRODUCTION**		
	A	Image Processing, Computer Vision and Computer Graphics , What is Computer Vision - Low-level, Mid-level, High-level		**CO1, CO6**
	B	Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval		**CO1, CO6**
	C	Video Data Processing, Multimedia, Virtual Reality and Augmented Reality		**CO1, CO6**
	Unit 2	**IMAGE FORMATION MODELS**		
	A	Monocular imaging system, Radiosity: The 'Physics' of Image Formation, Radiance, Irradiance, BRDF, color etc		**CO2, CO6**
	B	Orthographic & Perspective Projection,Camera model and Camera calibration, Binocular imaging systems, Multiple views geometry		**CO2, CO6**
	C	Structure determination, shape from shading, Photometric Stereo, Depth from Defocus , Construction of 3D model from images		**CO2, CO6**
	Unit 3	**IMAGE RPOCESSING and FEATURE EXTRACTION**		
	A	Image enhancement, restoration, segmentation, compression, filtering, registration, analysis,recognition		**CO3, CO6**
	B	Object detection and tracking,Image synthesis and rendering, edge detection,Corner detection,Blob detection,Scale-invariant feature transform (SIFT)		**CO3, CO6**
	C	Speeded Up Robust Features (SURF),Histogram-based features,Texture analysis,Shape-based features,Motion-based features,Deep learning-based feature extraction techniques		**CO3, CO6**
	Unit 4	**MOTION ESTIMATION**		
	A	Regularization theory, Optical computation		**CO4, CO5, CO6**
	B	Stereo Vision, Motion estimation, Structure from motion		**CO4, CO5, CO6**

	C	Case Study			**CO4, CO5, CO6**
	Unit 5	**APPLICATIONS**			
	A	Photo album ,Face detection, Face recognition ,Eigen faces,Active appearance and 3D shape models of faces Application:			**CO4, CO5**
	B	Surveillance ,foreground-background separation, particle filters ,Chamfer matching, tracking, and occlusion , combining views from			**CO4, CO5**
	C	multiple cameras ,human gait analysis Application: In-vehicle vision system: locating roadway ,road markings , identifying road signs ,locating pedestrians			**CO4, CO5**
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	D. Forsyth and J. Ponce(2012),Computer Vision - A modern approach, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw			
	Other References	E. R. Davies(2012), Computer & Machine Vision, Fourth Edition, Academic Press.			

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	**CO1:** Describe the fundamental image processing techniques required for computer vision	PO1, PO2, PO3, PO4, PO5, PO10, PSO1, PSO2,
2.	**CO2:** Estimate motion and analysis of images	PO1, PO2, PO3, PO4, PO5, PO10, PSO1, PSO2
3.	**CO3:** Estimate motion and analysis of images	PO1, PO2, PO3, PO4, PO5, PO6, PO7,PO10,PSO1, PSO2
4.	**CO4:** Extract features form Images and do analysis of Images	PO1, PO2, PO3, PO4, PO5, PO6,
5.	**CO5:** Develop applications using computer vision techniques	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2
6	**CO6:** Apply ethical considerations and best practices in Computer vision	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name: Computer Vision

