PROGRAMME STRUCTURE

SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY

Department of Computer Science & Applications

Bachelor of Science
(Specialization in Cloud Computing & Internet of Things)

Programme Code: SET0125
Batch: 2023-2026

Programme Structure								
Sharda School of Engineering & Technology								
Department of Computer Science & Applications								
B.SC in Cloud Computing & IoT								
Batch: Batch: 2023-26							SEMESTER: I	
S. No.	Course Code	Paper ID	Course	Teaching Load			Credits	Type of Course 1. CC 2. DSE 3. OE 4. SEC 5. AEC 6. VAC-I
				L	T	P		
THEORY SUBJECTS								
1	BCO175		Cloud Computing	4	0	0	4	CC
2	BCO172		Fundamentals of Computers and Programming in C	3	0	0	3	DSE
3	BCO176 BCO174		Open Elective-I Introduction to Computers & Technology Introduction of Entrepreneurship Development	3	0	0	3	OE
4	BCO191		Discrete Mathematics	3	0	0	3	SEC
5	ARP103		Communicative English-1	2	0	0	2	AECC
6	BCO173		Ethics and Social Implications of AI	3	0	0	3	VAC-1
Practical/Viva-Voce/Jury								
7	BOL175		Cloud Computing - Lab	0	0	2	1	CC
8	BOL172		Fundamentals of Computers and Programming in C - Lab	0	0	2	1	DSE
TOTAL CREDITS							20	

Programme Structure								
Sharda School of Engineering & Technology								
Department of Computer Science & Applications								
B.SC in Cloud Computing & IoT								
Batch: Batch: 2023-26							SEMESTER: II	
S. No.	Course Code	Paper ID	Course	Teaching Load			Credits	Type of Course 1. CC 2. DSE 3. OE 4. SEC 5. AEC 6. VAC-I
				L	T	P		
THEORY SUBJECTS								
1	BCO230		Cloud Security	3	0	0	3	CC
2	BCO226		Data Structures Using C	4	0	0	4	CC
3	BCO228 BCO229		Open Elective II Web Analytics Mobile Application Development	3	0	0	3	OE
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								
8	BOL230		Cloud Security - Lab	0	0	2	1	CC
9	BOL226		Data Structures Using C- Lab	0	0	2	1	CC
TOTAL CREDITS							20	

Programme Structure								
Sharda School of Engineering & Technology								
Department of Computer Science & Applications								
B.SC in Cloud Computing & IoT								
Batch: 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. AEC 6. VAC-I
				L	T	P		
THEORY SUBJECTS								
1	BCO332		Cloud Web Services	4	0	0	4	CC
2	BCO154		Principles of Database Management System	3	0	0	3	CC
3	BCO156		Object Oriented Programming Using Java	3	0	0	3	DSE
4	BCO330 BCO331		Open Elective-III Introduction to Blockchain Technologies Cyber Analytics	3	0	0	3	OE
5	BCO322		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								
8	BOL332		Cloud Web Services - Lab	0	0	2	1	CC
9	BOL154		Principles of Data Base Management System - Lab	0	0	2	1	CC
10	BOL156		Object Oriented Programming Using Java - Lab	0	0	2	1	DSE
11	RBL001		Research Based Learning-1	0	0	2	0	Audit Course
TOTAL CREDITS							21	

Programme Structure								
Sharda School of Engineering & Technology								
Department of Computer Science & Applications								
B.SC in Cloud Computing & IoT								
Batch: 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. SEC 5. AEC 6. VAC-I
				L	T	P		
THEORY SUBJECTS								
1	BCO404		Internet of Things	4	0	0	4	CC
2	BCO155		Operating System and Unix Shell Programming	3	0	0	3	CC
3	BCO220		Application based Programming in Python	4	0	0	4	DSE
4	BCO402 BCO405		Open Elective-IV Data Warehousing and Data Mining Natural Language Processing	3	0	0	3	OE
5	ARP210		Quantitative and Qualitative Aptitude Skill Building	2	0	0	2	AECC
Practical/Viva-Voce/Jury								
7	BOL404		Internet of Things - Lab	0	0	2	1	DSE
8	BOL155		Operating System and Unix Shell Programming - Lab	0	0	2	1	CC
9	BOL220		Application based Programming in Python - Lab	0	0	2	1	CC
10	RBL002		Research Based Learning-2	0	0	2	0	Audit Course
TOTAL CREDITS							19	

Programme Structure								
Sharda School of Engineering & Technology								
Department of Computer Science & Applications								
B.SC in Cloud Computing & IoT								
Batch: Batch: 2023-26							SEMESTER: V	
S. No.	Course Code	Paper ID	Course	Teaching Load			Credits	Type of Course 1. CC 2. DSE 3. OE 4. SEC 5. AEC 6. VAC-I
				L	T	P		
THEORY SUBJECTS								
1	BCO502		Amazon Web Services	4	0	0	4	CC
2	BCO503		Web Technologies	4	0	0	4	CC
3	BCO155		Computer Networks and Data Communication	4	0	0	4	CC
4	BRM002		Research Methodology	3	0	0	3	DSE
Practical/Viva-Voce/Jury								
6	BOL502		Amazon Web Services - Lab	0	0	2	1	CC
7	BOL503		Web Technologies - Lab	0	0	2	1	CC
8	RBL003		Research Based Learning-3	0	0	4	2	RBL
9	INC003		Industry Connect	0	0	2	1	Internship
TOTAL CREDITS							20	

Programme Structure									
Sharda School of Engineering & Technology									
Department of Computer Science & Applications									
B.SC in Cloud Computing & IoT									
Batch: Batch: 2023-26							SEMESTER: VI		
S. No.	Course Code	Paper ID	Course	Teaching Load			Credits	Type of Course 1. CC 2. DSE 3. OE 4. SEC 5. AEC 6. VAC-I	
				L	T	P			
THEORY SUBJECTS									
1	BCO606		Microsoft Azure	4	0	0	4	CC	
2	BCO607		Cloud-based IoT Applications	4	0	0	4	CC	
3	BCO608		Enterprise Network Design	4	0	0	4	CC	
4	BCO604 BCO605		Open Elective-V Information Security and Cyber Laws Bigdata Analytics	3	0	0	3	OE	
Practical/Viva-Voce/Jury									
6	BOL606		Microsoft Azure - Lab	0	0	2	1	CC	
8	BOL608		Enterprise Network Design - Lab	0	0	2	1	CC	
9	CCU108		Community Connect	0	0	0	1	VAC	
10	RBL004		Research Based learning -4	0	0	4	2	DSE	
TOTAL CREDITS							20		

Course Modules

TERM-I

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**I**	
1	Course Code	BCO175	Course Name
2	Course Title	Cloud Computing	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Elective	
5	Course Objective	1. Provide students with an overview of the fundamental concepts of Cloud Computing. 2. Gain insight into the challenges and limitations Models of cloud computing. 3. To learn the various technologies of the cloud computing paradigm and learn about recent advances in Cloud Computing and enabling technologies. 4. Prepare students for research in the area of cloud Computing risks and cloud security challenges.	
6	Course Outcomes	CO1. Define the basics of cloud and recall the computer Science concepts which clarify on demand service architecture. CO2. Classify and describe the architecture and taxonomy of parallel and distributed computing, including shared and distributed memory. CO3. Apply and Manage Virtualization and Workflow to use the cloud in file systems and applications. CO4. Categorize and Characterize between Infrastructure services, deployment models, and governance in cloud computing CO5. Evaluate the importance of cloud using monitoring and management of services for performance improvement of HPC and to follow the Governance and Compliances. CO6. Elaborate the design concept and formulate to build the solution using cloud service providers.	
7	Course Description	This course introduces advanced aspects of Cloud Computing, encompassing the principles, to analyze the cloud, identify the problems, and choose the relevant models and algorithms to apply.	
8	Outline syllabus		CO Mapping
	Unit 1	**Cloud Computing Fundamentals**	
	A B C	Types of Computing, Grid computing, distributed computing, Client-server computing, Introduction to distributed systems, Cloud Computing definition, Roots of Cloud Computing, Layers and Types of Clouds, Desired Features of a Cloud Infrastructure as a Service Providers, Platform as a Service Providers	CO1, CO2, CO3
	Unit 2	**Understanding Abstraction and Virtualization**	
	A B	Introduction to Virtual Machines, The Anatomy of Cloud Infrastructures,	CO1, CO2,CO3

	C	Management of Virtual Machines for Cloud Infrastructures, Understanding Machine Imaging, The Logical Design, Secure Distributed Data Storage in Cloud Computing.			
	Unit 3	**Cloud Computing Services and Applications**			
	A B C	Introduction of CometCloud, Aneka and CloudSim, Integration of Private and Public Clouds. Introduction of Enterprises Demand and Cloud Computing, Dynamic ICT Services, Workflow Engine for Clouds Scientific Application for Cloud Environments, Classification of Scientific Applications and Services in the Cloud,			CO2,CO3,CO4
	Unit 4	**Cloud Computing Risk and Performance Issues**			
	A B C	Model for Federated Cloud Computing, Security Considerations. HPC in the Cloud: Performance-related Issues, Game Hosting on Cloud Resources, Legal Issues in Cloud Computing(PCI DSS), Data Privacy and Security Issues, The CIA Triad: Confidentiality, Integrity, And Availability			CO3, CO4,CO5
	Unit 5	**AWS, MS Azure and Google Cloud Services**			
	A B C	AWS Services: Elastic Compute Cloud, Identity and Access Management, Simple Storage Service, Content Delivery Network, CloudWatch MS Azure Services: Azure Virtual Machine, SQL Server on Virtual Machines, Azure SQL Database, Azure Active Directory Google Cloud: Compute Engine, Migrate for Compute Engine, Cloud Functions, Cloud Lab Balancing			CO4,CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s* Other References	1. CLOUD COMPUTING Principles and Paradigms, Edited by Rajkumar Buyya, Jam 2. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter 3. Barrie Sosinsky "*Cloud Computing (Bible)"*,Wiley.			

		4. Ronald L. Krutz and Russell Dean Vines, "Cloud Security: A comprehensive Guide to Secure Cloud Computing", WILEY.	

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1: Define the basics of cloud and recall the computer Science concepts which are helpful in understanding on demand service architecture.	PO1,PO3,PO4,PO8,PO9,PO10,PSO1
2.	CO2: Classify and describe the architecture and taxonomy of parallel and distributed computing, including shared and distributed memory	PO1,PO2,PO3,PO4,PO8,PO9,PO10
3.	CO3: Apply and Manage Virtualization and Workflow to use the cloud in file systems and applications.	PO1,PO2,PO3,PO4,PO8,PO9,PO10
4.	CO4: Categorize and Characterize between Infrastructure services, deployment models, and governance in cloud computing	PO1,PO2,PO3,PO4,PO8,PO9,PO10,PSO1
5	CO5: Evaluate the importance of cloud using monitoring and management of services for performance improvement of HPC and to follow the Governance and Compliances.	PO1,PO2,PO3,PO4,PO8,PO9,PO10, PSO1
6	CO6: Elaborate the design concept and formulate to build the solution using cloud service providers.	PO1,PO2,PO3,PO4,PO5, PO7, PO8, PO9, PO10, PSO1

PO and PSO mapping with level of strength for Course Name Cloud Computing

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	PSO 1	PSO 2
Cloud Computing	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 & TECHNOLOGY**	
Batch		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**I**	
1	Course Code	BCO172	
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 organisation. 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	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	Practical			
	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, PO5, PO10, PSO1, PSO2
2.	CO2: Discuss programs using Array and String	PO1, PO2, PO3, PO4, PO9, PO10, PSO1, PSO2
3.	CO3: Develop Functions for any problem	PO1, PO2, PO3, PO5, PO6, PO8, PSO1, PSO2
4	CO4: Classify Union and Structure to write any program	PO1, PO2, PO3, PO4, PO6, PO8 PO10, PSO1, PSO2
5	CO5: Implement concept of Pointers	PO1, PO2, PO3, PO4, PO7, PO9, PSO1, PSO2
6	CO6: Predict a real world problem with the help of c programming	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2

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

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

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

Course Code	**Course Name**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PSO 1**	**PSO 2**
BCO172	Fundamentals of Computers and Programming in C	**2.8**	**2.5**	**2.7**	**2.5**	**2.3**	**2.3**	**2.5**	**2.3**	**2.7**	**2.5**	**2.7**	**2.8**

Strength of Correlation

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

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**I**	
1	**Course Code**	**BCO173**	
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*	1. Paula Boddington, ―Towards a Code of Ethics for Artificial Intelligence‖, Springer, 2017 2. Markus D. Dubber, Frank Pasquale, Sunit Das, ―The Oxford Handbook of Ethics of AI‖, Oxford University Press Edited book, 2020.			
	Reference Books	3. Wallach, W., & Allen, C, ―Moral machines: ceaching robots right from wrong‖, Oxford University Press, 2008. 4. 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

