KAMARAJ COLLEGE

(AUTONOMOUS)
Accredited with A+ Grade by NAAC
Among Top 150 Colleges in India - NIRF Ranking 2025
இந்து நாடார் சங்கங்களால் 1966-ல் தொடங்கப்பட்ட கல்லூரி
(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)
THOOTHUKUDI - 628 003.

B.C.A

Semester – I to VI

(for the students those who joined from the academic year 2025-2026)

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SYLLABUS

(for the students those who joined from the academic year 2025-2026)

Department Profile

Name of the Programme	**: B.C.A.,**
Programme Code	**: 04020**
Year of Establishment	**: 2014**

Vision:

Achieving excellence in Information Technology Enabled Services through Teaching, Extension and Consultancy.

Mission:

To offer accredited under graduate programmes with the state-of-art technology throughout the Nation to maintain high academic standards and teaching quality.

To be a centre of excellence for innovation in frontier areas of Computer Science and technology relevant to the country.

College Mail Id	kamarajcoll@gmail.com
College Website	www.kamarajcollege.ac.in

Undergraduate Degree Programme

1. Introduction

Programme Outcome, Programme Specific Outcomes and Course Outcomes

Students completing this programme will be able to present their core under-graduate discipline clearly and precisely, make abstract ideas precise by formulating them in the language of the specific discipline, describe related ideas from multiple perspectives and explain fundamental concepts. Completion of this programme will also enable the learners to join teaching profession, enhance their employability for government jobs, jobs in various other public and private enterprises.

Eligibility: Passed the 10 + 2 (Higher Secondary) examination conducted by Government of Tamil Nadu with Mathematics / Computer Science / Business Mathematics as one of the Subject or other equivalent examinations (Minimum Aggregate of 50%)

Learning Outcomes-Based Curriculum Framework Guidelines Based Regulations For Under Graduate Programme	
Programme:	B.C.A.
Programme Code:	04020
Duration:	3 Years (UG)
Programme Outcomes:	
PO1:	**Disciplinary knowledge**: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study.
PO2:	**Communication Skills**: Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.
PO3:	**Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.
PO4:	**Problem solving:** Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.

PO5:	**Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.
PO6:	**Research-related skills:** A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation.
PO7:	**Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.
PO8:	**Scientific reasoning:** Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.

Programme Specific Outcomes (PSOs):

PSO1: Placement: To prepare the students who will demonstrate respectful engagement with others ideas, behaviour and beliefs. Also apply diverse frames of reference to decisions and actions.

PSO2: Entrepreneur: To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skills that will facilities start-ups and high potential organisations.

PSO3: Research and Development: Design and implement HR system and practices grounded in research that complies with employment laws, leading the organisation towards growth and development.

PSO4: Contribution to Business Words: To produce employability, ethical and innovative professionals to sustain in the dynamic business world.

PSO5: Contribution to the Society: To contribute to the development of the society by collaborating with stakeholders for mutual benefits.

Methods of Assessment	
Recall (K1)	Simple definitions , MCQ, Recall steps, Concept definitions
Understand/ Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, Short summary or overview
Application (K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain
Analyze (K4)	Problem-solving questions, Finish a procedure in many steps, Differentiate Between various ideas, Map knowledge
Evaluate (K5)	Longer essay/Evaluation essay, Critique or justify with pros and cons
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

Methods of Evaluation		Marks	
Internal Evaluation	Continuous Internal Assessment Test	15	25
	Assignment (PPT) and Seminar	5	
	Group Discussion and Viva	5	
External Evaluation	End Semester Examination		75
Total			**100**

Extra Credits

Curricular Activities	Co-Curricular Activities	Extra-Curricular Activities
Paper Presentation	Cultural Competitions	NCC
Paper Publication	Domain Clubs	NSS
Placement Training		Sports
Quiz		YRC
Competitions		UBA
SWAYAM /NPTEL/MOOCs		

Level	Credit			
	Participation	III Prize	II Prize	I Prize
Intra college	1	2	3	4
Intercollegiate	2	3	4	5
District	3	4	5	6
University	4	5	6	7
State	5	6	7	8
National	6	7	8	9
International	7	8	9	10

****Paper Presentation for each paper: 1credit**

Total credits Under–Graduate Courses including Lab Hours – 2025 to 2026

Semester	Hours	Credits	Additional Credits
I	30	22	2
II	30	22	2
III	30	23	2
IV	30	24	2
V	30	25	3
VI	30	24	3
Total		**140**	**14**

**Extra Credit will be given on the basis of student's performances

Written Examination: Theory Paper (Bloom's Taxonomy based) Question paper Model Assessment Pattern

Continuous Internal Assessment (CIA) & End Semester Examination (ESE)

- CIA : 25
- ESE: 75

Theory Course:

For theory courses there shall be two tests conducted by the faculty concerned and the average of the two can be taken as the Continuous Internal Assessment (CIA).CIA is for 30 marks max and will be converted in to 15 marks. The duration of each test shall be 1 ¼ Hrs.

Continuous Internal Assessment (Writing)	15 marks
Assignment (PPT) & Seminar	5 marks
Viva & Group Discussion	5 marks

For theory Papers:

- Part A (10×1=10) Marks-Answer all questions (Multiple choice)
- Part B (5×5=25) Marks-Choosing either(a) or (b)
- Part C (5×8=40) Marks-Choosing either (a) or (b)

Total =75 marks

Laboratory Courses Assessment

- CIA - 40 marks
- ESE - 60 marks
- Mandatory Record submission, attendance and class participation.
- Two CIA for 40 marks max. The average of the best two can be taken as the Continuous Internal Assessment.
- The duration of each test shall be 3 hours. In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum. The S, M, L is based on the Course outcomes. The mapping is based on the revised Bloom's

Taxonomy Verbs used to describe your Course outcomes.

- Remember and Understanding–Lower level
- Apply and Analyze– Medium Level
- Evaluate and Create–Strong Level

Pedagogy:

- Technology Based Learning (PPT)
- Peer Teaching (Chalk & Talk)
- Virtual Lab
- Blended Learning (Online & Offline)
- Group Learning
- Self - Study
- Games Based Learning

Course Structure for Science Stream

First Year – Semester I

B.C.A

(With effect from the academic year 2025 to 2026 onwards)

Semester I	Course Code	Title of the Course	Hrs./ Week	Credit	Duration of ESE (Hrs.)	Marks Allotted		
						CIA	ESE	Total
Part - I	25ULTL11	தமிழ் இலக்கிய வரலாறு - I	6	3	3	25	75	100
Part - II	25ULEN11	General English - I	6	3	3	25	75	100
Part - II Core - I	25UMCA11	Python Programming	5	5	3	25	75	100
Core Lab - I	25UMCAL1	Python Programming Lab	5	4	3	40	60	100
EC - I	25UECA11 25UECA12	1.Introduction to AI 2.Fundamentals of Computer Architecture	4	3	3	25	75	100
Part - IV SEC - I Lab	25USCAL1	Design for Developers Lab	2	2	3	40	60	100
FC (Select any one)	25UFCA11 25UFCA12	1.Mathematics for AI 2.Fundamentals of Information Technology	2	2	3	25	75	100
		Total	**30**	**22**				

**** SEC-Skill Enhancement Course**
****EC –Elective Course**
****FC - Foundation course**
****CIA- Continuous Internal Assessment**
**** ESE- End Semester Examination**

Course Structure for Science Stream
First Year – Semester II
B.C.A
(With effect from the academic year 2025 – 2026 onwards)

Semester II	Course Code	Title of the Course	Hours/ Week L/P	Credit	Duration of ESE (Hrs.)	Marks Allotted		
						CIA	ESE	Total
Part - I	25ULTL21	தமிழ் இலக்கிய வரலாறு -II	6	3	3	25	75	100
Part - II	25ULEN21	General English – II	6	3	3	25	75	100
Part - III Core - II	25UMCA21	Object Oriented Programming in Java	5	5	3	25	75	100
Core Lab - 2	25UMCAL2	Object Oriented Programming in Java Lab	5	4	3	40	60	100
EC - II (Select any one	25UECA21 25UECA22	1. Python for Data Science and Analytics 2. Operating Systems	4	3	3	25	75	100
Part - IV SEC - II	25USCA21	Front–End Web Development	2	2	3	25	75	100
SEC - III Lab -2	25USCAL2	Front–End Web Development (Lab)	2	2	3	40	60	100
		Total	**30**	**22**				

**** SEC-Skill Enhancement Course** **** CIA- Continuous Internal Assessment**

**** EC –Elective Course** **** ESE- End Semester Examination**

Course Structure for Science Stream

Second Year – Semester III

B.C.A

(With effect from the academic year 2025 to 2026 onwards)

Semester III	Course Code	Title of the Course	Hours /Week	Credit	Duration of ESE (Hrs.)	Marks Allotted		
						CIA	ESE	Total
Part - I	25ULTL31	தமிழக வரலாறும் பண்பாடும்	6	3	3	25	75	100
Part - II	25ULEN31	General English Part - III	6	3	3	25	75	100
Part - III Core - III	25UMCA31	Data Structures and Algorithms	5	5	3	25	75	100
Core Lab - III	25UMCAL3	Data Structures and Algorithms - Lab	4	3	3	40	60	100
EC - III (Select any one)	25UECA31 25UECA32	1. Applied Statistics 2. Optimization Techniques	3	3	3	25	75	100
Part-IV SEC 4 - Lab	25USCAL3	Database Management Systems - Lab	2	2	3	40	60	100
Part - IV AEC - 1	25UACA31	Problem Solving through Aptitude	2	2	3	25	75	100
Part - IV	25UYOG31	Yoga, Culture & Heritage	2	2	1.5	25	75	100
Total			**30**	**23**				

- **SEC- Skill Enhancement Course**
- **EC– Elective Course**
- **AEC- I (Ability Enhancement Course)**

CIA- Continuous Internal Assessment
ESE- End Semester Examination

Course Structure for Science Stream
Second Year – Semester – IV
B.C.A
(With effect from the academic year 2025– 2026 onwards)

Semester IV	Course Code	Title of the Course	Hours /Week L/P	Credit	Duration of ESE (Hrs.)	Marks Allotted		
						CIA	ESE	Total
Part - I	25ULTL41	தமிழும் அறிவியலும்	6	3	3	25	75	100
Part - II	25ULEN41	General English - IV	6	3	3	25	75	100
Part - III Core - IV	25UMCA41	Machine Learning	5	5	3	25	75	100
Core Lab - 4	25UMCAL4	Machine Learning Lab	4	3	3	40	60	100
EC - IV (Select any one)	25UECA41 25UECA42	1. Internet of Things 2. Networking and Security	3	3	3	25	75	100
Part –IV SEC - V Lab - 4	25USCAL4	Full Stack Development - Lab	2	2	3	40	60	100
Part - IV	25UEVS41	Environmental Studies	2	2	3	25	75	100
Part - IV AEC - II	25UACA41	Analytical Reasoning and Problem Solving	2	2	3	25	75	100
Part - V	25UEA41	NCC/ NSS/ YRC/ SPORTS	-	1	-	-	-	100
		Total	**30**	**24**				

**** SEC-Skill Enhancement Course** **** CIA- Continuous Internal Assessment**

**** EC –Elective Course** **** ESE- End Semester Examination**

Course Structure for Science Stream
Third Year – Semester – V
B.C.A
(With effect from the academic year 2025 – 2026 on wards)

Semester V	Course Code	Title of the Course	Hours /Week	Credit	Duration of ESE (Hrs.)	Marks Allotted		
						CIA	ESE	Total
Part - III Core - V	25UMCA51	Operating Systems	5	4	3	25	75	100
Core - VI	25UMCA52	ASP .Net Programming	4	4	3	25	75	100
Core - VII	25UMCA53	Data Analytics using R	5	4	3	25	75	100
Core - Lab - 5	25UMCAL5	ASP .Net Programming Lab	4	3	3	40	60	100
EC - V (Select any one)	25UECA51 25UECA52	1. Software Project Management 2. MOOCs on SWAYAM	4	3	3	25	75	100
EC - VI (Select any one)	25UECA53 25UECA54	1. AI and its Applications 2. Machine Learning	4	3	3	25	75	100
Part - IV AEC - III	25UACA51	Enhancing the Programming Skills	2	2	3	25	75	100
Part – IV Training	25UINT51	*Internship	-	2	1.5	50	50	100
Part - V	25UPDT51	Personality Development	2	2	3	25	75	100
		Total	**30**	**27**				

**** SEC - Skill Enhancement Course** ****CIA - Continuous Internal Assessment**

****EC – Elective Course** **** ESE - End Semester Examination**

****AEC - Ability Enhancement Course**

***Internship – course duration - 7 to14 days (Report should be submitted & Viva Voce will be conducted for the report which is equivalent to the project Viva – voce).**

Course Structure for Science Stream
Third Year – Semester – VI
B.C.A
(With effect from the academic year 2025 – 2026 on wards)

Semester VI	Course Code	Title of the Course	Hours /Week	Credit	Duration of ESE (Hrs.)	Marks Allotted		
						CIA	ESE	Total
Part - III Core - VIII	25UMCA61	RDBMS with PL/SQL	5	5	3	25	75	100
Core - IX	25UMCA62	Image Processing	5	4	3	25	75	100
Core – Lab - 6	25UMCAL6	RDBMS with PL/SQL Lab	5	3	3	40	60	100
Project - 1	25UMCAP1	Project with Viva Voce	5	3	3	50	50	100
EC - VII (Select any one)	25UECA61 25UECA62	1. Robotics and Its Applications 2. Computer Networks	4	3	3	25	75	100
EC - VIII (Select any one)	25UECA63 25UECA64	1. Introduction to Data Science 2. Data Mining and Warehousing	4	3	3	25	75	100
Part - IV AEC - IV	25UACA61	MongoDB	2	2	3	25	75	100
		Total	**30**	**23**				

**** SEC - Skill Enhancement Course** ****CIA - Continuous Internal Assessment**

****EC – Elective Course** **** ESE - End Semester Examination**

****AEC - Ability Enhancement Course**

Semester – I

Python Programming

Title of the Course	Python Programming				
Core-I	Year I	Semester I	Course Code 25UMCA11	Credits 5	Hours 5

Learning Objectives:

1. To introduce students to the fundamental concepts of programming using Python.
2. To develop problem-solving skills through algorithmic thinking and coding.
3. To teach Python syntax, control structures, functions, and data structures.
4. To provide hands-on experience in developing simple Python applications.
5. To prepare students for advanced topics in data science, AI, or web development.

Syllabus

Unit - I

Introduction to Python: History of Python. Installing Python and IDEs. Writing and running Python scripts. Python syntax, keywords, variables. Data types and type conversions. Input/output operations

Unit - II

Data Types, Control Flow & Iteration: Built-in data types: int, float, bool, str. Type conversion and casting. Input/output functions. Conditional Statements: if, if-else, if-elif-else.Loops: for, while, nested loops. Loop control: break, continue, pass, else with loop

Unit - III:

Functions and Modular Programming: Defining and calling functions. Function arguments: positional, keyword, default, variable-length return statement. Recursion and lambda expressions. Scope and lifetime of variables. Built-in functions vs. user-defined functions. Importing and creating modules. Python standard libraries (math, random, time)

Unit –IV:

Python Data Structures: Lists: creation, indexing, slicing, methods. Tuples: immutability, unpacking. Sets: uniqueness, set operations. Dictionaries: key-value pairs, nested dictionaries. Iterating over data structures. List comprehensions and dictionary comprehensions

Unit –V:

File Handling and Exception Management Working with files: open (), read/write/append modes. Reading from and writing to text files. File object methods: read (), readline(), readlines(), write().CSV file operations using csv module. Exception handling: try, except, else, finally. Built-in exceptions and raising exceptions manually

Books for Study:

1. E. Balagurusamy – Introduction to Python Programming, McGraw-Hill Education (1st Edition, 2017)

2. Reema Thareja – Python Programming: Using Problem Solving Approach, Oxford University Press (1st Edition, 2017)

3. Dr. R. Nageswara Rao – Core Python Programming, Dream Tech Press (1st Edition, 2018)

4. Mark Lutz – Learning Python, O'Reilly Media (5th Edition, 2013)

5. Tony Gaddis – Starting Out with Python, Pearson Education (5th Edition, 2018)

Books for Reference:

1. Zed A. Shaw – Learn Python the Hard Way, Addison-Wesley (3rd Edition, 2013)
2. Paul Barry – Head First Python, O'Reilly Media (2nd Edition, 2016)
3. Allen B. Downey – Think Python, Green Tea Press (2nd Edition, 2015)
4. Ashok Namdev Kamthane – Programming and Problem Solving with Python, Pearson (1st Edition, 2018)
5. Satya Prakash Singh – Python Programming, Katson Publishing House (1st Edition, 2021)

Web Resources

1. https://www.w3schools.com/datascience/ds_python.asp
2. https://www.geeksforgeeks.org/data-science-with-python-tutorial/
3. https://www.learnpython.org/
4. https://www.simplilearn.com/tutorials/python-tutorial

Course Outcomes

Course outcomes: CO	On completion of this course, the students will be able to:
CO1	Understand the syntax and semantics of Python.
CO2	Write Python programs using variables, control flow, and functions.
CO3	Use built-in data structures such as lists, tuples, dictionaries, and sets.
CO4	Apply file handling and exception handling techniques.
CO5	Create basic Python applications using modular programming.