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	PSO 1	PSO 2
BCA602 **Computer Vision**	**CO1**	1	2	3	2	2	-	-	-	-	2	3	2
	CO2	2	3	3	2	3	-	-	-	-	2	3	3
	CO3	3	3	3	3	2	1	1	-	-	1	3	2
	CO4	3	3	3	3	2	2	1	-	-	2	3	2
	CO5	2	3	3	3	3	2	2	2	3	2	3	3
	CO6	2	3	3	3	3	2	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**	**PSO 1**	**PSO 2**
BCA602	**Computer Vision**	2.2	2.8	3.0	2.7	2.5	1.8	1.5	2.0	3.0	1.8	3.0	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		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**VI**	
1	**Course Code**	**BCA603**	
2	**Course Title**	**Predictive Analytics**	
3	**Credits**	**5**	
4	**Contact Hours (L-T-P)**	**5-0-0**	
	Course Status	Core	
5	Course Objective	• To know the basics of predictive analytics and modeling. • To observe the insights of data visualization. • To understand the importance of descriptive modeling. • To comprehend the fundamentals of predictive modeling. • To learn about model ensembles and text mining.	
6	Course Outcomes	Upon completion of this course, the students will be able to: **CO1:** Describe the fundamental image processing techniques required for computer vision **CO2:** Apply Image formation models and perform shape analysis **CO3:** Estimate motion and analysis of images **CO4:** Extract features form Images and do analysis of Images **CO5:** Develop applications using computer vision techniques **CO6:** Apply ethical considerations and best practices in Computer vision	
7	Course Description	This course deals with extensive data analysis and the concepts involved in prediction. Predictive analytics also includes the data mining and machine learning concepts which helps in predicting the unknown events.	
8	Outline syllabus		CO Mapping
	Unit 1	**INTRODUCTION TO PREDICTIVE ANALYSIS AND MODELING**	
	A	Overview of Predictive Analytics, About predictive analytics, Predictive analytics vs. Business Intelligence, Predictive Analytics vs. Statistics, Predictive Analytics vs. Data Mining	**CO1, CO6**
	B	Challenges in Predictive Analytics, Predictive Analytics processing steps,Business understanding, Defining data for predictive modeling, Defining the target variable	**CO1, CO6**
	C	Defining measures of success for predictive models – Predictive modeling out of order	**CO1, CO6**
	Unit 2	**DATA VISUALIZATION AND DATA PREPARATION**	
	A	Data Understanding, Single variable summaries, Data visualization in one dimension, Histograms, Multiple variable summaries	**CO2, CO6**
	B	Data visualization, two or higher dimensions, Value of statistical significance	**CO2, CO6**
	C	Data Preparation, Variable cleaning, Feature creation.	**CO2, CO6**
	Unit 3	**DESCRIPTIVE MODELING**	
	A	Data preparation issues with descriptive modeling, Principal component analysis	**CO3, CO6**
	B	Clustering algorithms, Interpreting Descriptive Models, Standard cluster model interpretation.	**CO3, CO6**
	C	Case Study	**CO3, CO6**
	Unit 4	**PREDICTIVE MODELING**	
	A	Decision trees, Logistic regression, Neural networks, K-Nearest neighbor Naïve Bayes	**CO4, CO5, CO6**
	B	Regression models, Linear regression, Other regression algorithms,	**CO4, CO5, CO6**
	C	Assessing Predictive Models, Batch approach to model assessment, Assessing regression models.	**CO4, CO5, CO6**
	Unit 5	**MODEL ENSEMBLES AND TEXT MINING**	

	A	Model ensembles, Motivation for ensembles, Bagging, Boosting, Improvements to bagging and boosting, Model ensembles and Occam's razor,			**CO4, CO5**
	B	Interpreting model ensembles, Text Mining, Motivation for text mining, Predictive modeling approach to text mining, Structured vs. Unstructured data,			**CO4, CO5**
	C	Data preparation steps, Text mining features, Modeling with text mining features, Regular expressions, Model deployment.			**CO4, CO5**
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Dean Abbott. (2014). Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst, John Wiley & Sons Inc., 1st Edition, pp. 1 – 432.			
	Other References	Anasse Bari, Mohamed Chaouchi, Tommy Jung. (2016). Predictive Analytics for Dummies, 2ndEdition, pp. 1 – 464.			

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	**CO1:** Compare AI and non-AI solutions. Basics of machine learning and differentiation with AI	PO1, PO2, PO3, PO4, PO5, PO10, PSO1, PSO2,
2.	**CO2:** To Apply machine learning on labelled and unlabelled data.	PO1, PO2, PO3, PO4, PO5, PO10, PSO1, PSO2
3.	**CO3:** To explore the concept of machine learning for various problem solving in AI	PO1, PO2, PO3, PO4, PO5, PO6, PO7,PO10,PSO1, PSO2
4.	**CO4:** Classify supervised and unsupervised learning and knowledge representation and introduction to fuzzy logic	PO1, PO2, PO3, PO4, PO5, PO6,
5.	CO5: Learning extension in the form of deep learning concepts.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2
6	CO6: Practical implementation on various types of data of Machine Leaning algorithms	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name: Predictive Analytics