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	**CO1:** ***Relate*** and explain the ethical considerations in the development and deployment of AI.	PO1, PO2, PO3, PO4, PO7, PO9,PO10, PSO1, PSO2
2.	**CO2:** ***Analyze*** and evaluate the social and ethical impacts of AI on various stakeholders and society as a whole.	PO1, PO2, PO3, PO4, PO10, PSO1, PSO2
3.	**CO3:** ***Extend*** propose ethical decision-making models relevant to AI applications.	PO1, PO2, PO3, PO4, PO5, PO8, PO10, PSO1, PSO2
4.	**CO4:** ***Make use of*** the implications of AI on privacy, data protection, bias, fairness, transparency, and accountability.	PO1, PO2, PO3, PO4, PO6, PO10, PSO1, PSO2
5	**CO5:** ***Explain*** and address ethical challenges in AI research, development, and governance.	PO1, PO2, PO3, PO4, PO5, PO6, PO10, PSO1, PSO2
6	**CO6:** ***Develop*** and discuss the ethical responsibilities of AI practitioners, policymakers, and organizations.	PO1, PO2, PO3, PO4, PO5, PO6, PO8,PO9, PO10, PSO1, PSO2

PO and PSO mapping with level of strength

Course Objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	2	2	1	1	-	-	2	-	1	1	2	1
CO2	1	3	3	2	-	-		-	-	3	1	3
CO3	2	1	2	1	1	-	-	1	-	2	1	2
CO4	1	2	1	3	-	1	-	-	-	1	3	1
CO5	2	2	2	2	-	2	-	-	-	1	2	2
CO6	2	3	2	3	2	2	-	2	2	2	1	2
AVFG	1.7	2.2	1.8	2.0	1.5	1.7	2.0	1.5	1.5	1.7	1.7	1.8

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
BCO173	Ethics and Social Implications of AI	1.7	2.2	1.8	2.0	1.5	1.7	2.0	1.5	1.5	1.7	1.7	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		**BSc in Cloud Computing & IoT Academic Year: 2023-24**
Semester		**I**
1	Course Code	BCO174
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 Development Institute of India (EDII),	CO4, CO6

	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	CE (VIVA)	ESE	
		25%	25	50%	
	Text book/s*	1. Udyamita by Dr. MMP. Akhouri and S.P Mishra, By National Institute for Entrepreneurship and Small Business Development (NIESBUD), NSIC-PATC Campus, Okhla 2. Entrepreneurial Development by Dr S S Khanka, S Chand & Company Ltd 3. Entrepreneurship Development & Small Business Enterprises by Poornima M Charantimath, Pearson. 4. Lall & Sahai: Entreprenurship (Excel Books 2 edition) Couger, C- Creativity and Innovation (IPP, 1999) 5. Kakkar D N - Enterpreneurship Development (Wiley Dreamtech)			

CO and PO Mapping

S. No.	Course Outcome (CO)	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1. To understand how start up entrepreneurship is supportive for enhancing business.	**PO1,PO2,PO3,PO4,PO9,PO10,PSO1, PSO2**
2.	CO2. Outline different ways of idea generation as innovator.	**PO1,PO2,PO3,PO4,PO9,PO10,PSO1, PSO2**
3.	CO3. Identify & utilize various Government policy for Small Scale Enterprises and its impact on Business.	**PO1,PO2,PO3,PO4,PO9,PO10,PSO1, PSO2**
4.	CO4. Analyze various financial schemes available to start up their enterprise.	**PO1,PO2,PO3,PO4,PO5,PO9,PO10,PSO1, PSO2**
5	CO5. Assess the importance & significance of institutional support at various levels for determining the entrepreneurial climate.	**PO1,PO2,PO3,PO4,PO5,PO9,PO10,PSO1, PSO2**
6	CO6. Develop the art of creativity and innovations in managing the entrepreneurial activities effectively.	**PO1,PO2,PO3,PO4,PO5,PO9,PO10,PSO1, PSO2**

PO and PSO mapping with level of strength for Course Name: Introduction of Entrepreneurship Development

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

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

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
BCO174	Introduction of Entrepreneurship Development	3	2	1.8	1.3	1	0	0	0	1.1	2.3	2.1	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		**BSc in Cloud Computing & IoT Academic Year: 2023-24**
Semester		**I**
1	Course Code	ARP103
2	Course Title	Communicative English-1
3	Credits	0
4	Contact Hours (L-T-P)	2-0-0
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 standardise 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 maximise 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**
	Topic 1	Subject Verb Agreement
	Topic 2	Parts of speech
	Topic 3	Writing well-formed sentences
	Unit B	**Vocabulary Building & Punctuation**
	Topic 1	Homonyms/ homophones, Synonyms/Antonyms
	Topic 2	Punctuation/ Spellings (Prefixes-suffixes/Unjumbled Words)
	Topic 3	Conjunctions/Compound Sentences
	Unit C	**Writing Skills**
	Topic 1	Picture Description – Student Group Activity
	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
	Topic 3	Story Completion Exercise –Building positive attitude - The Man from Earth (Watching a Full length Feature Film)

	Topic 4	Digital Literacy | Effective Use of Social Media
	Unit D	**Speaking Skill**
	Topic 1	Self-introduction/Greeting/Meeting people – Self branding
	Topic 2	Describing people and situations - To Sir With Love (Watching a Full length Feature Film)
	Topic 3	Dialogues/conversations (Situation based Role Plays)
	Unit E	**Professional Skills | Career Skills**
	Topic 1	Exploring Career Opportunities
	Topic 2	Brainstorming Techniques & Models
	Topic 3	Social and Cultural Etiquettes
	Topic 4	Internal Communication
	Unit F	**Leadership and Management Skills**
	Topic 1	Managerial Skills
	Topic 2	Entrepreneurial Skills
9	Evaluations	*Class Assignments/Free Speech Exercises / JAM Group Presentations/Problem Solving Scenarios/GD/Simulations (60% CA and 40% ETE*
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

CO and PO Mapping

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**	-	-

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
ARP103	Communicative English-1	-	-	-	-	-	-	-	-	1	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		**BSc in Cloud Computing & IoT Academic Year: 2023-24**			
Semester		**I**			
1	Course Code				
2	Course Title	Cloud Computing 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	CO1: Familiarize widely used cloud platforms CO2: Create and configure virtual machines CO3: Learn how to create containers and its orchestration CO4: Development, deployment and monitoring of cloud applications CO5: Understand the storage and networking options in cloud CO6: Analyze Load balancing and monitoring of cloud applications			
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				
		Create accounts in AWS and Google cloud, Explore the various services offered by Amazon and Google			CO1, CO3
	Unit 2				
		Virtualization concept in Virtualbox, Create and configure Virtual machine, Host a web server in the virtual machine			CO2, CO4
	Unit 3				
		Create containers using docker, Kubernetes and orcherstation of containers, Structured and unstructured storage in the cloud			CO3, CO6
	Unit 4				
		CloudSQL, Application development and deployment in cloud			CO4, CO6
	Unit 5				
		Load balancing and monitoring of cloud applications. Various networking options in cloud, Case study- private cloud setup using openstack			CO5, CO6
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	CE (Viva)	ESE	
		25%	25%	50%	
	Text book/s*	1. Cloud Computing : A hands on Approach, ArshdeepBagha - Vijay BaghaMadisetti , 2013, 2. Dan C. Marinescu, Cloud Computing: Theory and Practice, Elsevier Science, 2013,			

	Other References	1. https://www.qwiklabs.com/ 2. https://sites.google.com/google.com/gcp-teachingresources/home?pli=1&authuser=1		

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1: Familiarize widely used cloud platforms	**PO1,PO2,PO3,PO4,PO10**
2.	CO2: Create and configure virtual machines	**PO1,PO2,PO3,PO4,PO10**
3.	CO3: Learn how to create containers and its orchestration	**PO1,PO3,PO4,PO8,PO10,PSO1**
4.	CO4: Development, deployment and monitoring of cloud applications	**PO1,PO3,PO4,PO8,PO10**
5.	CO5: Understand the storage and networking options in cloud	**PO3,PO4,PO8,PO10,PSO1**
6.	CO6: Analyze Load balancing and monitoring of cloud applications	**PO1,PO2,PO3,PO4,PO5,PO8,PO10,PSO1 ,PSO2**

PO and PSO mapping with level of strength for Course Name: Cloud Computing Lab

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO2
	CO1	2	2	2	2	--	--	--	--	--	2	--	--
	CO2	2	2	2	2	--	--	--	--	--	2	--	--
	CO3	1	--	2	2	--	--	--	1	--	2	2	--
	CO4	1	--	2	3	--	--	--	1	--	2	--	--
	CO5	--	--	2	2	--	--	--	1	--	2	2	--
Cloud Computing Lab	CO6	2	1	2	3	3	--	--	3	--	3	3	2

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

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
BOL175	Cloud Computing Lab	**1.6**	**1.67**	**2**	**2.3**	**3**	**0**	**0**	**1.5**	**0**	**2.67**	**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***

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**			
Batch		**2023-26**			
Department		**Computer Science & Applications**			
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**			
Semester		**I**			
1	**Course Code**	**BOL172**			
2	**Course Title**	**Fundamentals of Computers and Programming in C -Lab**			
3	**Credits**	**2**			
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 (CO)	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1: Enumerate core concept of C Programming	PO3, PO4, PO5, PO10, PSO1, PSO2
2.	CO2: Discuss programs using Array and String	PO1, PO2, PO3, PO4, PO5, PO10, PSO1, PSO2
3.	CO3: Develop Functions for any problem	PO1, PO2, PO3, PO4, PO5, PO12, PSO1, PSO2
4.	CO4: Classify Union and Structure to write any program	PO1, PO2, PO3, PO4, PO5, PO12, PSO1, PSO2
5	CO5: Implement concept of Pointers	PO1, PO2, PO3, PO4, PO5, PO9, PO10 PO12, PSO1, PSO2
6	CO6: Predict a real world problem with the help of c programming	PO1, PO2, PO3, PO4, PO5, PO9, PO10 PO12, 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	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO2
Fundamentals of Computers and Programming in C -Lab	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/ Name	PO 1	PO 2	PO 3	P O 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO1	PSO2
Fundamentals of Computers and Programming in C -Lab	2.16	2.83	2.8	3.0	2.5	1.5	1	0.6	1	1.83	3.0	2.33

Strength of Correlation. **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		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**II**	
1	Course Code	BCO230	
2	Course Title	Cloud Security	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Core	
5	Course Objective	Gain knowledge on basic concepts of Cloud. Understand how to use Cloud Platform and understand the virtualization key concepts. Learn the basics of Cloud Security and its applications.	
6	Course Outcomes	CO1: Understand the fundamentals of virtualization. CO2: Identify the various architectures and standards of cloud computing. CO3: Analyze and understand the various features of server architectures involved in cloud computing. CO4: Understand the security structure of cloud computing. CO5: Understand the Cloud computing security protocols and their solution. CO6: Analyze Top Cloud Threats and Requirements of Security as a Service	
7	Course Description	This course provides an in-depth understanding of virtualization technologies and their role in cloud computing. It covers the concepts, principles, and best practices of virtualization and focuses on the security challenges and solutions specific to cloud environments.	
8	Outline Syllabus		CO Mapping
	Unit 1	**Basic Concepts of Cloud and Virtualization**	
		Virtualization Introduction, Cloud Computing Concepts, Cloud Delivery Models, Virtualization Concepts	CO1, CO2
	Unit 2	**Concepts on Cloud Trust Protocol and Transparency**	CO2, CO3
		Introduction to Cloud Trust Protocol and Transparency, Cloud Trust Protocol and its Transparency, Serving Cloud Consumer and Cloud Provider, Adaptability in Asset Model, Scopes	

	Unit 3	**Transparency as a Service**			CO2, CO3
		Transparency as a Service, Concept of Transparency, Security, Privacy aspects of cloud.			
	Unit 4	**Cloud Controls Matrix**			CO3, CO4
		Introduction to Cloud Controls Matrix, Cloud Controls Matrix, Trusted Cloud Initiative Architecture and Reference Model			
	Unit 5	**Top Cloud Threats**			CO5
		Introduction to Top Cloud Threats, Requirements of Security as a Service (SECaaS) model, Top Security Threats to the cloud model			
	Mode of examination	Practical			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Textbook/s *	Silvano Gai, Claudio DeSanti,"I/O Consolidation in the Data Center" Cisco Press; 1 edition [ISBN: 9781587058882]. 2014.			
	Other References	1. https://www.manageengine.com/network-monitoring/data-center-networking.html 2. https://www.networkworld.com/article/2217903/layer-2-data-center-interconnect-options.html			

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1: Understand the fundamentals of virtualization	**PO1,PO2,PO3,PO4,PO5,PO7,PO8,PO10, PSO1**
2.	CO2: Identify the various architectures and standards of cloud computing.	**PO1,PO3,PO4,PO5,PO6,PO7,PO8,PO10, PSO1,**
3.	CO3: Analyze and understand the various features of server architectures involved in cloud computing.	**PO1,PO2,PO3,PO4,PO6,PO8,PO10,PSO2**
4.	CO4: Understand the security structure of cloud computing.	**PO1,PO2,PO3,PO4,PO5,PO6,PO8,PO10,PSO2**
5.	CO5: Understand the Cloud computing security protocols and their solution.	**PO1,PO2,PO3,PO4,PO5,PO6,PO8,PO10,PSO2**
6.	CO6: Analyze Top Cloud Threats and Requirements of Security as a Service	**PO1,PO2,PO3,PO4,PO5,PO6,PO7,PO8, PO9,PO10,PSO2**

