

M.Sc Computer Science

Syllabus

AFFILIATED COLLEGES

Programme Code:32K

Effective for the candidates admitted
during 2026–2027 and Onwards



BHARATHIAR UNIVERSITY

(A State University, Accredited with “A++” Grade by NAAC,
Ranked 21st among Indian Universities by MHRD-NIRF)

Coimbatore-641046, Tamil Nadu, India

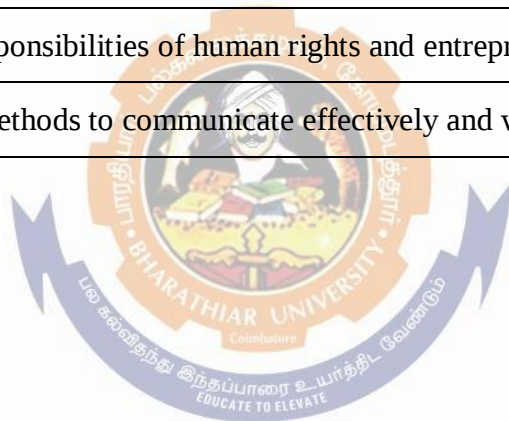
Programme Educational Objectives(PEOs)	
The M.Sc Computer Science programme describe accomplishments that graduates are expected to attain within Five to seven years after graduation	
PEO1	To enrich the students with the clear picture of the course objectives and to map their requirements.
PEO2	To enable the students, to understand the core concepts, visualize and to apply them in the real time scenarios.
PEO3	To impart the need for consistent learning, importance of research & development for the welfare of the society and to the nation at large.



Programme Specific Outcomes (PSOs)	
After the successful completion of M.Sc Computer Science programme, the students are expected to	
PSO1	Able to analyze, design and develop problem solving skills in the discipline of computer science.
PSO2	Acquire evaluation of potential benefits of alternative solution in designing software and/or hardware systems in broad range of open source programming languages to withstand technological changes.
PSO3	Able to pursue careers in IT industry/consultancy/research and development, teaching and allied areas related to computer science.
PSO4	Adapt to the continuous technological change in computational science and update themselves to meet the industry requirements and standards.
PSO5	Apply the practices and strategies of computer science for software project development to deliver a quality software product and contribute to research in the chosen field and perform effectively.



Programme Outcomes(POs)	
On successful completion of the M.Sc Computer Science programme	
PO1	Develop creativity and problem solving skills with the knowledge of computing and mathematics.
PO2	Ability to develop and carry out experiments, interpret and infer data.
PO3	Design algorithms and develop software to aid solutions to industry and governments.
PO4	Review the latest technology and tool handling mechanism.
PO5	Analyze the outcome to solve global environment related issues.
PO6	Apply the knowledge in lifelong learning journey to equip themselves.
PO7	Identify the perspective of business practices, risks and limitations.
PO8	Work with professional and ethical values.
PO9	Formulate the responsibilities of human rights and entrepreneurial spirit.
PO10	Understand the methods to communicate effectively and work collectively.



BHARATHIAR UNIVERSITY::COIMBATORE 641046

M.Sc Computer Science (Affiliated Colleges)

(Effective For the candidates admitted during the academic year -2026–2027 and Onwards)

REVISED SCHEME OF EXAMINATIONS– CBCS PATTERN

Course Code	Title of the Course	Credits	Hours		Maximum Marks		
			Theory	Practical	CIA	ESE	Total
FIRST SEMESTER							
13A	Paper I:Analysis & Design of Algorithms	4	5		25	75	100
13B	Paper II : Data Engineering	4	5		25	75	100
13C	Paper III: Python Programming	4	5		25	75	100
13D	Paper IV : Advanced Software Engineering	4	5		25	75	100
13P	Practical I: Data Engineering Lab	4		5	40	60	100
13Q	Practical II: Python Programming Lab	4		5	40	60	100
Total		24	20	10			600
SECOND SEMESTER							
23A	Paper V:Data Mining and Warehousing	4	4		25	75	100
23B	Paper VI: Advanced Database Management Systems	4	4		25	75	100
23C	Paper VII: Advanced Java Programming	4	4		25	75	100
23D	Paper VIII: Artificial Intelligence & Machine Learning	4	4		25	75	100
2EA/2EB /2EC/2ED	Elective–I Multimedia and Its Applications /Quantum Computing/ Internet of Things/Strategic and Design Thinking	4	4		25	75	100
23P	Practical III: Data Mining and Advanced DBMS Lab	4		5	40	60	100
23Q	Practical IV: Advanced Java Programming Lab	4		5	40	60	100
Total		28	20	10			700

THIRD SEMESTER							
33A	Paper IX: Digital Image Processing	4	4		25	75	100
33B	Paper X: Cloud Computing	4	4		25	75	100
33C	Paper XI: Network Security and Cryptography	4	4		25	75	100
33D	Paper XII: Data Science & Analytics	4	4		25	75	100
33E	Paper XIII : Health And Wellness	1	1		100 ^{\$}	-	100
3EA/ 3EB/ 3EC/ 3ED	Elective-II Deep Learning /Block Chain Technology/Web Services/ Robotic Process Automation for Business	3	3		25	75	100
33P	Practical V: Digital Image Processing Lab	4		4	40	60	100
33Q	Practical VI: Cloud Computing Lab	4		4	40	60	100
33R	Practical VII : Data Visualization Lab	2		2	20	30	50
Total		30	20	10			850
FOURTH SEMESTER							
47V	Project work and Viva-voce	8			50	150*	200
Total		8					200
Grand Total		90					2350
ONLINE COURSES							
1.	#SWAYAM/ MOOC	2					
2.	#Job oriented Certificate course	2					

*Project Evaluation-100 Marks & Viva Voce-50 Marks in ESE

During II or III Semester (Optional)

\$ Split for CIA 100 Marks

PART	DESCRIPTION	MARKS
A	Report	40
B	Attendance	20
C	Activities (Observation During Practice)	40
	TOTAL	100

ELECTIVE– I

Multimedia and its Applications

Quantum Computing

Internet of Things

Strategic and Design Thinking

ELECTIVE– II

Deep Learning

Block Chain Technology

Web Services

Robotic Process Automation for Business



First Semester

Course code		ANALYSIS & DESIGN OF ALGORITHMS	L	T	P	C
Core/Elective/Supportive		Core	5			4
Pre-requisite		Basic Data Structures & Algorithms	Syllabus Version		2021-22	
Course Objectives:						
The main objectives of this course are to:						
1. Enable the students to learn the Elementary Data Structures and algorithms.						
2. Presents an introduction to the algorithms, their analysis and design						
3. Discuss various methods like Basic Traversal And Search Techniques, divide and conquer method, Dynamic programming, backtracking						
4. Understood the various design and analysis of the algorithms.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Get knowledge about algorithms and determines their time complexity. Demonstrate specific search and sort algorithms using divide and conquer technique.					K1,K2
2	Gain good understanding of Greedy method and its algorithm.					K2,K3
3	Able to describe about graphs using dynamic programming technique.					K3,K4
4	Demonstrate the concept of backtracking & branch and bound technique.					K5,K6
5	Explore the traversal and searching technique and apply it for trees and graphs.					K6
K1-Remember;K2 -Understand; K3-Apply;K4 -Analyze; K5-Evaluate; K6 -Create						
Unit:1		INTRODUCTION			15hours	
Introduction: Algorithm Definition and Specification – Space complexity-Time Complexity-Asymptotic Notations - Elementary Data Structure: Stacks and Queues – Binary Tree - Binary Search Tree - Heap – Heap sort- Graph.						
Unit:2		TRAVERSAL AND SEARCH TECHNIQUES			15hours	
Basic Traversal And Search Techniques: Techniques for Binary Trees-Techniques for Graphs - Divide and Conquer: General Method – Binary Search – Merge Sort – Quick Sort.						
Unit:3		GREEDY METHOD			15hours	
The Greedy Method: General Method–Knapsack Problem–Minimum Cost Spanning Tree– Single Source Shortest Path.						
Unit:4		DYNAMIC PROGRAMMING			15hours	
Dynamic Programming: General Method–Multistage Graphs–All Pair Shortest Path–Optimal Binary Search Trees – 0/1 Knapsacks – Traveling Salesman Problem – Flow Shop Scheduling.						

Unit:5		BACKTRACKING	13hours
Backtracking: General Method–8-QueensProblem–Sum Of Subsets–Graph Coloring– Hamiltonian Cycles – Branch And Bound: - The Method – Traveling Salesperson.			
Unit:6		Contemporary Issues	2 hours
Expert lectures, online seminars– webinars			
		Total Lecture hours	75hours
Text Books			
1	Ellis Horowitz,“Computer Algorithms”,Galgotia Publications.		
2	Alfred V.Aho,John E.Hopcroft, Jeffrey D.Ullman,"Data Structures and Algorithms".		
Reference Books			
1	Goodrich,“Data Structures & Algorithms in Java”,Wiley 3 rd edition.		
2	Skiena,”The Algorithm Design Manual”,Second Edition,Springer,2008		
3	Anany Levith,”Introduction to the Design and Analysis of algorithm”,Pearson Education Asia 2003.		
4	Robert Sedgewick, Phillipe Flajolet,”An Introduction to the Analysis of Algorithms”, Addison-Wesley Publishing Company,1996.		
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]			
1	https://nptel.ac.in/courses/106/106/106106131/		
2	https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm		
3	https://www.javatpoint.com/daa-tutorial		
Course Designed By:			

Mapping with Programming Outcomes										
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	S	L	M	L	S	M
CO2	S	S	S	S	S	M	S	M	S	M
CO3	S	S	S	S	S	M	S	M	S	M
CO4	S	S	S	S	S	M	S	M	S	M
CO5	S	S	S	S	S	M	S	M	S	M

*S-Strong; M-Medium; L-Low

Course code		DATA ENGINEERING	L	T	P	C
Core/Elective/Supportive		Core	5			4
Pre-requisite		Basic Database and Data structure Concepts	Syllabus Version		2026-27	
Course Objectives:						
The main objectives of this course are to: 1. Understand the fundamentals of data engineering, data pipelines, and modern data architectures used in data-driven organizations. 2. Develop skills in data extraction, transformation, loading, orchestration, and governance using industry-standard tools and technologies. 3. Enable students to design, implement, and manage scalable data pipelines for analytics, machine learning, and business intelligence applications.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Explain the concepts, lifecycle, and architecture of modern data engineering systems.					K1,K2
2	Understand data extraction, ingestion, and storage techniques.					K2,K3
3	Understand Data Transformation and processing Techniques					K2,K3
4	Design and implement data security and privacy					K4,K5
5	Evaluate cloud-based data platforms, governance frameworks, and emerging trends in data engineering.					K5,K6
K1-Remember;K2 -Understand; K3-Apply;K4 -Analyze; K5-Evaluate; K6 –Create						
Unit:1 DATA ENGINEERING FUNDAMENTALS 15hours						
Introduction to Data Engineering - Role of Data Engineers - Evolution of Data Engineering - Data Engineering Lifecycle - Data Architecture - Data Engineering Maturity Model - Data Teams and Responsibilities - Data Culture in Organizations - Data Engineering versus Data Science and Analytics.						
Unit:2 DATA GENERATION, INGESTION AND STORAGE 15hours						
Sources of Data – Structured - Semi-Structured and Unstructured Data - Data Generation Systems - Data Ingestion Concepts - Batch Processing and Stream Processing - Data Integration - Data Storage Fundamentals – Databases - Data Warehouses - Data Lakes - Lakehouse Architecture - Storage Design Considerations.						
Unit:3 DATA TRANSFORMATION AND PROCESSING 15hours						
Data Transformation Principles - Data Modeling Fundamentals - Data Quality Management - Data Validation - Data Cleaning Techniques - Data Preparation - ETL and ELT Architectures - Data Processing Frameworks - Scalability Concepts - Performance Optimization - Workflow Design.						