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	PSO 1	PSO 2
BCA603 **Predictive Analytics**	**CO1**	1	2	3	2	2	-	-	-	-	2	3	2
	CO2	2	3	3	2	3	-	-	-	-	2	3	3
	CO3	3	3	3	3	2	1	1	-	-	1	3	2
	CO4	3	3	3	3	2	2	1	-	-	2	3	2
	CO5	2	3	3	3	3	2	2	2	3	2	3	3
	CO6	2	3	3	3	3	2	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	PSO 1	PSO 2
BCA603	**Predictive Analytics**	2.2	2.8	3.0	2.7	2.5	1.8	1.5	2.0	3.0	1.8	3.0	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		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**			
Batch:		**2023-26**			
Department		**Computer Science & Applications**			
Programme		**BCA. (AI-ML), Academic Year: 2023-24**			
Semester		**VI**			
1	Course Code	BCA604			
2	Course Title	Information Security and Cyber Laws			
3	Credits	3			
4	Contact Hours (L-T-P)	3	0	0	
	Course Status	Elective			
5	Course Objective	Enable learner to understand, explore, and acquire a critical understanding Cyber Law. Give learners in depth knowledge of Information Technology Act and legal frame work of Right to Privacy, Data Security, Data Protection and tools			
6	Course Outcomes	• On successful completion of this module students will be able to • CO1: Develop competencies for dealing with frauds and deceptions (confidence tricks, scams) and other cybercrimes for example, child pornography etc. that are taking place via the Internet • CO2: Explore the legal and policy developments in various countries to regulate Cyberspace • CO3: Formulate various security measures for cyber-attacks. • CO4: Apply the principles in real life situations. • CO5: Identify various Cybercrimes and take necessary actions. CO6: Assess the various online activities.			
7	Course Description	This course introduces aspects of cyber security, encompassing the principles, to analyze the data, identify the problems, and choose the relevant countermeasures to apply.			
8	Outline syllabus				CO Mapping
	Unit 1	Introduction to Cyber Security			
	A	Understanding Computers, Internet and Cyber Laws, information security legal liabilities,			CO1, CO2
	B	intellectual property, defamation, privacy concerns, censorship, cyber fraud, e – commerce law,			CO5, CO6, CO3
	C	insurance law, the clash of laws, cyber law dispute resolution, the law of linking, cyber crime			CO6, CO4, CO2
	Unit 2	Intellectual rights			
	A	Protection of Intellectual Property Rights in CyberSpace in India,			CO1,CO2. CO3
	B	Compensation and Adjudication of Violations of Provisions of It Act and Judicial Review, Some important Offeneces under the CyberSpace Law and the Internet in India,			CO4,CO5,CO6
	C	Other Offences under the Information Technology Act in India			CO1,CO6, CO3, CO4
	Unit 3	Role of Evidences and Rules			
	A	The Role of Electronic Evidence and the Miscellaneous Provisions of the IT Act,			CO1,CO2, CO4
	B	Legal Aspects of Electronic Records/Digital Signatures,			CO6, CO3,CO1
	C	The Rules and Regulations of Certifying Authorities in India			CO3,CO4,CO6,CO5
	Unit 4	Cyber Space Laws			
	A	International Efforts Related to CyberSpace Laws,			CO1,CO2, CO6
	B	Fundamental Jurisdiction Principles Under International Law, Classic U.S. Jurisdiction			CO2,CO4,CO6
	C	Principles, Council of Europe convention on cyber crimes			CO1,CO3,CO5

	Unit 5	Tools			
	A	Cyber Check, TrueBack,			CO1,CO2, CO6
	B	Hasher, EmailTracer			CO1.CO2,CO6,CO5
	C	Pasco, Nmap, BinText			CO2,CO3,CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Cyber Law and IT Protection, Chander Harish Handbook of Information Security, HosseinBidgol			

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1: Develop competencies for dealing with frauds and deceptions (confidence tricks, scams) and other cybercrimes for example, child pornography etc. that are taking place via the Internet	PO1,PO2,PO3,PO7,PO10,PSO1
2.	CO2: Explore the legal and policy developments in various countries to regulate Cyberspace	PO1,PO2,PO6,PO7,PO8,PO10, PSO1, PSO2
3	CO3: Formulate various security measures for cyber- attacks.	PO1, PO2, PO6, PO7, PO8, PO10, PSO1, PSO2
4	CO4: Apply the principles in real life situations.	PO1, PO2, PO3, PO4, PO5, PO10, PSO1
5	CO5: Identify various Cybercrimes and take necessary actions.	PO1, PO2, PO3,PO4, PO5,PO6,PO7, PO9,PO10, PSO1, PSO2
6	CO6: Assess the various online activities.	PO1, PO2,PO3,PO4,PO5,PO7 ,PO9,PO10, PSO1