PO and PSO mapping with level of strength for Course Name Cloud Security

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
Cloud Security	CO1	3	3	3	3	2	1	1	1	1	3	1	2
	CO2	2	0	2	2	3	3	1	1	3	2	1	2
	CO3	3	3	3	3	2	2	2	1	2	3	1	2
	CO4	2	2	2	2	2	2	2	1	2	2	1	2
	CO5	2	1	3	3	2	3	1	1	2	3	1	2
	CO6	0	1	2	2	3	3	2	2	3	3	1	2

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

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
BCO230	Cloud Security	2.4	2.0	2.5	2.5	2.3	2.3	1.50	1.16	2.16	2.6	1.0	2.00

Strength of Correlation

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

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

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**II**	
1	Course Code	BCO226	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 colouring.			CO4,CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		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	3. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein "Data Structures Using C and C++" , PHI 4. 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(OLB.SC201)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	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

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		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**II**	
1	**Course Code**	**BCO228**	
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-Folow 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

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1	**CO1: *Relate*** and understand the fundamental concepts and principles of web analytics.	**PO1, PO2, PSO1**
2	**CO2: *Analyze the*** proficiency in using web analytics tools to collect and analyze website data.	**PO1, PO2,PO4,PO10 PSO1**
3	**CO3: *Extend*** the key metrics and performance indicators to evaluate website effectiveness and user behavior.	**PO2, PO4, PO8, PS01,PSO2**
4	**CO4: *Make use of*** data-driven insights to optimize website performance, user experience, and conversion rates.	**PO2, PO3, PO4,PO6,PO8 PSO1, PSO2**
5	**CO5: *Explain*** Develop skills in data visualization and reporting to effectively communicate web analytics findings.	**PO1,PO2, PO3, PO8, PSO1, PSO2**
6	**CO6: *Develop*** and Utilize web analytics data to inform and support strategic decision-making in online marketing campaigns.	**PO2,PO3, PO4, PO6,PO10., PSO1, PSO2**

PO and PSO mapping with level of strength for Web Analytics

Course Code_ Course Name	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
BC0228 Web Analytics	CO1	2	2	3	-	-	2		2	1	2	1	3
	CO2	3	3	2	1	1	2		2	2	3	2	2
	CO3	1		2	2	3	2			3	2		2
	CO4		2	3	3	2	3				2	3	
	CO5	2	1	3					2	2		1	2
	CO6	3	3		2	3	-		1	1	3	2	3

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

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
BCO228	Web Analytics	1.83	1.83	2.17	1.33	1.50	1.50		1.17	1.50	2.00	1.50	2.00

Strength of Correlation

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

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

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**
Batch		**2023-26**
Department		**Computer Science & Applications**
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**
Semester		**II**
1	Course Code	**ARP105**
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 learnings from the previous semester to an advanced level of language learning and self-comprehension through the introduction of audio-visual aids as language enablers. It also leads learners to an advanced level of writing, reading, listening and speaking abilities, while also reducing the usage of L1 to minimal in order to increase the employability chances.
8	Outline syllabus	
	Unit A	**Acquiring Vision, Goals and Strategies through Audio-visual Language Texts**
	Topic 1	Pursuit of Happiness / Goal Setting & Value Proposition in life
	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
	Topic 2	Theme based Story Writing - Positive attitude
	Topic 3	Learning Diary Learning Log – Self-introspection
	Unit C	**Writing Skills 1**
	Topic 1	Precis
	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
	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
	Topic 2	Extempore
	Topic 3	Situation-based Role Play
	Unit F	**Leadership and Management Skills**
	Topic 1	Innovative Leadership and Design Thinking
	Topic 2	Ethics and Integrity
	Unit F	**Universal Human Values**
	Topic 1	Love & Compassion, Non-Violence & Truth
	Topic 2	Righteousness, Peace
	Topic 3	Service, Renunciation (Sacrifice)
	Unit G	**Introduction to Quantitative aptitude & Logical Reasoning**
	Topic 1	Analytical Reasoning & Puzzle Solving
	Topic 2	Number Systems and its Application in Solving Problems
9	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%
10	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

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	-	-	-	-	-	-	-	1	2	-	-

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

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
ARP105	Communicative English -2	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.50**	**2.00**	**1.50**	**2.00**

Strength of Correlation

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

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

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**II**	
1	Course Code	BOL230	
2	Course Title	Cloud Security - Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	● Understand Cloud Technologies and Tools ● Explore the way of use system resources effectively ● Examine the various types of tools and services using Azure web portal	
6	Course Outcomes	By the end of this course, the student will be able to: CO-1 To study the way of utilization of hardware resources CO-2 Explore the various types of technologies and web portal of cloud computing. CO3: Analyze and understand the various features of server architectures involved in cloud computing. CO4: Understand managing snapshot of VM and template of VM CO5: Understand Adding additional storage and sharing of files. CO6: Implementation of Storage Service in Cloud.	
7	Course Description	The Virtualization and Cloud Security - Lab is an advanced-level course designed to provide hands-on practical experience and in-depth knowledge of virtualization and cloud security concepts. This lab-based course complements the theoretical aspects covered in the Virtualization and Cloud Security course by providing students with the opportunity to apply their knowledge in a practical setting.	
8	Outline syllabus		CO Mapping
	Unit 1		
		● Creating a Virtual machine using a VMware workstation ● Usage of virtual Switches in VMware workstation	CO1, CO6
	Unit 2		
		● Creating a Virtual machine using hyper-V ● Usage of Hyper-V virtual Switches	CO2, CO6
	Unit 3		
		● Installation of ESXi Server, adding users & assigning permission ● Creating and managing of a snapshot of VM using vSphere ● Creating a template and clone of a VM using VMware HOL.	CO3, CO6
	Unit 4		
		● Adding additional storage and memory in the existing Virtual machine ● Sharing of files between host machine and guest machine	CO4, CO6
	Unit 5		
		● Creating VM and Adding additional HDD/SSD in Cloud (Azure) ● Implementation of Storage Service in Cloud (Azure)	CO5, CO6

		• Creating and configuring Virtual Networks in Cloud (Azure)				
	Mode of examination	Jury/Practical/Viva				
	Weightage Distribution	CA	CE (Viva)	ESE		
		25%	25%	50%		
	Text book/s*	Silvano Gai, Claudio DeSanti,"I/O Consolidation in the Data Center" Cisco Press; 1 edition [ISBN: 9781587058882]. 2014.				
	Other References	1. Microsoft Azure Security Documentation: https://docs.microsoft.com/en-us/azure/security/ 2. Open Web Application Security Project (OWASP): https://owasp.org/				

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO-1 To study the way of utilization of hardware resources	PO1, PO2, PO3, PO4, PO9, PO10, PSO1, PSO2
2.	CO-2 Explore the various types of technologies and web portal of cloud computing.	PO1, PO2, PO3, PO4, PO6, PSO1, PSO2
3.	CO3: Analyze and understand the various features of server architectures involved in cloud computing.	PO1, PO3, PO4, PO5, PO7, PO8, PO10, PSO1, PSO2
4	CO4: Understand managing snapshot of VM and template of VM	PO1, PO2, PO3, PO4, PO6, PO9, PSO1, PSO2
5	CO5: Understand Adding additional storage and sharing of files.	PO1, PO3, PO4, PO5, PO7, PO8, PO9, PO10, PSO1, PSO2
6	CO6: Implementation of Storage Service in Cloud.	PO1, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name : Cloud Security - Lab

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	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
BOL230	Cloud Security - Lab	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 Correlation1.* Addressed to*Slight (Low=1)extent 2.* Addressed to*Moderate (Medium=2) extent3.* Addressed to*Substantial (High=3) exten

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**			
Batch		**2023-26**			
Department		**Computer Science & Applications**			
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**			
Semester		**II**			
1	Course Code	BOL226			
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*	3. A Common-Sense Guide to Data Structures and Algorithms, Second Edition: Level Up Your Core Programming Skills 2nd Edition			

		4. Data Structures Through C (A Practical Approach) Paperback – 1 January 2016 by G.S. Baluja		
	Other References	3. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein "Data Structures Using C and C++" , PHI 4. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication		

CO and PO Mapping

S. No.	Course Outcome (CO)	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO-1 Apply the basic operations on arrays	PO1, PO2, PO3, PO4, PO8, PO9, PO10, PSO1
2.	CO-2 Construct complex programs like matrix implementations on arrays	PO1, PO2, PO3, PO4, PO8, PO10
3.	CO-3 Apply the concept of stacks and queues in real life problem solving	PO1, PO2, PO3, PO4, PO8, PO10, PSO1
4.	CO-4. Apply the concepts of data structure, like linked list to solve complex problems	PO1, PO2, PO3, PO4, PO8, PO10, PSO1
5	CO-5. Solving the real-life problems based on trees	PO1, PO2, PO3, PO4, PO6, PO10
6	CO-6 Implementing the graphs and apply graph concept in computer networks	PO1, PO2, PO3, PO4, PO5, PO6, 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	-	3	-	-	-	2	2	3	3	-
CO2	3	3	3	3	-	-	-	3	-	2	3	-
CO3	3	3	3	3	-	-	-	3	-	3	2	-
CO4	3	3	3	3	-	-	-	3	-	3	3	-
CO5	2	2	2	3	-	2	-	-	-	2	-	-
CO6	2	3	3	3	2	2	-	3	3	3	3	-

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

Course Code/ Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2
BOL226 Data Structure Using C Lab	2.7	2.8	2.8	3.0	2.0	2.0	-	2.8	2.5	2.7	2.8	-

Strength of Correlation

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

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

TERM-III

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**III**	
1	Course Code	BCO332	
2	Course Title	Cloud Web Services	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Core	
5	Course Objective	To impart the basic concepts of AWS Ecosystem and Security Services. To understand concepts about Compute and Networking Services. To understand basic concepts about storage services and Database engines.	
6	Course Outcomes	CO1: Analyze the cloud service categories. CO2: Distinguish compute services and implementation. CO3: Describe the Networking services and connecting from on premise to cloud. CO4: Knowledge of development and deployment and monitoring of cloud services. CO5: Monitor and analysis Amazon Cloud Watch. CO6 Design web applications for cloud	
7	Course Description	This course provides an in-depth understanding of virtualization technologies and their role in cloud computing. It covers the concepts, principles, and best practices of virtualization and focuses on the security challenges and solutions specific to cloud environments.	
8	Outline Syllabus		CO Mapping
	Unit 1	**Introduction to Cloud Services**	
		Introduction to AWS Ecosystem, AWS Certifications, Reference Architecture, Introduction to AWS Cloud Services, Security on AWS, Security your AWS Account with AWS Identity and Access Management, Securing AWS Cloud Services, monitoring to enhance Security, AWS Cloud Service- Specific Security	CO1, CO6
	Unit 2	**Compute and Networking Services**	CO2, CO6
		Introduction to AWS Compute Services, Amazon EC2, Amazon EC2 Container Services, AWS Elastic Beanstalk, AWS Lambda, Amazon LightSail, Mapping Elastic IP to running EC2 Instance, Mapping Elastic IP to Domain, AWS Batch, Introduction to Networking on AWS, Amazon Virtual	

		Private Cloud , AWS Direct Connect, Load Balancing, Virtual Private Network (VPN), Amazon Route53, Amazon Cloud Front	
	Unit 3	**Storage System and Database**	CO3, CO6
		Understanding Different Storage Options, Block Storage On AWS, Object Storage on AWS, System Operator Scenario, Additional Storage Solutions, Introduction to AWS Databases, Monitoring Amazon RDS, Non-Relational Databases, Amazon DynamoDB, Amazon Redshift, Monitoring Clusters, Amazon Elastic ache.	
	Unit 4	**Application Development and Management**	CO4, CO6
		Introduction to Application Development and Management, Deployment Strategies, Deployment Services, AWS Elastic Beanstalk, EC2 Container Service, AWS OpsWorks Stacks, AWS CloudFormation, Installing a LAMP, WebServer **High Availability:** Introduction to high Availability, Simple Queue Services, Simple Notification Service, Simple Email Service, highly available Architectures, Multi region high Availability, Disaster recovery	
	Unit 5	**Monitoring and Metrics**	CO5, CO6
		Introduction to Monitoring and Metrics, Overview of Monitoring, Amazon CloudWatch, Amazon CloudWatch Event, Amazon CloudWatch Logs, Monitoring AWS Charges AWS CloudTrail, AWSConfig.	
	Mode of examination	Practical	
	Weightage Distribution	CA: 25% / MTE: 25% / ETE: 50%	
	Textbook/s*	1.Rhoads, J., Digby, G., Cole, S., Qualheim, S., Sundrud, B., R 017). AWS Certified SysOps Administrator Offici Exam. Germany: Wiley. 2.Gaut, B., Baz, H., Bixler, T., Kelly, K. E., Senior, S., Stamp Certified Solutions Architect Official Study Guide: Associate E	
	Other References	3. https://www.aws.training/ 0. https://www.tutorialspoint.com/amazon_web_services/index.htm 3. https://www.youtube.com/watch?v=k1RI5locZE4 1. https://awsdocs.s3.amazonaws.com/gettingstarted/latest/awsgsg-intro.pdf	