Unit:4	DATA ORCHESTRATION, SECURITY AND GOVERNANCE	15 hours
Pipeline Orchestration Concepts - Workflow Scheduling - Monitoring and Logging - Metadata Management - Data Lineage - Data Observability - Data Security Principles - Privacy and Compliance - Data Governance Frameworks - Master Data Management - Risk Management in Data Systems.		
Unit:5	MODERN DATA ENGINEERING AND FUTURE TRENDS	13hours
Cloud Data Engineering - Cloud Storage and Compute Concepts - Distributed Data Systems - DataOps Principles - Data Reliability Engineering - Real-Time Analytics Concepts - Machine Learning Data Infrastructure - Data Mesh - Data Fabric - Emerging Trends and Future Directions in Data Engineering.		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars–webinars		
	Total Lecture hours	75hours
Text Books		
1	Fundamentals of Data Engineering, Joe Reis & Matt Housley, O'Reilly Media, 2022.	
Reference Books		
1	Designing Data-Intensive Applications, Martin Kleppmann, O'Reilly Media, 2017	
2	The Data Warehouse Toolkit, Ralph Kimball, Margy Ross, Wiley, 2013.	
3	Data Management for Researchers, Kristin Briney, Pelagic Publishing, 2020.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.tutorialspoint.com/data-engineering/index.html	
2	https://www.geeksforgeeks.org/data-engineering/data-engineering-101	
3	https://app.datacamp.com/learn/career-tracks/data-engineer-in-python	
Course Designed By:		

Mapping with Programming Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	M	M	L	L	L	L	L	L
CO2	M	M	S	M	M	L	L	L	L	L
CO3	M	M	S	S	M	L	L	L	M	L
CO4	M	M	M	S	M	M	M	L	L	M
CO5	M	M	S	S	M	M	L	L	L	M

*S-Strong; M-Medium; L-Low

Course code		PYTHON PROGRAMMING	L	T	P	C
Core/Elective/Supportive		Core	5			4
Pre-requisite		Basics of any OOProgramming Language	Syllabus Version		2021-22	
Course Objectives:						
The main objectives of this course are to:						
1. Presents an introduction to Python, creation of web applications, network applications and working in the clouds						
2. Use functions for structuring Python programs						
3. Understand different Data Structures of Python						
4. Represent compound data using Python lists, tuples and dictionaries						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the basic concepts of Python Programming					K1,K2
2	Understand File operations, Classes and Objects					K2,K3
3	Acquire Object Oriented Skills in Python					K3,K4
4	Develop web applications using Python					K5
5	Develop Client Server Networking applications					K5,K6
K1-Remember;K2 -Understand; K3-Apply;K4 -Analyze; K5-Evaluate; K6 -Create						
Unit:1		INTRODUCTION			15hours	
Python: Introduction–Numbers–Strings–Variables–Lists–Tuples–Dictionaries–Sets– Comparison.						
Unit:2		CODE STRUCTURES			15hours	
Code Structures: if, elseif, and else – Repeat with while – Iterate with for – Comprehensions – Functions – Generators – Decorators – Namespaces and Scope – Handle Errors with try and except – User Exceptions.						
Unit:3		MODULES, PACKAGES AND CLASSES			15hours	
Modules, Packages, and Programs: Standalone Programs – Command-Line Arguments – Modules and the import Statement – The Python Standard Library. Objects and Classes: Define a Class with class – Inheritance – Override a Method – Add a Method – Get Help from Parent with super–Inself Defense –Get and Set Attribute Values with Properties –Name Mangling for Privacy – Method Types – Duck Typing – Special Methods –Composition.						
Unit:4		DATA TYPES AND WEB			13hours	
Data Types: Text Strings–Binary Data. Storing and Retrieving Data: File Input/Output– Structured Text Files – Structured Binary Files - Relational Databases – NoSQL Data Stores.						
Web: Web Clients –Web Servers–Web Services and Automation						

Unit:5	SYSTEMS AND NETWORKS	15hours
Systems: Files–Directories–Programs and Processes–Calendars and Clocks.		
Concurrency: Queues– Processes–Threads–Green Threads and gevent–twisted–Redis.		
Networks: Patterns – The Publish-Subscribe Model – TCP/IP – Sockets – ZeroMQ –Internet Services – Web Services and APIs – Remote Processing – Big Fat Data and MapReduce – Working in the Clouds.		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars–webinars		
	Total Lecture hours	75hours
Text Books		
1	Bill Lubanovic,“Introducing Python”, O’Reilly, First Edition-SecondRelease,2014.	
2	Mark Lutz, “Learning Python”, O’Reilly, Fifth Edition, 2013.	
Reference Books		
1	David M. Beazley,“Python Essential Reference”, Developer’s Library, Fourth Edition,2009.	
2	Sheetal Taneja, Naveen Kumar, “Python Programming-A Modular Approach”, Pearson Publications.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.programiz.com/python-programming/	
2	https://www.tutorialspoint.com/python/index.htm	
3	https://onlinecourses.swayam2.ac.in/aic20_sp33/preview	
Course Designed By:		

Mapping with Programming Outcomes										
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	S	M
CO2	S	S	S	S	S	S	S	M	S	M
CO3	S	S	S	S	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	S	M
CO5	S	S	S	S	S	S	S	M	S	M

*S-Strong; M-Medium; L-Low

Course code		ADVANCED SOFTWARE ENGINEERING	L	T	P	C
Core/Elective/Supportive		Core	5			4
Pre-requisite		Basics of Software Engineering	Syllabus Version		2026-27	
Course Objectives:						
The main objectives of this course are to:						
1. Introduce to Software Engineering, Design, and Process.						
2. Enable the students to learn the concepts of Software Engineering.						
3. Learn about basic Prompt Engineering Concepts.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand about Software Engineering process					K1,K2
2	Analyze on Software Requirements and Specification					K2,K3
3	Understand and Analyze Agile development process					K2,K4
4	Understand Generative AI and Prompt Engineering concepts					K1,K2
5	Understand and Apply Large Language Models					K2,K3
K1-Remember;K2 -Understand; K3-Apply;K4 -Analyze; K5-Evaluate; K6 -Create						
Unit:1	SOFTWARE ENGINEERING - INTRODUCTION				15hours	
The Nature of Software – The Changing Nature of Software. Software Engineering: Defining the Discipline – The Software Process – Software Engineering Practice – Software Development Myths - Process Models: Prescriptive Process Models – Specialized Process Models – The Unified Process – Personal and Team Process Models.						
Unit:2	SOFTWARE REQUIREMENTS				15hours	
Understanding Requirements: Requirements Engineering – Establishing the Groundwork – Eliciting Requirements – Developing Use Cases – Building the Analysis Model – Negotiating Requirements. Design Concepts: Design within the Context of Software Engineering – The Design Process – Design Concepts – The Design Model.						
Unit:3	AGILE DEVELOPMENT				15hours	
Agile Development: Agility – Agility and the cost of Change – Agile Process – Other Agile Process Models – A Tool set for the Agile Process. Human Aspects of Software Engineering: Characteristics of a Software Engineer – The Psychology of Software Engineering – The Software Team – Team Structures – Agile Teams- The impact of social Media .						
Unit:4	GENERATIVE AI AND PROMPT ENGINEERING				15hours	

Generative AI Use Cases, Fundamentals, and Project Life Cycle: Use cases and Tasks – Foundation Models and Model Hubs – Generative AI Project Life Cycle – Generative AI on AWS – Why Generative AI on AWS – Building Generative AI Applications on AWS. Prompt Engineering and Context Learning: Prompts and Completions – Tokens – Prompt Engineering –Prompt Structure – In-Context Learning with Few-Shot Inference.		
Unit:5	LARGE-LANGUAGE FOUNDATION MODELS	13hours
Large-Language Foundation Models – Tokenizers – Embedding Vectors – Transformer Architecture – Types of Transformer Based Foundation Models – Pre-training Datasets – Scaling Laws.		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars–webinars		
	Total Lecture hours	75hours
Text Books		
1	Software Engineering - A Practitioners Approach, R.S.Pressman, Bruce R Maxim, McGraw Hill, 8 th Edition, 2023.	
2	Generative AI on AWS - Building Context-Aware Multimodel Reasoning Applications – Chris Fregly, Antje Barth & Shelbee Eigenbrode, O’Reilly , Second Reprint , 2025.	
Reference Books		
1	Software Engineering–K.K.Aggarwal andYogesh Singh, New Age International Publishers, 3rd edition.	
2	Fundamentals of Software Engineering - Carlo Ghezzi, M. Jarayeri, D. Manodrioli, PHI Publication.	
3	An Integrated Approach to Software Engineering–Pankaj Jalote, Narosa Publishing House, Delhi, 3rd Edition.	
4	AI Engineering – Building Applications with Foundation Models - Chip Huyen, O’Reily, First Edition , 2024.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.javatpoint.com/software-engineering-tutorial	
2	https://onlinecourses.swayam2.ac.in/cec20_cs07/preview	
3	https://www.tutorialspoint.com/prompt_engineering/index.htm	
Course Designed By:		

Mapping with Programming Outcomes										
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	M	M
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code		PRACTICAL I: DATA ENGINEERING LAB	L	T	P	C
Core/Elective/Supportive		Core			5	4
Pre-requisite		Python Programming Concept	Syllabus Version		2026-27	
Course Objectives:						
The main objectives of this course are to: 1. Develop practical skills in acquiring, exploring, and preprocessing datasets using python and data engineering tools. 2. Enable students to perform data transformation, integration, visualization, and quality assessment on real-world datasets. 3. Equip students with the ability to design and implement basic data engineering workflows for analytics and decision-making.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Acquire, explore, and assess the quality of datasets using Python libraries and data engineering techniques				K1,K2	
2	Apply data preprocessing, transformation, and aggregation methods to prepare data for analysis.				K3,K4	
3	Perform exploratory data analysis and visualize data using appropriate Python tools and libraries.				K4,K5	
4	Develop and implement data integration and processing workflows for real-world data engineering applications.				K5,K6	
K1-Remember;K2 -Understand; K3-Apply;K4 -Analyze; K5-Evaluate; K6 -Create						
LISTOF PROGRAMS				75hours		
Data Acquisition and Exploration						
1. Demonstrate how to identify and retrieve datasets from Kaggle and perform basic exploration using Python libraries such as Pandas and NumPy. 2. Write a Python program to compute descriptive statistical measures like mean, median, standard deviation, and summary statistics for a given dataset.						
Dataset Understanding and Data Quality						
3. Develop a Python program to load a dataset into a DataFrame and display its structure, including shape, data types, feature names, and summary statistics. 4. Write a Python program to detect and count missing values in a dataset and evaluate data quality using Pandas functions.						
Data Preprocessing						
5. Perform dataset preprocessing by handling missing values, removing duplicates, applying normalization, and detecting outliers.						
Exploratory Data Analysis and Visualization						
6. Carry out Exploratory Data Analysis (EDA) using Python by generating statistical summaries and visualizations such as histograms, boxplots, and heatmaps.						

Mapping with Programming Outcomes										
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	M	M	S	L	L	L	L	L
CO2	M	M	S	M	S	L	L	L	L	L
CO3	M	M	M	S	S	L	L	L	M	L
CO4	M	M	S	S	S	M	L	L	M	M

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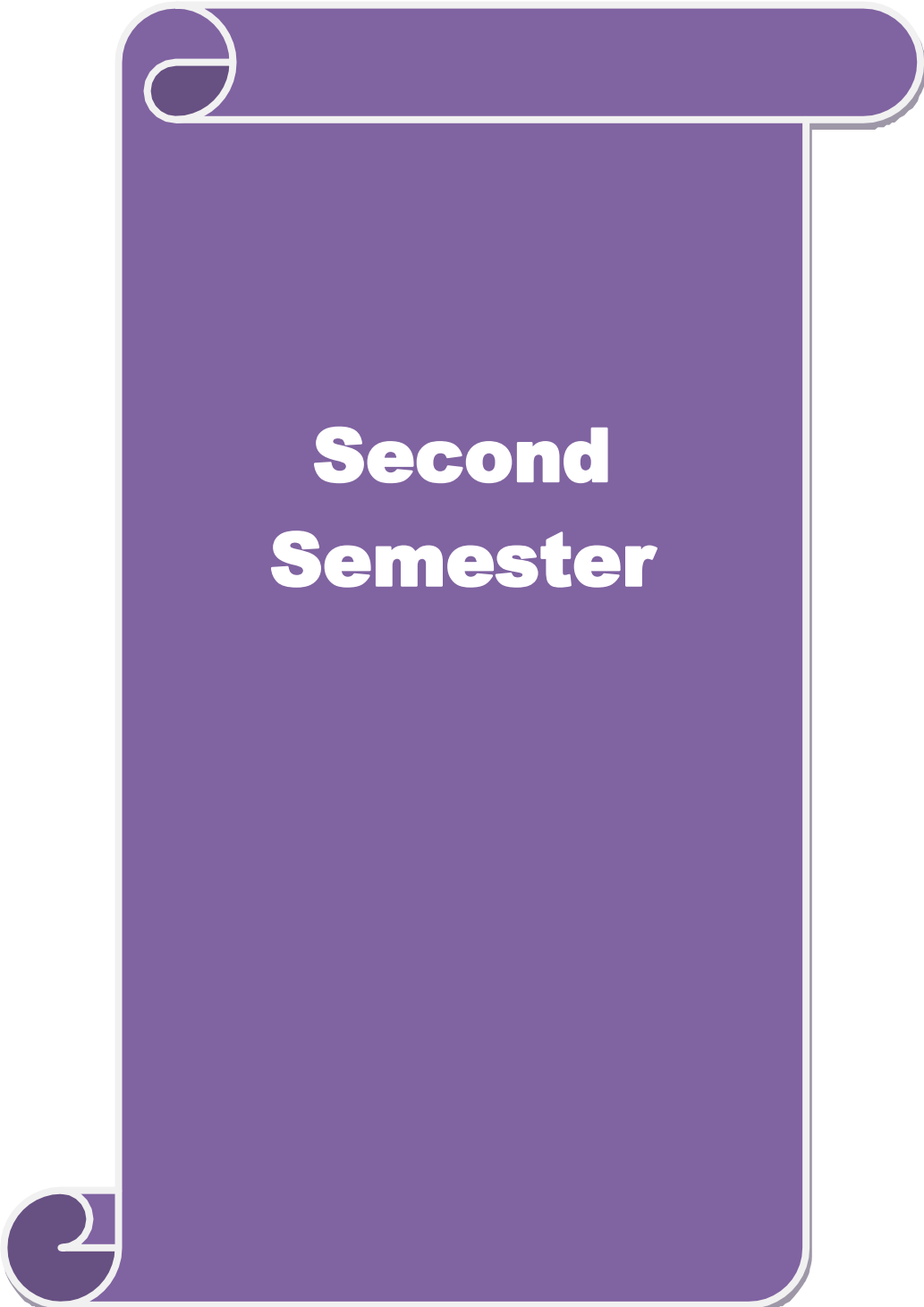
Course code		PRACTICAL II:PYTHON PROGRAMMING LAB	L	T	P	C
Core/Elective/Supportive		Core			5	4
Pre-requisite		Basics of any OOProgramming Language	Syllabus Version		2021-22	
Course Objectives:						
The main objectives of this course are to:						
1. This course presents an overview of elementary data items, lists, dictionaries, sets and tuples						
2. To understand and write simple Python programs						
3. To Understand the OOPS concepts of Python						
4. To develop web applications using Python						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Able to write programs in Python using OOPS concepts				K1,K2	
2	To understand the concepts of File operations and Modules in Python				K2,K3	
3	Implementation of lists, dictionaries, sets and tuples as programs				K3,K4	
4	To develop web applications using Python				K5,K6	
K1-Remember;K2 -Understand; K3-Apply;K4 -Analyze; K5-Evaluate; K6 -Create						
LIST OF PROGRAMS						
Implement the following in Python:						
1. Programs using elementary data items, lists, dictionaries and tuples						
2. Programs using conditional branches,						
3. Programs using loops.						
4. Programs using functions						
5. Programs using exception handling						
6. Programs using inheritance						
7. Programs using polymorphism						
8. Programs to implement file operations.						
9. Programs using modules.						
10. Programs for creating dynamic and interactive web pages using forms.						
Total Lecture hours					75hours	
Text Books						
1	Bill Lubanovic,“Introducing Python”,O’Reilly, First Edition-Second Release,2014.					
2	Mark Lutz,“Learning Python”, O’Reilly, Fifth Edition, 2013.					
Reference Books						