PO and PSO mapping with level of strength for Course Name Information Security and Cyber Laws (Course Code)

Course Code_ Course Name	CO's	PO1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO2
BCA604 Information Security and Cyber Laws	CO1	2	2	3	--	--	--	3	--	--	3	2	--
	CO2	3	3	--	--	--	2	2	3	--	3	3	2
	CO3	2	2	--	--	--	2	2	2	--	2	3	3
	CO4	2	2	2	3	3	--	--	--	--	3	2	--
	CO5	2	2	2	2	2	2	2	--	2	2	2	3
	CO6	3	2		2	2	--	3	--	3	2	2	--

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch:		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BCA. (AI-ML), Academic Year: 2023-24**	
Semester		**VI**	
1	Course Code	BCA605	Course Name
2	Course Title	Big Data Analytics	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective	
5	Course Objective	1. Understand the Big Data Platform and its Use cases 2. Provide an overview of Basic Statistical Methods 3. Provide Probability and Time series Concepts. 4. Understand Machine Learning. 5. Apply analytics on Large Database.	
6	Course Outcomes	The students will be able to: CO1: Define role, responsibilities, features, and design of operating system. CO2: Demonstrate the Basic Statistical Methods. CO3: Implement tools and utility of Probability & Time Series.. CO4: Apply various Machine Learning techniques to understand Big data Analytics. CO5: Understand the concepts of Database Management. CO6: Design and develop solutions to real world Big Data problem using DBMS tools.	
7	Course Description	This course on Big Data Analysis provides a comprehensive introduction to the concepts and techniques used to analyze large and complex datasets. Students will learn how to collect, process, and analyze massive amounts of data to extract valuable insights and make data-driven decisions. Through hands-on exercises and real-world case studies, students will develop practical skills in data manipulation, visualization, and machine learning algorithms for big data analysis.	
8	Outline syllabus		CO Mapping
	Unit 1	**INTRODUCTION TO BIG DATA**	
	A	Introduction to Big Data, V's of BigData, Importance of Big data	CO1, CO2
	B	Types of Digital Data, The history of big data.	CO1, CO2
	C	Challenges of Big Data Big Data Analytics	CO1, CO2
	Unit 2	**BASIC STATISTICAL METHODS**	
	A	Data Collection & Visualization: Concepts of measurement, scales of measurement, design of data collection, data quality and, cleaning and treatment of missing data, principles of data visualization	CO1, CO2,CO4
	B	Basic Statistics: Frequency table, histogram, measures of location, measures of spread, skewness, Kurtosis, percentiles, box plot, correlation and simple linear regression	CO1, CO2,CO4

	C	Contingency Tables: Two way contingency tables, measures of association, testing for dependence.			CO1, CO2,CO4
	Unit 3	**PROBABILITY & TIME SERIES**			
	A	Basic Probability : Concepts of experiments, Outcomes, Sample space, Events, Combinatorial probability, Birthday paradox, Principle of inclusion & exclusion, Conditional probability,			CO1,CO2,CO3
	B	Probability Distribution: Random Variables: discrete and continuous probability models, some probability distributions			CO1,CO2,CO3
	C	Components of time series: Smoothing auto correlation, stationary, concepts of AR, MA, ARMA & ARIMA models with illustrations.			CO4
	Unit 4	**MACHINE LEARNING AND BIG DATA**			
	A	Supervised Learning, Techniques of Supervised Machine Learning.			CO1,CO2,CO3
	B	Unsupervised Learning Techniques of Unsupervised Machine Learning.			CO1,CO2,CO3
	C	Reinforcement Learning Techniques of Reinforcement Machine Learning.			CO1,CO2,CO3
	Unit 5	**DATABASE MANAGEMENT**			
	A	Basic Concepts : Different data models, ER and EER diagram, schema, table, Big Data Concepts and Hadoop Ecosystem			CO1,CO2,CO3
	B	Relational and Non-Relational Databases: Structure, various *operations*, normalization, SQL, No-SQL, Graph Database, Parallel and distributed data base, Map-Reduce			CO1,CO2,CO3
	C	Implementation: ORACLE SQL/MS SQL/MySQL, Hadoop Ecosystem, Concept of database security.			CO1,CO2,CO3
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. A First Course in Probability: Shelden M. Ross, 2014.Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015 2. Statistics: David Freedman, Pobert Pisani & Roger Purves, WW.Norten& Co. 4th Edition 2007.			
	Other References	1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007. 2. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013) 3. Database system concepts : Abraham Silberschartz, Henry F. Korth and S. Surarshan, McGraw Hill, 2011. 4. Anand Rajaraman and Jef rey David Ulman, "Mining of Massive Datasets", Cambridge University Press, 2012.			