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1: Analyse the cloud service categories. implementation.	**PO1,PO2, PO3,PO5, PSO1,PSO2**
2.	CO2: Distinguish compute services and	**PO1,PO2, PO3,PO5**
3.	CO3: Describe the Networking services and connecting from on premise to cloud.	**PO1,PO2, PO3, PO4, PO5,PSO2**
4.	CO4: Knowledge of development and deployment and monitoring of cloud services.	**PO1,PO2, PO3,PSO1**
5.	CO5: Monitor and analysis Amazon Cloud Watch.	**PO1,PO2, PO3, PO5,PSO1,PSO2**
5.	*CO-6* Design web applications for cloud	**PO1,PO2, PO3, PO5, PSO1,PSO2**

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

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
BCO332 Cloud Web Services	**CO1**	3	3	2	3	2	--	--	--	--	--	2	3
	CO2	3	3	3	3	2	--	--	--	--	--	2	3
	CO3	3	3	2	3	2	--	--	--	--	--	2	3
	CO4	2	3	2	2	2	--	--	--	--	--	2	3
	CO5	2	3	2	2	2	--	--	--	--	--	2	3
	CO6	2	3	2	2	2	--	--	--	--	--	2	3

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

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
BCO332	Cloud Web Services	**2.5**	**3**	**2.16**	**2.5**	**2**						**2**	**3**

Strength of Correlation

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

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

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**III**	
1	Course Code	BCO154	
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*	1. Korth , Silberschatz& Sudarshan, Data base Concepts, Tata McGraw-Hill 2. Elmasri, Navathe, Fundamentals of Database Systems, Pearson Education Inc.		
	Other References	1. Thomas Connolly, Carolyn Begg, Database Systems: A Practical Approach to design, Implementation and Management, Pearson Education, Latest Edition. 2. Jeffrey D. Ullman, Jennifer Windon, A first course in Database Systems, Pearson Education. 3. Date C.J., An Introduction to Database Systems, Addison Wesley. 4. Richard T. Watson, Data Management: databases and organization, Wiley.		

CO and PO Mapping

S. No.	Course Outcome (CO)	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	Explain the basics concepts of database & design an ER model for a given example from real world description.	PO1, PO4, PO8, PO9, PO10
2.	Design & Solve the given problem using Relational Algebra, Relational Calculus, SQL and PL/SQL.	PO1, PO2, PO4, PO8, PO10
3.	Apply normalization techniques to reduce redundancy from the database.	PO1, PO2, PO3, PO4, PO8, PO10
4.	To appraise the basic issues of Transaction processing, Serializability & deadlock.	PO1, PO2, PO3, PO4, PO8
5	Determine the roles of concurrency control techniques in database design.	PO1, PO2, PO3, PO4, PO10
6	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: Database Management Systems (Course Code: BCO154**)**

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	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
BCO154 / **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		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**III**	
1	**Course Code**	**BCO156**	
2	**Course Title**	**Object Oriented Programming Using Java**	
3	**Credits**	**4**	
4	**Contact Hours (L-T-P)**	**4-0-0**	
	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	Basics of HTML, formatting and fonts, commenting code, color, hyperlink, lists, tables, images,			CO5, CO6
	B	forms, XHTML, frames and frame sets, Overview and features of HTML 5.			CO5, CO6
	C	Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2, Overview and features of CSS3.			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			

PO and PSO mapping with level of strength for Course Name Introduction to OOP using Java Lab (Course Code BCO156)

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
BCO156_ Introducti on to OOP 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	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
BCO156	Introduction to OOP 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***

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**			
Batch		**2023-26**			
Department		**Computer Science & Applications**			
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**			
Semester		**III**			
1	Course Code	BCO330			
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. Permissionless 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, Hashgraphs			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	1. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015 (article available for free download) { curtain raiser kind of generic article, written by seasoned experts and pioneers}. 2. J.A.Garay et al, The bitcoin backbone protocol - analysis and applications EUROCRYPT 2015 LNCS VOl 9057, (VOLII), pp 281-310. (Also available at eprint.iacr.org/2016/1048) . (serious beginning of discussions related to formal models for bitcoin protocols). 3. R. Pass et al, Analysis of Blockchain protocol in Asynchronous networks, EUROCRYPT 2017, (eprint.iacr.org/2016/454) . A significant progress and consolidation of several principles). 4. R.Pass et al, Fruitchain, a fair blockchain, PODC 2017 (eprint.iacr.org/2016/916).			

CO and PO Mapping

No.	Course Outcome	ogramme Outcomes (PO) & Programme ecific Outcomes (PSO)
	CO1: Define principles of Blockchain networks, stributed ledger, and the layered architecture of ockchain	PO1, PO2, PSO1,PSO2
	CO2: Demonstrate an understanding of key terms lated to cryptocurrencies	PO1,PO2,PO3,PSO1,PSO2
	CO3: Evaluate the differences among key consensus gorithmS	PO1, PO3, PO5, PSO1, PSO2
	CO4: Evaluate the Ethereum and Hyperledger Fabric ockchain frameworks and their applications in terprise contexts	PO1, PO4, PO6, PO7, PSO1,PSO2
	CO5: Apply the knowledge of smart contracts to sign and develop simple programs using the Solidity ogramming language and Remix IDE	PO5,PO7, PO8, PO9, PSO1,PSO2
	CO6: Evaluate the benefits and challenges of using ockchain technology in various domains and identify tential use cases	PO10,,PSO1

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

Introduction to Blockchain Technologies	**CO's**	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**
Introduction to Blockchain Technologies	**CO1**	2	2		-	-	-	-	-	-	-	2	2
	CO2	2	2	2	-	-	-	-	-	-	-	2	2
	CO3	2	-	2	-	2	-	-	-	-	-	2	2
	CO4	2	-	-	2	-	2	2	-	-	-	2	2
	CO5	-	-	-	-	2	-	2	2	2		2	-
	CO6	-	-	-	-	-	-	-	-	-	2	2	-

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**	**PO10**	**PSO 1**	**PSO 2**
BCO330	**Introduction to Blockchain Technologies**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**

Strength of Correlation

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

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

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**III**	
1	**Course Code**	**BCO331**	
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	CurrentThreats 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 Distribution	CA	MTE	ETE	
		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, PO5, PO8, PSO1
2.	***CO2: Describe*** the operational and psychology security Aspects.	PO1, PO2, PO3, PSO1
3.	***CO3: Explain*** Authentication Methods and Intrusion detection system	PO1, PO2, PO3, PO5, PO9, PSO1
4.	***CO4: Describe*** the Cyber Crime Strategy analysis.	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	***CO5: Apply*** the Concepts of Cyber Crime and Digital Forensics in Real Time Scenarios.	PO1, PO2, PO3, PO8, PO9, PSO2,
6.	**CO6: *Develop*** and Utilize cyber analytics data to inform and support strategic decision-making in online marketing campaigns.	PO1, PO2, PO4, PO5, PO6, PO7, PO10 , PSO1

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

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
BCO331 Cyber Analytics	CO1	3	3	-	-	2	-	-	3	-	-	-	-
	CO2	3	3	2	-	-	-	-	-	-	-	-	-
	CO3	3	3	2	-	2	-	-	-	2	-	3	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	3
	CO5	3	2	3	-	-	-	-	3	3	-	-	3
	CO6	3	3	-	3	3	3	3	-	-	3	3	-

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
BCO331	**Cyber Analytics**	3	2.7	2.3	3	2.2	3	3	2.6	2.5	3	2	2

Strength of Correlation

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

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

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**		
Batch		**2023-26**		
Department		**Computer Science & Applications**		
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**		
Semester		**III**		
1	Course Code	**BCO322**		
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, limitations of testing		CO4

	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 (Course Code BCO322)

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	PSO2
BCO322 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
BCO322	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		**BSc in Cloud Computing & IoT Academic Year: 2023-24**
Semester		**III**
1	Course Code	ARP209
2	Course Title	**Logical Skills Building and Soft Skills**
3	Credits	2
4	Contact Hours (L-T-P)	2-0-0
	Course Status	Compulsory
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 – OLB.SC306	
	Unit 1	**BELLS (Building Essential Language and Life Skills)**
	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.
	B	Techniques of Self Awareness | Self Esteem & Effectiveness| Building Positive Attitude | Building Emotional Competence

	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) |
	Unit 2	**Introduction to APTITUDE TRAINING- Reasoning- Logical/ Analytical**
	A	Syllogism | Letter Series | Coding, Decoding , Ranking & Their Comparison Level-1
	B	Number Puzzles
	C	Selection Based On Given Conditions
	Unit 3	**Quantitative Aptitude**
	A	Number Systems Level 1 | Vedic Maths Level-1
	B	Percentage ,Ratio & Proportion | Mensuration - Area & Volume |Algebra
	Unit 4	**Verbal Abilities - 1**
	A	Reading Comprehension
	B	Spotting the Errors
	Unit 5	**Time & Priority Management**
	A	Steven Covey Time Management Matrix
	B	Creating Self Time Management Tracker
	Evaluation Weightage Distribution	Practical Basis - Class Assignment/Free Speech Exercises / JAM | Group Presentations/Mock Interviews/GD/ Reasoning, Quantitative Aptitude and Logical Reasoning (CA,CE and ESE component) and NO MSE CA-25%; CE-25%; ESE-50%
	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

CO PO mapping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
OLB.SC306.1	-	-	-	-	1	-	-	-	1	3	-	-
OLB.SC306.2	-	-	-	-	1	-	-	-	1	3	-	-
OLB.SC306.3	-	-	-	-	1	-	-	-	1	3	-	-
OLB.SC306.4	-	-	-	-	-	-	-	-	1	2	-	-
OLB.SC306.5	1	-	-	-	-	-	-	-	1	2	-	-
OLB.SC306.6	1	-	-	-	-	-	-	-	1	2	-	-

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

Course Code	**Course Name**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PSO 1**	**PSO 2**
BCO322	Software Engineering and Quality Assurance	1	-	-	-	3	-	-	-	1	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		**BSc in Cloud Computing & IoT Academic Year: 2023-24**		
Semester		**III**		
1	Course Code	BOL332		
2	Course Title	Cloud Web Services - Lab		
3	Credits	1		
4	Contact Hours (L-T-P)	0-0-2		
	Course Status	Compulsory		
5	Course Objective	• Gain practical experience in developing and deploying web applications on cloud platforms. • Understand the fundamental concepts and architectures of cloud-based web services. • Learn to utilize various cloud services and tools for building and deploying web applications. • Develop skills in designing and implementing scalable and fault-tolerant web applications on the cloud.		
6	Course Outcomes	By the end of this course, the student will be able to: CO1: Overview of cloud computing and its benefits CO2: Introduction to web services and their significance in cloud-based applications CO3: Virtual machines and containers for web application deployment CO4: Storage services for managing web application data. CO5: Compare different techniques to securing server in AWS. CO6: Evaluate the different type of Securing Applications & monitoring in AWS		
7	Course Description	Cloud Web Services Lab is a practical-oriented course that provides students with hands-on experience in developing and deploying web applications using cloud-based platforms and services. This lab-based course complements the theoretical aspects covered in the Cloud Web Services course by offering students the opportunity to apply their knowledge in a practical setting. Throughout the course, students will gain proficiency in utilizing cloud technologies and services to build scalable, reliable, and secure web applications.		
8	Outline syllabus			
	Unit 1	1 Applying and verifying the policies assigned for IAM users and groups		
		2. Creating and Configuring EC2 instance for Windows and Linux		
	Unit 2	3. Creating and Configuring Load balancer and auto scaling for the web server		
		4. Creating and Configuring the Security group and VPC for instance.		
	Unit 3	5. Creating and Configuring S3 Bucket for static Web Site		
		7. Creating and configuring S3 bucket for Policies and permissions		
	Unit 4	8. Creating and Configuring the RDS for MySQL database engine		
		9. Deploying and publishing a application using Elastic Beanstalk		
	Unit 5	10. Configuring AWS Lambda function for automating the task between two services.		
		11. Configuring the CloudTrail for Event logs.		
	Mode of examination	Jury/Practical/Viva		
	Weightage Distribution	CA	CE (Viva)	ESE
		25%	25%	50%

	Text book/s*	• "Cloud Computing: Concepts, Technology, and Architecture" by Thomas Erl, Ricardo Puttini, and Zaigham Mahmood
	Other References	• Microsoft Azure Documentation: https://docs.microsoft.com/en-us/azure/ • Google Cloud Documentation: https://cloud.google.com/docs

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1: Overview of cloud computing and its benefits	PO1, PO2, PO3, PO4, PSO1
2.	CO2: Introduction to web services and their significance in cloud-based applications	PO1, PO3, PO4, PSO2
3.	CO3: Virtual machines and containers for web application deployment	PO1, PO2, PO3, PO4,PO6
4.	CO4: Storage services for managing web application data	PO9, PO10, PO11, PSO5,PO7
5.	CO5: Compare different techniques to securing server in AWS.	PO5,PO7, PO8, PO9, PSO1,PSO2
6.	**CO6:** Evaluate the different type of Securing Applications & monitoring in AWS	PO10,PO11,PO12,PSO1,PSO3

PO and PSO mapping with level of strength for Course Name Cloud Web Services - Lab

Course Code, Course Name	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
BOL332 Cloud Web Services - Lab	CO1	3	3	2	2	--	--	--	2	2	1	3	2
	CO2	2	2	3	3	--	--	--	2	2	2	2	3
	CO3	3	3	3	3	--	2	--	1	1	1	3	2
	CO4	2	2	2	2	2	--	-2	2	3	3	2	2
	CO5	-	-	-	-	2	-	2	2	2		2	-
	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	PSO1	PSO2
BOL332	Cloud Web Services - Lab	**2.5**	**2.5**	**2.5**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**

Strength of Correlation1. 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		BSc in Cloud Computing & IoT Academic Year: 2023-24			
Semester		III			
1	Course Code	BOL154			
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*	1. Korth, Silberschatz & Sudarshan, Database Concepts, Tata McGraw-Hill			
	Other References	1. Elmasri, Navathe, Fundamentals of Database Systems, Pearson Education Inc. 2. Thomas Connolly, Carolyn Begg, Database Systems: A Practical Approach to design, Implementation and Management, Pearson Education, Latest Edition.			