1	David M. Beazley, "Python Essential Reference", Developer's Library, Fourth Edition, 2009.
2	Sheetal Taneja, Naveen Kumar, "Python Programming-A Modular Approach", Pearson Publications.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.programiz.com/python-programming/
2	https://www.tutorialspoint.com/python/index.htm
3	https://onlinecourses.swayam2.ac.in/aic20_sp33/preview
Course Designed By:	

Mapping with Programming Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	S	S
CO2	S	S	S	S	S	S	S	M	S	M
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low





Second Semester

Course code		DATA MINING AND WAREHOUSING	L	T	P	C
Core/Elective/Supportive		Core	4			4
Pre-requisite		Basics of Data base & Algorithms	Syllabus		2021-22	
Course Objectives:						
The main objectives of this course are to:						
1. Enable the students to learn the concepts of Mining tasks, classification, clustering and Data Warehousing.						
2. Develop skills of using recent data mining software for solving practical problems.						
3. Develop and apply critical thinking, problem-solving , and decision-making skills.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the basic data mining techniques and algorithms					K1,K2
2	Understand the Association rules, Clustering techniques and Data warehousing contents					K2,K3
3	Compare and evaluate different data mining techniques like classification, prediction, Clustering and association rule mining					K4,K5
4	Design data warehouse with dimensional modeling and apply OLAP operations					K5,K6
5	Identify appropriate data mining algorithms to solve real world problems					K6
K1-Remember;K2-Understand;K3 -Apply; K4-Analyze;K5 -Evaluate;K6-Create						
Unit:1	BASICS AND TECHNIQUES				12hours	
Basic data mining tasks – data mining versus knowledge discovery in databases – data mining issues – data mining metrics – social implications of data mining – data mining from a database perspective.						
Data mining techniques: Introduction – a statistical perspective on data mining – similarity measures – decision trees – neural networks – genetic algorithms.						
Unit:2	ALGORITHMS				12hours	
Classification: Introduction –Statistical based algorithms – distance based algorithms-decision tree-based algorithms-neural network based algorithms– rule based algorithms–combining Techniques.						
Unit:3	CLUSTERING AND ASSOCIATION				12hours	
Clustering: Introduction–Similarity and Distance Measures–Outliers–Hierarchical Algorithms - Partitional Algorithms.						
Association rules: Introduction - large item sets - basic algorithms – parallel &distributed algorithms – comparing approaches- incremental rules – advanced association rules techniques – measuring the quality of rules.						
Unit:4	DATA WAREHOUSING AND MODELING				11hours	
Data warehousing: Introduction-characteristics of a data ware house–data marts–other aspects						

Of data mart. Online analytical processing : Introduction- OLTP &OLAP systems		
Data modeling –Star schema for multidimensional view –data modeling – multi fact star schema or snow flake schema – OLAP TOOLS – State of the market – OLAP TOOLS and the internet.		
Unit:5	APPLICATIONS OF DATAWAREHOUSE	11 hours
Developing a data WAREHOUSE: why and how to build a data warehouse –data warehouse architectural strategies and organization issues - design consideration – data content – metadata distribution of data – tools for data warehousing – performance considerations – crucial decisions in designing a data warehouse. Applications of data warehousing and data mining in government: Introduction - national data warehouses – other areas for data warehousing and data mining.		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars–webinars		
	Total Lecture hours	60 hours
Text Books		
1	Margaret H.Dunham, “Data Mining: Introductory and Advanced Topics”, Pearson education,2003.	
2	C.S.R. Prabhu, “Data Warehousing Concepts, Techniques, Products and Applications”, PHI, Second Edition.	
Reference Books		
1	Arun K.Pujari, “Data Mining Techniques”, Universities Press(India)Pvt.Ltd.,2003.	
2	Alex Berson, Stephen J.Smith, “Data Warehousing,Data Mining and OLAP”,TMCH, 2001.	
3	Jiawei Han & Micheline Kamber, “Data Mining Concepts &Techniques”, 2001, demic press.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.javatpoint.com/data-warehouse	
2	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs12/	
3	https://www.btechguru.com/training--it--database-management-systems--file-structures--introduction-to-data-warehousing-and-olap-2-video-lecture--12054--26--151.html	
Course Designed By:		

Mapping with Programming Outcomes										
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	M	M	M	M
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code		ADVANCED DATABASE MANAGEMENT SYSTEMS	L	T	P	C
Core/Elective/Supportive		Core	4			4
Pre-requisite		Basics of DBMS concept	Syllabus Version		2026-27	
Course Objectives:						
The main objectives of this course are to:						
1. To understand parallel and distributed database architectures and processing techniques						
2. To introduce NoSQL databases and MongoDB fundamentals						
3. To understand Cassandra architecture and distributed data storage concepts						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Explain the concepts of parallel and distributed database architectures and storage techniques					K2
2	Apply parallel query processing and distributed transaction management techniques for efficient data processing					K3
3	Illustrate MongoDB architecture, NoSQL concepts, CRUD operations and database administration methods					K2
4	Implement MongoDB query processing techniques including indexing, aggregation, replication and sharding					K3
5	Analyze Cassandra architecture, consistency models and distributed data management concepts					K4
K1-Remember;K2 -Understand; K3-Apply;K4 -Analyze; K5-Evaluate; K6 -Create						
Unit:1		PARALLEL AND DISTRIBUTED DATABASE ARCHITECTURE AND STORAGE			11hours	
Centralized Database Systems- Server System Architectures – Parallel Systems – Distributed Systems – Transaction Processing in Parallel and Distributed Systems – Cloud Based Services – Data Partitioning – Replication – Parallel Indexing – Distributed file Systems – Parallel key-value Stores.						
Unit:2		PARALLEL AND DISTRIBUTED QUERY PROCESSING			11 hours	
Parallel Sort – Parallel Join – Query Processing on Shared-Memory Architectures – Query Optimization for Parallel Execution –Parallel Processing of Streaming Data – Distributed Query Processing – Distributed Transactions – Commit Protocols – Concurrency Control in Distributed Databases.						
Unit:3		INTRODUCTION TO MONGODB			12hours	
Introduction to MongoDB – Overview of the MongoDB Architecture - The concept of NoSQL Databases - Types of NoSQL database management systems - Introduction to MongoDB basics, core concepts, and vocabulary - MongoDB Databases – Collections –Documents. Introduction to MongoDB Shell - MongoDB administration commands and methods – MongoDBquery, write operation commands and MongoDB methods. MongoDB CRUD Operations: Create, Read, Update, Delete and write.						
Unit:4		ADVANCED MONGODB OPERATIONS AND DATA PROCESSING TECHNIQUES			12hours	
MongoDB Query Selectors: Introduction to query selectors. Projection in MongoDB: Introduction to projection - Introduction to projection operators. Introduction to MongoDB Indexes: Creating an						

index – Index types – Using an index – Deleting an index. Aggregation in Mongo DB - Aggregation method syntax and use - The mapReduce() method - MongoDB aggregation pipeline. Replication in MongoDB - Sharding in MongoDB.

Unit:5	APACHE CASSANDRA	12hours
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Beyond Relational Databases – Need for Cassandra – Introduction to Apache Cassandra – Distributed Peer-to-Peer System – Nodes, Clusters and Data Centers – Cassandra Query Language (CQL) – CRUD Operations using CQL – Cassandra Data Model – Keyspaces and Tables – Cassandra Architecture – Replication and Partitioning – Consistency Levels – Applications of Cassandra.

Unit:6	Contemporary Issues	2 hours
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Expert lectures, online seminars– webinars

	Total Lecture hours	60 hours
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Text Books

- | | |
|---|--|
| 1 | Abraham Silberschatz, Henry F. Korth and S. Sudarshan, “Database System Concepts”, Sixth Edition, McGraw Hill Education, 2020. |
| 2 | Manu Sharma, “MongoDB Complete Guide”, First Edition, BPB Publications, 2021. |
| 3 | Jeff Carpenter, Eben Hewitt, “Cassandra: The Definitive Guide”, Third Edition, O’Reilly Media, 2022. |

Reference Books

- | | |
|---|---|
| 1 | Elmasri Ramez and Navathe Shamkant B., “Fundamentals of Database Systems”, Seventh Edition, Pearson Education, 2015. |
| 2 | Kristina Chodorow, “MongoDB: The Definitive Guide”, Third Edition, O’Reilly Media, 2019. |
| 3 | Russell Bradbery, Eric Lubow, “Practical Cassandra- A Developer’s Guide”, First Edition, Addison-Wesley Publications, 2014. |

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

- | | |
|---|---|
| 1 | https://db-book.com |
| 2 | https://learn.mongodb.com |

Course Designed By:

Mapping with Programming Outcomes										
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	L	M	L	L	L	L	L	L
CO2	S	S	M	S	L	L	L	L	L	L
CO3	M	M	S	S	L	L	L	L	L	L
CO4	S	M	S	S	L	M	L	L	L	L
CO5	S	M	M	S	M	M	L	L	L	L

*S-Strong; M-Medium; L-Low

Course code		ADVANCED JAVA PROGRAMMING	L	T	P	C
Core/Elective/Supportive		Core	4			4
Pre-requisite		Basics of Java & its Usage	Syllabus		2021-22	
Course Objectives:						
The main objectives of this course are to:						
1. Enable the students to learn the basic functions, principles and concepts of advanced java programming.						
2. Provide knowledge on concepts needed for distributed Application Architecture.						
3. Learn JDBC, Servlet packages, Java Server Pages and JAR file format						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the advanced concepts of Java Programming				K1,K2	
2	Understand JDBC and RMI concepts				K2,K3	
3	Apply and analyze Java in Database				K3,K4	
4	Handle different event in java using the delegation event model, event listener and class				K5	
5	Design interactive applications using Java Servlet, JSP and JDBC				K5,K6	
K1-Remember;K2 -Understand; K3-Apply;K4-Analyze; K5-Evaluate; K6 -Create						
Unit:1						
INTRODUCTION TO JAVA LANGUAGE			12hours			
Overview of Java – Basic Java Concepts – Principles of Object Oriented Programming in Java – Programming in Java – Java Packages – New Features in Java – Eclipse IDE for Programming. Generics and Collections: Introduction-Generic Programming –Collections-Implementing Collection Classes.						
Unit:2						
LAMBDA AND MULTITHREADING			12hours			
Lambdas and Functional Programming: Introduction-Functional Programming- Functional Programming in Java –Object Oriented versus functional Programming-Lambdas-Date and Time API. Multithreading and Reactive programming: Introduction-Reactive Programming –What is Multithreading?-Concurrency-Understanding Deadlock-Concurrent Data Structure-Multithreading Examples-Designing Concurrent Java Programs.						
Unit:3						
JAVA SERVLETS & JAVA SERVER PAGES			10hours			
Java Servlets : Java Servlets and Common Gateway Interface Programming -A simple Java Servlet – Anatomy of Java Servlet -Reading Data from a Client - Reading HTTP Request Headers - Sending Data to a client and Writing the HTTP Response Header-working with Cookies. Java Server Pages: JSP- JSP Tags-Tomcat - Request String – User Sessions- Cookies – Session Objects						
Unit:4						
JAVA RMI & JDBC OBJECTS			12hours			
Java Remote Method Invocation: Java Remote Method Invocation Concepts –Server Side –Client side. JDBC Objects: The concept of JDBC – JDBC Driver Types – JDBC Packages – A Brief Overview of the JDBC Process – Database Connection-Associating the JDBC/ODBC Bridge with the Database – Statement Objects – ResultSet – Transaction Processing – Metadata – Data types.						
Unit:5						
INTRODUCTION TO SPRING AND HIBERNATE			12hours			

Spring Framework – Spring Architecture – Spring MVC. Introduction to Hibernate: Architecture – Installation and Configuration – Java Object in Hibernate – Inheritance Mapping – Collection Mapping – Mapping with Map – Hibernate Query Language.

Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars–webinars		
Total Lecture hours		60 hours
Text Books		
1	The Complete Reference J2EE, Jim Keogh, McGraw Hill . 36 th Reprint 2014	
2	Full Stack Java Development with Spring, MVC, Hibernate, JQuery and BootStrap, Mayur Ramgir, Wiley, First Edition 2020.	
Reference Books		
1	Jamie Jaworski, “Java Unleashed”, SAMS Tech media Publications,1999.	
2	The Java Tutorial, Campione, Walrath and Huml, AddisonWesley,1999.	
3	Deitel and Deitel, “Java How to Program”, Third Edition,PHI/Pearson Education Asia.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.javatpoint.com/servlet-tutorial	
2	https://www.tutorialspoint.com/java/index.htm	
3	https://onlinecourses.nptel.ac.in/noc19_cs84/preview	
Course Designed By:		

Mapping with Programming Outcomes										
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	M	M	M	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code		ARTIFICIAL INTELLIGENCE & MACHINE LEARNING	L	T	P	C
Core/Elective/Supportive		Core	4			4
Pre-requisite		Basics of AI & An Introduction about ML	Syllabus		2021-22	
Course Objectives:						
The main objectives of this course are to:						
1. Enable the students to learn the basic functions of AI, Heuristic Search Techniques.						
2. Provide knowledge on concepts of Representations and Mappings and Predicate Logic.						
3. Introduce Machine Learning with respect Data Mining, Big Data and Cloud.						
4. Study about Applications & Impact of ML.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Demonstrate AI problems and techniques					K1,K2
2	Understand machine learning concepts					K2,K3
3	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning					K3,K4
4	Analyze the impact of machine learning on applications					K4,K5
5	Analyze and design a real world problem for implementation and understand the dynamic behavior of a system					K5,K6
K1-Remember;K2 -Understand; K3-Apply;K4 -Analyze; K5-Evaluate; K6 -Create						
Unit:1						
INTRODUCTION						
12hours						
Introduction: AI Problems - AI techniques - Criteria for success. Problems, Problem Spaces, Search: State space search - Production Systems - Problem Characteristics - Issues in design of Search.						
Unit:2						
SEARCH TECHNIQUES						
12hours						
Heuristic Search techniques: Generate and Test - Hill Climbing- Best-First, Problem Reduction, Constraint Satisfaction, Means-end analysis. Knowledge representation issues: Representations and mappings -Approaches to Knowledge representations -Issues in Knowledge representations - Frame Problem.						
Unit:3						
PREDICATE LOGIC						
12hours						
Using Predicate logic: Representing simple facts in logic - Representing Instance and Isa relationships - Computable functions and predicates - Resolution - Natural deduction. Representing knowledge using rules: Procedural Vs Declarative knowledge- Logic programming -Forward Vs Backward reasoning -Matching-Control knowledge.						
Unit:4						
MACHINE LEARNING						
12hours						

Understanding Machine Learning: What Is Machine Learning?- Defining Big Data- Big Data in Context with Machine Learning- The Importance of the Hybrid Cloud- Leveraging the Power of Machine Learning-The Roles of Statistics and Data Mining with Machine Learning-Putting Machine Learning in Context-Approaches to Machine Learning.		
Unit:5	APPLICATIONS OF MACHINE LEARNING	10hours
Looking Inside Machine Learning: The Impact of Machine Learning on Applications-Data Preparation-The Machine Learning Cycle.		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars–webinars		
	Total Lecture hours	60hours
Text Books		
1	Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill Publishers company Pvt Ltd, Second Edition, 1991.	
2	George F Luger, "Artificial Intelligence",4 th Edition, Pearson Education Publ, 2002.	
Reference Books		
1	Machine Learning For Dummies®, IBM Limited Edition Kirsch.	by Judith Hurwitz, Daniel
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.ibm.com/downloads/cas/GB8ZMQZ3	
2	https://www.javatpoint.com/artificial-intelligence-tutorial	
3	https://nptel.ac.in/courses/106/105/106105077/	
Course Designed By:		

Mapping with Programming Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	M	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code		PRACTICAL III: DATA MINING AND ADVANCED DBMS LAB	L	T	P	C
Core/Elective/Supportive		Core			5	4
Pre-requisite		Basics of DM Algorithms, R, DBMS and MongoDB Concepts	Syllabus Version		2026-27	
Course Objectives:						
The main objectives of this course are to:						
1. To enable the students to learn the concepts of Data Mining algorithms namely classification, clustering, regression.... 2. To understand & write programs using the DM algorithms Using R 3. To enable students to learn and understand advanced database concepts including parallel processing, data partitioning, NoSQL databases, aggregation techniques, spatial and multimedia data processing, and time-series data management using MongoDB. 4. To understand and write programs using MongoDB concepts						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Able to write programs using R for Association rules, Clustering techniques using R				K1,K2	
2	To implement data mining techniques like classification, prediction using R				K2,K3	
3	Implement CRUD operations, indexing techniques and advanced query processing for efficient data management using MongoDB				K3,K5	
4	Examine aggregation pipelines and document transformation techniques for complex data analysis and formulate time-series data storage and temporal data analysis using MongoDB collections				K4,K6	
K1-Remember;K2 -Understand; K3-Apply;K4 -Analyze; K5-Evaluate; K6 –Create						
LIST OF PROGRAMS						
					75hours	
Implement the following programs using R						
1. Implement Apriori algorithm to extract association rule of data mining. 2. Implement k-means clustering technique. 3. Implement any one Hierarchal Clustering. 4. Implement Classification algorithm. 5. Implement Decision Tree. 6. Linear Regression.						
Implement the following programs using MongoDB						
1. Demonstrate parallel processing of aggregation, filtering, sorting, and join operations. 2. Implement horizontal and vertical partitioning techniques on database tables. 3. Perform CRUD (Create, Read, Update, Delete) operations using MongoDB. 4. Demonstrate indexing techniques and query optimization in MongoDB. 5. Implement aggregation pipelines for data analysis in MongoDB. 6. Perform advanced query operations using MongoDB Query Selectors and operators. 7. Demonstrate data transformation and document restructuring in MongoDB. 8. Demonstrate multimedia data storage and retrieval using MongoDB. 9. Create and query Time Series collections in MongoDB for temporal data analysis.						

Total Lecture hours	
75 hours	
Text Books	
1	Margaret H.Dunham, “Data Mining: Introductory and Advanced Topics”, Pearson education,2003.
2	Ramez Elmasri, Shamkant B. Navathe, 2020, "Fundamentals of Database Systems”, 7th Edition, Pearson Publication.
Reference Books	
1	Arun K.Pujari, “Data Mining Techniques”, Universities Press(India) Pvt.Ltd.,2003.
2	Kristina Chodorow, “MongoDB: The Definitive Guide”, Third Edition, O’Reilly Media, 2019.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.javatpoint.com/data-warehouse
2	https://www.mongodb.com/docs/manual/
3	https://www.btechguru.com/training--it--database-management-systems--file-structures--introduction-to-data-warehousing-and-olap-2-video-lecture--12054--26--151.html
Course Designed By:	

Mapping with Programming Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	S	S
CO2	S	S	S	S	S	S	S	M	S	M
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low



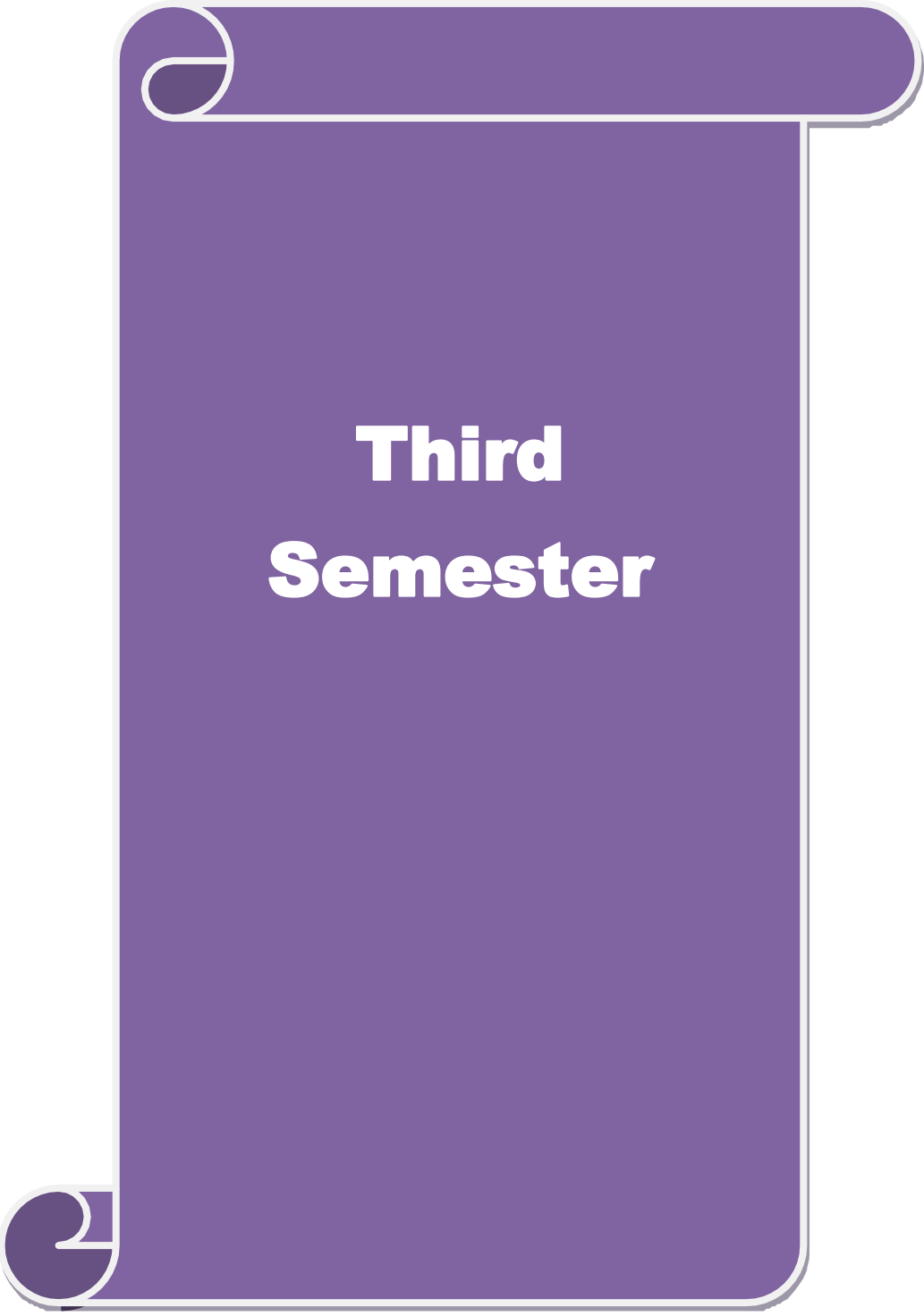
Course code		PRACTICAL IV: ADVANCED JAVA LAB	L	T	P	C
Core/Elective/Supportive		Core			5	4
Pre-requisite		Basics in Java Programming	Syllabus		2021-22	
Course Objectives:						
The main objectives of this course are to:						
1.To enable the students to implement the simple programs using JSP,JAR						
2.To provide knowledge on using Servlets, Applets						
3.To introduce JDBC and navigation of records						
4.To understand RMI & its implementation						
5.To introduce to Socket programming						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand to the implement concepts of Java using HTML forms, JSP&JAR				K1,K2	
2	Must be capable of implementing JDBC and RMI concepts				K3,K4	
3	Able to write Applets with Event handling mechanism				K4,K5	
4	To Create interactive web based applications using servlets and jsp				K5,K6	
K1-Remember;K2 -Understand; K3-Apply;K4 -Analyze; K5-Evaluate; K6 -Create						
LIST OF PROGRAMS						
75hours						
1. Display a welcome message using Servlet.						
2. Design a Purchase Order form using Html form and Servlet.						
3. Develop a program for calculating the percentage of marks of a student using JSP.						
4. Design a Purchase Order form using Html form and JSP.						
5. Prepare a Employee payslip using JSP.						
6. Write a program using JDBC for creating a table, Inserting, Deleting records and list out the records.						
7. Write a program using Java servlet to handle form data.						
8. Write a simple Servlet program to create a table of all the headers it receives along with their associated values.						
9. Write a program in JSP by using session object.						
10. Write a program to build a simple Client Server application using RMI.						
11. Create an applet for a calculator application.						
12. Program to send a text message to another system and receive the text message from the system (use socket programming).						
Expert lectures, online seminars–webinars						
Total Lecture hours						
75hours						

Text Books	
1	Jamie Jaworski, “Java Unleashed”, SAMS Techmedia Publications,1999.
2	Campione, Walrath and Huml,“The Java Tutorial”, AddisonWesley,1999.
Reference Books	
1	Jim Keogh, ”The Complete Reference J2EE”,Tata McGraw Hill Publishing Company Ltd,2010.
2	David Sawyer McFarland,“Java Script And JQuery-The Missing Manual”,Oreilly Publications, 3rd Edition,2011.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.javatpoint.com/servlet-tutorial
2	https://www.tutorialspoint.com/java/index.htm
3	https://onlinecourses.nptel.ac.in/noc19_cs84/preview
Course Designed By:	

Mapping with Programming Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	S	M
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low





Third Semester

Course code		DIGITAL IMAGE PROCESSING	L	T	P	C
Core/Elective/Supportive		Core	4			4
Pre-requisite		Basics of Image Processing	Syllabus		2021-22	
Course Objectives:						
The main objectives of this course are to:						
1. Learn basic image processing techniques for solving real problems.						
2. Gain knowledge in image transformation and Image enhancement techniques.						
3. Learn Image compression and Segmentation procedures..						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the fundamentals of Digital Image Processing					K1,K2
2	Understand them mathematical foundations for digital image representation, image acquisition, image transformation, and image enhancement					K2,K3
3	Apply, Design and Implement and get solutions for digital image processing problems					K3,K4
4	Apply the concepts of filtering and segmentation for digital image retrieval					K4,K5
5	Explore the concepts of Multi-resolution process and recognize the objects in an efficient manner					K5,K6
K1-Remember;K2 -Understand; K3-Apply;K4 -Analyze; K5-Evaluate; K6 -Create						
Unit:1	INTRODUCTION				12hours	
Introduction: What is Digital image processing – the origin of DIP – Examples of fields that use DIP – Fundamentals steps in DIP – Components of an image processing system. Digital Image Fundamentals: Elements of Visual perception – Light and the electromagnetic spectrum – Image sensing and acquisition – Image sampling and Quantization – Some Basic relationship between Pixels – Linear & Nonlinear operations.						
Unit:2	IMAGE ENHANCEMENT				12hours	
Image Enhancement in the spatial domain:- Background – some basic Gray levelTransformations – Histogram Processing – Enhancement using Arithmetic / Logic operations – Basics of spatial filtering – Smoothing spatial filters – Sharpening spatial filters – Combining spatial enhancement methods.						
Unit:3	IMAGE RESTORATION				12hours	
Image Restoration: A model of the Image Degradation / Restoration Process – Noise models – Restoration is the process of noise only – Spatial Filtering – Periodic Noise reduction by frequency domain filtering – Linear, Portion – Invariant Degradations – Estimating the degradation function – Inverse filtering – Minimum mean square Error Filtering – Constrained least squares filtering – Geometric mean filter – Geometric Transformations.						