Mapping with Programme Outcomes CO – PO – PSO

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	1	3	2	2
CO2	3	3	2	2	3	1	3	2	2
CO3	3	3	3	2	3	2	3	3	2
CO4	3	3	3	3	3	2	3	3	3
CO5	3	3	2	3	3	2	3	3	3
Average	3.00	2.80	2.40	2.20	2.80	1.60	3.00	2.60	2.40

Strong - 3 Moderate -2 Weak-1 No Correlation-0

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Python Programming – Lab

Title of the Course	Python Programming - Lab				
Core Lab –I	Year I	Semester I	Course Code 25UMCAL1	Credits 4	Hours 5

Learning Objectives

1. To provide practical experience with Python programming concepts and techniques.
2. To enable students to work on projects that reinforce programming concepts learned in the theory course.
3. To develop debugging and testing skills while working with Python.
4. To provide hands-on experience in solving real-world problems using Python.

Course Modules

Experiments
1. Write a Python program to swap two variables. 2. Write a Python program to check if a number is even or odd. 3. Write a Python program to find the largest among three numbers. 4. Write a Python program to find factorial of a number using recursion. 5. Write a Python program to generate Fibonacci series up to n terms. 6. Write a Python program to check whether a string is palindrome or not. 7. Write a Python program to count the number of vowels in a given string. 8. Write a Python program to check if a given number is a prime number. 9. Write a Python program to display the multiplication table of a given number. 10. Write a Python program to find the sum and average of elements in a list. 11. Write a Python program to perform linear search in a list. 12. Write a Python program to sort a list using bubble sort. 13. Write a Python program to demonstrate the use of dictionaries. 14. Write a Python program to remove duplicate elements from a list. 15. Write a Python program to count the occurrence of each word in a string.

References

1. **Zed Shaw**, "Learn Python the Hard Way", Addison-Wesley, 2014.
2. **Eric Matthes**, "Python Crash Course: A Hands-On, Project-Based Introduction to Programming", No Starch Press, 2016.
3. **Michael Dawson**, "Python Programming for the Absolute Beginner", Cengage Learning, 2010.
4. **Al Sweigart**, "Automate the Boring Stuff with Python", No Starch Press, 2015.
5. **Mark Lutz**, "Learning Python", O'Reilly Media, 2013.

Course Outcomes

Upon successful completion of the course, students will be able to:

Course Outcome (CO)	Description
CO1	Implement basic Python programs and solve computational problems in a lab setting.
CO2	Understand how Python can be used to manipulate data, handle exceptions, and perform tasks programmatically.
CO3	Develop Python-based applications and scripts that solve real-world problems.
CO4	Debug Python programs, identify issues, and improve code quality.
CO5	Evaluate and optimize Python code for performance and functionality.

Mapping with Programme Outcomes CO – PO – PSO

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	1	3	2	2
CO2	3	3	3	2	3	1	3	2	2
CO3	3	3	3	3	3	2	3	3	2
CO4	3	3	3	3	3	2	3	3	3
CO5	3	3	3	3	3	2	3	3	3
Average	**3.00**	**2.80**	**2.80**	**2.40**	**2.80**	**1.60**	**3.00**	**2.60**	**2.40**

Strong - 3 Moderate -2 Weak-1 No Correlation-0

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**

Introduction to AI

Title of the Course	Introduction to AI				
	Year	Semester	Course Code	Credits	Hours
Elective - I	I	I	25UECA11	3	4

Learning Objectives:

1. Understand AI Concepts and Industry-Specific Applications
2. Explore Data Processing and AI Model Deployment
3. Analyze AI-Powered Decision-Making and Automation
4. Examine AI Ethics, Regulations, and Challenges
5. Design and implement AI-driven applications tailored to real-world industry needs.

Syllabus

Unit I:

Fundamentals of AI for Industry Applications : Introduction to AI and Machine Learning in Industry. Supervised, Unsupervised, and Reinforcement Learning Basics. Industry-Specific AI Challenges and Opportunities. AI Model Lifecycle: Data Collection, Training, Deployment, and Monitoring. AI in Decision Support Systems

Unit II:

AI in Healthcare and Finance: AI in Healthcare: Disease Prediction and Diagnosis (Deep Learning for Medical Imaging). AI in Drug Discovery and Personalized Medicine.AI-powered Healthcare Chatbots and Virtual Assistants. Predictive Analytics for Patient Monitoring.

AI in Finance: Fraud Detection and Risk Management. Algorithmic Trading and Stock Market Prediction. Credit Scoring and Loan Approval using AI. AI for Customer Service in Banking

Unit III: AI in Manufacturing, Retail, and Supply Chain (12 Hours)

AI in Manufacturing: Predictive Maintenance and Fault Detection. AI-powered Robotics and Smart Factories. AI for Quality Control and Process Optimization

AI in Retail and E-commerce: Personalized Recommendations and Customer Behavior Analysis. AI-driven Demand Forecasting and Inventory Optimization. AI-powered Chatbots for Customer Support

AI in Supply Chain and Logistics: AI for Route Optimization and Delivery Efficiency. Warehouse Automation and Smart Inventory Management

Unit IV: AI in Smart Cities, Transportation, and Agriculture (12 Hours)

AI in Smart Cities: AI-powered Traffic Management and Smart Infrastructure. AI for Public Safety and Surveillance Systems

AI in Transportation: Self-driving Vehicles and Autonomous Systems. AI-based Traffic Flow Optimization. AI for Fleet Management and Ride-sharing Services

AI in Agriculture: Precision Farming using AI and IoT. AI-driven Crop Disease Prediction and Soil Monitoring. Drone-based AI Applications in Agriculture

Unit V: AI Ethics, Security, and Future Trends (12 Hours)

AI Ethics and Responsible AI Practices.Bias, Fairness, and Transparency in AI Applications.AI Regulatory Frameworks in Various Industries.Security Risks in AI Systems and Mitigation Strategies. Future Trends: AI in Space Exploration, Climate Change, and Sustainability

Books for Study:

1. Rajendra Akerkar – Artificial Intelligence for Business, Springer (2019)
2. Tom Taulli – Artificial Intelligence Basics: A Non-Technical Introduction, Apress (2019)
3. Patrick Bangert – Machine Learning and Data Science in the Oil and Gas Industry, Elsevier (2020)

Books for Reference:

1. B. V. Ravindran – Introduction to Machine Learning and AI Applications, McGraw Hill India (2020)
2. Parag Kulkarni – Artificial Intelligence: Building Intelligent Systems, PHI Learning (2020)
3. Dr. N. Gupta – AI and Industry 4.0: Applications and Challenges, Wiley India (2020)

Web References:

1. https://ocw.mit.edu/
2. https://www.coursera.org/learn/ai-for-everyone
3. https://cloud.google.com/solutions/ai
4. https://www.microsoft.com/en-us/ai/ai-business-school
5. https://aimi.stanford.edu/

Course Outcomes:

Course outcomes: CO	**On completion of this course, the students will be able to:**
CO1	Explain AI techniques and their role in different industries.
CO2	Apply AI models to industry-specific problems in healthcare, finance, and manufacturing.
CO3	Analyze AI-powered decision-making systems and automation techniques in various sectors.
CO4	Evaluate ethical, security, and regulatory challenges in AI applications across industries.
CO5	Design and develop AI-driven solutions tailored for real-world industry needs.

Mapping with Programme Outcomes CO – PO – PSO

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	1	3	2	2
CO2	3	3	2	2	3	1	3	3	2
CO3	3	3	3	3	2	2	3	3	3
CO4	3	2	3	3	3	2	3	3	2
CO5	2	3	2	3	2	1	3	3	3
Average	2.80	2.60	2.60	2.60	2.40	1.40	3.00	2.80	2.40

Strong - 3 Moderate -2 Weak-1 No Correlation-0

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Fundamentals of Computer Architecture

Title of the Course	Fundamentals of Computer Architecture				
Elective - I	Year I	Semester I	Course Code 25UECA12	Credits 3	Hours 4

Learning Objectives:

1. Introduce students to the essential concepts of computer organization and architecture.
2. Explain how various components of a computer system interact with each other.
3. Provide hands-on experience with assembly language and machine-level programming.
4. Explain how memory management works in architecture
5. Enhance students' problem-solving skills by analyzing the architecture of real-world computer systems.

Syllabus

Unit I:

Introduction to Computer Science and Architecture: Basic concepts in computer science: hardware, software, and data representation. Overview of computer architecture: definition, history, and evolution. The Von Neumann architecture and its components: CPU, memory, I/O systems. Introduction to the different types of computers

Unit II:

Number Systems and Data Representation: Binary, octal, hexadecimal, and decimal number systems. Conversions between number systems. Representation of data in computers: integers, floating-point numbers, characters, and strings. Representation of negative numbers: Two's complement, signed magnitude.

Unit III:

Central Processing Unit (CPU) Architecture: The architecture of the CPU: ALU, control unit, registers, and buses. The instruction cycle: fetch, decode, execute. Machine-level programming and assembly language. The role of the instruction set architecture (ISA) in CPU design. Caching and pipelining techniques in CPU performance.

Unit IV:

Memory Hierarchy and Storage: Types of memory: RAM, ROM, cache memory, and secondary storage (HDD, SSD). The concept of memory hierarchy: registers, cache, main memory, and virtual memory. Addressing modes: direct, indirect, indexed, and relative addressing. Memory management and virtual memory concepts. The role of the memory management unit (MMU).

Unit V:

Input/Output Systems and Computer Performance: Overview of input and output devices: keyboards, mice, monitors, printers, and external storage. Input/output control mechanisms: interrupts, DMA, and polling. The role of buses and I/O ports in communication. Performance metrics: clock cycles, execution time, throughput, and latency. RISC vs. CISC architectures and their impact on performance.

Books for Study:

1. M. Morris Mano, "Computer System Architecture", Pearson Education.
2. David A. Patterson and John L. Hennessy, "Computer Organization and Design", Morgan Kaufmann Publishers.
3. P. Pal Chaudhuri, "Computer Organization and Design", Prentice Hall India (PHI).
4. V. Rajaraman and T. Radhakrishnan, "Computer Organization and Architecture", PHI Learning Pvt. Ltd.
5. B. Govindarajulu, "Computer Architecture and Organization: Design Principles and Applications", Tata McGraw Hill

Books for Reference:

1. William Stallings, "Computer Organization and Architecture: Designing for Performance", Pearson.
2. S. K. Basu, "Computer Organization and Architecture", Vikas Publishing.
3. Hennessy & Patterson, "Computer Architecture: A Quantitative Approach", Morgan Kaufmann.
4. John P. Hayes, "Computer Architecture and Organization", McGraw Hill.
5. SubrataGhoshal, "Computer Architecture and Organization", Pearson, India.

Web Resources

1. https://www.w3schools.com/datascience/ds_python.asp
2. https://www.geeksforgeeks.org/data-science-with-python-tutorial/
3. https://www.learnpython.org/
4. https://www.simplilearn.com/tutorials/python-tutorial

Course Outcomes (CO):

Course outcomes: CO	**On completion of this course, the students will be able to:**
CO1	Understand the syntax and semantics of Python.
CO2	Write Python programs using variables, control flow, and functions.
CO3	Use built-in data structures such as lists, tuples, dictionaries, and sets.
CO4	Apply file handling and exception handling techniques.
CO5	Create basic Python applications using modular programming.

Mapping with Programme Outcomes CO – PO – PSO

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	1	3	2	2
CO2	3	3	2	2	3	1	3	2	2
CO3	3	3	3	2	3	2	3	3	2
CO4	3	3	3	3	3	2	3	3	3
CO5	3	3	2	3	3	2	3	3	3
Average	3.00	2.80	2.40	2.20	2.80	1.60	3.00	2.60	2.40

Strong - 3 Moderate -2 Weak-1 No Correlation-0

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Design for Developers Lab

Title of the Course	Design for Developers Lab				
Skill Enhancement Course - Lab - I	Year I	Semester I	Course Code 25USCAL1	Credits 2	Hours 2

Learning Objectives:

1. Introduce students to core concepts of UI/UX design.
2. Teach techniques for creating functional and visually appealing interfaces.
3. Explore tools and methodologies for prototyping and usability testing.
4. Enhance collaboration between developers and design teams.
5. In still a user-centered approach to software development.

Experiments
1. Create a user persona for a travel booking app. 2. Design a 12-column grid layout for a portfolio website using Figma. 3. Apply color theory by creating a mood board for a fitness app. 4. Redesign a poorly structured login form following UI best practices. 5. Build a mobile-first responsive navbar using HTML/CSS. 6. Conduct a user survey (Google Forms) on preferences for e-commerce apps. 7. Design wireframes (low-fidelity) for a food delivery app (Balsamiq/Figma). 8. Recreate a Figma UI kit (buttons, icons, cards). 9. Design a high-fidelity mockup of a weather app. 10. Create an interactive prototype (link screens for a shopping cart flow). 11. Export developer assets (SVG icons, style guides) from Figma. 12. Conduct usability testing on a prototype (observe 3 users). 13. Critique a popular app (e.g., Spotify) using Nielsen's heuristics. 14. Create a reusable component library (Figma). 15. Convert a desktop webpage layout into a mobile-friendly design while maintaining usability and visual hierarchy.

Books for Study:

1. Ben Shneiderman, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", Pearson.
2. Alan Cooper, Robert Reimann, David Cronin, "About Face: The Essentials of Interaction Design", Wiley.
3. Jesse James Garrett, "The Elements of User Experience: User-Centered Design for the Web and Beyond", Pearson.
4. Rajesh R. "UI/UX Design: A Beginner's Guide", BPB Publications (Indian Author).
5. Golden Krishna, "The Best Interface is No Interface: The Simple Path to Brilliant Technology", Pearson.

Books for Reference:

1. Don Norman, "The Design of Everyday Things", Basic Books.
2. Steve Krug, "Don't Make Me Think: A Common Sense Approach to Web Usability", Pearson.
3. SundaravalliNarayanaswami, "Human-Computer Interaction and User Experience Design", Springer (Indian Author).
4. PawanVora, "Web Application Design Patterns", Morgan Kaufmann.
5. Debjani Banerjee, "Human-Computer Interaction and UX/UI Design", CRC Press (Indian Author).

Web Resources

1. https://developer.mozilla.org/en US/docs/Learn web_development/Core/Design_for_developers
2. https://www.oreilly.com/library/view/design-for-developers/9781617299476/
3. https://blog.ishandeveloper.com/design-for-devs

Course Outcomes (CO):

Course outcomes: CO	**On completion of this course, the students will be able to:**
CO1	Understand the syntax and semantics of Python.
CO2	Write Python programs using variables, control flow, and functions.
CO3	Use built-in data structures such as lists, tuples, dictionaries, and sets.
CO4	Apply file handling and exception handling techniques.
CO5	Create basic Python applications using modular programming.

Mapping with Programme Outcomes CO – PO – PSO

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	1	3	2	2
CO2	3	3	2	2	3	1	3	2	2
CO3	3	3	3	2	3	2	3	3	2
CO4	3	3	3	3	3	2	3	3	3
CO5	3	3	2	3	3	2	3	3	3
Average	3.00	2.80	2.40	2.20	2.80	1.60	3.00	2.60	2.40

Strong - 3 Moderate -2 Weak-1 No Correlation-0

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Mathematics for AI

Title of the Course	Mathematics for AI				
FC	Year I	Semester I	Course Code 25UFCA11	Credits 2	Hours 2

Learning Objectives:

1. Understand and apply linear algebra concepts, including vector spaces, matrices in AI models.
2. Analyze probabilistic models and statistical techniques to handle uncertainty and randomness in AI applications.
3. Implement optimization techniques such as gradient descent, convex optimization.
4. Apply calculus principles in AI, including differentiation for back propagation and integration for probabilistic models.
5. Explore discrete mathematics and graph theory to understand AI algorithms like decision trees, graph neural networks.

Syllabus

Unit I:

Linear Algebra for AI: Definition of vectors, vector norms, dot product, and cross product. Vector spaces, subspaces, basis, dimension. Applications of vector spaces in AI. Types of matrices: diagonal, symmetric, orthogonal, and sparse matrices. Matrix addition, multiplication, and transpose.