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. (K2)	PO1, PO3, PO4, PO8, PO9, PO10, PSO1
2.	CO2: Demonstrate various DDL Commands used to create and alter a table. (K2)	PO1, PO2, PO3, PO4, PO8, PO9, PO10
3.	CO3: Experiment with operations using Data Manipulation Language statements like Insert, Update and Delete. (K3)	PO1, PO2, PO3, PO4, PO8, PO9, PO10
4.	CO4: Examine data to apply various grouping clauses and aggregate functions. (K4)	PO1, PO2, PO3, PO4, PO8, PO9, PO10, PSO1
5	CO5: Evaluate the queries using the concepts like sub-queries, JOINS, Views, Cursors, Triggers. (K5)	PO1, PO2, PO3, PO4, PO8, PO9, PO10, PSO1
6	CO6: Develop project based on various SQL commands. (K6)	PO1, PO2, PO3, PO4, PO5, PO7, PO8, PO9, PO10, PSO1

PO and PSO mapping with level of strength for Course Name Database Management System lab (Course Code: BOL154**)**

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**	**PO2**	**PO 3**	**PO 4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO 1**	**PSO 2**
BOL154 DBMS lab	3	3	3	2.2	2	-	2	2.8	2	2	2	-

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**			
Batch		**2023-26**			
Department		**Computer Science & Applications**			
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**			
Semester		**III**			
1	Course Code	BOL156			
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 Introduction to OOP using Java Lab (Course Code BOL156)

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
BOL156 Introduction to OOP 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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
BOL156	**Introduction to OOP 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***

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**			
Batch		**2023-26**			
Department		**Computer Science & Applications**			
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**			
Semester		**III**			
1	Course Code	**RBL101**	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 revie 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 revie 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)

CO/PO Mapping (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Low												
Cos	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PSO 1	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	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
BOL156	**Introduction to OOP using Java Lab**	**3**	**2**	**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		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**IV**	
1	Course Code	BCO404	
2	Course Title	Internet of Things	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Core	
5	Course Objective	Provide basic concepts of Internet of Things. Offer knowledge on connectivity, communication and enabling technologies. Familiarize with various IoT applications through case studies.	
6	Course Outcomes	CO1: Explain the principles of the Internet of Things, M2M communications and fundamental concepts. CO2: Describe different connectivity technologies for IoT systems. CO3: Use different communication technologies for IoT systems. CO4: Describe Cloud computing and Fog computing with respect to IoT. CO5: Investigate various applications of IoT. CO6: Discuss the various domains where IOT can be applied successfully	
7	Course Description	This course provides an in-depth understanding of virtualization technologies and their role in cloud computing. It covers the concepts, principles, and best practices of virtualization and focuses on the security challenges and solutions specific to cloud environments.	
8	Outline Syllabus		CO Mapping
	Unit 1	**Emergence of IoT**	
		Evolution, IoT versus M2M, IoT versus CPS, IoT versus WoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components, Addressing Strategies in IoT, Address management classes, Addressing during node mobility. IoT Sensing and Actuation: Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Scalar sensing, Virtual sensing, Sensing Considerations, Actuator Types, Hydraulic actuators, Pneumatic actuators, Electric actuators, Thermal or magnetic actuators, Mechanical actuators, Soft actuators, Shape memory polymers, Actuator Characteristics. IoT Hardware: Microcontroller Boards: Arduino, RaspberryPi, NodeMCU	CO1
	Unit 2	**IoT Connectivity Technologies**	CO2
		Introduction, IEEE 802.15.4, Zigbee, Thread, ISA 100.11A, WirelessHART, RFID, NFC, DASH7, Z-wave, Weightless, Sigfox, LoRa, NB-IoT, WiFi, Bluetooth Private Cloud, AWS Direct Connect, Load Balancing, Virtual Private Network (VPN), Amazon Route53, Amazon Cloud Front	
	Unit 3	**IoT Communication Technologies**	CO3
		Introduction, Constrained nodes and networks, Constraint Devices, Low Power and Lossy Network, Infrastructure protocols: LOADng, IPv6, 6LoWAPN, Discovery Protocols, Data Protocols: MQTT, MQTT-SN, CoAP, AMQP, XMPP, SOAP, REST, WebSocket, Identification Protocols:	

		EPC, uCode, URL. IoT Interoperability: Taxonomy of Interoperability, Standards and Frameworks.			
	Unit 4	**Associated IoT Technologies**			CO4
		Cloud Computing: Introduction, Virtualization, Cloud Models, SLA, Cloud Implementations Fog Computing and Its Applications: Fog nodes, deployment model, Fog Computing Architecture, Fog Computing in IoT, Selected Applications of Fog Computing.			
	Unit 5	**IoT Applications, Case Studies, and Future Trends**			CO5
		Agricultural IoT: Components of an agricultural IoT, Advantages, Case Study; Vehicular IoT: Components of vehicular IoT, Advantages, Case Study; Healthcare IoT: Components of healthcare IoT, Advantages, Case Studies; IoT in Home Automation, IoT in Smart City, Paradigms, Challenges, and the Future.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Textbook/s*	Sudip Misra, Anandarup Mukherjee, Arijit Roy, Introduction to IoT, Cambridge University Press, 2021			
	Other References	5. Pethuru Raj and Anupama C. Raman, The Internet of Things Enabling Technologies, Platforms, and Use Cases, CRC Press, 2017. 2. K Chandrasekharan, Essentials of Cloud Computing, CRC Press, 2015 3. D. Patranabis, Sensors and Transducers, PHI Publication, New Delhi 5. Michael J. McGrath and Cliodhna Ní Scanaill, Sensor Technologies: Healthcare, Wellness, and Environmental Applications, APress Media, 2014.			

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1: Explain the principles of the Internet of Things, M2M communications and fundamental concepts.	PO1, PO2, PO3, PO6, PO7, PO12, PSO1
2.	CO2: Describe different connectivity technologies for IoT systems.	PO1, PO2, PO3, PO6, PO7, PO12, PSO1
3.	CO3: Use different communication technologies for IoT systems.	PO1, PO2, PO3, PO4, PO6, PO7, PO12, PSO1
4.	CO4: Describe Cloud computing and Fog computing with respect to IoT.	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, P011, PO12, PSO1, PSO2, PSO3
5.	CO5: Investigate various applications of IoT.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO12, PSO1
6.	CO6: Discuss the various domains where IOT can be applied successfully.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO12, PSO1

PO and PSO mapping with level of strength for Course Name Internet of Things (Course Code BCO404)

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
BCO404 **Internet of Things**	**CO1**	3	1	1	-	-	2	1	-	-	-	3	-
	CO2	2	2	1	-	-	1	3	-	-	-	3	-
	CO3	3	1	1	2	-	2	1	-	-	-	3	-
	CO4	**3**	**3**	**3**	**3**	**2**	**2**	**-**	**3**	**3**	**3**	**2**	**2**
	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	PSO2
BCO404	**Internet of Things**	2.7	2.0	1.8	2.5	2.7	1.8	2.2	3.0	3.0	3.0	2.8	2.0

Strength of Correlation

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

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

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**		
Batch		**2023-26**		
Department		**Computer Science & Applications**		
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**		
Semester		**IV**		
1	Course Code		BCO155	
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 Windows Operating System, Disk structure , Disk scheduling(FCFS,SSTF, SCAN, LOOK,C-SCAN, C-LOOK)	CO2,CO3, CO5
	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: 25% / MTE: 25% / ESE: 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 Uinux	PO1,PO2,PO10,PSO1,PSO2

PO and PSO mapping with level of strength for Course Name Operating Systems and Unix shell Programming **(Course Code BCO155)**

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
BCO155 OS & 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	2	2	2	2	1	--	--	2	3	3	2	2
	CO5	2	2	2					3	3	1	3	
	CO6	3	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
BCO155	OS & shell Programming	**2.83**	**2.67**	**1.67**	**1.67**	**1.00**	**-**	**-**	**2.00**	**1.00**	**2.67**	**2.5**	**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		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**IV**	
1	Course Code	**BCO220**	
2	Course Title	**Application based Programming in Python**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	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, LibraryFunctions	
	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			

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 dictionary.	PO1,PO2,PO3,PO4,PO8,PO10, PSO1,PSO2
4.	CO4. Incorporate object-oriented programming concept in programming.	PO1,PO2,PO3,PO4,PO5,PO8,PO 10, PSO1,PSO2
5.	CO5: Creating python packages in Complex applications.	PO1,PO2,PO3,PO4,PO5,PO8,PO 10, PSO1,PSO2
6.	CO6: Design real life Applications in python using Machine Learning with implementation of supervised and unsupervised learning on dataset	PO1,PO2,PO3,PO4,PO5,PO8,PO 10, PSO1,PSO2,

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

COs	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PSO 1	PSO 2
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
BCO220	**Application based Programming in Python and Machine Learning**	3	2.66	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		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**IV**	
1	Course Code	BCO402	
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 datamining 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) & Programme Specific Outcomes (PSO)
1.	CO1: To understand the basic concept of data mining	PO1,PO2,PO3,PO4,PSO1
2.	CO2: Demonstrate the Data Pre-processing & transformation Techniques	PO1, PO3, PO4, PSO2
3.	CO3: Explain Various Pattern Mining Methodology	PO1,PO2,PO3,PO4
4.	CO4: Compare & Contrast Classification & Prediction Mechanism	PO9, PO10,PO11, PSO5
5.	CO5: Experiment with Clustering Algorithms	PO1,PO2,PO3,PO4,PSO1,PSO9
6.	CO6: Apply Data mining Techniques in real world Knowledge Discovery	PO1, PO2, PO3, PO4, PO5, PO12, PSO1, PSO2, PSO3

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

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	3	2	3	--	--	--	--	--	--	3	2
CO2	3	3	3	3	--	--	--	--	--	--	2	3
CO3	3	3	2	3	--	--	--	--	--	--	3	2
CO4	2	2	2	2	1	--	--	--	--	--	2	2
CO5	2	2	2	2	1	--	--	--	--	--	2	2
CO6	2	2	2	3	2	--	--	--	--	--	2	2
AVG	2.50	2.50	2.17	2.67	1.33	--	--	--	--	--	2.33	2.17

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		**BSc in Cloud Computing & IoT Academic Year: 2023-24**		
Semester		**IV**		
1	**Course Code**	**BCO405**		
2	**Course Title**	**Natural Language Processing**		
3	**Credits**	**3**		
4	**Contact Hours (L-T-P)**	**3-0-0**		
	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 theoretic approach, Dictionary-Based Disambiguation: Disambiguation based on sense,	**CO3, CO6**
	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 | MTE | ETE	
		25% | 25% | 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. NitinIndurkhya, 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

Course Outcome	ogramme Outcomes (PO) & Programme Specific Outcomes (PSO)
CO1: Apply the principles and Process of Human Languages such As English and other Indian Languages using computers.	PO1,PO2,PO5,PO12, PSO1, PSO2, PSO3
CO2: Realize semantics and pragmatics of English language for text processing and Create CORPUS linguistics based on digestive approach(TextCorpusmethod)	PO1,PO2,PO5,PO12, PSO1, PSO2, PSO3
CO3: Perform POS tagging for a given natural language and select a suitable language modelling technique based on the structure of the language.	PO1,PO2,PO3,PO5,PO9,PO11, PSO1, PSO2, PSO3
CO4: Demonstrate the state-of-the-art algorithms and techniques forext-based processing of natural language with respect to morphology.	PO1,PO2,PO5,P12, PSO1, PSO2, PSO3
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,PO5,PO12, PSO1, PSO2, PSO3
CO6: Apply ethical considerations and best practices in Natural Language Processing	PO1,PO2,PO3,PO4, PO5,PO6,PO9,PO11,PO12 PSO1,PSO2,PSO3