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	**CO1** Define role, responsibilities, features, and design of operating system.	PO1, PO2, PO3, PO4, PO5, PO10, PSO1, PSO2,
2.	**CO2:** Demonstrate the Basic Statistical Methods.	PO1, PO2, PO3, PO4, PO5, PO10, PSO1, PSO2
3.	**CO3:** : Implement tools and utility of Probability & Time Series	PO1, PO2, PO3, PO4, PO5, PO6, PO7,PO10,PSO1, PSO2
4.	**CO4:** Apply various Machine Learning techniques to understand Big data Analytics.	PO1, PO2, PO3, PO4, PO5, PO6,
5.	**CO5:** Understand the concepts of Database Management.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2
6	**CO6:** Design and develop solutions to real world Big Data problem using DBMS tools	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name: Big Data Analytics

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	PSO 1	PSO 2
BCA 605 Big Data Analytics	CO1	1	2	3	2	2	-	-	-	-	2	3	2
	CO2	2	3	3	2	3	-	-	-	-	2	3	3
	CO3	3	3	3	3	2	1	1	-	-	1	3	2
	CO4	3	3	3	3	2	2	1	-	-	2	3	2
	CO5	2	3	3	3	3	2	2	2	3	2	3	3
	CO6	2	3	3	3	3	2	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	PSO 1	PSO 2
BCA605	**Big Data Analytics**	2.2	2.8	3.0	2.7	2.5	1.8	1.5	2.0	3.0	1.8	3.0	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		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**			
Batch:		**2023-26**			
Department		**Computer Science & Applications**			
Programme		**BCA. (AI-ML), Academic Year: 2023-24**			
Semester		**VI**			
1	Course Code	**RBL004**			
2	Course Title	Research 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 Research. 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 a Hypothesis. CO3: Develop the solution by using different aspects of Research Methodology. CO4: Classify and understand various tools and techniques for verification and validation of Research. CO5: Analyze and make use of modern methods 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 RBL, the students will learn how to define the problem for developing Research, 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	Developing a draft literature review paper based on RBL 3.			CO1,CO4
	Unit 2	Framing a research based framework for solving the problem identified or bridging the research gap identified.			CO2,CO6
	Unit 3	Justification of Research Methods or tools applied			CO3
	Unit 4	Verification and Validation of propose research framework using proper tools.			CO4,CO5
	Unit 5	Communicating and Publishing the research article			CO6
	Mode of examination	Practical /Viva			
	Weight age Distribution	CA	CE(Viva)	ETE	
		25%	25%	50%	

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO)
1.	CO1: Identify and formulate problem statement.	PO1, PO2, PO4,PO6, PO8,PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
2.	CO2: Design a Hypothesis.	PO1, PO2, PO3,PO4,PO5, PO7, PO8, PO9, PO11, PO12 , PSO1,PSO2,PSO3
3.	CO3: Develop the solution by using different aspects of Research Methodology.	PO1, PO2, PO3,PO4,PO5, PO6, PO8, PO9, PO11, PO12, PSO1,PSO2
4.	CO4: Classify and understand various tools and techniques for verification and validation of Research.	PO1, PO2, PO3,PO4,PO5, PO8,PO9, PO10, PO11, PO12 ,PSO1,PSO2,PSO3
5.	CO5: Analyze and make use of modern methods 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-	PO2, PO4, PO8,PO9, PO10, PO11,

	long learning, along with the ability to communicate effectively with others.	PO12,PSO1,PSO3