Unit:4	IMAGE COMPRESSION	11hours
ImageCompression:Fundamentals–Imagecompressionmodels–ElementsofInformation Theory – Error Free compression – Lossy compression – Image compression standards.		
Unit:5	IMAGE SEGMENTATION	11hours
Image Segmentation: Detection and Discontinuities – Edge Linking and Boundary deduction – Thresholding – Region-Based segmentation – Segmentation by Morphological watersheds – The use of motion in segmentation.		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars–webinars		
	Total Lecture hours	60hours
Text Books		
1	Rafael C.Gonzalez,Richard E.Woods, “Digital Image Processing”, Second Edition, PHI/Pearson Education.	
2	B.Chanda, D.Dutta Majumder, “Digital Image Processing and Analysis”, PHI,2003.	
Reference Books		
1	Nick Efford,“Digital Image Processing a practical introducing using Java”,Pearson Education, 2004.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/117/105/117105135/	
2	https://www.tutorialspoint.com/dip/index.htm	
3	https://www.javatpoint.com/digital-image-processing-tutorial	
Course Designed By:		

Mapping with Programming Outcomes										
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	M	S	M	M	S
CO2	S	S	S	S	S	M	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code		CLOUD COMPUTING	L	T	P	C
Core/Elective/Supportive		Core	4			4
Pre-requisite		Basics of Cloud & its Applications	Syllabus		2021-22	
Course Objectives:						
The main objectives of this course are to:						
1. Gain knowledge on cloud computing, cloud services, architectures and applications.						
2. Enable the students to learn the basics of cloud computing with real time usage						
3. How to store and share, in and from cloud?						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the concepts of Cloud and its services					K1,K2
2	Collaborate Cloud for Event & Project Management					K3,K4
3	Analyze on cloud in –Word Processing, Spread Sheets, Mail, Calendar, Database					K4,K5
4	Analyze cloud in social networks					K5,K6
5	Explore cloud storage and sharing					K6
K1-Remember;K2 -Understand; K3-Apply;K4 -Analyze; K5-Evaluate; K6 -Create						
Unit:1						
INTRODUCTION						
12hours						
INTRODUCTION: Cloud Computing Introduction From Collaboration to cloud - Working of cloud computing - pros and cons – benefits - developing cloud computing services - Cloud service development - discovering cloud services.						
Unit:2						
CLOUD COMPUTING						
12hours						
CLOUD COMPUTING FOR EVERYONE: Centralizing email communications – cloud computing for community - collaborating on schedules - collaborating on group projects and events - cloud computing for corporation – mapping – schedules - managing projects - presenting on road.						
Unit:3						
CLOUD SERVICES						
12hours						
USING CLOUD SERVICES: Collaborating on calendars - Schedules and task management - exploring on line scheduling and planning - collaborating on event management - collaborating on contact management - collaborating on project management - collaborating on word processing - spreadsheets and databases.						
Unit:4						
OUTSIDE THE CLOUD						
12hours						
OUTSIDE THE CLOUD: Evaluating web mail services - Evaluating instant messaging - Evaluating web conference tools - creating groups on social networks - Evaluating online						

Groupware - collaborating via blogs and wikis.		
Unit:5	STORING AND SHARING	10hours
STORING AND SHARING: Understanding cloud storage - evaluating on line file storage - exploring on line book marking services - exploring on line photo editing applications - exploring photo sharing communities - controlling it with web based desktops.		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars–webinars		
	Total Lecture hours	60hours
Text Books		
1	Michael Miller, “Cloud Computing”, Pearson Education, New Delhi, 2009.	
Reference Books		
1	Anthony T. Velte, “Cloud Computing: A Practical Approach”, 1st Edition, Tata McGraw Hill Education Private Limited, 2009.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/106/105/106105167/	
2	https://www.tutorialspoint.com/cloud_computing/index.htm	
3	https://www.javatpoint.com/cloud-computing-tutorial	
Course Designed By:		

Mapping with Programming Outcomes										
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	S	M	S	M	S	M	M	M	S
CO2	M	S	M	S	S	S	M	M	M	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	M	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		NETWORK SECURITY AND CRYPTOGRAPHY	L	T	P	C
Core/Elective/Supportive		Core	4			4
Pre-requisite		Basics of Networks & its Security	Syllabus		2021-22	
Course Objectives:						
The main objectives of this course are to:						
1. Enable students to learn the Introduction to Cryptography, Web Security and Case studies in Cryptography. 2. To gain knowledge on classical encryption techniques and concepts of modular arithmetic and number theory. 3. To explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, and public key algorithms. 4. To explore the design issues and working principles of various authentication Applications and various secure communication standards including Kerberos, IPsec, and SSL/TLS and email.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the process of the cryptographic algorithms					K1,K2
2	Compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication					K2,K3
3	Apply and analyze appropriate security techniques to solve network security problem					K3,K4
4	Explore suitable cryptographic algorithms					K4,K5
5	Analyze different digital signature algorithms to achieve authentication and design secure applications					K5,K6
K1-Remember;K2 -Understand; K3-Apply;K4 -Analyze; K5-Evaluate; K6 -Create						
Unit:1						
INTRODUCTION			12hours			
Introduction to Cryptography – Security Attacks – Security Services –Security Algorithm- Stream cipher and Block cipher - Symmetric and Asymmetric-key Cryptosystem Symmetric Key Algorithms: Introduction – DES – Triple DES – AES – IDEA – Blowfish – RC5.						
Unit:2						
CRYPTO SYSTEM			12hours			
Public-key Cryptosystem: Introduction to Number Theory-RSA Algorithm–Key Management -Diffie-Hellman Key exchange–Elliptic Curve Cryptography Message Authentication and Hash functions – Hash and Mac Algorithm – Digital Signatures and Authentication Protocol.						
Unit:3						
NETWORK SECURITY			12hours			
Network Security Practice: Authentication Applications–Kerberos–X.509Authentication services and Encryption Techniques. E-mail Security – PGP – S / MIME – IP Security.						

Unit:4	WEB SECURITY	10hours
Web Security-Secure Socket Layer–Secure Electronic Transaction. System Security-Intruders and Viruses – Firewalls– Password Security.		
Unit:5	CASE STUDY	12hours
Case Study: Implementation of Cryptographic Algorithms–RSA–DSA–ECC(C/JAVA Programming).		
Network Forensic – Security Audit - Other Security Mechanism: Introduction to: Stenography – Quantum Cryptography – Water Marking - DNA Cryptography		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars–webinars		
	Total Lecture hours	60hours
Text Books		
1	William Stallings, “Cryptography and Network Security”, PHI/Pearson Education.	
2	Bruce Schneir, “Applied Cryptography”, CRC Press.	
Reference Books		
1	A.Menezes, P Van Oorschot and S.Vanstone, “Hand Book of Applied Cryptography”, CRC Press, 1997	
2	Ankit Fadia, ”Network Security”,MacMillan.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/106/105/106105031/	
2	http://www.nptelvideos.in/2012/11/cryptography-and-network-security.html	
3	https://www.tutorialspoint.com/cryptography/index.htm	
Course Designed By:		

Mapping with Programming Outcomes										
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	L	S	M	S	M	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		DATA SCIENCE & ANALYTICS	L	T	P	C
Core/Elective/Supportive		Core	4			4
Pre-requisite		Basics of Data Science & its Applications	Syllabus Version		2026-27	
Course Objectives:						
The main objectives of this course are to:						
1. Introduce the students to data science and its process.						
2. Learn to handle Large Data.						
3. Understand the NoSQL and GAP theorem.						
4. Understand Graph databases, Text mining and Text Analytics.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the concept of data science and its techniques					K1,K2
2	Understand to handle large data in a single computer					K2,K3
3	Analyze data storage and processing, and apply big data frame work applications					K3,K4
4	Analyze the graph databases					K4,K5
5	Analyze text mining and text analytics					K4,K6
K1-Remember; K2-Understand; K3 -Apply; K4-Analyze; K5 -Evaluate; K6-Create						
Unit:1						
DATA SCIENCE IN A BIG DATA WORLD AND ITS PROCESS						
12 hours						
Data science in a big data world: Benefits and uses of data science and big data – Facets of data. The data science process: Overview of the data science process – Defining research goals and creating project charter – Retrieving data – Cleansing, integrating and transforming data – Exploratory data analysis – Building the models – Presenting findings and building applications on top of them.						
Unit:2						
HANDLING LARGE DATA ON A SINGLE COMPUTER						
12hours						
The problem faced when handling large data – General techniques for handling large volume of data – General programming tips for dealing with large data sets – Case Study: Predicting malicious URLs.						
Unit:3						
FIRST STEP IN BIG DATA						
12hours						
Distributing data storage and processing with frameworks – Case Study: Assessing risk when loaning money. Join The NoSQL Movement: Introduction to NoSQL – ACID – GAP Theorem – The Base principles of NoSQL Databases – NoSQL Database types.						
Unit:4						
THE RISE OF GRAPH DATABASES						
12hours						
Introducing connected data and graph databases – Why and when should use a graph database – Introducing Neo4j: a graph database – Cypher: a graph query language – Connected data example: a recipe recommendation engine.						

Unit:5		TEXT MINING AND TEXT ANALYTICS	10hours
Text mining in the real world – Text mining techniques – Bag of words – stemming and lemmatization – Decision Tree classifier – Case Study: Classifying Redditposts .			
Unit:6		Contemporary Issues	2 hours
Expert lectures, online seminars–webinars			
		Total Lecture hours	60hours
Text Books			
1	Introducing Data Science, Davy Cielen, Arno D.B. Meysman, Mohamed Ali, Manning Publication, dream tech Press, Reprint 2023.		
Reference Books			
1	A simple introduction to Data Science-Lars Nielson 2015		
2	Data science in big data analytics, Wiley 2015		
3	Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services, Wiley 2015		
Related Online Contents[MOOC, SWAYAM, NPTEL, Websitesetc.]			
1	https://www.tutorialspoint.com/python_data_science/index.htm		
2	https://www.javatpoint.com/data-science		
3	https://nptel.ac.in/courses/106/106/106106179/		
Course Designed By:			

Mapping with Programming Outcomes										
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	M	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code		PRACTICAL V:DIGITAL IMAGE PROCESSING Using MATLAB	L	T	P	C
Core/Elective/Supportive	Core				4	4
Pre-requisite	Basic Programming of Image Processing & an intro to MATLAB		Syllabus Version		2021-22	
Course Objectives:						
The main objectives of this course are to:						
1.To understand the basics of Digital Image Processing fundamentals, image enhancement and image restoration techniques						
2. To enable the students to learn the fundamentals of image compression and segmentation						
3. To understand Image Restoration & Filtering Techniques						
4. Implementation of the above using MATLAB						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	To write programs in MATLAB for image processing using the techniques				K1,K2	
2	To able to implement Image Enhancements& Restoration techniques				K2,K3	
3	Capable of using Compression techniques in an Image				K3,K4	
4	Must be able to manipulate the image and Segment it				K5,K6	
K1-Remember;K2 -Understand; K3-Apply;K4 -Analyze; K5-Evaluate; K6 -Create						
LIST OF PROGRAMS						
60hours						
1. Implement Image enhancement Technique.						
2. Histogram Equalization						
3. Image Restoration.						
4. Implement Image Filtering.						
5. Edge detection using Operators(Roberts, Prewitts and Sobels operators)						
6. Implement image compression.						
7. Image Subtraction						
8. Boundary Extraction using morphology.						
9. Image Segmentation						
Total Lecture hours					60hours	
Text Books						
1	Rafael C.Gonzalez, Richard E.Woods, “Digital Image Processing”,Second Edition,					

[illegible]