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

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

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

Course Code	Course Name	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
BCO405	Natural Language Processing	**2.33**	**2.5**	**3.0**	**1.0**	**2.5**	**2.0**	**-**	**-**	**2.0**	**-**	**2.0**	**2.0**

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		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**IV**	
1	Course Code	**ARP210**	
2	Course Title	**Quantitative and Qualitative Aptitude Skill Building**	
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, behavioral 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 2nd phase of employability enhancement and skill building activity exercise.	
6	Course Outcomes	After completion of this course, students will be able to: CO1: Develop and deliver effective presentations to interpret the deeper meaning of life. CO2: Improve listening skills to understand complex business communication in a variety of global English accents through proper pronunciation. CO3: Demonstrate a good understanding of effective business writing. and telephone handling Skills CO4: Acquire higher level competency in use of aptitude, logical and analytical reasoning. CO5: Develop higher level strategic thinking and diverse mathematical concepts through building number puzzles. CO6: Demonstrate higher level quantitative aptitude tools for making business decisions.	
7	Course Description	This course bundle allows students to build vision, mission and strategy statements while exposing them to various models of communication along with MTI reduction and the 2nd level of quant, aptitude and reasoning abilities.	
8	Outline syllabus – **ARP210**		CO MAPPING
	Unit 1	**Communicate to Conquer**	
	A	VMOSA (Vision, Mission, Values and Ethics)| Business Communication - Verbal Communication Skills | Barriers in communication | Basics of effective communication – PRIDE & STAR Model	CO 1
	B	Different styles of communication & style flexing (Based on the 4 social styles- Analytical, Driving, Expressive, Amiable) | Importance of Listening & practice of Active Listening | The Art of Giving Feedbacks| Feedback Skills | Asking fact finding questions- Probing Skills	CO 2

	C	Email Etiquette | Business Writing Skills| Telephone Etiquette Skills (Telephone Handling Skills) | Non Verbal Communication-Kinesthetics, Proxemics, Paralanguage | MTI Reduction Program |	CO 3
	Unit 2	**Introduction to APTITUDE TRAINING- Reasoning- Logical/ Analytical**	
	A	Coding Decoding , Ranking & Their Comparison Level-2	CO 4
	B	Series, Blood Relations & Number Puzzle	CO 5
	Unit 3	**Quantitative Aptitude**	
	A	Number System Level 2	CO 5
	B	Vedic Maths Level-2 | Probability | Permutation & Combination	CO 6
	C	Percentage, Profit & Loss ,Partnership, Simple Interest & Compound Interest	CO 6
	Unit 4	**Verbal Abilities - 2**	
	A	Paragraph Jumbles	CO 2
	B	Critical Reasoning	CO 2
	Unit 5	**Basics of GD and PI**	
	A	Understanding and Practicing Mock Group Discussions	CO 2
	B	Understanding and Practicing Mock Personal Interviewsss	CO 2
	Weightage Distribution	*CA-25% MTE-25% ETE-50%*	
	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	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PSO 1	PSO2
CO1	-	-	-	-	-	-	-	-	1	2	-	-
CO2	-	-	-	-	-	-	-	-	1	2	-	-
CO3	-	-	-	-	-	-	-	-	1	2	-	-
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		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**IV**	
1	Course Code	BOL155	
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 Using Linux Lab **(Course Code BOL155)**

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
BOL155 OS & 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	2	2	2	2	2	--	--	2	3	3	2	2
	CO5	2	2	2	2	2	--	--	2	3	3	2	2
	CO6	2	2	2	2	2	--	--	2	3	3	2	2

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

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
BOL155	OS & shell Programming lab	**2.5**	**2.33**	**2.5**	**2.5**	**1.0**	**-**	**-**	**1.8**	**2.3**	**2.1**	**2.3**	**2.1**

Strength of Correlation

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

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

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**IV**	
1	Course Code	**BOL220**	
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: 25% / CE (Viva): 25% / ESE: 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 and Machine Learning

COs	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PSO 1	PSO 2
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**
BOL220	**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		**BSc in Cloud Computing & IoT 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				
4	Contact Hours (L-T-P)				
	Course Status	Compulsory/ Qualifying 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 revie 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 revie 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 (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Low												
Cos	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PSO 1	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		-

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
RBL002	Research Based Learning 2	3	3	2.25	2.5	2	2	-	2.5	3	2.5	2	2

Strength of Correlation

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

TERM-V

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**
Batch		**2023-26**
Department		**Computer Science & Applications**
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**
Semester		**V**
1	Course Code	BCO502
2	Course Title	Amazon Web Services
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Core
5	Course Objective	Understand the concepts of cloud computing and Amazon Web Services. Explore the perceptions of Amazon EC2 instance with Amazon Machine Image and Load Balancing. Examine the concepts of AWS Database RDS along with AWS region and zones. Assess the various AWS Storages and AWS security services. Create and setup different AWS Network Scenario along with Route53 for DNS System and Cloud front.
6	Course Outcomes	CO1: Explain the fundamental understanding of cloud computing and the basic principles of AWS. CO2: Illustrate the Amazon EC2 instances, Amazon machine images with elastic IP and load balancing. CO3: Recognize and examine the basics of AWS RDS Database with Amazon region and availability zone. CO4: Appraise the concepts of AWS S3, EBS and Glacier Storages along with Dynamo DB and AWS security. CO5: Construct different AWS Networking Scenario with Route53 for DNS System and Cloud front.
7	Course Description	This course provides a comprehensive introduction to Amazon Web Services (AWS), the leading cloud computing platform. Students will gain a solid understanding of AWS architecture, core services, and best practices for building and deploying applications in the AWS cloud environment. The course combines theoretical concepts with hands-on exercises, allowing students to develop practical skills in using AWS services and managing cloud resources effectively.
8	Outline Syllabus		CO Mapping
	Unit 1	**Introduction Amazon Web Services**	
		Introduction to Amazon Web Services, Why Amazon? Use Cases, AWS Storage Options, AWS Compute Options, AWS Database Options, AWS Workflow Automation and Orchestration Options, AWS Systems Management and Monitoring Options, AWS Virtual Private Cloud Introduction, Pricing Concepts.	CO1
	Unit 2	**Introduction to EC2**	CO2
		Introduction To EC2, Instance Types and Uses, Auto scaling Instances, Amazon Machine Images (AMIS), Modifying Existing Images, Creating New Images of Running Instances, Converting an Instance Store AMI to an EBS AMI, Instances Backed by Storage Types, Elastic IPS, Elastic Load Balancing.	
	Unit 3	**AWS Database**	CO3
		Introduction to AWS database, what is Amazon RDS? Overview, DB instances, AWS Regions and Availability Zones, Security, Monitoring an Amazon RDS DB instance, how to work with	

		Amazon RDS? How you are charges for Amazon RDS? DB Instances, DB instance storage, Regions, Availability Zones and Local Zones, Multi AZ deployments, DB instance billing for Amazon RDS, Setting up AWS DB instance.	
	Unit 4	**AWS Storage and AWS Security**	CO4
		Amazon Storage, S3 Storage, Basics, Buckets and Objects, Creating A Web Server Using S3 Endpoints, Managing Voluminous Information with EBS, Glacier Storage Service, Describe Amazon Dynamo DB. Introduction to AWS Security, Describe Amazon Identity and Access Management (IAM), AWS Directory Service, AWS Key Management Service, Securing Data at Rest and In Motion.	
	Unit 5	**AWS Networking**	CO5
		Introduction to AWS Networking, Access Control Lists (ACLs), Setting Up a Security Group, Setting Up VPC And Internet Gateway, Setting Up A VPN, Setting Up A Customer Gateway For VPN, Setting Up Dedicated Hardware For VPC, Scenario 1:VPC With A Public Subnet Only (Standalone Web), Scenario 2: VPC with Public And Private Subnets (3 Tier App), Scenario 3:VPC With Public And Private Subnets And Hardware VPN Access (Web On The Cloud, Database and App On Prem) Scenario 4: VPC With A Private Subnet Only And Hardware VPN Access. (Extension Of Your Corporate Network), Route53 for DNS System, Cloud front, Case Study.	
	Mode of examination	Theory	
	Weightage Distribution	CA: 25% / MTE: 25% / ETE: 50%	
	Textbook/s*	Joe Baron, Hisham Baz, Tim Bixler , Biff Gaut , Kevin E. Kelly , Sean Senior , John Stamper , "AWS Certified Solutions Architect Official Study Guide: Associate Exam, John Wiley and Sons Publications, 2017.	
	Other References	1. https://www.softwebsolutions.com/resources/cloud-computing-service-models.html 2. https://www.geeksforgeeks.org/cloud-deployment-models/ 3. https://cloud.netapp.com/blog/ebs-efs-amazons3-best-cloud-storage-system 4. https://docs.aws.amazon.com/ec2/index.html 5. https://aws.amazon.com/startups/start-building/how-to-build-a-web-app/	

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1: Explain the fundamental understanding of the cloud computing and the basic principles of AWS.	**PO1,PO2,PO3, PO9, PSO1,PSO2**
2.	CO2: Illustrate the Amazon EC2 instances, Amazon machine images with elastic IP and load balancing.	**PO1,PO3, PO4, PO5, PO9, PO11,PSO1,PSO2**
3.	CO3: Recognize and examine the basics of AWS RDS Database with Amazon region and availability zone.	**PO1,PO3,PO4, PO9, PSO2**
4.	CO4: Appraise the concepts of AWS S3, EBS and Glacier Storages along with Dynamo DB and AWS security.	**PO1,PO3,PO4, PO9, PSO2**

5.	CO5: Construct different AWS Networking Scenario with Route53 for DNS System and Cloud front.	**PO1,PO3,PSO2**
6	CO6: Recognize and examine the basics of AWS RDS Database with Amazon region and availability zone.	**PO1,PO2,PO3,PO4,PO9, PO11,PSO1 PSO2,PSO3**

PO and PSO mapping with level of strength for Course Name- Amazon Web Services

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
BCO502 Amazon Web Services	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**	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PSO 1**	**PSO 2**
BCO502	Amazon Web Services	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) exten***

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**V**	
1	Course Code	BCO503	
2	Course Title	Web Technologies	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Core/Compulsory	
5	Course Objective	To develop skills in analyzing the usability of a web and understand fundamentals of tools and technology of web design.	
6	Course Outcomes	CO1: Analyze a web page and identify its elements and attributes. CO2: Apply the languages HTML and CSS to develop web page. CO3: Apply HTML and CSS to design web pages. CO4: Demonstrate the concepts of PHP. CO5: Understand the working of MYSQL CO6: Design webpages using different web technologies to real world.	
7	Course Description	This course is an overview of the modern Web technologies used for the Web development. The purpose of this course is to give students the basic understanding of how things work in the Web world.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to web**	
	A	Introduction to Web: History of Internet, WWW, Client or Browser, website, internet browsers,	CO1
	B	HTTP Protocol: Basic features of HTTP, Working of HTTP, Request and Response, Web browser and Web servers, Features of Web 2.0	CO1
	C	Web Design: Web site design principles, Concepts of effective web design, Web design issues, planning the site and navigation.	CO1
	Unit 2	**HTML & STYLE SHEETS**	
	A	HTML: HTML: History of HTML (Hypertext Mark-up Language), Structure of HTML Document: Text Basics, Structure of HTML Document: Images and Multimedia, Links and webs, Document Layout, Creating Forms, Frames and Tables.	CO2, CO6
	B	Style sheets: Need for CSS, introduction, basic syntax and structure, using CSS, background images,	CO2, CO6
	C	Colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2	CO2, CO6
	Unit 3	**Java Script & DHTML**	
	A	Javascript: Client-side scripting, what is Javascript, how to develop Javascript, simple Javascript, variables, functions, conditions, loops and repetition	CO3, CO6
	B	Advance script, Javascript and objects, the DOM and web browser environments, forms and validations	CO3, CO6

	C	DHTML: Combining HTML, CSS and Javascript, events and buttons, controlling the browser, Events and buttons			CO3, CO6
	Unit 4	**PHP**			
	A	**PHP: -** Introduction and basic syntax of PHP, decision and looping with examples			CO4,CO6
	B	PHP and HTML, Arrays, Functions, Form processing,			CO4,CO6
	C	Advance Features: Cookies and Sessions, Object Oriented Programming with PHP			CO4,CO6
	Unit 5	**PHP and MySQL:**			
	A	PHP and MySQL: PHP myadmin, Basic commands with PHP examples, Connection to server,			CO5, CO6
	B	Creating database, selecting a database, listing database			CO5, CO6
	C	listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. HTML Complete Reference, BPB Publication			
	Other References	1. HTML, DHTML, JavaScript, Perl, CGI, Ivan Bayross, BPB Publication. 2. HTML Complete Reference, BPB Publication 3. Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", Pearson			

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1: Analyze a web page and identify its elements and attributes	PO1, PO2, PO3, PO4, PO10, PSO1
2.	CO2: Apply the languages HTML and CSS to develop web page.	PO1, PO2, PO3, PO4, PO5, PO10, PSO1, PSO2
3.	CO3: Apply the Java Script and DHTML in web page.	PO1, PO2, PO3, PO4, PO5, PO10, PSO1
4	CO4: Demonstrate the concepts of PHP.	PO1, PO2, PO3, PO4, PO5, PSO1
5	CO5: Understand the working of MYSQL	PO1, PO2, PO3, PO4, PO5, PO8 PO10, PSO1
6	CO6: Design webpages using different web technologies to real world	PO1, PO2, PO3, PO4, PO5, PO7, PO9, PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name Web Technology (Course Code BCO503)

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

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

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
BCO503	Web Technology	2.7	2.8	3	2.7	2.7	-	2	2	2	2.2	2.7	3

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		**BSc in Cloud Computing & IoT Academic Year: 2023-24**		
Semester		**V**		
1	Course Code	**BCO155**		
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	2. Tanenbaum, A.S." Computer Networks", 4th Edition, PHI 1. 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 (BCO155)

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		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**V**	
1	Course Code	BMR002	
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.	