PO and PSO mapping with level of strength for Course Name Research Based Learning -3 (Course Code RBL003)

CO/PO Mapping (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Low															
COs	Programme Outcomes(POs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**			
Batch:		**2023-26**			
Department		**Computer Science & Applications**			
Programme		**BCA. (AI-ML), Academic Year: 2023-24**			
Semester		**VI**			
1	Course Code	**CCU108**			
2	Course Title	Community Connect			
3	Credits	Qualifying Course			
4	Contact Hours (L-T-P)	0-0-0			
	Course Status	Compulsory			
5	Course Objective	1. The objective of assigning the project related to community work is to expose our students to different social issues faced by the people in different sections of society. 2. This type of project work will help the students to develop better understanding of problems of people living in disadvantage position in the society, may be socially, medically, economically, or otherwise. 3. This type of live project work will help our students to connect their class-room learning with practical issues/problems in the society.			
6	Course Outcomes	Students will be able to: 1. **CO1: Students develop awareness** of the social, health, and environmental challenges faced by the community 2. **C02: Students are more appreciative** of socio-economic realities beyond textbooks and classrooms 3. **CO3: Students learn to apply their knowledge** through research, awareness creation, and services for community benefit 4. **CO4: Students are able to carry** out community-based projects with sincerity, teamwork and timely delivery 5. **CO5: Students learn to respectfully engage** with communities with purposive intent to contribute to society and sustainable development 6. **C06: Students are able to document and present** their community project findings in an academically robust manner			
7	Course Description	In Community Connect projects, students will learn how to identify problems of rural and underprivileged communities by conducting surveys, or will help the communities by providing services or solutions for the issues faced by them.			
8	Outline syllabus				CO Mapping
	Unit 1	Team/Group formation and Project Assignment. Problem Definition & Finalizing the problem statement, Resource requirement, if any.			CO1, CO2
	Unit 2	Develop a useful questionnaire or service to the community that will aid in achieving the objectives of the project.			CO2, CO3. CO4
	Unit 3	Learn how to interact with the community members, whether in survey or service-based project – to help develop a more open mindset in the students.			CO3, CO4, CO5
	Unit 4	Analysis of survey data and/or impact on the community members.			CO3, CO4
	Unit 5	Demonstrate and justify their findings in light of the data they have gathered, or show the benefits to the community of the actions they have taken.			CO4, CO5, CO6
	Mode of examination	Practical /Viva			
	Weight age	CA	CE	ETE	

	Distribution	25%	25%	50%	

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO)
1.	**CO1: Students develop awareness** of the social, health, and environmental challenges faced by the community	PO2, PO3, PO4, PO6, PO8, PO9, PO10, PO12
2.	**C02: Students are more appreciative** of socio-economic realities beyond textbooks and classrooms	PO1, PO2, PO3, PO4, PO6, PO8, PO9, PO10, PO11, PO12
3.	**CO3: Students learn to apply their knowledge** through research, awareness creation, and services for community benefit	PO1, PO2, PO3, PO4, PO5, PO6, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
4.	**CO4: Students are able to carry** out community-based projects with sincerity, teamwork and timely delivery	PO2, PO3, PO6, PO8, PO9, PO10, PO11, PO12, PSO2
5.	**CO5: Students learn to respectfully engage** with communities with purposive intent to contribute to society and sustainable development	PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12 PSO1, PSO2, PSO3
6.	**C06: Students are able to document and present** their community project findings in an academically robust manner	PO1, PO2, PO4, PO5, PO9, PO10, PO11, PO12, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name: Community Connect (Course Code CCU108)

CO/PO Mapping (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Low												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1		1	1	2		3		1	1	1		
CO2	1	2	1	3		3		1	1	1		
CO3	3	3	3	3	2	3			1	2	1	1
CO4		3	3	3		3		3	3	3		1
CO5		2	1	1	1	3	3	3	2	3	1	1
CO6	2	3	1	1	3				2	2		2
Avg PO attainted	1	2.3	1.7	2.3	1	2.5	0.5	1.3	1.7	2	0.3	0.8