Course code		PRACTICAL VI: CLOUD COMPUTING LAB	L	T	P	C
Core/Elective/Supportive		Core			4	4
Pre-requisite		Basic Programming using Cloud	Syllabus Version		2021-22	
Course Objectives:						
The main objectives of this course are to:						
1. This course covers the basic data structures like Stack, Queue, Tree, List.						
2. This course enables the students to learn the applications of the data structures using various techniques						
3. It also enable the students to understand C++ language with respect to OOAD concepts						
4. Application of OOPS concepts						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the concepts of object oriented with respect to C++				K1,K2	
2	Able to understand and implement OOPS concepts				K3,K4	
3	Implementation of data structures like Stack, Queue, Tree, List using C++				K4,K5	
4	Application of the data structures for Sorting, Searching using different techniques.				K5,K6	
K1-Remember; K2 -Understand; K3-Apply; K4 -Analyze; K5-Evaluate; K6 -Create						
LIST OF PROGRAMS						
					60hours	
1. Working with Google Drive to make spreadsheet and notes.						
2. Launch a Linux Virtual Machine.						
3. To host a static website						
4. Exploring Google cloud for the following a)Storage b)Sharing of data c)manage your calendar, to-do lists, d) a document editing tool						
5. Working and installation of Google App Engine						
6. Working and installation of Microsoft Azure						
7. To Connect Amazon Redshift with S3 bucket						
8. To Create and Query a NoSQL Table						
Expert lectures, online seminars– webinars						
Total Lecture hours					60hours	
Text Books						
1	Michael Miller, “Cloud Computing”, Pearson Education, New Delhi, 2009.					
Reference Books						

1	Anthony T. Velte, “Cloud Computing: A Practical Approach”, 1st Edition, Tata McGrawHill Education Private Limited, 2009.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/106/105/106105167/
2	https://www.tutorialspoint.com/cloud_computing/index.htm
3	https://www.javatpoint.com/cloud-computing-tutorial
Course Designed By:	

Mapping with Programming Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	S	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

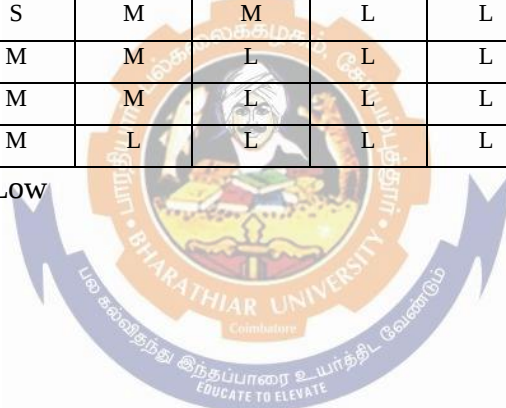


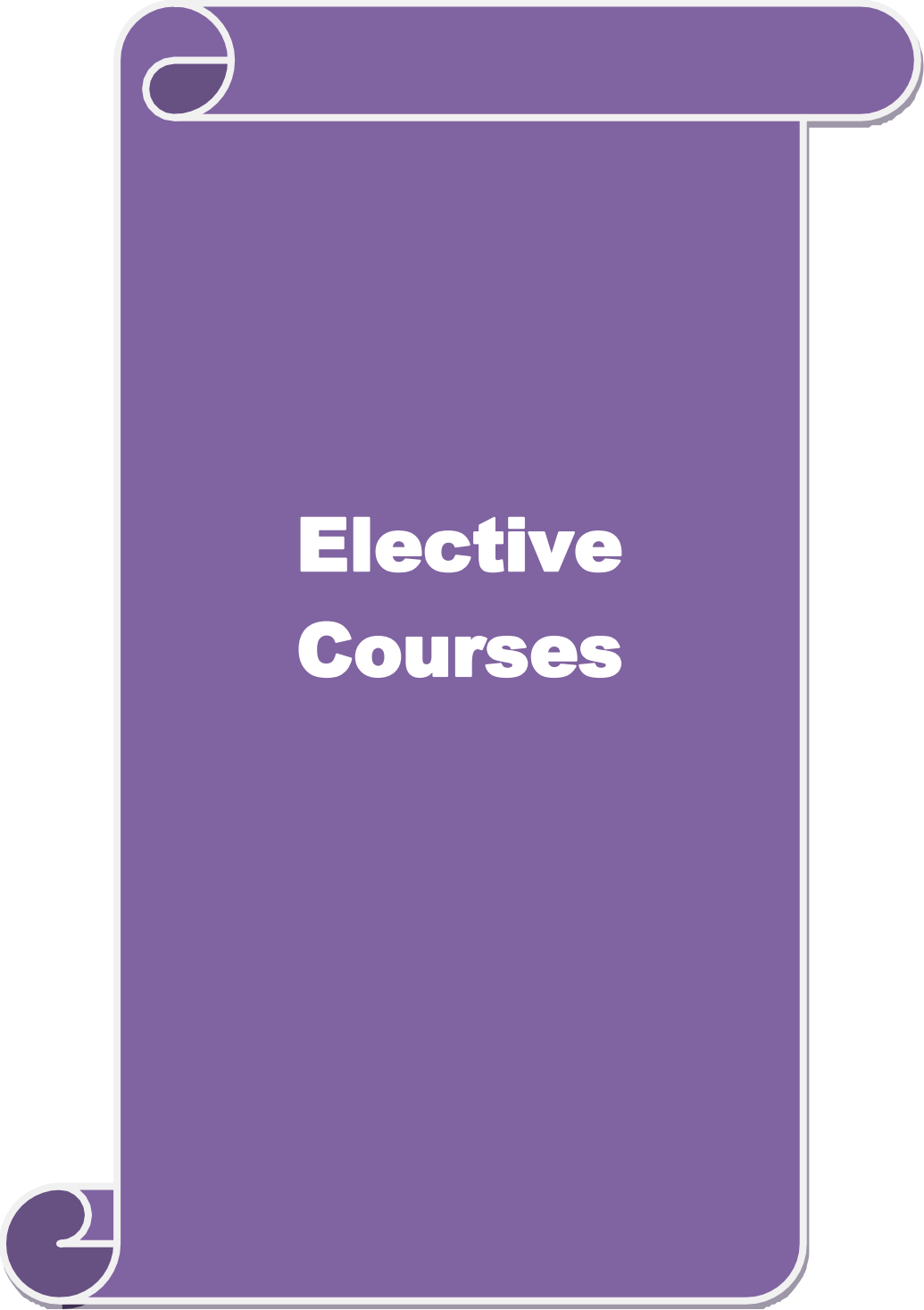
		PRACTICAL VII : DATA VISUALIZATION LAB				
Course code			L	T	P	C
Core/Elective/Supportive		Core			2	2
Pre-requisite		Basic Data science Programming	Syllabus Version		2026-27	
Course Objectives:						
The main objectives of this course are to: 1. To understand the key concepts of business intelligence and the Power BI ecosystem 2. To perform different operations by using the data 3. To learn about the creation of data models and final reports 4. To understand the use of dashboards, apps and security 5. To conduct the business data analysis tasks						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the key concepts of business intelligence and Power BI Desktop				K1,K2	
2	Perform data transformation tasks and create the data models				K3,K6	
3	Apply advanced visualization and create the reports				K3,K4,K6	
4	Create the dashboards and apps, Use data gateways and refreshing datasets				K4,K5,K6	
K1-Remember;K2 -Understand; K3-Apply;K4 -Analyze; K5-Evaluate; K6 –Create						
LIST OF PROGRAMS			30hours			
1. Create a Bar Chart for sales analysis and arrange visuals into a dashboard 2. Import a CSV Dataset and generate a report using different visualization tools in Power BI 3. Load a sales dataset and identify the available tables and columns and verify whether the imported data contains null or missing values. 4. Analyse business performance using DAX calculations and Create visualizations based on calculated measures. 5. Using DAX in Power BI Desktop Work with Filter Context and Time Intelligence. 6. Identify and correct syntax errors in DAX formulas and troubleshoot relationship errors affecting calculations. 7. Create separate report pages for: - Sales Analysis, Profit Analysis - Regional Performance, Product Performance 8. Navigate through different report pages in Power BI Service, apply filters and slicers while viewing reports. 9. Configure user permissions for dashboards and reports, Assign Viewer, Member, and Admin roles in a workspace. 10. Identify the different types of data gateways available in Power BI and Connect Power BI Service to an on-premises data source using a gateway						

Total Lecture hours	
30hours	
Text Books	
1	Data Visualization with Microsoft Power BI – Alex Kolokolov, Maxim Zelensky, O'Reilly, First Edition, 2024.
Reference Books	
1	Microsoft Power BI dummies , Jack Hyman, Wiley India Pvt Ltd, Reprint 2025.
2	Mastering Power BI, Chandraish Sinha, BPB Publications, Second Edition 2025.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.tutorialspoint.com/power_bi/index.html
2	https://www.depts.ttu.edu/itts/apps/handouts/PBI-Slides-ShortCourse_Handout.pdf
3	https://download.microsoft.com/download/0/8/1/0816F8D1-D1A5-4F60-9AF5-BC91E18D6D64/Microsoft_Press_ebook_Introducing_Power_BI_PDF_mobile.pdf4
Course Designed By:	

Mapping with Programming Outcomes										
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	M	L	L	L	L	L
CO2	S	S	M	M	L	L	L	L	L	L
CO3	S	S	M	M	L	L	L	L	L	L
CO4	S	S	M	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low





Elective Courses

Course code	MULTIMEDIA AND ITS APPLICATIONS		L	T	P	C
Core/Elective/Supportive	Elective		4			4
Pre-requisite	Basics of Multimedia		Syllabus Version		2026-27	
Course Objectives:						
The main objectives of this course are to:						
1. To introduce the students the concepts of Multimedia.						
2. To introduce Multimedia images and sound.						
3. To understand the Multimedia Animation techniques.						
4. To study about the Stages of Multimedia Project						
5. To know about Multimedia Planning and Costing.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the basic concepts of Multimedia				K1,K2	
2	Understand the concepts of Multimedia images and Sound				K2,K3	
3	Analyze the concepts Multimedia Animation				K4,K5	
4	Apply and Analyze the Multimedia Projects				K4,K5	
5	Analyze multimedia planning and Costing Process				K5,K6	
K1-Remember;K2 -Understand; K3-Apply;K4 -Analyze; K5-Evaluate; K6 -Create						
Unit:1	INTRODUCTION				12hours	
Multimedia Definition - Use of Multimedia Delivering Multimedia - Text: About Fonts and Faces – Using Text in Multimedia - Computers and Text Font Editing and Design Tools Hypermedia and Hypertext.						
Unit:2	IMAGES AND SOUND				12hours	
Images: Plan Approach – Organize Tools - Configure Computer Workspace – Making Still Images - Color - Image File Formats.						
Sound: The Power of Sound – Digital Audio - Midi Audio - Midi vs. Digital Audio						
Multimedia System Sounds Audio File Formats - Vaughan's Law of Multimedia Minimums – Adding Sound to Multimedia Project.						
Unit:3	ANIMATION				10hours	
Animation: The Power of Motion - Principles of Animation – Animation by Computer – Making Animations that Work.						
Video: Using Video –Working with Video and Displays Digital Video Containers - Obtaining Video Clips–Shooting and Editing Video.						
Unit:4	MAKING MULTIMEDIA				12hours	
Making Multimedia: The Stage of Multimedia Project - The Intangible Needs - The Hardware Needs – The Software Needs - An Authoring Systems Needs Multimedia Production Team.						

Unit:5	PLANNING AND COSTING	12hours
Planning and Costing: The Process of Making Multimedia – Scheduling – Estimating - RFPs and Bid Proposals. Designing and Producing - Content and Talent: Acquiring Content Ownership of Content Created for Project Acquiring Talent.		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars-webinars		
	Total Lecture hours	60hours
Text Books		
1	Tay Vaughan, “Multimedia making it work”, Fifth Edition, Tata McGraw Hill.	
Reference Books		
1	Judith Jeffloat, “Multimedia in Practice (Technology and Applications)” , PHI, 2003.	
2	John F.Koegel Bufford, “Multimedia Systems”, Pearson Education.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.tutorialspoint.com/multimedia/index.htm	
2	https://www.tutorialspoint.com/basics_of_computer_science/basics_of_computer_science_multimedia.htm	
3	https://nptel.ac.in/courses/117/105/117105083/	
Course Designed By:		

Mapping with Programming Outcomes										
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	M	M	M	S
CO2	S	S	S	S	M	S	M	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		QUANTUM COMPUTING	L	T	P	C
Core/Elective/Supportive		Elective	4			4
Pre-requisite		Basics of Maths, Physics and Computer Science	Syllabus Version		2026-27	
Course Objectives:						
The main objectives of this course are to:						
1. Ability to know about the quantum mechanical preliminaries						
2. Gain the knowledge about quantum model of computation						
3. Learn about quantum circuit model and quantum algorithms						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand quantum mechanical preliminaries				K1,K2	
2	Understand quantum model computation				K2,K3	
3	Analyze quantum circuit model				K3,K4	
4	Apply Quantum computing using mathematical representation				K5	
5	Understand various quantum algorithms				K5,K6	
K1-Remember;K2 -Understand; K3-Apply;K4 -Analyze; K5-Evaluate; K6– Create						
Unit:1	QUANTUM MECHANICAL PRELIMINARIES				12Hours	
Quantum mechanics – Wave particle duality – Uncertainty principle – Postulates of Quantum Mechanics – General uncertainty relation – different formulation of quantum mechanics – Transition probability and amplitude of transition probability – inference of amplitudes transition – principles of superposition states – Quantum computer and Quantum mechanics – Quantum computers: step by step development.						
Unit:2	QUANTUM MODEL OF COMPUTATION				12Hours	
Classical bit – Quantum bit – mathematical foundation of quantum bits – Dirac notation – Matrix representation of superposition state – Bloch sphere – Myth about a single bit – Quantum measurement postulate – Bipartite system and multipartite system.						
Unit:3	QUANTUM CIRCUIT MODEL				12Hours	
Quantum dance – Turing machine – Quantum circuit – Introduction to quantum gates – M-Gate – Implementation of single quantum gate using Python Programming Language.						
Unit:4	QUANTUM SUPREMACY				10Hours	
Mathematical background – Visual representation of multipartite state – Multiple Qubit quantum gates – Matrix representation for quantum gates – Matrix representation for quantum circuits – Half adder – Oracle – No Cloning theorem – Quantum parallelism.						
Unit:5	THE VERSATILITY OF QUANTUM COMPUTING				12Hours	
Fundamental equation in quantum mechanics – Quantum entanglement – Teleportation – Super dense Coding – Quantum Algorithms – Physical realization of quantum computer – Challenge in development of quantum computer – Application of quantum computing.						
Unit:6	Contemporary Issues				2 hours	
Expert lectures, online seminars–webinars						