Unit II:

Probability and Statistics for AI:
Probability spaces, axioms, conditional probability, Bayes' theorem. Random variables: discrete and continuous. Probability density functions (PDF) and cumulative distribution functions (CDF).

Unit III:

Optimization Techniques for AI: Gradient descent and its variants: Batch, Stochastic, and Mini-batch gradient descent. Momentum-based methods: Nesterov Accelerated Gradient (NAG), RMSProp, Adam optimizer.

Unit IV:

Calculus for AI: Basics of differentiation, chain rule, product rule. Partial derivatives and gradients. Hessian and Jacobian matrices in neural networks. Role of derivatives in neural networks.

Unit V:

Discrete Mathematics and Graph Theory for AI: Graphs, adjacency matrices, and degree distribution. Graph search algorithms: BFS, DFS, Dijkstra's, A*. Applications in social network analysis and knowledge graphs.

Books for Study:

1. S. Kumaresan – *Linear Algebra: A Geometric Approach*, Prentice Hall of India.
2. S.C. Gupta & V.K. Kapoor – *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons.
3. Stephen Boyd &LievenVandenberghe, "Convex Optimization," Cambridge University Press.
4. Christopher M. Bishop, "Pattern Recognition and Machine Learning," Springer.
5. Richard S. Sutton & Andrew G. Barto, "Reinforcement Learning: An Introduction," MIT Press.

Books for Reference:

1. N.P. Bali & Manish Goyal – *A Textbook of Engineering Mathematics*, Laxmi Publications.
2. B.S. Grewal – *Higher Engineering Mathematics*, Khanna Publishers.
3. Sheldon Ross, "Introduction to Probability and Statistics for Engineers and Scientists," Elsevier.
4. Gilbert Strang, "Introduction to Linear Algebra," Wellesley-Cambridge Press.
5. Erwin Kreyszig, "Advanced Engineering Mathematics," Wiley.

Web Resources:

1. https://www.geeksforgeeks.org/machine-learning-mathematics/
2. https://www.w3schools.com/ai/ai_mathematics.asp

Course Outcomes:

Course outcomes: CO	**On completion of this course, the students will be able to:**
CO1	Understand and apply concepts of linear algebra, including matrices, vector spaces, eigenvalues, and SVD in AI models.
CO2	Analyze probability and statistics principles to model uncertainty and randomness in AI.
CO3	Implement optimization techniques, including gradient descent and convex optimization, for AI applications.
CO4	Apply calculus concepts like differentiation, integration, and backpropagation in deep learning models.
CO5	Utilize discrete mathematics and graph theory for AI applications such as search algorithms and Markov models.

Mapping with Programme Outcomes CO – PO – PSO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	3	2	2	3	2
CO2	3	3	2	2	3	3	2
CO3	3	3	3	3	2	3	2
CO4	3	2	3	3	3	3	2
CO5	2	3	2	3	2	2	2
CO6	3	2	3	2	2	3	2
Average	2.80	2.60	2.60	2.60	2.40	1.40	2

Strong - 3 Moderate -2 Weak-1 No Correlation-0

CO/PSO	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3
CO2	3	3	2	3
CO3	3	3	3	3
CO4	3	3	2	3
CO5	3	3	3	3
CO6	3	2	2	3
Average	3.00	2.80	2.40	3.00

Fundamentals of Information Technology

Title of the Course	Fundamentals of Information Technology				
FC	Year I	Semester I	Course Code 25UFCA12	Credits 2	Hours 2

Learning Objectives:

1. Understand the basic concepts and terminology of information technology
2. Be able to identify data storage and its usage
3. Have a basic understanding of personal computers and their operation
4. Get great knowledge of software and its functionalities
5. Understand about operating systems and their uses

Syllabus

Unit I:

Introduction to Computers: Introduction, Definition, Characteristics of computer, Evolution of Computer, Block Diagram of a computer, Generations of Computer, Classification of Computers, Applications of Computer, Capabilities and limitations of computer.

Unit II: Basic Computer Organization: Role of I/O devices in a computer system. Input Units: Keyboard, Terminals and its types. Pointing Devices, Scanners and its types, Voice Recognition Systems, Vision Input System, Touch Screen, and Output Units: Monitors and its types. Printers: Impact Printers and its types. Non-Impact Printers and its types, Plotters, types of plotters, Sound cards, Speakers.

Unit III:

Storage Fundamentals: Primary Vs Secondary Storage, Data storage & retrieval methods. Primary Storage: RAM ROM, PROM, EPROM, EEPROM. Secondary Storage: Magnetic Tapes, Magnetic Disks. Cartridge tape, hard disks, Floppy disks Optical Disks, Compact Disks, Zip Drive, Flash Drives

Unit IV:

Storage: Software and its needs, Types of S/W. System Software: Operating System, Utility Programs Programming Language: Machine Language, Assembly Language, High Level Language their advantages & disadvantages. Application S/W and its types: Word Processing, Spread Sheets Presentation, Graphics, DBMS

Unit V:

Operating System: Functions, Measuring System Performance, Assemblers, Compilers and Interpreters. Batch Processing, Multiprogramming, Multi-Tasking, Multiprocessing, Time Sharing, DOS, Windows, Unix/Linux.

Books for Study:

1. Anoop Mathew, S. Kavitha Murugeshan (2009), "Fundamental of Information Technology", Majestic Books.
2. Alexis Leon, Mathews Leon," Fundamental of Information Technology", 2nd Edition.
3. K Bansal, "Fundamental of Information Technology"

Books for Reference:

1. Bhardwaj Sushil Puneet Kumar, "Fundamental of Information Technology"
2. GG WILKINSON, "Fundamentals of Information Technology", Wiley-Blackwell
3. A Ravichandran , "Fundamentals of Information Technology", Khanna Book Publishing

Web Resources:

- https://testbook.com/learn/computer-fundamentals
- https://www.tutorialsmate.com/2020/04/computer-fundamentals tutorial.html
- https://www.javatpoint.com/computer-fundamentals-tutorial
- https://www.tutorialspoint.com/computer_fundamentals/index.htm
- https://www.nios.ac.in/media/documents/sec229new/Lesson1.pdf

Course Outcomes:

CO No.	Course Outcome (CO)
CO1	Understand and apply concepts of linear algebra, including matrices, vector spaces, eigenvalues, and SVD in AI models.
CO2	Analyze probability and statistics principles to model uncertainty and randomness in AI.
CO3	Implement optimization techniques, including gradient descent and convex optimization, for AI applications.
CO4	Apply calculus concepts like differentiation, integration, and backpropagation in deep learning models.
CO5	Utilize discrete mathematics and graph theory for AI applications such as search algorithms and Markov models.

Mapping with Programme Outcomes CO – PO – PSO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	3	2	2	3	2
CO2	3	3	2	2	3	3	2
CO3	3	3	3	3	2	3	2
CO4	3	2	3	3	3	3	2
CO5	2	3	2	3	2	2	2
CO6	3	2	3	2	2	3	2
Average	2.80	2.60	2.60	2.60	2.40	1.40	2

Strong - 3 Moderate -2 Weak-1 No Correlation-0

CO/PO	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3
CO2	3	3	2	3
CO3	3	3	3	3
CO4	3	3	2	3
CO5	3	3	3	3
CO6	3	2	2	3
Average	3.00	2.80	2.40	3.00

Semester - II

Object Oriented Programming in Java

Title of the Course		Object Oriented Programming in Java					
Course Type		Core - II					
Year	I	Semester	II	Credits	5	Course Code	25UMCA21
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		3	2		--	5	

Learning Objectives:

1. Understand the Fundamentals of Object-Oriented Programming
2. Develop Modular and Reusable Java Programs
3. Implement Exception Handling and File I/O Operations
4. Explore Multithreading and Synchronization
5. Design GUI Applications and Work with Databases

Syllabus

UNIT I:

Introduction to Java and OOPs: Java Essentials, JVM, Java Features, Creation and Execution of Programs, Data Types, Type Conversion, Casting, Conditional Statements, Loops, Branching Mechanism, Classes, Objects, Class Declaration, Abstraction, Polymorphism, Inheritance, Encapsulation, Method Declaration and Invocation, Method Overloading.

UNIT II: 3

Core OOP Principles in Java: Constructors: Parameterized Constructors - Constructor Overloading - Garbage Collection –Static Members - Access Control – Nested of methods – this keyword. Inheritance: Defining Inheritance – Types of Inheritance – Extends Keyword, Overriding methods –super, final keyword, Abstract classes, Interfaces, Abstract Class versus Interfaces. Packages: Creating and Using Packages, Access Protection, Wrapper Classes, String Class, String Buffer Class.

UNIT III:

Exception Handling: Introduction - Limitations of Error handling – Advantages of Exception Handling – Types of Errors – Exception Handling Techniques, User-Defined Exceptions. Multithreading: Creating Threads – Life of a Thread – Defining & Running Thread – Thread Methods – Thread Priority - synchronization – Implementing Runnable Interface – Thread Scheduling.

UNIT IV:

I/O Streams: File – Streams – Advantages – The stream classes – Byte streams – Character streams. Applet: Life cycle – Creating & Executing an Applet – Applet tags in HTML – Parameter tag – Aligning the display – Common Methods Used in Displaying the Output.

UNIT V:

Event Handling: Introduction, Types of Events – Example. AWT: Introduction-Components – Containers - Labels – Buttons – Check Boxes –Radio Buttons – Scroll Bars - Layouts. Database Handling Using JDBC: Introduction, Types of JDBC Drivers, Load the Driver, Establish Connection, Create Statement, Execute Query, Iterate Resultset, Scrollable Resultset, Developing a JDBC Application.

Books for Study:

1. Herbert Schildt – Java the Complete Reference, McGraw Hill, 7th edition.
2. Sachin Malhotra, SaurabhChoudhary, Programming in Java (2e)
3. *Sagayaraj, Denis, Karthick and Gajalakshmi, "Java Programming for Core and advanced learners", Universities Press (INDIA) Private Limited 2018.*
4.

Books for Reference:

1. E. Balagurusamy, "Programming with Java", TataMc-Graw Hill, 5th Edition.
2. Y. Daniel Liang, Introduction to Java Programming (10e)

Web Resources

1. https://developer.mozilla.org/en US/docs/Learn_web_development/Core/Design_for_developers
2. https://www.oreilly.com/library/view/design-for-developers/9781617299476/
3. https://blog.ishandeveloper.com/design-for-devs

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB /NET/UGC – CSIR/GATE/TNPSC/others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Course outcomes	On completion of this course, students will be able to:
CO1	Understand the fundamental principles of Object-Oriented Programming (OOPs), including encapsulation, inheritance, polymorphism, and abstraction.
CO2	Apply OOP concepts to design and implement Java programs using classes, objects, and interfaces.
CO3	Analyze Java programs to optimize code reusability, maintainability, and performance using advanced OOP principles.
CO4	Develop Java applications using exception handling, multithreading, and file handling.
CO5	Evaluate and compare different OOP-based Java design patterns and best practices in software development.

Mapping With Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**3**	**3**	**3**	3	3	3	**3**	3
CO 2	3	3	2	3	2	3	3	2
CO 3	3	2	3	3	3	1	2	3
CO 4	2	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	3	3	1

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Object Oriented Programming in Java Lab

Title of the Course	Object Oriented Programming in Java Lab						
Course Type	Core Lab - II						
Year	I	Semester	II	Credits	4	Course Code	25UMCAL2
Instructional Hours Per week	Lecture	Tutorial		Lab Practice		Total	
	1	-		4		5	

Learning Objectives

1. To introduce the principles of Object-Oriented Programming and their application in Java.
2. To enable students to design and develop software using OOP concepts.
3. To provide practical experience in creating robust and reusable code through Java programming.

Experiments

1. Write a Java program to print Fibonacci series using loops.
2. Write a Java program to check for prime number.
3. Write a Java program to find the factorial of a number using recursion.
4. Write a Java program to demonstrate conditional statements and loops.
5. Write a Java program to demonstrate array operations (1D and 2D arrays).
6. Write a Java program to demonstrate classes and objects.
7. Write a Java program to implement constructor overloading.
8. Write a Java program to implement method overloading and overriding.
9. Write a Java program to demonstrate use of this, super, final, and static keywords.
10. Write a Java program to implement inheritance (single and multilevel).
11. Write a Java program to implement abstract class and interface.
12. Write a Java program to implement multiple inheritance using interfaces.
13. Write a Java program to demonstrate exception handling using try-catch-finally.
14. Write a Java program to create and throw user-defined exception.
15. Write a Java program to create a file, write data, and read it.

Extended Professional Component(is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB /NET/UGC –CSIR/GATE/TNPSC/others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

References

1. Herbert Schildt, *Java: The Complete Reference*, McGraw-Hill, 2018.
2. Cay S. Horstmann and Gary Cornell, *Core Java Volume I–Fundamentals*, Pearson, 2016.
3. Kathy Sierra and Bert Bates, *Head First Java*, O'Reilly Media, 2005.
4. Paul Deitel and Harvey Deitel, *Java: How to Program*, Prentice Hall, 2017.
5. Joshua Bloch, *Effective Java*, Addison-Wesley, 2017.

Course outcomes	On completion of this course, students will be able to:
CO1	Define key Object-Oriented Programming (OOP) concepts and terminology, such as classes, objects, inheritance, and polymorphism.
CO2	Describe how OOP principles are applied in Java to create modular, reusable, and efficient code.
CO3	Implement OOP principles by writing Java programs with classes, methods, and inheritance.
CO4	Analyze code to understand the interaction between objects and evaluate object-oriented design.
CO5	Evaluate different OOP approaches for solving real-world problems effectively.

Mapping With Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**3**	**3**	**3**	3	3	3	**3**	3
CO 2	3	3	2	3	2	3	3	2
CO 3	3	2	3	3	2	1	2	3
CO 4	2	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	3	3	1

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Python for Data Science and Analytics

Title of the Course	Python for Data Science and Analytics						
Course Type	Elective - II						
Year	I	Semester	II	Credits	3	Course Code	25UECA21
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		3	1		-	4	

Learning Objective:

1. To introduce foundational programming concepts using Python.
2. To develop skills in data handling, manipulation, and visualization.
3. To apply Python libraries (NumPy, Pandas, Matplotlib, Seaborn) for analytical tasks.
4. To perform basic statistical and predictive modeling using Python.
5. To build real-world mini-projects in business and financial analytics.

Syllabus

UNIT I:

Introduction to Python Programming: Introduction to Programming and Python Environment : Setting up Python, Jupyter Notebook, Google Colab, Python IDEs (VS Code, Anaconda). Basic Syntax and Data Types: Numbers, Strings, Boolean, Type Conversion, Operators: Arithmetic, Logical, Comparison, Conditional Statements (if, elif, else), Iterative Statements (for, while), Functions and Parameters: Built-in Functions, User-defined Functions, return, Input/Output and File Handling: Reading/Writing Text & CSV Files, Exception Handling: try, except, finally.

UNIT II:

Data Structures & Data Handling: Built-in Data Structures: Lists, Tuples, Dictionaries, Sets, Indexing, Slicing, Nested Structures, Mutability, Aliasing, and Copying, String Manipulation and String Methods, List Comprehensions, Dictionary Comprehensions, Lambda Functions, map(), filter(), reduce(), Working with Date and Time (datetime module), JSON and Dictionary Conversion.

UNIT III:

NumPy and Pandas for Data Analysis: NumPy Library: Arrays, Array Operations, Indexing and Slicing, Mathematical and Statistical Operations, Broadcasting and Vectorized Computation. Pandas Library: Series and Data Frame Objects, Creating, Indexing, Renaming, and Reshaping DataFrames, Filtering, Sorting, Grouping (groupby), Merging, Joining, Concatenation, Handling Missing Data: isnull(), fillna(), dropna(), Importing and Exporting Data (CSV, Excel)

UNIT IV:

Data Visualization & Exploratory Data Analysis: Matplotlib Basics: Line Plot, Bar Chart, Histogram, Scatter Plot, Pie Chart, Customizing Axes, Titles, Labels, Legends. Seaborn Library: Heatmaps, Pairplots, Boxplots, Distribution Plots, Advanced Seaborn Plotting with Categorical Data, Visualizing Trends and Outliers, Plot Aesthetics and Themes Creating Dashboards with Plotly (Optional Advanced Topic), Introdction to Data Storytelling, Basic EDA Case Study (e.g., Sales Data / COVID-19 Data).