PO and PSO mapping with level of strength for Course Name Research Methodology (Course Code OLB.SC504**)**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	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	PO5	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		**BSc in Cloud Computing & IoT 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)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	3	-	2	-	1	-	1	2	-	2	2
CO2	3	2	2	2	2	-	-	1	2	-	2	1
CO3	3	2	2	2	2	3	-	1	2	-	2	2
CO4	3	3	2	2	3	-	-	1	2	-	2	2
CO5	3	2	-	-	3	-	-	1	2	-	2	2
CO6		1	-	1	-	-	-	2	2	3	1	-
Avg PO attained	3	2.2	1	1.5	1.7	0.7	0	1.2	2	1	2	1.5

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		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**V**	
1	Course Code	INC003	
2	Course Title	**Industry connect**	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	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. Sutherland			
	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,PSO2
2.	CO2. Identify, formulate and model problems and find engineering solution based on a systems approach.	PO1,PO2,PO3,PO4,PO5,PO7,PO8,PO9, PSO1,PSO2
3.	CO3. Develop teamwork and apply prior acquired knowledge in problem solving.	PO1,PO3,PO4,PO5, PO8,PO9, 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	PO2	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)**
3-**Substantial (High)**

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**
Batch		**2023-26**
Department		**Computer Science & Applications**
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**
Semester		**V**
1	Course Code	BOL503
2	Course Title	Web Technologies Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Core/Compulsory
5	Course Objective	The objective of this course is to provide a foundation of technologies and technical skills in web development. Based upon the development of a web, this course provides an insight of computer and networking technologies, and hands on experience in web programming.
6	Course Outcomes	CO1: Understand the basic concepts of HTML. CO2: Design the web page using CSS CO3: Apply java script to validate the different fields of the web pages. CO4: Implement the basic construct, arrays, and session using PHP. CO5: Demonstrate to build a connection with database and perform the basic operations of DBMS. CO6: Develop a website using html, CSS, JavaScript and MYSQL
7	Course Description	This course is an overview of the modern web technologies used for the Web development. The purpose of this course is to give students the basic understanding of how things work in the Web world from the technology point of view as well as to give the basic overview of the different technologies.
8	Outline syllabus	CO Mapping

	Unit 1	**Introduction**	
	A	Introduction to various HTML Tags.	CO1
	B	Write a program to display list of items in different styles.	CO1
	C	Write an HTML program to design an entry form of student details.	CO1
	Unit 2	**CSS**	
	A	Create Style sheet to set formatting for text tags and embed that style sheet on web pages created for your site.	CO2
	B	Develop and demonstrate the usage of inline, internal and external style sheet using CSS	CO2
	C	Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next in the list. Add CSS to customize the properties of the font of the capital (color, bold and font size).	CO2
	Unit 3	**Java Script**	
	A	Design signup form to validate username, password, and phone numbers etc. using Java script.	CO3
	B	Write a JavaScript program to convert temperatures to and from Celsius, Fahrenheit.	CO3
	C	Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.	CO3
	Unit 4	**PHP**	
	A	Implement the basic construct of PHP	CO4
	B	Write programs to implement arrays and functions in PHP	CO4
	C	Implement the advanced features of PHP like, Cookies and Sessions	CO4
	Unit 5	**MYSQL**	
	A	Create the database-on-database server like MYSQL, Orcale. Perform basic DDL operation on it.	CO5
	B	Perform the basic operation like Insert, update, delete and select	CO5, CO6

	C	Write an HTML program to design an entry form of student details and send it to store at database server like MYSQL, Oracle etc.			CO6
	Mode of examination	Practical/Viva			
	Weightage Distribution	CA	CE(Viva)	ESE	
		25%	25%	50%	
	Text book/s*	1. HTML and CSS: Design and build websites, by Jon Duckett 2. Learning Web Design: A beginner's guide to HTML, CSS, JavaScript, and Web Graphics, By Jennifer Niederst Robbins			

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1: Understand the basic concepts of HTML.	PO1, PO2, PO3, PO5, PO10, PSO1, PSO2
2.	CO2: Design the web page using CSS	PO1, PO2, PO3, PO4, PO9, PO10, PSO1, PSO2
3.	CO3: Apply java script to validate the different fields of the web pages.	PO1, PO2, PO3, PO5, PO6, PO8, PSO1, PSO2
4	CO4: Implement the basic construct, arrays, and session using PHP.	PO1, PO2, PO3, PO4, PO6, PO8 PO10, PSO1, PSO2
5	CO5: Demonstrate to build a connection with database and perform the basic operations of DBMS.	PO1, PO2, PO3, PO4, PO7, PO9, PSO1, PSO2
6	CO6: Develop a website using html, CSS, JavaScript and MYSQL	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name Web Technology Lab (Course Code BOL503)

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

CO6	2	3	3	3	2	3	3	2	3	3	3	3

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

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
BOL503	Web Technology Lab	2.2	2.7	3	2.75	2.3	2.3	2.5	2	2.3	2.25	2.8	2.8

Strength of Correlation:

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

TERM-VI

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**VI**	
1	Course Code	BCO606	
2	Course Title	Microsoft Azure	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Core	
5	Course Objective	To teach and make the students feel the working environment about Creating and managing networking. To design and concepts regarding Azure SQL To introduce to methodology and tricks to Understand Azure hosting To understand the performance of the Server. To Understand the features of MS Azure.	
6	Course Outcomes	CO1: Aappropriate server operating system for Creating Virtual Machines. CO2: Handle operation with the server with Configuring End Points CO3: Apply concepts learned in Shell Script CO4: Configure the server-side part concepts Migrating on premise DB to SQL Azure CO5: Creating a VM from a custom Image. CO6: Installation of VM on server	
7	Course Description	This course provides a comprehensive introduction to Microsoft Azure, a cloud computing platform and service offered by Microsoft. Students will gain a solid understanding of Azure architecture, core services, and best practices for building and deploying applications in the Azure cloud environment. The course combines theoretical concepts with hands-on exercises, allowing students to develop practical skills in using Azure services and managing cloud resources effectively.	
8	Outline Syllabus		CO Mapping
	Unit 1	**Introduction**	
		MS. Azure, Virtual Machines: Creating Virtual Machines, Difference Between Basic and Standard VMs, logging in to a VM and Working, attaching an empty Hard Disk to VM, hosting a Website in VM, Configuring End Points, scaling up and down, creating a custom Image from VM, creating a VM from a custom Image, shut down VM without Getting Billed, VM Pricing.	CO1

	Unit 2	**Azure Virtual Networks**			CO2
		Azure Virtual Networks, Highly Available Azure Virtual Machines, Virtual Machine Configuration Management, Customizing Azure Virtual Machine Networking. Load Balancing: Creating Cloud Services, Adding Virtual Machines to a Cluster, Configuring Load Balancer.			
	Unit 3	**Windows Azure**			CO3
		What is a Storage Account, Advantages, Tables, blobs, queues and drives, Azure App fabric: Connectivity and Access control Automation: Introduction Windows Power Shell, Creation of Runbooks, uploading a Shell Script, Authoring a Shell Script			
	Unit 4	**SQL Azure**			CO4
		Creating a SQL Server, creating a SQL DB, Creating Tables, Adding Data to the Tables, View Connection Strings, Security Configurations, Migrating on premise DB to SQL Azure			
	Unit 5	**Websites**			CO5
		Creating a website, setting deployment credentials, choosing a platform, Setting up Default page for website, Scaling, Auto Scaling by Time, Auto Scaling by Metric, Difference between Free, Shared, Basic and Standard websites, Creating a website using Visual Studio			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Textbook/s*	1.Cloud Computing: Principles and Paradigms. (2011). United ingdom: Wiley. 2. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010			
	Other References	1. https://www.tutorialspoint.com/microsoft_azure/index.htm 2. https://www.javatpoint.com/microsoft-azure 3. ww.guru99.com/microsoft-azure-tutorial.html 4. https://azure.microsoft.com/en-in/get-started/			

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1: Aappropriate server operating system for Creating Virtual Machines.	PO1, PO2, PO3, PO5, PO10, PSO1, PSO2
2.	CO2: Handle operation with the server with Configuring End Points	PO1, PO2, PO3, PO4, PO9, PO10, PSO1, PSO2
3.	CO3: Apply concepts learned in Shell Script	PO1, PO2, PO3, PO5, PO6, PO8, PSO1, PSO2
4	CO4: Configure the server-side part concepts Migrating on premise DB to SQL Azure	PO1, PO2, PO3, PO4, PO6, PO8 PO10, PSO1, PSO2
5	CO5: Creating a VM from a custom Image.	PO1, PO2, PO3, PO4, PO7, PO9, PSO1, PSO2
6	CO6: Installation of VM on server	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name: Microsoft Azure

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

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

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
BCO606	Microsoft Azure	2.2	2.7	3	2.75	2.3	2.3	2.5	2	2.3	2.25	2.8	2.8

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		**BSc in Cloud Computing & IoT Academic Year: 2023-24**
Semester		**VI**
1	Course Code	BCO608
2	Course Title	Enterprise Network Design
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Core
5	Course Objective	To analyse the Business goals and constraints using network design methodology. To understand the protocols and services for AAA. To understand Testing, Optimizing and documenting methodology for Network Design.
6	Course Outcomes	CO1: Analyse technical goals, Constraints, and trade-offs in Network Design methodology. CO2: Understand the customer requirements and Apply a Methodology to Design logical Network Security enterprise network for given Topologies. CO3: Analyse evaluate software vulnerabilities and Work on Firewalls and network devices. CO4: Explain the need for security protocols Appreciate knowledge on AAA services. CO5: Appreciate knowledge on Network Testing and optimization of Network Design. CO6: Implement Network Security: Acquire knowledge of network security principles and best practices.
7	Course Description	The Enterprise Network Design course provides a comprehensive understanding of the principles, methodologies, and best practices for designing robust and scalable networks to meet the complex requirements of modern enterprises. Students will learn how to analyse business needs, evaluate network technologies, and design network architectures that provide reliable connectivity, security, and performance.
8	Outline Syllabus	CO Mapping
	Unit 1	**Introduction to Network Design**

		Analyzing Business Goals and Constraints: Network-based Architectural Styles Classification Methodology, using a Top-Down Network Design Methodology, Analyzing Business Goals, Analyzing Business Constraints. Analyzing Technical Goals and Tradeoffs: Scalability, Availability, Network Performance, Security, Manageability, Usability, Adaptability, Affordability, Making Network Design Tradeoffs. Characterizing the Existing Internetwork: Characterizing the Network Infrastructure, Checking the health of the Existing Internetwork	CO1
	Unit 2	**Designing Logical Network**	CO2
		Designing Network Topology: Hierarchical Network Design, Redundant Network Design Topologies, Modular Network Design, designing a Campus Network Design Topology, Designing the Enterprise Edge Topology, Secure Network Design Topologies. Developing Network Security Strategies: Network Security Design, Security Mechanisms, Modularizing Security Design	
	Unit 3	**Enterprise Network Devices**	CO3
		Technologies and Devices for Enterprise Network: Remote Access Technologies, Key Requirements for Secure Remote Access, Selecting Remote access devices for an enterprise network design, WAN Technologies, WAN Design. Security Technologies: Firewalls, Intrusion Detection Systems (IDS) and Intrusion Prevention Systems (IPS),Cisco Any Connect Secure Mobility, Virtual Private Networks, Cloud and Virtualization Security.	
	Unit 4	**AAA Protocols and Services**	CO4
		Authentication, Authorization and Accounting (AAA) Services: AAA Protocols and Services supported by Cisco ASA, Generic 3-Tier "AAA" model, Designing an authentication Server, Configuring HTTP Authentication for ASDM Users, Authenticating Firewall sessions, customizing authentication prompts, Configuring authorization, configuring accounting, Troubleshooting administrative Connections to Cisco ASA. Transparent Firewalls: Architectural Overview, Restrictions when using Transparent Firewalls, Configuration of Transparent Firewalls, Deployment Scenarios, Monitoring and Troubleshooting Transparent Firewalls.	
	Unit 5	**Testing and Optimizing Network Design**	CO5
		Testing Network Design: Using Industry Tests, Building and testing a prototype network system, Writing, and Implementing a test plan, Tools for testing a Network Design. Optimizing Network Design: Optimizing bandwidth usage with IP multicast technologies, Reducing Serialization Delay, Cisco IOS features for Optimizing Network Performance, Documenting Network Design: Responding to a customer's request for proposal, Contents of a network design document.	
	Mode of examination	Theory	
		CA | MTE | ETE	