	Total Lecture hours	60Hours
Text Books		
1	Introductory Quantum Computing – A practical approach using python , Nikhil Ranjan Roy and Kuntal Mukherjee, S.Chand And Company Ltd, First Edition, 2024.	
Reference Books		
1	Quantum Computation and Quantum Information, Michael A. Nielsen and Issac L. Chuang, Cambridge University Press, Reprint 2025.	
2	Quantum Computation , Helmut Bez and Tony Croff, CRC press, Reprint 2025.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.tutorialspoint.com/quantum-computing/index.htm	
2	https://www.geeksforgeeks.org/blogs/introduction-quantum-computing/	
Course Designed By:		

Mapping with Programming Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	S	M	S	S	M	M	S
CO2	M	M	S	S	M	S	M	S	S	S
CO3	M	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		INTERNET OF THINGS	L	T	P	C
Core/Elective/Supportive		Elective	4			4
Pre-requisite		Basics of Sensors & its Applications	Syllabus		2021-22	
Course Objectives:						
The main objectives of this course are to:						
1. About Internet of Things where various communicating entities are controlled and managed for decision making in the application domain.						
2. Enable students to learn the Architecture of IoT and IoT Technologies						
3. Developing IoT applications and Security in IoT, Basic Electronics for IoT, Arduino IDE, Sensors and Actuators Programming NODEMCU using Arduino IDE.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand about IoT, its Architecture and its Applications					K1,K2
2	Understand basic electronics used in IoT & its role					K2,K3
3	Develop applications with Cusing Arduino IDE					K4
4	Analyze about sensors and actuators					K5,K6
5	Design IoT in real time applications using today’s internet & wireless technologies					K6
K1-Remember;K2 -Understand; K3-Apply;K4 -Analyze; K5-Evaluate; K6 -Create						
Unit:1	INTRODUCTION					12hours
Introduction to IoT: Evolution of IoT – Definition & Characteristics of IoT - Architecture of IoT– Technologies for IoT – Developing IoT Applications – Applications of IoT – Industrial IoT – Security in IoT						
Unit:2	BASIC ELECTRONICS FOR IoT					12hours
Basic Electronics for IoT: Electric Charge, Resistance, Current and Voltage – Binary Calculations – Logic Chips – Microcontrollers – Multipurpose Computers – Electronic Signals – A/D and D/A Conversion – Pulse Width Modulation.						
Unit:3	PROGRAMMING USING ARDUINO					12hours
Programming Fundamentals with C using Arduino IDE: Installing and Setting up the Arduino IDE – Basic Syntax – Data Types/ Variables/ Constant – Operators – Conditional Statements and Loops – Using Arduino C Library Functions for Serial, delay and other invoking Functions – Strings and Mathematics Library Functions.						
Unit:4	SENSORS AND ACTUATORS					10hours
Sensors and Actuators: Analog and Digital Sensors–Interfacing temperature sensor, ultrasound						

Sensor and infrared (IR) sensor with Arduino– Interfacing LED and Buzzer with Arduino.		
Unit:5	SENSOR DATA IN INTERNET	12hours
Sending Sensor Data Over Internet: Introduction to ESP8266 NODEMCU WiFi Module – Programming NODEMCU using Arduino IDE – Using WiFi and NODEMCU to transmit data from temperature sensor to Open Source IoT cloud platform (Thing Speak).		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars–webinars		
	Total Lecture hours	60 hours
Text Books		
1	Arshdeep Bahga,Vijay Madiseti, “Internet of Things: A Hands-On Approach”,2014. ISBN: 978-0996025515	
2	Boris Adryan, Dominik Obermaier, Paul Fremantle, “The Technical Foundations of IoT”,Artech Houser Publishers, 2017.	
Reference Books		
1	Michael Margolis,“Arduino Cook book”,O’Reilly,2011	
2	Marco Schwartz, “Internet of Things with ESP8266”,Packt Publishing, 2016.	
3	Dhivya Bala,“ESP8266:Step by Step Tutorial for ESP8266 IoT,Arduino NODEMCU Dev. Kit”, 2018.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://onlinecourses.nptel.ac.in/noc20_cs66/preview	
2	https://www.javatpoint.com/iot-internet-of-things	
3	https://www.tutorialspoint.com/internet_of_things/index.htm	
Course Designed By:		

Mapping with Programming Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	M	S	M	M	S	M
CO2	M	S	M	S	M	S	M	S	S	S
CO3	S	S	S	S	M	S	M	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		STRATEGIC AND DESIGN THINKING	L	T	P	C
Core/Elective/Supportive		Elective	4			4
Pre-requisite		Basics of Logical & Reasoning Skills	Syllabus		2026-27	
Course Objectives:						
The main objectives of this course are to:						
1. Learn critical thinking and its related concepts						
2. Learn design thinking and its related concepts						
3. Develop Thinking patterns, Problem solving & Reasoning						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the concepts of Critical thinking and its related technology					K1,K2
2	Focus on the explicit development of critical thinking and problem solving skills					K2,K3
3	Apply design thinking in problems					K3,K4
4	Make a decision and take actions based on analysis					K4,K5
5	Analyze the concepts of Thinking patterns, Problem solving & Reasoning in real time applications					K5,K6
K1-Remember;K2 -Understand; K3-Apply;K4-Analyze; K5-Evaluate; K6 -Create						
Unit:1	CRITICAL THINKING					12hours
Critical Thinking: Definition, Conclusions and Decisions, Beliefs and Claims, Evidence –finding, evaluation, Inferences, Facts – opinion, probable truth, probably false, Venn diagram. Applied critical thinking: Inference, Explanation, Evidence, Credibility, Two Case Studies, critical thinking and science, critical evaluation, self assessment.						
Unit:2	DESIGN THINKING					12hours
Design Thinking: Introduction, Need of Design Thinking, problem to question - design thinking process, Traditional Problem Solving versus Design Thinking, phases of Design Thinking, problem exploration, Stake holder assessment, design thinking for manufacturers, smart Idea to implementation.						
Unit:3	CASE STUDY					12hours
Thinking to confidence, fear management, duty Vs passion, Team management, Tools for Thinking, prototype design, Relevance of Design and Design Thinking in engineering, human centered design, case study: apply design thinking in problem.						
Unit:4	PROBLEM SOLVING					10hours
Problem solving: problem definition, problem solving methods, selecting and using information, data processing, solution methods, solving problems by searching, recognizing patterns, spatial						

reasoning, necessity and sufficiency, choosing and using models, making choices and decisions.		
Unit:5	REASONING	12hours
Reasoning: Deductive and hypothetical reasoning, computational problem solving; generating, implementing, and evaluating solutions, interpersonal problem solving. Advanced problem solving: Combining skills – using imagination, developing models, Carrying out investigations, Data analysis and inference. Graphical methods of solution, Probability, tree diagrams and decision trees		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars–webinars		
	Total Lecture hours	60hours
Text Books		
1	John Butter worth and Geoff Thwaites, Thinking skills :Critical Thinking and Problem Solving, Cambridge University Press, 2013.	
2	H.S.Fogler and S.E.LeBlanc, Strategies for Creative Problem Solving, 2 nd edition, Pearson, Upper Saddle River, NJ, 2008.	
Reference Books		
1	A. Whimbey and J. Lochhead, Problem Solving & Comprehension, 6th edition, Lawrence Erlbaum, Mahwah, NJ, 1999.	
2	M. Levine, Effective Problem Solving, 2nd edition, Prentice Hall, Upper Saddle River, NJ, 1994.	
3	Michael Baker, The Basic of Critical Thinking, The Critical Thinking Copress, 2015.	
4	David Kelley and TomKelley,CreativeConfidence,2013.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.tutorialspoint.com/critical_thinking/index.htm	
2	https://www.tutorialspoint.com/design_thinking/design_thinking_quick_guide.htm	
3	https://nptel.ac.in/courses/109/104/109104109/	
Course Designed By:		

Mapping with Programming Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	S	S	S
CO2	S	S	M	S	S	S	M	S	S	S
CO3	S	S	M	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		DEEP LEARNING	L	T	P	C
Core/Elective/Supportive		Elective	3			3
Pre-requisite		Basics of Data mining	Syllabus Version		2026-27	
Course Objectives:						
The main objectives of this course are to:						
1. Know the basics of deep learning						
2. Understand the machine learning concepts						
3. Learn various deep learning models						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the basics of neural networks and concepts of deep learning					K1,K2
2	Understand the evolution of machine learning algorithms					K2,K3
3	Analyze Artificial Neural Networks					K4
4	Analyze Convolutional Neural Networks					K4,K5
5	Analyze Recurrent Neural Network and LSTM					K4,K5
K1-Remember; K2-Understand;K3-Apply;K4 -Analyze;K5 -Evaluate;K6-Create						
Unit:1	INTRODUCTION TO DEEP LEARNING				9 hours	
Introduction – Basics of Neural Networks – Key concepts in deep learning – Deep learning Architecture – Training deep Neural Networks – DL tools and frameworks – Applications of deep learning – Current trends and Future directions.						
Unit:2	MACHINE LEARNING FUNDAMENTALS				9 hours	
Introduction and evolution of Machine Learning – Significance of ML – Role of data and algorithms in ML – Types of ML Algorithms – Data preprocessing in ML – Model selection Evaluation – Supervised learning algorithms – Unsupervised learning algorithms – Reinforcement learning algorithms – Applications of ML.						
Unit:3	INTRODUCTION TO ARTIFICIAL NEURAL NETWORK				8 hours	
Introduction – Biological inspiration – Structure of ANN – Types of ANN – Learning process in ANN – Activation functions – Learning and training in ANN –Example applications of ANN – Challenges and limitations of ANN – Advances and future trends in ANN.						
Unit:4	CONVOLUTIONAL NEURAL NETWORK				8 hours	
Introduction – Role of neural networks in CNN – Fundamentals of CNN – Activation functions – Architecture of CNN – Applications of CNN – Advanced concepts in CNN.						
Unit:5	RECURRENT NEURAL NETWORK AND LONG Short- Term MEMORY				9 hours	

Introduction to RNN – Fundamentals of RNN – Types of RNN – Training and optimization of RNN – Applications of RNN – Advanced architectures and variants of RNNs – Implementing RNN in Python – Challenges and future directions.		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars–webinars		
	Total Lecture hours	45 hours
Text Books		
1	Deep Learning – Algorithms and Applications, R.Ramalakshmi, T,Marimuthu and Vaibhav Gandhi, Cengage Learning India Pvt. Ltd, First Edition, 2025.	
Reference Books		
1	Deep Learning, Amit Kumar Das, Saptarsi Goswami, Pabitra Mitra and Amlanchakra barti, Pearson, Reprint, 2026.	
2	Deep Learning Using Python, Dr.S.Lovelyn Rose, Dr.L.Ashok Kumar and Dr.D.Karthika Renuka, Wiley India Pvt Ltd, Reprint, 2024.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.tutorialspoint.com/python_deep_learning/index.htm	
2	https://www.geeksforgeeks.org/deep-learning/deep-learning-tutorial/	
3	https://nptel.ac.in/courses/106106184	
Course Designed By:		