UNIT V:

Statistical Analysis & Business Applications: Descriptive Statistics in Python: Mean, Median, Mode, Range, Standard Deviation, Variance, Correlation and Covariance: Pearson, Spearman, Heatmap Representation, Linear Regression using scikit-learn, Training and Testing Data, Model Building, Simple Linear Regression, R^2 Score, Residuals. Business Case Studies: Sales Forecasting, Customer Churn Prediction, Loan Default Prediction, Stock Price Analysis. Capstone Project (Mini): End-to-end project with Data Cleaning, EDA, Visualization, and Predictive Modeling.

Books for Study:

1. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython Author: Wes McKinney
2. Design Patterns in Python Author: Sergei Solntsev
3. Data Science from Scratch: First Principles with Python Author: Joel Grus

Books for References:

1. Python Data Science Handbook: Essential Tools for Working with Data

2. Python for Data Analysis: Data Wrangling with pandas, NumPy, and Jupyter, Third Edition (Grayscale Indian Edition)

Web Resources:

1. https://www.w3schools.com/datascience/ds_python.asp
2. https://www.geeksforgeeks.org/data-science-with-python-tutorial/
3. https://www.geeksforgeeks.org/data-analysis-with-python/

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Course outcomes	**On completion of this course, students will be able to:**
CO1	Understand the fundamental principles of Object-Oriented Programming (OOPs), including encapsulation, inheritance polymorphism, and abstraction.
CO2	Apply OOP concepts to design and implement Java programs using classes, objects, and interfaces.
CO3	Analyze Java programs to optimize code reusability, maintainability, and performance using advanced OOP principles.
CO4	Develop Java applications using exception handling, multithreading, and file handling.
CO5	Evaluate and compare different OOP-based Java design patterns and best practices in software development.

Mapping With Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**3**	**3**	**3**	3	3	3	**3**	3
CO 2	3	3	2	3	2	3	3	2
CO 3	3	2	2	3	2	1	2	3
CO 4	2	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	3	3	1

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Operating Systems

Title of the Course	Operating Systems						
Course Type	Elective - II						
Year	I	Semester	II	Credits	3	Course Code	25UECA22
Instructional Hours per week		Lecture	Tutorial		Lab Practice		Total
		3	1		-		4

Learning Objective:

1. Explain the role, functions, and types of operating systems.
2. Understand process scheduling algorithms such as FCFS, SJF, Round Robin, and Priority Scheduling.
3. Learn memory allocation strategies like paging, segmentation, and virtual memory.
4. Discuss demand paging, page replacement algorithms, and thrashing.
5. Understand file system structures, file allocation methods, and disk scheduling algorithms.

Syllabus:

UNIT I:

Operating System Overview: Introduction-Objectives and functions–Evolution of operating system-Operating System Structure and Operations-System calls – System programs, Operating-System Design and Implementation, Operating-System Debugging.

UNIT II: Process Management:

Processes: Process concept – Process scheduling – Operations on processes – Interprocess communication. Threads: Overview – Multithreading models – Thread issues. CPU Scheduling: FCFS, SJF, Priority, Round robin scheduling. Process synchronization – Critical section problem –Mutex locks – Semaphores, Deadlocks – Avoidance – Prevention – Detection and Recovery.

UNIT III:

Memory Management: Main Memory: Contiguous memory allocation – Segmentation – Paging. Virtual Memory: Demand paging – Page replacement algorithms – Allocation of Frames – Thrashing.

UNIT IV:

Storage Management: Mass Storage Structure: Overview – Disk scheduling and management. File System Storage: File concepts– Directory and disk structure – Sharing and protection. File System Implementation: File system structure– Directory structure – Allocation methods – Free space management.

UNIT V:

I/O Systems and Security: Overview - I/O Hardware - Application I/O Interface - Kernel I/O Subsystem –Transforming 1/0 Requests to Hardware Operations - System Protection: Goals -Domain - Access matrix. System Security: The Security Problem - Threats – Encryption- User Authentication.

Books for Study:

1. Abraham Silberschatz, Peter B Galvin, Greg Gagne, "*Operating System Concepts*", Wiley India Pvt. Ltd 2018, 9 th Edition.

Books for Reference:

1. William Stallings, "*Operating Systems Internals and Design Principles*", Pearson, 2018, 9th Edition.
2. Andrew S. Tanenbaum, Herbert Bos, *"Modern Operating Systems",*Pearson 2014, 4th Edition.
3. RamezElmasri, A Gil Carrick, David Levine, "*Operating Systems A Spiral Approach*", Tata McGraw Hill Edition, 2010.

Web Resources

1. https://www.geeksforgeeks.org/operating-systems/
2. https://www.scaler.com/topics/operating-system/
3. https://www.tutorialspoint.com/operating_system/index.htm
4. https://www.javatpoint.com/operating-system

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Course outcomes: CO	**On completion of this course, the students will be able to:**
CO1	Explain the fundamental concepts and functions of an operating system.
CO2	Implement and analyze process scheduling and synchronization techniques.
CO3	Analyze memory management strategies, including paging, segmentation, and virtual memory.
CO4	Evaluate file systems, disk scheduling algorithms, and access control mechanisms.
CO5	Assess security mechanisms and modern trends in operating system development.

Mapping With Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**3**	**3**	**3**	3	3	3	**3**	3
CO 2	3	3	2	3	2	3	3	2
CO 3	3	2	3	3	3	1	2	3
CO 4	2	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	3	3	1

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Front–End Web Development

Title of the Course		Front–End Web Development					
Paper Number		Skill Enhancement Course - II					
Year	I	Semester	II	Credits	2	Course Code	25USCA21
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		2	-		-	2	

Learning Objectives:

1. Understand the structure and semantics of HTML.
2. Design aesthetically pleasing layouts using CSS.
3. Enhance interactivity on web pages with JavaScript.
4. Build static and responsive websites from scratch.
5. Understand the basics of web hosting and deployment.

Syllabus

UNIT-I:

Introduction to Web Development: What is Web Development? Client-side vs. Server-side. Structure of a Web Page. Introduction to HTML5.Basic Tags: headings, paragraphs, lists, links, images, tables, forms.

UNIT-II:

Styling with CSS: Introduction to CSS. Inline, Internal, and External CSS. Selectors, Colors, Fonts. Box Model: Margin, Padding, Border. Flex box and Grid Layouts. Media Queries & Responsive Design.

UNIT-III:

JavaScript Fundamentals: Introduction to JavaScript. Variables, Data Types, Operators. Control Structures: Conditions and Loops. Functions, Events, and DOM Manipulation. Form validation.

UNIT IV:

Web Page Structure and Best Practices: HTML5 Semantic Tags. Site Navigation and Accessibility. Linking CSS and JavaScript to HTML. Debugging and Console Logging. File structure and project organization.

UNIT-V: Mini Project and Deployment:

Build a static website using HTML, CSS, and JavaScript. Responsive layout using Flexbox/Grid. Host the site using GitHub Pages / Netlify / Vercel. Introduction to version control (Git basics). Website testing and improvement.

Books for Study:

1. HTML and CSS: Design and Build Websites – Jon Ducket
2. Eloquent JavaScript – Marijn Haverbeke
3. Learning Web Design – Jennifer Niederst Robbins

Books for References:

1. Head First HTML and CSS – Elisabeth Robson, Eric Freeman
2. Web Technologies: HTML, JavaScript, PHP, Java, JSP, ASP.NET, XML and Ajax – Uttam K. Roy (Indian author)

Web Resources:

1. https://www.geeksforgeeks.org/front-end-development/
2. https://cloudinary.com/guides/front-end-development/front-end-development-the-complete-guide
3. https://www.w3resource.com/

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Course outcomes CO	On completion of this course, the students will be able to
CO1	Develop working knowledge of HTML
CO2	Learn to Develop Web pages using Hypertext Mark-up Language (HTML).
CO3	Have the ability to optimize page styles and layout with Cascading Style Sheets (CSS).
CO4	Develop PHP programs
CO5	Get knowledge to develop PHP functions

Mapping With Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**3**	**3**	**3**	3	3	3	**3**	3
CO 2	3	3	2	3	2	3	3	2
CO 3	3	2	3	3	3	1	2	3
CO 4	2	3	3	2	3	3	3	3
CO 5	3	3	3	3	3	3	3	1

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Front–End Web Development Lab

Title of the Course	Front–End Web Development Lab						
Course Type	Skill Enhancement Course – III - Lab						
Year	I	Semester	II	Credits	2	Course Code	25USCAL2
Instructional Hours Per week		Lecture	Tutorial		Lab Practice		Total
		-	-		2		2

Learning Objectives

1. To introduce the fundamentals of HTML, CSS, and JavaScript.
2. To build responsive user interfaces using front-end frameworks.
3. To develop form-based web applications with client-side validation.
4. To implement interactive elements and animations using JavaScript.
5. To demonstrate the usage of modern front-end libraries for UI design.

Experiments

1. Create a simple static web page using basic HTML tags.
2. Design a web page layout using HTML5 semantic elements.
3. Develop a personal portfolio page using HTML and internal CSS.
4. Apply external CSS for consistent website styling across pages.
5. Create a multi-column responsive layout using Flexbox.
6. Design a responsive photo gallery using CSS Grid.
7. Develop a navigation bar with dropdown using HTML & CSS.
8. Implement hover effects and transitions in CSS.
9. Create a registration form with HTML and CSS.
10. Implement client-side form validation using JavaScript.
11. Develop a simple JavaScript calculator.
12. Create a digital clock using JavaScript.
13. Build a to-do list using JavaScript DOM manipulation.

14. Add event handling to HTML elements using JavaScript. 15. Create an image slider/carousel using JavaScript. 16. Develop a responsive website using Bootstrap framework. 17. Use Bootstrap components like modals, navbars, and cards. 18. Integrate icons using Font Awesome in a webpage. 19. Build a single-page layout using basic React.js concepts. 20. Create a simple React app with components and state management.	
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/GATE/TNPSC/others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

References

1. Jon Duckett – HTML and CSS: Design and Build Websites, Wiley, 2011.
2. Thomas Powell – JavaScript: The Complete Reference, McGraw-Hill, 2013.
3. Eric Freeman & Elisabeth Robson – Head First HTML and CSS, O'Reilly, 2012.
4. Mark Myers – A Smarter Way to Learn JavaScript, Kindle Edition, 2020.
5. Ethan Brown – Learning React, O'Reilly Media, 2020.

Course outcomes	On completion of this course, students will be able to:
CO1	Know the basic concept in HTML.Concept of resources in HTML
CO2	Know Design concept, Concept of Forms. Understand the concept of save the files
CO3	Understand the page formatting. Concept of CSS
CO4	Creating Links. Know the concept of embedding audio and video in a page.
CO5	Understand the table creation.

Mapping With Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**3**	**3**	**3**	3	3	3	**3**	3
CO 2	3	3	2	3	2	3	3	2
CO 3	3	2	3	3	3	1	2	3
CO 4	2	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	3	3	1

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Semester – III

Data Structures and Algorithms

Title of the Course	Data Structures and Algorithms				
Core III	Year II	Semester III	Course Code 25UMCA31	Credits 5	Hours 5

Learning Objectives:

1. Introduce basic data structures such as arrays, linked lists, stacks, and queues.
2. Introduce algorithm design strategies like divide-and-conquer, dynamic programming, and greedy algorithms.
3. Understand and implement common searching and sorting algorithms.
4. Evaluate time and space complexity for these techniques.
5. Implement traversal algorithms such as BFS, DFS, and shortest path algorithms.

Syllabus

Unit I:

Arrays: Abstract Data Types (ADTs) - List ADT-array-based implementation - Definition - Terminology - One dimensional array - Multi dimensional arrays. Linked lists: Definition - Circular linked lists - Double linked lists - Circular double linked lists.

Unit II:

Stacks: Definition - Representation of a Stack - operations on Stacks - Evaluation of Arithmetic expressions. Queues: Definition – Representation of Queues - various queue structures.

Unit III:

Trees: Basic terminologies - Definition and concepts - Representation of Binary tree - Binary tree traversal. Graph: Definition- Representation of Graph- Types of graph- Breadth first traversal – Depth first traversal-Topological sort- Bi-connectivity – Cut vertex- Euler circuits-Applications of graphs.

Unit IV:

Sorting: Terminologies – Techniques – Bubble sort – Insertion sort – Quick sort – Radix sort – Searching – Terminologies - Linear search with arrays – Binary Search.

Unit V:

Algorithm Development: Basic Steps. Algorithm Design Methods: Sub goals - Hill Climbing - Working Backward - Heuristics - Backtrack Programming – Branch and Bound – Recursion.

Books for Study:

1. Samanta, D. (2009). *Classic Data Structures*, (2nd Ed.). PHI Learning Pvt. Ltd.

2. Goodman, S. E. &Hedetniemi, S. T. (1988). *Introduction to the Design and Analysis of Algorithms*, McGraw Hill International Edition.

3. Ellis Horowitz, E. &Sahni, S. (1985). *Fundamentals of Data Structure*, Galgotia Publications.

Books for References:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education 2014, 4th Edition.

2. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education 2003.

Website and eLearning Sources

1. https://www.programiz.com/dsa

2. https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial

3. https://nptel.ac.in/courses/106106127

Course Outcomes:

CO No.	On completion of this course, students will be able to:
CO1	Explain the fundamental concepts of data structures and their applications.
CO2	Implement searching, sorting, and basic data structures such as arrays, linked lists, stacks, and queues.
CO3	Analyze algorithm efficiency using time and space complexity.
CO4	Implement advanced data structures such as trees and graphs, and perform traversal operations.
CO5	Evaluate and optimize algorithmic performance using different strategies.

Mapping With Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**3**	**3**	**3**	3	3	3	**3**	3
CO 2	3	3	2	3	2	3	3	2
CO 3	3	2	3	3	3	1	2	3
CO 4	2	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	3	3	1

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Data Structures and Algorithms Lab

Title of the Course	Data Structures and Algorithms Lab				
Core Lab III	Year II	Semester III	Course Code 25UMCAL3	Credits 3	Hours 4

Learning Objectives

1. To develop practical skills in implementing fundamental data structures such as arrays, linked lists, stacks, queues, trees, and graphs using a programming language.
2. To understand the applications of various data structures in solving real-world problems efficiently.
3. To apply algorithmic techniques such as recursion, sorting, and searching to build robust and optimized code.
4. To analyze and compare the performance of different data structures and algorithms in terms of time and space complexity.
5. To gain hands-on experience in writing modular, reusable, and maintainable code for solving computational problems.

Course Modules

Experiments
1. Implement linear and binary search. 2. Implement bubble, insertion, and selection sort. 3. Implement merge sort and quick sort. 4. Implement stack using arrays. 5. Implement queue and circular queue using arrays. 6. Implement singly linked list (insert, delete, display). 7. Implement doubly linked list. 8. Stack and queue using linked list. 9. Convert infix to postfix using stack. 10. Evaluate postfix expression using stack. 11. Implement recursion for factorial, Fibonacci, and GCD.

12. Binary tree traversals (inorder, preorder, postorder).
13. Binary Search Tree operations.
14. Graph representation using adjacency list/matrix.
15. Breadth First Search (BFS) and Depth First Search (DFS).
16. Dijkstra's algorithm.
17. Kruskal's and Prim's MST algorithms.
18. Hashing with linear probing and chaining.
19. Heap and heap sort.
20. Topological sort of a DAG.

References

1. "Data Structures and Algorithms in Java" by Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser
2. "Data Structures and Algorithm Analysis in Java" by Mark Allen Weiss
3. "Algorithms, 4th Edition" by Robert Sedgewick and Kevin Wayne
4. "Java Structures: Data Structures in Java for the Principled Programmer" by Duane A. Bailey

Course Outcomes

Course Outcome (CO)	On completion of this course, students will be able to:
CO1	Define key Object-Oriented Programming (OOP) concepts and terminology, such as classes, objects, inheritance, and polymorphism.
CO2	Describe how OOP principles are applied in Java to create modular, reusable, and efficient code.
CO3	Implement OOP principles by writing Java programs with classes, methods, and inheritance.
CO4	Analyze code to understand the interaction between objects and evaluate object-oriented design.
CO5	Evaluate different OOP approaches for solving real-world problems effectively.

Mapping With Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**3**	**3**	**3**	3	3	3	**3**	3
CO 2	3	3	2	3	2	3	3	2
CO 3	3	2	3	3	3	1	2	3
CO 4	2	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	3	3	1

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Applied Statistics

Title of the Course	Applied Statistics				
Elective - III	Year II	Semester III	Course Code 25UECA31	Credits 3	Hours 3

Learning Objectives:

1. Learn basic statistical terminologies, data types, and data collection methods.
2. Compute and interpret mean, median, mode, variance, and standard deviation.
3. Understand probability concepts and different probability distributions.
4. Explore normal, binomial, and Poisson distributions for real-world scenarios.
5. Interpret p-values, confidence intervals, and statistical significance.