	Weightage Distribution	25%	25%	50%	
	Textbook/s*	1. Oppenheimer, P. (2010). Top-Down Network Design (3rd ed.). Cisco Press. 2. Frahim, J., Santos, O., & Ossipov, A. (2014). Cisco ASA: All-in-one Next-Generation Firewall, IPS, and VPN Services (3rd ed.). WebEx Communications. 3. Lammle, T., & Barkl, A. (2006). CCDA: Cisco Certified Design Associate Study Guide: Exam 640-861. Wiley.			
	Other References	1. https://olympic.instructure.com/files/70000521/download?download_frd=1 2. https://www.cisco.com/c/en/us/tech/security-vpn/index.html 3. https://networklessons.com/cisco/asa-firewall/ 4. http://nsoe.in/ccie-security-ASACAMP-ASA-LaB.Scmp.html			

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1: Analyse technical goals, Constraints, and trade-offs in Network Design methodology.	**PO1,PO2,PO3, PO9, PSO1,PSO2**
2.	CO2: Understand the customer requirements and Apply a Methodology to Design logical Network Security enterprise network for given Topologies.	**PO1,PO3, PO4, PO5, PO9, PO11,PSO1,PSO2**
3.	CO3: Analyse evaluate software vulnerabilities and Work on Firewalls and network devices.	**PO1,PO3,PO4, PO9, PSO2**
4.	CO4: Explain the need for security protocols Appreciate knowledge on AAA services.	**PO1,PO3,PO4, PO9, PSO2**
5.	CO5: Appreciate knowledge on Network Testing and optimization of Network Design.	**PO1,PO3,PSO2**
6	CO6: Implement Network Security: Acquire knowledge of network security principles and best practices.	**PO1,PO2,PO3,PO4,PO9, PO11,PSO1 PSO2,PSO3**

PO and PSO mapping with level of strength for Course Name- Enterprise Network Design

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
BCO608 Enterprise Network Design	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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2

BCO608	Enterprise Network Design	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) exten***

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**VI**	
1	Course Code	BCO604	
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 framework 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			
	Other References				

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, PO5, PO10, PSO1, PSO2
2.	CO2: Explore the legal and policy developments in various countries to regulate Cyberspace.	PO1, PO2, PO3, PO4, PO9, PO10, PSO1, PSO2
3.	CO3: Formulate various security measures for cyber-attacks.	PO1, PO2, PO3, PO5, PO6, PO8, PSO1, PSO2
4	CO4: Apply the principles in real life situations.	PO1, PO2, PO3, PO4, PO6, PO8 PO10, PSO1, PSO2
5	CO5: Identify various Cybercrimes and take necessary actions.	PO1, PO2, PO3, PO4, PO7, PO9, PSO1, PSO2
6	CO6: Assess the various online activities.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name: Information Security and Cyber Laws

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

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

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
BCO604	Information Security and Cyber Laws	2.2	2.7	3	2.75	2.3	2.3	2.5	2	2.3	2.25	2.8	2.8

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		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**VI**	
1	Course Code	BCO605	
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	Big Data Analytics is a course that focuses on the principles, techniques, and tools used to analyze large and complex datasets, commonly referred to as big data. This course aims to provide students with a comprehensive understanding of big data analytics and its applications in various domains.	
8	Outline syllabus		CO Mapping
	Unit 1	**INTRODUCTION TO BIG DATA**	
	A	Introduction to Big Data, V's of Big Data, 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, PO5, PO10, PSO1, PSO2
2.	CO2: Demonstrate the Basic Statistical Methods.	PO1, PO2, PO3, PO4, PO9, PO10, PSO1, PSO2
3.	CO3: Implement tools and utility of Probability & Time Series.	PO1, PO2, PO3, PO5, PO6, PO8, PSO1, PSO2
4	CO4: Apply various Machine Learning techniques to understand big data Analytics.	PO1, PO2, PO3, PO4, PO6, PO8 PO10, PSO1, PSO2
5	CO5: Understand the concepts of Database Management.	PO1, PO2, PO3, PO4, PO7, PO9, 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

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

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

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
BCO605	Big Data Analytics	2.2	2.7	3	2.75	2.3	2.3	2.5	2	2.3	2.25	2.8	2.8

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		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**VI**	
1	Course Code	BOL606 Course Name	
2	Course Title	Microsoft Azure Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Core	
5	Course Objective	1. Understand the fundamentals of cloud computing and the Microsoft Azure platform. 2. Gain proficiency in using Azure services and tools for building and deploying cloud applications. 3. Develop skills in designing and implementing scalable and reliable cloud solutions on Azure. 4. Acquire knowledge of Azure infrastructure, networking, and security concepts. 5. Learn to monitor, manage, and troubleshoot Azure resources and services. 6. Explore best practices for optimizing performance, scalability, and cost-efficiency in Azure deployments.	
6	Course Outcomes	CO1: Introduction to Azure and Cloud Computing CO2: Overview of cloud computing concepts and benefits CO3: Introduction to the Microsoft Azure platform and its services CO4: High availability, scalability, and disaster recovery in Azure CO5: Azure App Services and Web Applications CO6: Creating and deploying web applications using Azure App Service	
7	Course Description	The B.SC Microsoft Azure course introduces students to the fundamentals of cloud computing and the Microsoft Azure cloud platform. This course focuses on the concepts, services, and practical skills needed to design, deploy, and manage applications and services on the Azure platform. Students will gain hands-on experience in utilizing Azure services and tools to develop scalable, secure, and efficient cloud solutions.	
8	Outline syllabus		CO Mapping
	Unit 1		
	A	List and create a report on various services offered by the windows azure Platform.	CO1, CO2, CO3
	B	Evaluate and make a report on Azure pricing.	
	Unit 2		
	A	Create a virtual machine from the gallery of Windows Server 2016 in Azure portal.	CO1, CO2, CO3
	B	Create and Demonstrate a Virtual Network in Azure.	
	Unit 3		
	A	Create and Deploy a Storage Account in Azure and document the process.	CO2, CO3, CO4
	B		

		Create users and set user roles with identity and access management in Azure and document the process.			
	Unit 4				
	A B	Demonstrate provisioning storage to a VM in Windows Azure. Create an SQL server in Azure and document the process.			CO3, CO4, CO5
	Unit 5				
	A B	Perform SQL queries in Azure platform. Creating a website using Windows Azure and documenting the process.			CO4, CO5, CO6
	Mode of examination	Practical			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Textbook/s* Other References	1. CLOUD COMPUTING Principles and Paradigms, Edited by Rajkumar Buyya, Jam 2. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter 3. Barrie Sosinsky "*Cloud Computing (Bible)"*,Wiley. 4. Ronald L. Krutz and Russell Dean Vines, "Cloud Security: A comprehensive Guide to Secure Cloud Computing", WILEY.			

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1: Introduction to Azure and Cloud Computing	**PO1,PO2,PO3, PO9, PSO1,PSO2**
2.	CO2: Overview of cloud computing concepts and benefits	**PO1,PO3, PO4, PO5, PO9, PO11,PSO1,PSO2**
3.	CO3: Introduction to the Microsoft Azure platform and its services	**PO1,PO3,PO4, PO9, PSO2**
4.	CO4: High availability, scalability, and disaster recovery in Azure	**PO1,PO3,PO4, PO9, PSO2**
5.	CO5: Azure App Services and Web Applications	**PO1,PO3,PSO2**
6	CO6: Creating and deploying web applications using Azure App Service	**PO1,PO2,PO3,PO4,PO9, PO11,PSO1 PSO2,PSO3**

PO and PSO mapping with level of strength for Course Name- Microsoft Azure Lab

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
BOL606	CO1	2	2	3	2	2	2	-	-	2	-	3	2
	CO2	3	2	3	2	2	2	-	-	3	-	3	3

Microsoft Azure Lab	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
BOL606	Microsoft Azure 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) exten***

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**	
Batch		**2023-26**	
Department		**Computer Science & Applications**	
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**	
Semester		**VI**	
1	Course Code	BCO608	Course Name
2	Course Title	Enterprise Network Design Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Core	
5	Course Objective	1. Gain practical experience in developing and deploying web applications on cloud platforms. 2. Understand the fundamental concepts and architectures of cloud-based web services. 3. Learn to utilize various cloud services and tools for building and deploying web applications. 4. Develop skills in designing and implementing scalable and fault-tolerant web applications on the cloud. 5. Explore different cloud service models and their application in web development.	
6	Course Outcomes	CO1: Gain practical experience in designing enterprise-level networks. CO2: Develop proficiency in configuring network devices and protocols. CO3: Learn network troubleshooting techniques and methodologies. CO4: Understand network security principles and best practices. CO5: Acquire knowledge of network services and technologies. CO6: Foster collaboration and teamwork skills.	
7	Course Description	The B.SC Enterprise Network Design Lab is a practical-oriented course that provides students with hands-on experience in designing and implementing enterprise-level networks. This lab-based course complements the theoretical aspects covered in the Enterprise Network Design course by offering students the opportunity to apply their knowledge in a practical setting. Throughout the course, students will develop skills in network design, configuration, troubleshooting, and security.	
8	Outline syllabus		CO Mapping
	Unit 1		
	A B	Installing and Configuring VPN and Routing Installing and Configuring Network Policy Server (NPS	CO1, CO2, CO3
	Unit 2		
	A B	Configuring NPS Policies Preparing the ASA for Administration	CO1, CO2,CO3
	Unit 3		

	A B C	Fundamental ASA Configuration AAA for Administrative Access Network Address Translation			CO2,CO3,CO4
	Unit 4				
	A B	Basic Access Control Basic Clientless SSL VPN			CO3, CO4, CO5
	Unit 5				
	A B C	Create an IPsec VPN tunnel using Packet Tracer Remote Access IP Sec VPN Bypassing Firewalls using VPN			CO4, CO5, CO6
	Mode of examination	Practical			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Textbook/s* Other References	"Enterprise Network Design and Implementation: Theories and Techniques" by En-Yu Chen and Nen-Fu Huang Cisco Networking Academy: https://www.netacad.com/ Juniper Networks Design and Implementation Guides: https://www.juniper.net/documentation/ TechTarget Networking Guides: https://searchnetworking.techtarget.com/guides			

CO and PO Mapping

S. No.	Course Outcome	Programme Outcomes (PO) & Programme Specific Outcomes (PSO)
1.	CO1: Gain practical experience in designing enterprise-level networks.	PO1, PO2, PO3, PO5, PO10, PSO1, PSO2
2.	CO2: Develop proficiency in configuring network devices and protocols.	PO1, PO2, PO3, PO4, PO9, PO10, PSO1, PSO2
3.	CO3: Learn network troubleshooting techniques and methodologies.	PO1, PO2, PO3, PO5, PO6, PO8, PSO1, PSO2
4	CO4: Understand network security principles and best practices.	PO1, PO2, PO3, PO4, PO6, PO8 PO10, PSO1, PSO2
5	CO5: Acquire knowledge of network services and technologies.	PO1, PO2, PO3, PO4, PO7, PO9, PSO1, PSO2
6	CO6: Foster collaboration and teamwork skills.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name: Enterprise Network Design Lab

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

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

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2
BOL608	Enterprise Network Design Lab	2.2	2.7	3	2.75	2.3	2.3	2.5	2	2.3	2.25	2.8	2.8

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		**BSc in Cloud Computing & IoT Academic Year: 2023-24**			
Semester		**VI**			
1	Course Code	**RBL004**	Course Name: Research Based Learning -4		
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 a 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 statements. 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: Analyse 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 4 (Course Code RBL004)

CO/PO Mapping (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Low												
Cos	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2
CO1	3	3	-	2	-	1	-	1	2	-	2	2
CO2	3	2	2	2	2	-	-	1	2	-	2	1
CO3	3	2	2	2	2	3	-	1	2	-	2	2
CO4	3	3	2	2	3	-	-	1	2	-	2	2
CO5	3	2	-	-	3	-	-	1	2	-	2	2
CO6		1	-	1	-	-	-	2	2	3	1	-
Avg PO attained	3	2.2	1	1.5	1.7	0.7	0	1.2	2	1	2	1.5

School		**SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY**			
Batch		**2023-26**			
Department		**Computer Science & Applications**			
Programme		**BSc in Cloud Computing & IoT Academic Year: 2023-24**			
Semester		**VI**			
1	Course Code	**CCU108**	Course Name: Community Connect		
2	Course Title	Community Connect			
3	Credits	1			
4	Contact Hours (L-T-P)	0-0-2			
	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 can 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 Distribution	CA	CE	ETE	
		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