Mapping with Programming Outcomes										
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	M	L	L	M	S	M	M	M	M
CO2	S	S	S	M	M	S	M	S	S	S
CO3	S	S	S	S	M	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		BLOCKCHAIN TECHNOLOGY	L	T	P	C
Core/Elective/Supportive		Elective	3			3
Pre-requisite		Basics of Block Chain & Crypto Currency	Syllabus		2021-22	
Course Objectives:						
The main objectives of this course are to:						
1. Understand the fundamentals of block chain and crypto currency.						
2. Understand the influence and role of block chain in various other fields.						
3. Learn security features and its significance.						
4. Identify problems & challenges posed by Block Chain.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Demonstrate block chain technology and crypto currency					K1,K2
2	Understand them the mechanism in block chain					K2
3	Apply and identify security measures, and various types of services that allow people to trade and transact with bit coins					K3,K4
4	Apply and analyze Block chain in healthcare industry					K4,K5
5	Analyze security, privacy, and efficiency of a given Block chain system					K5,K6
K1-Remember;K2 -Understand; K3-Apply;K4 -Analyze; K5-Evaluate; K6 -Create						
Unit:1						
INTRODUCTION						
8 hours						
Introduction to Block chain - The big picture of the industry – size, growth, structure, players. Bitcoin versus Crypto currencies versus Block chain - Distributed Ledger Technology (DLT). Strategic analysis of the space – Block chain platforms, regulators, application providers. The major application: currency, identity, chain of custody.						
Unit:2						
NETWORK AND SECURITY						
8 hours						
Advantage over conventional distributed database, Block chain Network, Mining Mechanism, Distributed Consensus, Block chain 1.0, 2.0 and 3.0 – transition, advancements and features. Privacy, Security issues in Block chain.						
Unit:3						
CRYPTO CURRENCY						
9 hours						
Crypto currency - History, Distributed Ledger, Bit coin protocols -Symmetric-key cryptography - Public-key cryptography - Digital Signatures -High and Low trust societies - Types of Trust model: Peer-to-Peer, Leviathan, and Intermediary. Application of Cryptography to Blockchain						
Unit:4						
CRYPTO CURRENCY REGULATION						
9 hours						
Crypto currency Regulation-Stake holders, Roots of Bit coin, Legal views-exchange of crypto currency-Black Market-Global Economy. Cyrpto economics–assets, supply and						

demand, inflation and deflation – Regulation.		
Unit:5	CHALLENGES IN BLOCK CHAIN	9 hours
Opportunities and challenges in Block Chain – Application of block chain: Industry 4.0 – machine to machine communication –Data management in industry 4.0–future prospects. Block chain in Health 4.0 – Block chain properties - Healthcare Costs - Healthcare Quality - Healthcare Value - Challenges for using block chain for healthcare data		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars–webinars		
	Total Lecture hours	45 hours
Text Books		
1	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, Princeton University Press (July 19, 2016).	
2	Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”	
Reference Books		
1	Satoshi Nakamoto, “Bitcoin: A Peer-to-Peer Electronic Cash System”	
2	Rodrigoda Rosa Righi, Antonio Marcos Alberti, Madhusudan Singh, “Blockchain Technology for Industry 4.0” Springer 2020.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.javatpoint.com/blockchain-tutorial	
2	https://www.tutorialspoint.com/blockchain/index.htm	
3	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs01/	
Course Designed By:		

Mapping with Programming Outcomes										
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		WEB SERVICES	L	T	P	C
Core/Elective/Supportive		Elective	3			3
Pre-requisite		Basics of Distributed Computing	Syllabus Version		2021-22	
Course Objectives:						
The main objectives of this course are to:						
1. Present the Web Services , Building real world Enterprise applications using Web Services with Technologies XML, SOAP , WSDL , UDDI						
2. Get overview of Distributed Computing, XML, and its technologies						
3. Update with QoS and its features						
4. Develop Standards and future of Web Services						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand web services and its related technologies					K1,K2
2	Understand XML concepts					K2,K3
3	Analyze on SOAP and UDDI model					K4,K5
4	Demonstrate the road map for the standard sand future of web services					K5
5	Analyze QoS enabled applications in web services					K5,K6
K1-Remember;K2 -Understand; K3-Apply;K4 -Analyze; K5-Evaluate; K6 -Create						
Unit:1	INTRODUCTION					8 hours
Introduction to web services – Overview of Distributed Computing- Evolution and importance of web services-Industry standards, Technologies and concepts underlying web services-Web services and enterprises-web services standards organization-web services platforms.						
Unit:2	XML FUNDAMENTALS					8 hours
XML Fundamentals–XML documents –XML Namespaces-XML Schema–Processing XML						
Unit:3	SOAP MODEL					9 hours
SOAP: The SOAP model- SOAP messages-SOAP encoding- WSDL: WSDL structure- interface definitions-bindings-services-Using SOAP and WSDL-UDDI: About UDDI- UDDI registry Specification- Core data structures-Accessing UDDI						
Unit:4	TECHNOLOGIES AND STANDARDS					9 hours
Advanced web services technologies and standards: Conversations overview-web services conversation language-WSCL interface components. Workflow: business process management-workflows and workflow management systems Security: Basics-data handling and forwarding-data storage-errors-Web services security issues.						

Unit:5		QUALITY OF SERVICE	9 hours
Quality of Service: Importance of QoS for web services-QoS metrics-holes-design patterns-QoS enabled web services-QoS enabled applications. Web services management-web services standards and future trends.			
Unit:6		Contemporary Issues	2 hours
Expert lectures, online seminars–webinars			
		Total Lecture hours	45 hours
Text Books			
1	Sandeep Chatterjee, James Webber, “Developing Enterprise Web Services: An Architects Guide”, Prentice Hall, Nov 2003.		
2	Keith Ballinger, “NET Web services: Architecture and Implementation with .Net”, Pearson Education, First Edition, Feb 2003.		
Reference Books			
1	Ramesh Nagappan, “Developing Java Web Services: Architecting and developing secure Web Services Using Java”, John Wiley and Sons, first Edition Feb 2003.		
2	Eric A Marks and Mark J Werrell, “Executive Guide to Webservices”,JohnWileyand sons, March 2003.		
3	Anne Thomas Manes, “Web Services: Amanagers Guide”, Addison Wesley, June2003.		
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]			
1	https://www.tutorialspoint.com/webservices/index.htm		
2	https://www.javatpoint.com/web-services-tutorial		
3	https://www.btechguru.com/training--programming--xml--web-services--web-services-part-1-video-lecture--11801--24--147.html		
Course Designed By:			

Mapping with Programming Outcomes										
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	M	S	M	M	M	S
CO2	S	S	S	M	M	S	M	S	M	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

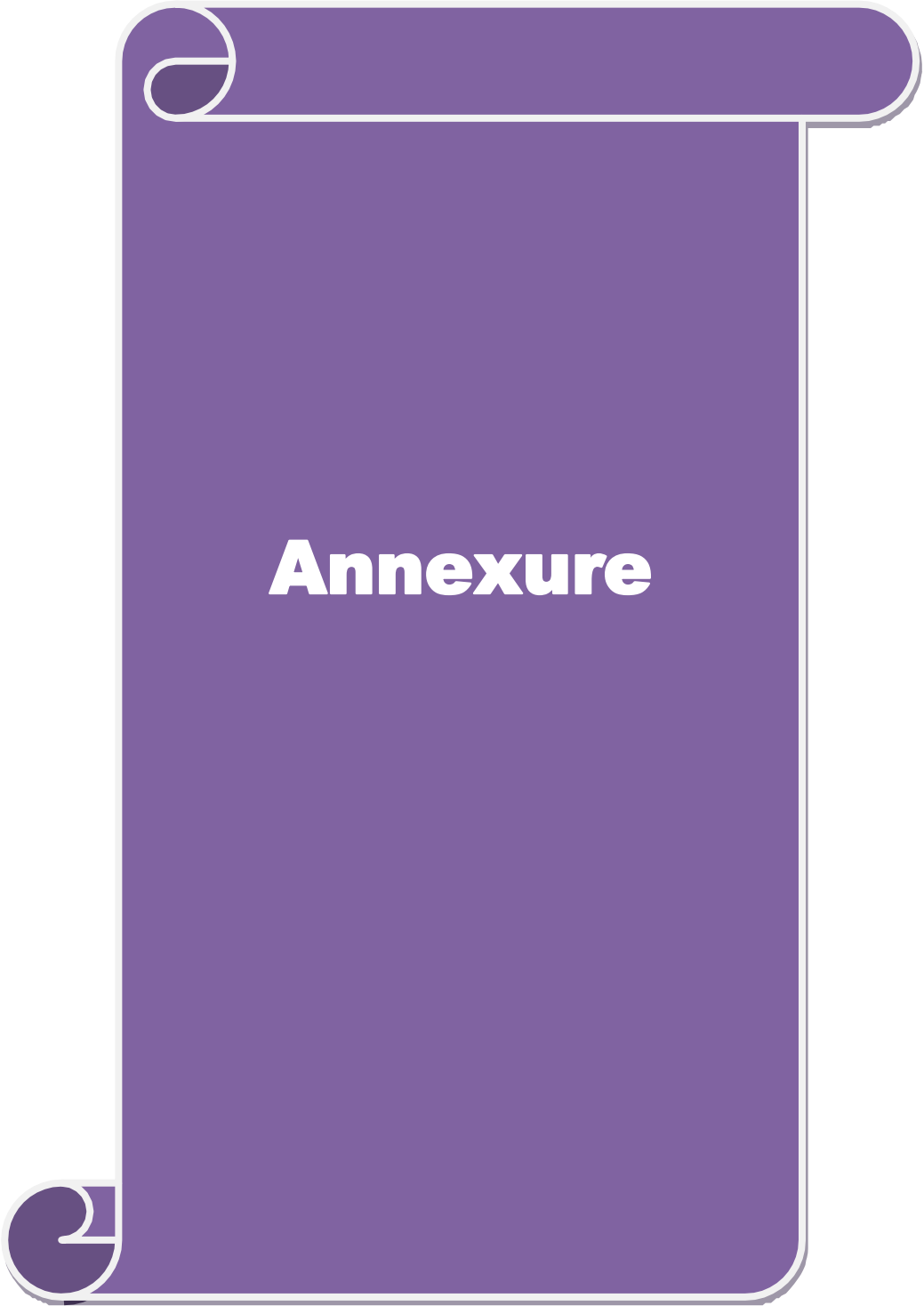
*S-Strong; M-Medium; L-Low

Course code		ROBOTIC PROCESS AUTOMATION FOR BUSINESS	L	T	P	C
Core/Elective/Supportive		Elective	3			3
Pre-requisite		Basics of Robots & its Applications	Syllabus		2021-22	
Course Objectives:						
The main objectives of this course are to:						
1. Learn the concepts of RPA, its benefits, types and models.						
2. Gain the knowledge in application of RPA in Business Scenarios.						
3. Identify measures and skills required for RPA						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Demonstrate the benefits and ethics of RPA					K1,K2
2	Understand the Automation cycle and its techniques					K2
3	Draw inferences and information processing of RPA					K3,K4
4	Implement & Apply RPA in Business Scenarios					K5
5	Analyze on Robots & leveraging automation					K5,K6
K1-Remember;K2 -Understand; K3-Apply;K4 -Analyze; K5-Evaluate; K6 –Create						
Unit:1						
INTRODUCTION						
9 hours						
Introduction to RPA –Overview of RPA –Benefits of RPA in a business environment -Industries & domains fit for RPA - Identification of process for automation - Types of Robots - Ethics of RPA & Best Practices - Automation and RPA Concepts - Different business models for implementing RPA-Centre of Excellence –Types and their applications –Building an RPA team -Approach for implementing RPA initiatives.						
Unit:2						
AUTOMATION						
8 hours						
Role of a Business Manager in Automation initiatives-Skills required by a Business Manager for successful automation - The importance of a Business Manager in automation - Analyzing different business processes - Process Mapping frameworks - Role of a Business Manager in successful implementation – Part 1 - Understanding the Automation cycle – First 3 automation stages and activities performed by different people.						
Unit:3						
AUTOMATION IMPLEMENTATION						
8 hours						
Evaluating the Automation Implementation Detailed description of last 3 stages and activities performed by different people - Role of a Business Manager in successful completion – Part 2 - Activities to be performed post-implementation - Guidelines for tracking the implementation success - Metrics/Parameters to be considered for gauging success - Choosing the right licensing option - Sending emails - Publishing and Running Workflows.						
Unit:4						
ROBOT						
9 hours						

Ability to process information through scopes/systems - Understand the skill of information processing and its use in business - Leveraging automation - Creating a Robot - New Processes. Establish causality by variable behavior - Understand the skill of drawing inference or establishing causality by tracking the behavior of a variable as it varies across time/referenced variable - Leveraging automation for this skill - Robot & new process creation.		
Unit:5	ROBOT SKILL	9 hours
Inference from snapshots of curated terms – Omni-source data curation - Multisource trend tracking - Understand the skill of drawing inference from the behavior of curated terms by taking snapshots across systems in reference to time/variable(s) - Leveraging automation for this skill – Robot creation and new process creation for this skill.		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars–webinars		
	Total Lecture hours	45 hours
Text Books		
1	Alok Mani Tripathi” Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool” Packt Publishing Limited March 2018.	
2	Tom Taulli, “The Robotic Process Automation Handbook”, Apress,February 2020.	
Reference Books		
1	Steve Kaelble, ”Robotic Process Automation”, John Wiley & Sons ,Ltd., 2018	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.tutorialspoint.com/uiopath/uiopath_robotic_process_automation_introduction.htm	
2	https://www.javatpoint.com/rpa	
3	https://onlinecourses.nptel.ac.in/noc19_me74/preview	
Course Designed By:		

Mapping with Programming Outcomes										
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low



Annexure

M.Sc COMPUTER SCIENCE

Syllabus (Effect for 2026-2027 Onwards)

Program Code:32K

DEPARTMENT OF COMPUTER SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

MISSION

1. To keep pace with emerging technologies and concepts, students are thrown open to the ever changing arena, meeting the industry requirements and standards, with the necessary knowledge and skill sets.
2. A retrained to explore more, at their own pace, knowing the demands of the IT world.
3. Apart from all the technical stuff, to inculcate the students about the Human Values and Professional ethics and to play a vital role in the society. Imparting them not only as world class Professionals, but also as tech savvy human beings to serve mankind.

4. **ELECTIVE– I**

5. 1.1.Multimedia and its Applications
6. 1.2.Quantum Computing
7. 1.3.Internet of Things
8. 1.4.Strategic and Design Thinking

9. **ELECTIVE– II**

10. 2.1. Deep Learning
11. 2.2.Block Chain Technology
12. 2.3.WebServices
13. 2.4.Robotic Process Automation for Business