Syllabus

Unit I:

Standard distributions in statistics: Review of Probability and Random variables, Binomial distribution, Poisson distribution (mean and variance only) and normal distribution (moments and properties).

Unit II:

Sampling distributions: Review of parameter and statistic, assumptions of sampling distribution, Definitions of Chi-square, T and F statistic, mean and variance of chi-square distribution, Moments of T distribution, Student's T distribution.

Unit III:

Estimation: Point estimation, definition of estimator, unbiasedness of an estimator, unbiased estimator of parameters of binomial, Poisson and normal distributions, consistency of an estimator, sufficient condition for an estimator to be consistent, consistent estimator of parameters of binomial, Poisson and normal distributions
Interval estimation: Shortest length confidence interval for normal parameters.

Unit IV:

Estimation: Critical region, level of significance, p-value, types of errors in hypothesis testing and power of the test, association of attributes, chi-square test for independence of attributes (2X2 and r X s contingency table), chi-square test for goodness of fit, T- Test for single mean.
(Definitions and simple problems only).

Unit V:

Analysis of variance: Definition of ANOVA, layout of one-way and two-way ANOVA, Hypothesis of one-way and two-way ANOVA, ANOVA table for one-way and two-way ANOVA. Examples and Problems only. Non-parametric tests: The Man-Whitney U test for small samples and large samples.

Examples and Problems only.

Books for Study:

1. Gupta, S. CandKapoor, V.K (2007), Fundamentals of Applied Statistics, Sultan Chand and Sons, New Delhi.

2. Gupta, S.CandKapoor, V.K (2002), Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.

3. Gupta, S.P. (2022) Statistical Methods 46th ed, Sultan Chand and Sons, New Delhi.

Books for References:

1. Hogg, R. V., Craig, A. T. and Mckean, J. W. (2005). Introduction to Mathematical Statistics (6th ed.). Pearson Education, Asia

2. Miller, I. and Miller, M. (2006). John E. Freund's Mathematical Statistics with Applications, 7th Ed., Pearson Education, Asia.

Website and eLearning Sources

1. https://vnsgu.ac.in/VNSGU/VNSGU/Free%20Download%20E-Book/Applied%20Statistics.pdf
2. https://researchleap.com/applied-statistics-basic-principles-and-application/

Course Outcomes:

CO No.	On completion of this course, students will be able to:
CO1	Explain the fundamental concepts of statistics and data analysis.
CO2	Compute measures of central tendency and dispersion for dataset interpretation
CO3	Analyze probability distributions and their applications in real-world problems.
CO4	Conduct hypothesis testing and statistical inference for decision-making.
CO5	Apply regression analysis and correlation techniques for predictive modeling.

Mapping With Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**3**	**3**	**3**	3	3	3	**3**	3
CO 2	3	3	2	3	2	3	3	2
CO 3	3	2	3	3	3	1	2	3
CO 4	2	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	3	3	1

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Optimization Techniques

Title of the Course	Optimization Techniques				
Elective - III	Year II	Semester III	Course Code 25UECA32	Credits 3	Hours 3

Learning Objectives

1. Learn the basic principles of optimization, including problem formulation and classification.
2. Understand the role of optimization in decision-making and problem-solving.
3. Study graphical and simplex methods for solving linear programming problems.
4. Understand gradient-based and gradient-free optimization techniques.
5. Apply multi-objective optimization techniques to real-world applications
6. Learn the basic principles of optimization, including problem formulation and classification.
7. Understand the role of optimization in decision-making and problem-solving.
8. Study graphical and simplex methods for solving linear programming problems.
9. Understand gradient-based and gradient-free optimization techniques.
10. Apply multi-objective optimization techniques to real-world applications

Unit	Contents
I	**Introduction to Optimization** Optimization Problem Formulation. Classification of Optimization Problems (Linear, Non-Linear, Discrete, Continuous).Applications of Optimization in Engineering, Management, and Data Science. Convex and Non-Convex Optimization.
II	**Linear Programming and Integer Programming** Formulation of Linear Programming Problems (LPP). Graphical Method and Simplex Method Duality in Linear Programming. Integer Linear Programming (Branch and Bound, Cutting Plane Methods). Applications of Linear Programming in Supply Chain and Finance.

III	**Non-Linear and Constrained Optimization** Unconstrained Optimization: Gradient Descent, Newton's Method. Constrained Optimization: Lagrange Multipliers, Karush-Kuhn-Tucker (KKT) Conditions. Quadratic Programming. Multi-objective Optimization and Pareto Efficiency.
IV	**Advanced Optimization Techniques** Metaheuristic Optimization: Genetic Algorithms, Simulated Annealing, Particle Swarm Optimization. Evolutionary Algorithms and Swarm Intelligence.Stochastic Optimization Methods. Constraint Handling in Metaheuristics.
V	**Optimization and Engineering Applications** Loss Functions, Backpropagation, Hyperparameter Tuning. Operations Research Applications in Scheduling, Transportation, and Resource Allocation. Case Studies: Energy Optimization, Robotics, Financial Modeling.

Books for Study:

1. Optimization for Engineering Design: Algorithms and Examples, Kalyanmoy Deb, 2nd Edition, 2012.
2. Engineering Optimization: Theory and Practice, S. S. Rao, 4th Edition, 2009.
3. An Introduction to Optimization, Edwin K. P. Chong, Stanislaw H. Zak, 4th Edition, 2013.

Books for Reference:

1. Introduction to Optimization: Operations Research, J. C. Pant, 3rd Edition, 2012.
2. Operations Research: An Introduction, H. A. Taha, 9th Edition, 2010.

Course Outcomes:

CO No.	On completion of this course, students will be able to:
CO1	Solve algebraic and transcendental equations using numerical methods.
CO2	Apply interpolation techniques to derive unknown values.
CO3	Compute derivatives and definite integrals using numerical differentiation and integration.
CO4	Solve ordinary differential equations using numerical approaches.
CO5	Implement numerical algorithms using programming tools.

Mapping With Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**3**	**3**	**3**	3	3	3	**3**	3
CO 2	3	3	2	3	2	3	3	2
CO 3	3	2	3	3	3	1	2	3
CO 4	2	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	3	3	1

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Database Management Systems Lab

Title of the Course	Database Management Systems Lab				
Skill Enhancement Course - IV	Year II	Semester III	Subject Code 25USCAL3	Credits 2	Hours 2

Learning Objective:

1. Introduce the fundamental concepts of databases, database management systems (DBMS), and data models.
2. Explain database architecture, database users, and system structures.
3. Learn normalization techniques and functional dependency to improve database efficiency.
4. Explore advanced SQL operations, including joins, subqueries, and stored procedures.
5. Explore SQL databases and their applications

Experiments

1. Create Database & Tables – Create tables with appropriate data types and constraints (PRIMARY KEY, NOT NULL, UNIQUE).
2. Insert Records – Insert multiple records into the created tables.
3. Update & Delete – Perform update and delete operations on table data.
4. Simple SELECT Queries – Retrieve specific columns and rows using SELECT and WHERE.
5. Sorting & Filtering – Use ORDER BY, LIKE, IN, BETWEEN, DISTINCT.
6. Aggregate Functions – Perform queries using COUNT, SUM, AVG, MIN, MAX.
7. GROUP BY & HAVING – Execute queries with grouping and conditions.
8. Joins – Perform INNER JOIN, LEFT JOIN, RIGHT JOIN, and FULL OUTER JOIN.
9. Subqueries – Write nested queries using IN, ANY, ALL, EXISTS.
10. Views – Create, update, and drop views in a database.
11. Constraints – Demonstrate usage of PRIMARY KEY, FOREIGN KEY, CHECK, DEFAULT.

12. Indexing – Create indexes and show query performance improvement.

13. String & Date Functions – Use functions like UPPER (), LOWER (), SUBSTR (), ROUND (), NOW (), DATEADD ().

14. Set Operators – Perform UNION, INTERSECT, and MINUS queries.

15. Transactions – Demonstrate ACID properties using COMMIT, ROLLBACK, and SAVEPOINT.

Books for Study.

1. Silberschatz, A., Henry, F. K. & Sudarshan. (2015). *Database System Concepts*, (6th d.).McGraw-Hill International Edition.

2. Meier, A. & Kaufmann, M. (2019). *SQL & NoSQL Databases,* Springer.

Books for Reference

1. Elmasri, R. & Shamkant, B. N. (2016). *Fundamental of Database Systems, (7th Ed.).* Pearson

2. S. Sumathi, S. Esakkirajan, "*Fundamentals of Relational Database Management System*", Springer International Edition 2007.

3. Alexis Leon & Mathews Leon, "Fundamentals of DBMS", Vijay Nicole Publications 2014, 2nd Edition.

Web Resources

1. https://www.geeksforgeeks.org/rdbms

2. https://intellipaat.com/blog/tutorial/sql-tutorial/rdbms/

3. https://www.geeksforgeeks.org/introduction-to-nosql/

4. https://www.w3schools.com/sql/sql_intro.asp

Course Outcomes:

CO No.	Course Outcome (CO)
CO1	Explain the fundamental concepts, architecture, and functions of DBMS.
CO2	Design an efficient database using ER modeling and normalization techniques.
CO3	Develop and execute SQL queries for data manipulation, retrieval, and management.
CO4	Analyze transaction management, concurrency control, and recovery techniques.
CO5	Evaluate indexing, hashing, and query optimization techniques for performance improvement.

Mapping With Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**3**	**3**	**3**	3	3	3	**3**	3
CO 2	3	3	2	3	2	3	3	2
CO 3	3	2	3	3	3	1	2	3
CO 4	2	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	3	3	1

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Problem Solving through Aptitude

Title of the Course	Problem Solving through Aptitude				
AEC - 1	Year II	Semester III	Subject Code 25UACA31	Credits 2	Hours 2

Learning Objectives:

1. Develop a strong foundation in quantitative aptitude, including number systems, arithmetic, algebra, and data interpretation.
2. Enhance logical reasoning and critical thinking to tackle problems involving patterns, sequences, and puzzles.
3. Improve problem-solving speed and accuracy through shortcut techniques, heuristics, and time management strategies.
4. Apply mathematical and analytical skills to solve real-world business, engineering, and competitive exam problems.
5. Build confidence in handling aptitude-based assessments for job placements, competitive exams, and higher education entrance tests.

Syllabus

Unit -1:

Arithmetic Fundamentals: Introduction to numbers: properties, factors, multiples, and prime numbers. Ratio and proportion. Percentages: growth, decrease, and comparisons. Profit and loss, discounts, and markups. Averages and weighted averages.

Unit – 2:

Algebraic Techniques: Simplification using algebraic identities. Linear and quadratic equations: solving and applications. Progressions: arithmetic and geometric progressions. Surds, indices, and logarithms. Simplifying complex expressions.

Unit - 3:

Time, Work, and Efficiency: Work problems: individual and group efficiency. Time and work with variable efficiency rates. Pipes and cisterns problems. Basics of scheduling and optimization.

Unit –4:

Time, Speed, and Distance: Problems involving trains, boats, and streams. Average and relative speeds. Distance calculations with varying speeds. Problems on circular tracks and races. Real-world applications of speed and distance.

Unit –5:

Geometry and Spatial Reasoning: Basics of lines, angles, and triangles. Area and perimeter of 2D shapes: squares, rectangles, circles, and triangles. Surface area and volume of 3D shapes: cubes, cuboids, cylinders, and spheres. Coordinate geometry basics for computer graphics. Applications in technical problem-solving**.**

Books for Study:

1. R.S. Aggarwal – *Quantitative Aptitude for Competitive Examinations*, S. Chand Publishing (10th Edition, 2020)

2. Rajesh Verma – *Fast Track Objective Arithmetic*, Arihant Publications (2016)

Books for Reference:

1. Sarvesh K. Verma – *Quantitative Aptitude Quantum CAT*, Arihant Publications (2019)

2. Nishit K. Sinha – *The Pearson Guide to Quantitative Aptitude*, Pearson Education (2010)

3. Arun Sharma – *How to Prepare for Quantitative Aptitude for CAT*, Tata McGraw-Hill Education (7th Edition, 2020)

Web Resources:

1. https://www.indiabix.com/

2. https://www.geeksforgeeks.org/aptitude-gq/

3. https://www.careerride.com/

4. https://www.hitbullseye.com/

Course Outcomes:

CO No.	On completion of this course, students will be able to:
CO1	Understand fundamental concepts of quantitative aptitude, including number systems, algebra, percentages, and ratios.
CO2	Apply logical reasoning techniques to solve problems related to sequences, coding-decoding, syllogisms, and puzzles.
CO3	Analyze data interpretation questions involving charts, graphs, and tables to extract meaningful insights.
CO4	Develop problem-solving strategies to improve efficiency and accuracy in aptitude-based assessments.
CO5	Evaluate and optimize time management techniques for competitive exams, job placements, and real-world problem-solving.

Mapping With Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**3**	**3**	**3**	3	3	3	**3**	3
CO 2	3	3	2	3	2	3	3	2
CO 3	3	2	3	3	3	1	2	3
CO 4	2	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	3	3	1

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Semester – IV

Machine Learning

Core Course-CC 7	Machine Learning				
Core - IV	Year II	Semester IV	Course Code 25UMCA41	Credits 5	Hours 5

Learning Objective:

1. Learn basic concepts, types of machine learning and real-world applications.
2. Implement model evaluation techniques, including cross-validation and confusion matrices.
3. Understand clustering techniques such as k-Means and hierarchical clustering.
4. Explore dimensionality reduction methods like PCA and t-SNE.
5. Explore ethical considerations and interpretability in machine learning models.

Syllabus

Unit I:
Introduction: Machine Learning Foundations – Overview – Design of a Learning System – Types of Machine Learning – Supervised Learning and Unsupervised Learning – Applications of Machine Learning – Tools Overview for ML

Unit II: Supervised Learning – I: Simple Linear Regression – Multiple Linear Regression – Polynomial Regression – Ridge Regression – Lasso Regression – Evaluating Regression Models – Model Selection – Bagging – Ensemble Methods.

Unit -III:
Supervised Learning – II: Classification – Logistic Regression – Decision Tree Regression and Classification – Random Forest Regression and Classification – Support Vector Machine Regression and Classification – Evaluating Classification Models.

Unit IV:
Unsupervised Learning: Clustering – K-Means Clustering – Density-Based Clustering – Hierarchical Clustering-Dimension reduction: Principal Component Analysis, Linear Discriminant Analysis.

Unit V:
Modelling and Evaluation: Building the model, training a model, evaluating a model, improving a model. Random Forest Classification, K Means Clustering and Density based Clustering. Performance metrics - accuracy, precision, recall, sensitivity, specificity, AUC, RoC, Bias Variance decomposition.

Books for Study

1. Dutt, S., Chandramouli, S. & Das, A. K. (2019). "*Machine Learning"* Pearson Education
2. EthemAlpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014

Books for Reference

1. Kevin P. Murphy, "*Machine Learning: A Probabilistic Perspective*", MIT Press, 2012
2. Tom Mitchell, "*Machine Learning*", McGraw-Hill, 1997.
3. Raschka, S. &Mirjalili, V.(2019).*Python Machine Learning*, (3rd Ed.). Packt Publishing.
4. Carol Quadros," Machine Learning with python, scikit-learn and Tensorflow", Packt Publishing, 2018

Web Resources

1. https://www.geeksforgeeks.org/machine-learning/
2. https://www.simplilearn.com/tutorials/machine-learning-tutorial
3. https://www.datacamp.com/blog/what-is-machine-learning
4. https://www.techtarget.com/searchenterpriseai/definition/machine-learning-ML

Course Outcomes:

CO No.	On completion of this course, students will be able to:
CO1	Explain the fundamental concepts and types of machine learning.
CO2	Perform data preprocessing and feature engineering for machine learning models.
CO3	Implement supervised learning algorithms for regression and classification problems.
CO4	Apply unsupervised learning techniques for clustering and pattern recognition.
CO5	Evaluate machine learning models using appropriate performance metrics and optimization techniques.

Mapping With Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**3**	**3**	**3**	3	3	3	**3**	3
CO 2	3	3	2	3	2	3	3	2
CO 3	3	2	3	3	3	1	2	3
CO 4	2	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	3	3	1

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Machine Learning Lab

Title of the Course	Lab - Machine Learning				
Core - Lab - 4	Year II	Semester IV	Course Code 25UMCAL4	Credits 3	Hours 4

Learning Objectives

1. Learn basic concepts, types of machine learning and real-world applications.
2. Implement model evaluation techniques, including cross-validation and confusion matrices.
3. Understand clustering techniques such as k-Means and hierarchical clustering.
4. Explore dimensionality reduction methods like PCA and t-SNE.
5. Explore ethical considerations and interpretability in machine learning models.

Experiments

1. **Implement Linear Regression** using scikit-learn.
2. **Implement Multiple Linear Regression** and evaluate performance metrics.
3. **Implement Polynomial Regression** and compare with linear regression.
4. **Implement Logistic Regression** for binary classification.
5. **Implement K-Nearest Neighbors (KNN)** classifier with tuning of K.
6. **Implement Decision Tree Classifier** and visualize the tree.
7. **Implement Random Forest Classifier** and evaluate feature importance.
8. **Implement Support Vector Machine (SVM)** with different kernels.
9. **Implement Naive Bayes Classifier** for text classification.
10. **Implement K-Means Clustering** with elbow method for optimal K.
11. **Implement Hierarchical Clustering** and generate dendrogram.
12. **Implement Principal Component Analysis (PCA)** for dimensionality reduction.
13. **Implement DBSCAN Clustering** and analyze performance on noisy data.
14. **Implement Gradient Descent Optimization** for cost minimization in regression.
15. **Implement Ensemble Methods** like Bagging and AdaBoost.
16. **Implement Cross-Validation Techniques** (K-Fold, Stratified K-Fold).
17. **Train-Test Split and Performance Evaluation** using accuracy, precision, recall, F1-score.
18. **Handle Missing Data and Outliers** using preprocessing techniques.
19. **Feature Scaling and Normalization** using MinMaxScaler and StandardScaler.
20. **Build an End-to-End ML Pipeline** including preprocessing, training, testing, and deployment using sklearn pipeline.

References

1. “Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor Flow” by Aurélien Géron
2. “Python Machine Learning” by Sebastian Raschka and Vahid Mirjalili
3. Machine Learning: A Probabilistic Perspective” by Kevin P. Murphy
4. “Pattern Recognition and Machine Learning” by Christopher M. Bishop

Course Outcomes

Course Outcome (CO)	On completion of this course, students will be able to:
CO1	Explain the fundamental concepts and types of machine learning
CO2	Perform data preprocessing and feature engineering for machine learning models.
CO3	Implement supervised learning algorithms for regression and classification problems.
CO4	Apply unsupervised learning techniques for clustering and pattern recognition.
CO5	Evaluate machine learning models using appropriate performance metrics and optimization techniques.

Mapping With Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**3**	**3**	**3**	3	3	3	**3**	3
CO 2	3	3	2	3	2	3	3	2
CO 3	3	2	3	3	3	1	2	3
CO 4	2	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	3	3	1

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Internet of Things

Title of the Course	Internet of Things				
Elective - IV	Year II	Semester IV	Course Code 25UECA41	Credits 3	Hours 3

Learning Objectives:

1. Learn about IoT components, communication protocols, and AI applications in IoT systems.
2. Understand data acquisition, real-time processing, and AI-powered edge computing techniques.
3. Implement machine learning models for predictive maintenance, anomaly detection, and automation in IoT.
4. Learn about cybersecurity threats, data privacy regulations, and secure AI-driven IoT solutions.
5. Design smart systems in healthcare, agriculture, smart cities, and industrial automation.

Syllabus

Unit I:

Fundamentals of IoT and AI: Introduction to IoT: Architecture, Protocols, and Communication Models. Overview of AI and Machine Learning in IoT.IoT Hardware Platforms: Raspberry Pi, Arduino, ESP32. IoT Communication Protocols: MQTT, CoAP, HTTP, LoRaWAN. Cloud vs. Edge vs. Fog Computing in IoT

Unit II:

IoT Data Analytics and AI Models: Data Acquisition, Storage, and Preprocessing in IoT. AI Models for IoT: Supervised, Unsupervised, and Reinforcement Learning. Real-time Data Processing with Edge AI and TinyML.AI for Sensor Data Fusion and Anomaly Detection. Case Studies: Predictive Maintenance, Smart Grids, and Industrial IoT
Security Challenges in IoT Networks. AI-Powered Threat Detection and Cybersecurity Measures Blockchain for IoT Data Integrity and Security.Data Privacy Regulations (GDPR, PDPB) in AI-IoT Systems. Ethical Concerns in AI-driven IoT Applications

Unit IV:

Cloud and Edge AI for IoT: Cloud Platforms for IoT: AWS IoT, Google Cloud IoT, Microsoft Azure IoT Hub. Edge Computing for Low Latency AI Inference. Federated Learning in IoT Networks. AI Model Deployment on IoT Devices (TensorFlowLite, OpenVINO). Case Studies: AI on Wearables, Smart Cameras, and Connected Vehicles

Unit V:

Applications and Future Trends : Smart Cities and AI-powered Traffic Management. AI-driven Healthcare IoT Systems (Wearables, Remote Patient Monitoring). IoT in Precision Agriculture and Environmental Monitoring. Future of AI-IoT Integration: 6G, Neuromorphic Computing, and Digital Twins. Hands-on Project: Building an AI-powered IoT Prototype

Books for Study:

1. Rajkumar Buyya, Amir Vahid Dastjerdi – *Internet of Things: Principles and Paradigms*, Elsevier (2016)
2. Arshdeep Bahga & Vijay Madisetti – *Internet of Things: A Hands-On Approach*, Universities Press (2014)
3. Milan Milenkovic – *Artificial Intelligence and the Internet of Things*, Springer (2020)

Books for Reference:

1. Bhawani Shankar Chowdhry, Faryal Talpur – *IoT and AI: Technologies, Applications, and Security*, Springer (2023)
2. Sudip Misra, Anandarup Mukherjee, Arijit Roy – *Introduction to IoT*, Cambridge University Press (2021)
3. Satish Kumar Saravanan & Arvind Chandrasekaran – *Edge AI for IoT Applications*, CRC Press (2023)

WEB REFERENCES:

1. https://ocw.mit.edu/
2. https://www.coursera.org/specializations/aiot
3. https://learn.microsoft.com/en-us/azure/iot-fundamentals/
4. https://cloud.google.com/solutions/iot

Course Outcomes:

CO No.	On completion of this course, students will be able to:
CO1	Explain the architecture, communication protocols, and integration of AI with IoT.
CO2	Apply AI techniques for real-time data processing and predictive analytics in IoT.
CO3	AnalyzeIoT security challenges and implement AI-based threat detection.
CO4	Evaluate cloud, edge, and fog computing frameworks for AI-powered IoT applications.
CO5	Design and develop intelligent IoT systems for real-world applications.

Mapping With Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**3**	**3**	**3**	3	3	3	**3**	3
CO 2	3	3	2	3	2	3	3	2
CO 3	3	2	3	3	3	1	2	3
CO 4	2	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	3	3	1

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Networking and Security

Title of the Course	Networking and Security				
Elective - IV	Year II	Semester IV	Course Code 25UECA42	Credits 3	Hours 3

Learning Objectives:

1. To understand the fundamentals of computer networks and layered architecture.
2. To study various transmission media, switching techniques, and protocols.
3. To explore network addressing, routing, and internetworking concepts.
4. To introduce cryptographic techniques and network security measures.
5. To identify threats, vulnerabilities, and strategies for securing networks and data

Syllabus

Unit I:
Introduction to Computer Networks: Network types: LAN, MAN, WAN. Topologies: Bus, Ring, Star, Mesh. OSI & TCP/IP models. Protocols and standards. Transmission media: Guided & unguided

Unit II:

Data Communication and Networking Devices: Switching techniques: Circuit, Packet, and Message switching. Error detection and correction: Parity, CRC, Hamming Code. Multiplexing: TDM, FDM, CDM. Networking devices: Hub, Switch, Router, Gateway, Modem.

Unit -III:
IP Addressing and Routing: IPv4 and IPv6 Addressing. Subnetting and Supernetting. Routing concepts and algorithms: Distance Vector, Link State. Static vs Dynamic Routing (RIP, OSPF, BGP). Network Address Translation (NAT), DHCP, DNS.

Unit IV:

Cryptography and Network Security: Principles of security: Confidentiality, Integrity, Availability. Symmetric and Asymmetric Encryption (AES, DES, RSA). Hash functions: MD5, SHA. Digital signatures and certificates. Key management and authentication protocols

Unit V:
Network Security Tools and Protocols: Firewalls and VPNs. Intrusion Detection and Prevention Systems (IDS/IPS). Wireless security: WEP, WPA, WPA2. Secure protocols: SSL/TLS, HTTPS, SSH, IPsec. Cyber threats and ethical hacking overview

Books for Study

1. Behrouz A. Forouzan – *Data Communications and Networking*
2. William Stallings – *Cryptography and Network Security*
3. Andrew S. Tanenbaum – *Computer Networks*
4. Atul Kahate – *Cryptography and Network Security* (Indian Author)
5. D. Comer – *Internetworking with TCP/IP, Volume 1*

Books for Reference

1. S. Keshav – *An Engineering Approach to Computer Networking*
2. Udaya Shankar – *Foundations of Computer Networking*
3. P.C. Gupta – *Data Communication and Computer Networks*
4. Sanjay Sharma – *Data Communication and Networking*
5. Nina Godbole & Sunit Belapure – *Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*

E-Learning Resources:

1. https://www.tutorialspoint.com/network_security/index.htm
2. https://www.w3schools.com/cybersecurity/cybersecurity_networking.php
3. https://www.geeksforgeeks.org/computer-network-tutorials/

Course Outcomes:

CO No.	On completion of this course, students will be able to:
CO1	Explain the basic concepts and protocols of computer networks.
CO2	Illustrate the working of OSI and TCP/IP models and their layers.
CO3	Analyze network addressing, routing protocols, and subnetting techniques.
CO4	Apply cryptographic algorithms for securing data and communications..
CO5	Evaluate different network security protocols and intrusion detection systems.

Mapping With Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**3**	**3**	**3**	3	3	3	**3**	3
CO 2	3	3	2	3	2	3	3	2
CO 3	3	2	3	3	3	1	2	3
CO 4	2	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	3	3	1

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Full Stack Web Development Lab

Title of the Course	Full Stack Web Development Lab				
Skill Enhancement Course - V	Year II	Semester IV	Course Code 25USCAL4	Credits 2	Hours 2

Learning Objectives:

1. Learn the basics of web technologies, including HTML, CSS, JavaScript, and version control.
2. Understand client-server architecture and web application workflows.
3. Implement RESTful APIs for data communication between front-end and back-end.
4. Understand relational (MySQL, PostgreSQL) and NoSQL (MongoDB) databases.
5. Optimize application performance, security, and scalability.

Experiments

1. **Hello Java Web App** – Create a simple Java program that runs on console & prints "Hello Full Stack".

2. **OOP Concepts** – Implement a Student Management system using classes, objects, inheritance, and polymorphism.

3. **Exception Handling** – Build a program for online order validation with try-catch-finally.

4. **File Handling** – Store and retrieve customer details from a text file.

5. **Collections Framework** – Create a shopping cart using ArrayList, HashMap, and HashSet.
6. **JDBC Basics** – Connect Java application with MySQL and fetch employee records.

7. **CRUD Operations** – Perform Insert, Update, Delete, and Select operations via JDBC.

8. **Prepared Statements** – Prevent SQL Injection by using PreparedStatement in login validation.

9. **Hibernate ORM** – Implement mapping of a Student entity with MySQL using Hibernate.

10. **Hibernate CRUD** – Build CRUD operations for a Product entity using Hibernate annota
11. **HTML + JSP Form** – Create a contact form in HTML and submit data to a JSP file.

12. **AJAX with JSP** – Implement live search suggestion using AJAX + JSP + MySQL.

13. **RESTful API with Spring Boot** – Create a REST API to manage users (GET, POST, PUT, DELETE).

14. **Spring Boot + Thymeleaf** – Build a web app to display employee details using Thymeleaf templates.

15. **Full Stack Mini Project** – Develop an **E-commerce Application**

Books for Study

1. Robin Nixon – Learning PHP, MySQL & JavaScript (O'Reilly)
2. Ethan Brown – Web Development with Node & Express (O'Reilly)
3. Kyle Simpson – You Don't Know JS (O'Reilly)

Books for Reference

1. Subramanya K.V. – *Web Technologies: HTML, JavaScript, PHP, and MySQL* (McGraw-Hill)
2. Kogent Learning Solutions Inc. – *HTML5 Black Book* (Dreamtech Press)
3. Pankaj Sharma – *Full Stack Web Development for Beginners*

Web Resources

1. https://developer.mozilla.org
2. https://www.freecodecamp.org
3. https://www.theodinproject.com
4. https://fullstackopen.com
5. https://www.w3schools.com

Course Outcomes:

CO No.	On completion of this course, students will be able to:
CO1	Explain the fundamental concepts of front-end, back-end, and full-stack development.
CO2	Develop responsive and interactive front-end applications using modern JavaScript frameworks.
CO3	Implement back-end logic and RESTful APIs using server-side frameworks.
CO4	Integrate databases, authentication, and real-time communication into web applications.
CO5	Deploy and optimize full-stack applications with security and performance considerations.

Mapping With Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**3**	**3**	**3**	3	3	3	**3**	3
CO 2	3	3	2	3	2	3	3	2
CO 3	3	2	3	3	3	1	2	3
CO 4	2	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	3	3	1

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Analytical Reasoning and Problem Solving

Title of the Course	Analytical Reasoning and Problem Solving				
AEC - 2	Year II	Semester IV	Course Code 25UACA41	Credit 2	Hours 2

Learning Objectives:

1. Develop strong analytical reasoning skills.
2. Enhance problem-solving abilities through logical and structured approaches.
3. Improve critical thinking and decision-making skills.
4. Foster the ability to interpret and analyze data.
5. Equip students with tools and techniques for solving complex problems.

Syllabus

Unit I:

Logical Reasoning – Basic: Number Systems - Properties of numbers - Divisibility rules - Prime and composite numbers HCF and LCM - Methods to find HCF and LCM - Word problems involving HCF and LCM Ratio and Proportion - Basic concepts and properties - Solving ratio and proportion problems Percentages - Percentage calculations - Profit and loss - Discount and mark-up.

Unit -II:

Data Interpretation: Linear Equations - Solving single and system of linear equations - Applications in word problems. Quadratic Equations - Solving quadratic equations by factorization and formula - Nature of roots. Inequalities - Solving linear and quadratic inequalities - Graphical representation. Simplification and Approximation - Techniques for simplifying expressions - Approximation methods.

Unit -III:

Geometry and Mensuration: Basic Geometric Shapes and Properties - Points, lines, angles, triangles, quadrilaterals, circles - Properties of geometric shapes. Area and Perimeter - Formulas for area and perimeter of various shapes - Word problems. Volume and Surface Area - Formulas for volume and surface area of solids - Practical applications.

Unit IV:

Algebra and Equations: Tables and Charts - Reading and interpreting data from tables - Solving problems using data from tables and charts Graphs (Bar, Line, Pie) - Interpreting bar graphs, line graphs, and pie charts - Drawing conclusions from graphical data Data Sufficiency - Identifying sufficient data to solve problems - Practice problems with data sufficiency.

Unit -V:

Basic Arithmetic: Series and Sequences - Number series, alphabet series, and mixed series - Identifying patterns in sequences Analogies - Word analogies, number analogies - Finding relationships between pairs of words/numbers Classification - Identifying the odd one out - Grouping based on common properties Blood Relations - Solving problems based on family relationships - Drawing family trees

Books for Study:

1. R.S. Aggarwal. *Quantitative Aptitude for Competitive Examinations.* Revised Edition, S. Chand Publishing, 2021.
2. Abhijit Guha. *Quantitative Aptitude for All Competitive Examinations.* 5th Edition, McGraw Hill, 2020.
3. Arun Sharma. *How to Prepare for Quantitative Aptitude for CAT.* 10th Edition, McGraw Hill, 2021.
4. Nishit K. Sinha. *Quantitative Aptitude for Competitive Examinations.* 2nd Edition, Pearson Education, 2019.
5. Dinesh Khattar. *The Pearson Guide to Quantitative Aptitude for Competitive Examinations.* 3rd Edition, Pearson Education, 2018.

Books for References:

1. S.N. Jha. *A Complete Book of Aptitude and Reasoning.* 1st Edition, Arihant Publications, 2022.
2. Rajesh Verma. *Fast Track Objective Arithmetic.* 1st Edition, Arihant Publications, 2018.
3. Dr. R.S. Aggarwal. *A Modern Approach to Verbal & Non-Verbal Reasoning.* Revised Edition, S. Chand Publishing, 2020.
4. Shakuntala Devi. *Puzzles to Puzzle You.* 1st Edition, Orient Paperbacks, 2017.
5. Edgar Thorpe. *Course in Mental Ability and Quantitative Aptitude.* 2nd Edition, McGraw Hill, 2021.

Web Resources:

1. https://testbook.com/reasoning/analytical-reasoning
2. https://www.geeksforgeeks.org/analytical-reasoning-non-verbal-reasoning/
3. https://blogmedia.testbook.com/blog/wp-content/uploads/2021/12/analytical-reasoning-292e7ec0.pdf
4. https://unacademy.com/content/cat/study-material/data-interpretation-and-logical-reasoning/types-of-analytical-reasoning/
5. https://www.lpude.in/SLMs/Master%20of%20Computer%20Applications/Sem_1/DEPEA515_ANALYTICAL_SKILLS-I.pdf

Course Outcomes (CO):

COs	On completion of this course, students will be able to:
CO1	Apply analytical reasoning techniques to solve problems.
CO2	Demonstrate critical thinking in evaluating information and arguments.
CO3	Analyze and interpret data to make informed decisions.
CO4	Analyze data to uncover patterns and trends
CO5	Analyze complex problems to identify underlying issues

Mapping With Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**3**	**3**	**3**	3	3	3	**3**	3
CO 2	3	3	2	3	2	3	3	2
CO 3	3	2	3	3	3	1	2	3
CO 4	2	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	3	3	1

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Semester - V

Operating Systems

Title of the Course		Operating Systems					
Course Type		CORE - V					
Year	III	Semester	V	Credits	4	Course Code	25UMCA51
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		3	2		--	5	

Learning Objectives	
LO1	To acquire the fundamental knowledge of the operating system architecture and components and to know the various operations performed by the operating system.
LO2	Understand the basic working process of an operating system.
LO3	Understand the importance of process and scheduling.
LO4	Understand the issues in synchronization and memory management.
LO5	To acquire the fundamental knowledge of the operating system architecture and components and to know the various operations performed by the operating system.

UNIT	CONTENTS
I	**Introduction:** What Operating system do? – Computer System Operation – Storage Structure - Operating System Structure - Operating System Operation. **System Structures:** Operating System Services – System Calls – System Programs – Operation System Generation- System Boot.
II	**Process Concept:** Process Concept- Process Scheduling – Operation on Processes- Inter Process Communication. **Process Scheduling:** Basic concept-Scheduling criteria- Scheduling algorithm-Multiple Processor Scheduling - Real Time CPU Scheduling.
III	**Synchronization:** Background - The Critical section problem-Peterson's solution - Semaphores – Classic problems of Synchronization. **Dead Locks:** System model-Deadlock Characterization Methods for handling deadlocks- Deadlock Prevention-Deadlock Avoidance-Deadlock detection - Recovery from deadlock.

IV	**Memory Management:** Background–Swapping-Contiguous Memory allocation – Segmentation – paging. Virtual Memory Management: Background - Demand paging -Copy and Write-page replacement.
V	**File System:** File Concept - Access Method - Directory and Disk Structure - File sharing-Protection. **Mass Storage Structure**: Overview of Mass Storage Structure- Disk Structure-Disk Scheduling - Disk Management

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this Course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Texts:

1	A. Silberschatz, and P.B. Galvin., Operating Systems Concepts, 9th Edition, John Wiley & Sons (ASIA) Pte Ltd. ,2012

References Books:

1	William Stallings, Operating System: Internals and Design Principles, Seventh Edition, Prentice-Hall of India, 2012.
2	H.M. Deitel, Operating Systems, Third Edition, Pearson Education Asia, 2011

Web Resources:

1	https://en.wikipedia.org/wiki/Operating_system https://www.geeksforgeeks.org/what-is-an-operating-system/

Course outcomes	On completion of this course, students will be able to:
CO1	Describe the fundamental concepts and techniques of natural language processing.
CO2	Explain the advantages and disadvantages of different NLP technologies and their applicability in different business situations.
CO3	Distinguish among the various techniques, taking into account the assumptions, strengths, and weaknesses of each
CO4	Use NLP technologies to explore and gain a broad understanding of text data.
CO5	Analyze large volume text data generated from arrange of real-World applications. Use NLP methods to perform topic modelling.

Mapping With Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	3	3	3	3	2	3	3	3
CO3	3	2	3	1	3	3	3	2
CO4	3	3	2	3	3	2	3	3
CO5	1	2	3	3	2	3	3	2

Strong (3) Medium (2) Low (1)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3
CO2	3	2	3	1	2
CO3	3	3	3	3	3
CO4	2	3	2	3	2
CO5	3	2	3	3	3

ASP .Net Programming

Title of the Course		ASP .Net Programming					
Course Type		CORE - VI					
Year	III	Semester	V	Credits	4	Course Code	25UMCA52
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		2	2		--	4	

Learning Objectives	
LO1	To identify and understand the goals and objectives of the .NET framework and ASP.NET with C# language.
LO2	To develop ASP.NET Web application using standard controls.
LO3	To implement file handling operations.
LO4	To handles SQL Server Database using ADO.NET.
LO5	To handles SQL Server Database using ADO.NET.

UNIT	CONTENTS
I	Overview of .NET framework: Common Language Runtime (CLR), Framework Class Library- C# Fundamentals: Primitive types and Variables – Operators - Conditional statements -Looping statements – Creating and using Objects – Arrays – String operations.
II	Introduction to ASP.NET - IDE-Languages supported Components -Working with Web Forms – Web form standard controls: Properties and its events – HTML controls -List Controls: Properties and its events.
III	Rich Controls: Properties and its events – validation controls: Properties and its events– File Stream classes - File Modes – File Share – Reading and Writing to files – Creating, Moving, Copying and Deleting files – File uploading.
IV	ADO.NET Overview – Database Connections – Commands – Data Reader - Data Adapter - Data Sets - Data Controls and its Properties – Data Binding.
V	Grid View control: Deleting, editing, Sorting and Paging. XML classes – Web form to manipulate XML files - Website Security – Authentication - Authorization – Creating a Web application.

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Texts:	
1	Svetlin Nakov, Veselin Kolev & Co, Fundamentals of Computer Programming with C#, Faber Publication, 2019.
2	Mathew, Mac Donald, The Complete Reference ASP.NET, Tata McGraw-Hill,2015
References Books:	
1	Herbert Schildt, The Complete Reference C#.NET, TataMcGraw-Hill, 2017.
2	Kogent Learning Solutions, C# 2012 Programming Covers .NET 4.5 Black Book, Dreamtech pres, 2013.
3	Anne Boehm, Joel Murach, Murach's C# 2015, Mike Murach & Associates Inc.2016.
4	DenielleOtey, Michael Otey, ADO.NET: The Complete reference, Mc Graw Hill, 2008.
5	Matthew MacDonald, Beginning ASP.NET 4 in C# 2010, APRESS, 2010.
Web Resources:	
1	https://www.geeksforgeeks.org/introduction-to-net-framework/
2	https://www.javatpoint.com/net-framework

Course outcomes	**On completion of this course, students will be able to:**
CO1	Develop working knowledge of C# programming.
CO2	To develop a software to solve real-world problems using ASP.NET.
CO3	To Work on Various Controls Files.
CO4	To create a web application using Microsoft ADO.NET.
CO5	To develop web applications using XML.

Mapping With Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	3	3	3	3	2	3	3	3
CO3	3	2	3	2	3	3	3	2
CO4	3	3	2	3	3	2	1	3
CO5	1	2	3	3	2	3	3	2

Strong (3) **Medium (2)** **Low (1)**

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3
CO2	2	2	3	1	2
CO3	3	3	3	3	3
CO4	2	3	2	3	2
CO5	3	2	3	3	3

Data Analytics using R

Title of the Course		Data Analytics using R					
Course Type		Core - VII					
Year	III	Semester	V	Credits	4	Course Code	25UMCA53
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		4	1		--	5	

Learning Objectives	
LO1	To understand the problem-solving approaches
LO2	To learn the basic of Big Data
LO3	To learn the basic programming constructs in R Programming
LO4	To use R Programming data structures.
LO5	To do input/output with files in R Programming.

Unit	Contents
I	Big Data: Evolution of Big data, Best Practices for Big data Analytics, Big data characteristics, Validating, The Promotion of the Value of Big Data, Big Data Use Cases, Characteristics of Big Data Applications, A General Overview of High-Performance Architecture, HDFS, Map Reduce And YARN, Map Reduce Programming Model
II	Control Structures: Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes
III	Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations
IV	Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Text Concordance Accessing List Components and Values Applying Functions to Lists, Data Frames, Creating Data Frames, Accessing Data Frames.
V	Factors and Tables: Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables , Extracting a Sub table, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Functions for Statistical Distributions R PROGRAMMING .

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/GATE /TNPSC/others to be solved (To be discussed during the Tutorial hour) Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency Professional Communication and Transferrable Skill
Text Book	1. Seema Acharya and Subhashini Chellappan, "Big Data and Analytics", Wiley India Pvt. Ltd., 2016. 2. Norman Matl off, The Art of R Programming-A Tour of Statistical Software Design, 2011
Reference Books	1. Garrett Grolemund, Hadley Wickham, Hands-On Programming with R: Write Your Own Functions and Simulations , 1st Edition, 2014 2. Roger D.Peng, R Programming for data science, 2012
Web Resources	https://www.simplilearn.com

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	3	3	3	3	2	3	3	3
CO3	3	2	3	1	3	3	3	2
CO4	3	3	2	3	3	2	3	3
CO5	1	2	3	3	2	3	2	2

Strong (3) Medium (2) Low (1)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3
CO2	3	2	3	1	3
CO3	3	3	3	3	3
CO4	2	3	2	3	2
CO5	3	2	3	3	3

ASP.Net Programming Lab

Title of the Course	ASP.Net Programming Lab						
Course Type	CORE – LAB - 5						
Year	III	Semester	V	Credits	3	Course Code	25UMCAL5
Instructional Hours Per week	Lecture	Tutorial		Lab Practice		Total	
	1	-		3		4	

Learning Objectives	
LO1	To develop ASP.NET Web application using standard controls.
LO2	To create rich database applications usingADO.NET.
LO3	To implement file handling operations
LO4	To implement XML classes.
LO5	To utilize ASP.NET security features for authenticating the website.

EXPERIMENTS

1. Create an exposure of Web applications and tools.
2. Implement the Html Controls.
3. Implement the Server Controls.
4. Web application using Web controls.
5. Web application using List controls.
6. Web Page design using Rich control. Validate user input using Validation controls. Working with File concepts.
7. Web application using Data Controls.
8. Data binding with Web Controls.
9. Data binding with Data Controls.
10. Database application to perform insert, update and delete operations.
11. Ticket reservation using ASP.NET controls.
12. Online examination using ASP.NET controls

Extended Professional Component (is apart of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB /NET/UGC – CSIR/GATE/TNPSC/others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	1. Svetlin Nakov, Veselin Kolev & Co, Fundamentals of Computer Programming with C#, Faber publication, 2019... 2. Mathew, Mac Donald, the Complete Reference ASP.NET, Tata McGraw-Hill, 2015.
Reference Books:	1. Herbert Scheldt, The Complete Reference C#.NET, Tata Mc Graw-Hill, 2017. 2. Kogent Learning Solutions, C# 2012 Programming Covers .NET 4.5 Black Book, Dreamtech press, 2013. 3. Anne Boehm, Joel Murach, Murach's C# 2015, Mike Murach& Associates Inc.2016. 4. DenielleOtey, Michael Otey, ADO.NET: The Complete reference, Mc Graw Hill, 2008. 5. Matthew MacDonald, Beginning ASP.NET 4 in C# 2010, APRESS, 2010.
Web resources:	https://alison.com/course/introduction-to-c-plus-plus-programming

Course outcomes: CO	On completion of this course, the students will be able to
CO1	Create web applications and implement various controls
CO2	Create a web page in Rich control.
CO3	Develop knowledge about file handling operations.
CO4	An ability to design database application
CO5	To develop a software to solve real world problems using ASP.NET

Mapping With Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	3	3	2	3	3
CO2	3	3	3	3	2	3	3	3
CO3	3	2	3	1	3	3	3	2
CO4	3	3	2	3	3	2	1	3
CO5	1	2	3	3	2	3	3	2

Strong (3) **Medium (2)** **Low (1)**

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	2	3	1	2
CO3	3	3	3	3	3
CO4	3	3	2	3	2
CO5	1	2	3	3	3

Software Project Management

Title of the Course	Software Project Management						
Course Type	Elective - V						
Year	III	Semester	V	Credits	3	Course Code	25UECA51
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		3	1		-	4	
Learning Objectives							
LO1	To define and highlight importance of software project management.						
LO2	To formulate and define the software management metrics & strategy in managing projects						
LO3	Understand to apply software testing techniques in commercial environment						
LO4	To know about critical chain						
LO5	Analyze the legal issues in software						

UNIT	CONTENTS
I	Introduction to Competencies - Product Development Techniques - Management Skills - Product Development Life Cycle - Software Development Process and models - The SEI CMM - International Organization for Standardization.
II	Managing Domain Processes - Project Selection Models - Project Portfolio Management - Financial Processes - Selecting a Project Team - Goal and Scope of the Software Project -Project Planning - Creating the Work Breakdown Structure - Approaches to Building a WBS - Project Milestones - Work Packages - Building a WBS for Software.
III	Tasks and Activities - Software Size and Reuse Estimating - The SEI CMM - Problems and Risks - Cost Estimation - Effort Measures - COCOMO: A Regression Model - COCOMO II
IV	Project Management Resource Activities - Organizational Form and Structure - Software Development Dependencies - Brainstorming - Scheduling Fundamentals - PERT and CPM - Levelling Resource Assignments - Critical Chain Scheduling.
V	Quality: Requirements – The SEI CMM - Guidelines - Challenges - Quality Function Deployment - Building the Software Quality Assurance - Plan - Software Configuration Management: Principles - Requirements - Planning and Organizing - Tools - Benefits - Legal Issues in Software - Case Study

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	Robert T. Futrell, Donald F. Shafer, Linda I. Safer, "Quality Software Project Management", Pearson Education Asia 2002.
Reference books	1. Pankaj Jalote, "Software Project Management in Practice", Addison Wesley 2002. 2. Hughes, "Software Project Management", Tata McGraw Hill 2004, 3rd Edition.
Web Resources	NPTEL & MOOC courses titled Software Project Management www.smartworld.com/notes/software-project-management

Course outcomes: CO	**On completion of this course, the students will Be able to:**
CO1	Understand the principles and concepts of project management
CO2	Knowledge gained to train software project managers
CO3	Apply software project management methodologies.
CO4	Able to create comprehensive project plans.
CO5	Evaluate and mitigate risks associated with software development process

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	3	3	3	3	2	3	3	3
CO3	3	2	3	2	3	3	3	2
CO4	3	3	2	3	3	2	1	3
CO5	1	2	3	3	2	3	3	2

Strong (3) **Medium (2)** **Low (1)**

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3
CO2	2	2	3	1	2
CO3	3	3	3	3	3
CO4	2	3	2	3	2
CO5	3	2	3	3	3

MOOCs on SWAYAM

Title of the Course	**MOOCs on SWAYAM**						
Course Type	**Elective - V**						
Year	**III**	**Semester**	**V**	**Credits**	**3**	**Course Code**	**25UECA52**
Instructional Hours per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		3	**1**		**-**	**4**	

AI and its Applications

Title of the Course	AI and its Applications						
Course Type	Elective - VI						
Year	III	Semester	V	Credits	3	Course Code	25UECA53
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		3	1		-	4	

Learning Objectives	
LO1	Understand AI Concepts and Industry-Specific Applications
LO2	Explore Data Processing and AI Model Deployment
LO3	Analyze AI-Powered Decision-Making and Automation
LO4	Examine AI Ethics, Regulations, and Challenges
LO5	Design and implement AI-driven applications tailored to real-world industry needs.

UNIT	CONTENTS
I	Introduction to Artificial Intelligence: Artificial Intelligence, How Does AI Work?, Advantages and Disadvantages of Artificial Intelligence, History of Artificial Intelligence, Types of Artificial Intelligence, Weak AI, Strong AI.
II	Machine Intelligence: Defining Intelligence, Components of Intelligence, Differences Between Human and Machine Intelligence, Agent and Environment, Search, Uninformed Search Algorithms, Informed Search Algorithms: Pure Heuristic Search, Best-First Search Algorithm (Greedy Search).
III	Introduction to Prompt Engineering, Introduction to Prompt Engineering, The Evolution of Prompt Engineering, Types of Prompts, How Does Prompt Engineering Work?, Comprehending Prompt engineering's Function in Communication, The Advantages of Prompt Engineering, The Future of LLM Communication. Prompts for Creative Thinking: Introduction, Unlocking Imagination and Innovation. Prompts for Effective Writing: Introduction, Igniting the Writing Process with Prompts.
IV	Trends in AI: AI and Ethical Concerns, AI as a Service (AIaaS), Recent trends in AI, Expert System, Internet of Things, Artificial Intelligence of Things (AIoT).
V	Industrial Applications of AI: Application of AI in Healthcare, Application of AI in Retail, Application of AI in Agriculture, Application of AI in Education, Application of AI in Transportation, AI in Experimentation and Multi- disciplinary research.

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the a bove topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	1. Reema Thareja, Artificial Intelligence: Beyond Classical AI, Pearson Education, 2023. 2. Ajantha Devi Vairamani and Anand Nayyar, Prompt Engineering: Empowering Communication, 1st Edition, CRC Press, Taylor & Francis Group, 2024. (DOI: https://doi.org/10.1201/9781032692319). 3. Saptarsi Goswami, Amit Kumar Das and Amlan Chakrabarti, "AI for Everyone – A Beginner's Handbook for Artificial Intelligence", Pearson, 2024
Reference books	1. B. V. Ravindran – Introduction to Machine Learning and AI Applications, McGraw Hill India (2020) 2. Parag Kulkarni – Artificial Intelligence: Building Intelligent Systems, PHI Learning (2020) 3. Dr. N. Gupta – AI and Industry 4.0: Applications and Challenges, Wiley India (2020).
Web Resources	1. https://ocw.mit.edu/ 2. https://www.coursera.org/learn/ai-for-everyone 3. https://cloud.google.com/solutions/ai 4. https://www.microsoft.com/en-us/ai/ai-business-school 5. https://aimi.stanford.edu/

Course Outcomes:

Course outcomes: CO	On completion of this course, the students will be able to:
CO1	Explain AI techniques and their role in different industries.
CO2	Apply AI models to industry-specific problems in healthcare, finance, and manufacturing.
CO3	Analyze AI-powered decision-making systems and automation techniques in various sectors.
CO4	Evaluate ethical, security, and regulatory challenges in AI applications across industries.
CO5	Design and develop AI-driven solutions tailored for real-world industry needs.

Mapping With Programme Outcomes and Programme Specific Outcomes

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	**3**	**2**	**3**	**2**	**2**	**1**	**3**	**2**	**2**
CO2	**3**	**3**	**2**	**2**	**3**	**1**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**
CO4	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**2**
CO5	**2**	**3**	**2**	**3**	**2**	**1**	**3**	**3**	**3**
Average	**2.80**	**2.60**	**2.60**	**2.60**	**2.40**	**1.40**	**3.00**	**2.80**	**2.40**

Strong (3) **Medium (2)** **Low (1)**

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Machine Learning

Title of the Course	**Machine Learning**						
Course Type	**Elective - VI**						
Year	**III**	**Semester**	**V**	**Credits**	**3**	**Course Code**	**25UECA54**
Instructional Hours per week		**Lecture**		**Tutorial**	**Lab Practice**	**Total**	
		3		**1**	**-**	**4**	

Learning Objectives	
LO1	To Learn about Machine Intelligence and Machine Learning applications
LO2	To implement and apply machine learning algorithms to real-world applications
LO3	To identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems
LO4	To create instant based learning
LO5	To apply advanced learning

UNIT	**CONTENTS**
I	Introduction- Machine Learning - Relationship Between AI, Machine Learning and Deep Learning - Machine learning vs big data - Scope of Machine Learning - Applications of Machine Learning - Key terminology - How to choose the right algorithm - Steps in developing a machine learning application -Types of Machine Learning - Parametric and non-parametric models.
II	Introduction - Linear Regression - Logistic Regression - Bayesian Learning - Naïve Bayes classifier - K-Nearest Neighbour (KNN) - Why do we need a K-NN Algorithm? **–** How does KNN work - Support Vector Machines (SVM) - Decision Tree - How does a Decision Tree work?
III	Introduction– K-means Clustering – Association Rule Mining – Apriori Algorithm- FP Growth – How does FP-Growth work – DBSCAN – How does DBSCAN work - DBSCAN Key Concepts and Parameters- Hierarchical Clustering - Why hierarchical clustering matters in machine learning - Hierarchical vs K-Means clustering.
IV	Concept Learning – Maximum Likelihood Estimation – Minimum Description Length Principle – EM Algorithm - Gibbs Algorithm – Mistake Bound Model. Instance based learning – Radial Basis Functions – Case-Based Learning Recommendation systems – Opinion mining – Sequential Covering Algorithm – First Order Rules - Explanation Base Learning – FOCL Algorithm - Reinforcement Learning - Q-Learning – Temporal Difference Learning.

V	Biological and Artificial Neural networks – Basic Building Blocks of Neural Networks– Perceptrons – Multilayer Perceptron - Back Propagation Networks. **Genetic Algorithms (GA)** – Basic terminologies - General genetic algorithm – Operators in GA.

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	1. Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013. 2. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning" 2015, MIT Press.
Reference books	1. Ethem Alpaydin, —Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004. 2. Stephen Marsland, —Machine learning: An Algorithmic Perspective, CRC Press, 2009.
Web Resources	1. https://www.learnovita.com/machine-learning-algorithms-for-data-science-tutorial 2. https://www.aionlinecourse.com/tutorial/machine-learning?utm_source=chatgpt.com 3. https://medium.com/data-science/comparative-study-on-classic-machine-learning-algorithms-24f9ff6ab222?utm_source=chatgpt.com https://scikit-learn.org/

Course Outcomes:

Course outcomes: CO	On completion of this course, the students will be able to:
CO1	Understand machine learning concepts.
CO2	Analyze supervised machine learning algorithm.
CO3	Analyze unsupervised machine learning algorithm.
CO4	Learn advanced topics on Machine Learning
CO5	Understand the concept of Neural Network and Genetic Algorithm

Mapping With Programme Outcomes and Programme Specific Outcomes

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	**3**	**2**	**3**	**2**	**2**	**1**	**3**	**2**	**2**
CO2	**3**	**3**	**2**	**2**	**3**	**1**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**
CO4	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**2**
CO5	**2**	**3**	**2**	**3**	**2**	**1**	**3**	**3**	**3**
Average	**2.80**	**2.60**	**2.60**	**2.60**	**2.40**	**1.40**	**3.00**	**2.80**	**2.40**

Strong (3) Medium (2) Low (1)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Enhancing the Programming Skills

Title of the Course	Enhancing the Programming Skills						
Course Type	Ability Enhancement Course – III						
Year	III	Semester	V	Credits	2	Course Code	25UACA51
Instructional Hours per week		Lecture		Tutorial	Lab Practice	Total	
		2		-	-	2	

Learning Objectives	
LO1	To understand the character set and different data types in C
LO2	To learn the different condition and branching
LO3	To learn arrays and Functions
LO4	To explore Pointers
LO5	To understand about structures and unions

UNIT	CONTENTS
I	**Overview of C:** Overview of C - Structure of a C program – Data types – Declarations – operators – Expressions – Type conversions – Built-in functions.
II	**Control and Branching** : Data Input and Output – Control statements: IF, ELSE-IF, GOTO, SWITCH, WHILE-DO, DO-WHILE, FOR, BREAK and CONTINUE.
III	**Arrays and Functions:** Arrays: Defining and processing Arrays – Multidimensional arrays –String functions – String Manipulation. Functions: Defining and Accessing Arguments – recursive functions – call by value, call by reference, storage classes –character arrays and string functions.
IV	**Pointers:** Pointers –Defining and Declaration of Pointers – Operations on pointers – pointers to functions – Pointer and strings –array of pointers – pointer expressions.
V	**Structures and Unions:** Structure and Unions: Defining, giving values to members, initialization and comparison of structure variables, arrays of structures –structures and pointers – unions.

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	"Programming in C" – E.Balagurusamy – Fifth Edition, Tata McGraw Hill Publications.
Reference books	1. "Programming with C" – Byron S.Gottfried – Schaum's outline series – Tata McGraw Hill Publications. 2. "Let Us C "– Kanetkar.Y, Eighteenth Edition, BPB Publications, 2021. 3. "A first course in Programming with C" – T.Jeyapoovan, Vikas Publishing Hous Pvt. Ltd., New Delhi.
Web Resources	https://www.codechef.com/learn/course/c

Course outcomes CO	**On completion of this course, the students will be able to**
CO1	Understand the usage of data types, variables, operators and expressions
CO2	Analyse the conditional and branching statements
CO3	Create own arrays and user defined functions
CO4	explore Pointers
CO5	Work with Union, Structures

Mapping With Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	2	3
CO2	3	3	3	3	2	3	3	3
CO3	3	2	3	2	3	3	3	2
CO4	3	3	2	3	3	2	2	3
CO5	1	2	3	3	2	3	3	2

Strong (3) **Medium (2)** **Low (1)**

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3
CO2	2	2	3	1	2
CO3	3	3	3	3	3
CO4	2	3	2	3	2
CO5	3	2	3	3	3

Personality Development

Title of the Course		Personality Development			
Course Type		Indian Knowledge System (IKS)			
Course Code		25UPDT51			
Year	III	Semester	V	Credits	2

Instructional Hours Per week	Lecture	Tutorial	Lab Practices	Total
	1	1	--	2

UNIT – I

Personality - Definition – Determinants – Personality Traits –Theories of Personality – Importance of Personality Development. Self-Awareness – Meaning – Benefits of Self – Awareness – Developing Self – Awareness. Swot – Meaning – Importance- Application – Components. Goal Setting Meaning-Importance – Effective goal setting – Principles of goal setting – Goal setting at the Right level.

UNIT – II

Self-Monitoring – Meaning – High self – monitor versus low self-monitor – Advantages and Disadvantages self-monitor- Self –monitoring and job performance. Perception- Definition- Factor influencing perception-Perception process –Errors in perception – Avoiding perceptual errors. Attitude – Meaning- Formation of attitude – Types of attitude - Measurement of Attitudes – Barriers to attitude change – Methods to attitude change. Assertiveness - Meaning – Assertiveness in Communication – Assertiveness Techniques – Benefits of being Assertive – Improving Assertiveness.

UNIT – III

Team Building – Meaning – Types of teams – Importance of Team building-Creating Effective Team. Leadership – Definition – Leadership style- Theories of leadership – Qualities of an Effect leader. Negotiation Skills – Meaning – Principles of Negotiation – Types of Negotiation – The Negotiation Process – Common mistakes in Negotiation process. Conflict Management – Definition-Types of Conflict- Levels of Conflict – Conflict Resolution – Conflict management.

UNIT –IV

Communication – Definition – Importance of communication – Process of communication - Communication Symbols – Communication network – Barriers in communication – Overcoming Communication Barriers. Transactional Analysis – Meaning – Ego States – Types of Transactions – Johari Window- Life Positions. Emotional Intelligence- Meaning – Components of Emotional Intelligence- Significance of managing Emotional intelligence – How to develop Emotional Quotient. Stress Management – Meaning – Sources of Stress – Symptoms of Stress – Consequences of Stress – Managing Stress

UNIT – V

Social Graces – Meaning – Social Grace at Work – Acquiring Social Graces. Table Manners – Meaning – Table Etiquettes in Multicultural Environment- Do's and Don'ts of Table Etiquettes. Dress Code – Meaning- Dress Code for selected Occasions – Dress Code for an Interview. Group Discussion – Meaning – Personality traits required for Group Discussion- Process of Group Discussion- Group Discussion Topics. Interview – Definition- Types of skills – Employer Expectations –Planning for the Interview – Interview Questions- Critical Interview Questions.

References:

1. Dr.S. Narayana Rajan, Dr. B. Rajasekaran, G. Venkadasalapthi, V. Vijuresh Nayaham and Herald M.Dhas, **Personality Development**, Publication Division, Manonmaniam Sundaranar University, Tirunelveli
2. Stephan P.Robbins, **Organisational Behaviour**, Tenth Edition, Prentice Hall of India Private Limited, New Delhi,2008
3. Jit S. Chandan, **Oragnisational Behaviour**, Third Edition, Vikas Publishing House Private Limited, 2008
4. Dr.K.K. Ramachandran and Dr.K.K. Karthick, **From Campus to Corporate**, Macmillan Publishers India Limited, New Delhi, 2010.

Semester - VI RDBMS with PL/SQL

Title of the Course		RDBMS with PL/SQL					
Course Type		CORE - VIII					
Year	III	Semester	VI	Credits	5	Course Code	25UMCA61
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		3	2		--	5	

Learning Objectives	
LO1	Describe basic concepts of database system
LO2	Design a Data model and Schemas in RDBMS
LO3	Competent in use of SQL
LO4	Analyze functional dependencies for designing robust Database
LO5	Describe basic concepts of database system

UNIT	CONTENTS
I	**Introduction to DBMS:** Data and Information - Database – Database Management System – Objectives - Advantages. ER Model: Building blocks of ER Diagram – Relationship Degree – Classification – ER diagram to Tables – ISA relationship – Constraints – Aggregation and Composition – Advantages
II	**Relational Model:** CODD's Rule- Relational Data Model -Key-Integrity– Relational Algebra Operations – Advantages and limitations – Relational Calculus – Domain Relational Calculus - QBE.
III	**Structure of Relational Database**: Introduction to Relational Database Design - Objectives – Tools – Redundancy and Data Anomaly – Functional Dependency - Normalization – 1NF – 2NF – 3NF – BCNF. Transaction Processing – Database Security.
IV	**SQL:** Commands – Data types – DDL - Selection, Projection, Join and Set Operations – Aggregate Functions – DML – Modification - Truncation - Constraints – Subquery.
V	**PL/SQL:** Structure - Elements – Operators Precedence – Control Structure – Iterative Control - Cursors - Procedure - Function - Packages – Exceptional Handling - Triggers.

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC/others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts:	
1	S. Sumathi, S. Esakkirajan, "Fundamentals of Relational Database Management System", Springer International Edition 2007.
References Books:	
1	Abraham Silberchatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw Hill 2019, 7th Edition.
2	Alexis Leon & Mathews Leon, "Fundamentals of DBMS", Vijay Nicole Publications 2014, 2nd Edition.
Web Resources:	
1	NPTEL & MOOC courses titled Relational Database Management Systems
2	https://nptel.ac.in/courses/106106093/
3	https://nptel.ac.in/courses/106106095/

Course outcomes	On completion of this course, students will be able to:
CO1	Understand the basic concepts of database system
CO2	Design a Data model and Schemas in RDBMS
CO3	Competent in use of SQL
CO4	Analyze functional dependencies for designing robust Database
CO5	Understand basic concepts of database system

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	2	3
CO2	3	3	3	3	2	3	3	3
CO3	3	2	3	2	3	3	3	2
CO4	3	3	2	3	3	2	2	3
CO5	1	2	3	3	2	3	3	2

Strong (3) **Medium (2)** **Low (1)**

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3
CO2	3	2	3	1	2
CO3	3	3	3	3	3
CO4	2	3	2	3	2
CO5	3	2	3	3	3

Image Processing

Title of the Course		Image Processing					
Course Type		CORE - IX					
Year	III	Semester	VI	Credits	4	Course Code	25UMCA62
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		3	2		--	5	

Learning Objectives	
LO1	To learn fundamentals of digital image processing.
LO2	To learn about various 2D Image transformations
LO3	To learn about various image enhancement processing methods and filters
LO4	To learn about various classification of image segmentation techniques
LO5	To learn about various image compression techniques

UNIT	CONTENTS
I	Introduction & Fundamentals: Definition of image and Digital image processing - Examples of Digital image processing- Fundamental steps in Digital image processing- Components of image processing system- Image acquisition- A simple image model- Zooming and shrinking of digital image.
II	Image enhancement in spatial domain: Introduction- Mathematical analysis of enhancement in spatial domain- Basic gray level transformation- Histogram processing- Histogram equalization - Histogram matching- Image enhancement using arithmetic and logical operation- Basic transformation- Basics of spatial filtering- Image enhancement infrequency domain: One dimensional fourier transform and its inverse- Two dimensional fourier transform and its inverse- Basics of filtering in frequency domain- Homomorphic filtering.
III	Color image processing: Introduction- Advantages of Color image processing- Categories of Color image processing- Color fundamentals- Primary colors - Secondary colors- Primary and secondary colors for pigments- Characteristics that are used for differentiating different colors- Color models- conversion between color models- Pseudo color image processing- Color transformation- Color image smoothing and sharpening- Color segmentation.

IV	Image Compression: Introduction-Mathematical analysis- Types of data redundancies- Image compression model - Compression strategies- Morphological Image processing: Introduction- Basic concept of set theory- Logic operations involving binary images- Dilation and erosion- opening and closing
V	Feature extraction and image segmentation: Introduction- Classification of features- Features of an image - Attributes of features- Complete process of feature extraction -Image segmentation - Thresholding- Region based segmentation.

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Texts:

Digital image processing – Abhishek and Poonam Yadav-university science press

References Books:

1. "The Handbook of Digital Imaging" by H. H. Arnold and J. W. Willson- **Edition**: 1st Edition
2. "Fundamentals of Digital Image Processing" by Anil K. Jain **Edition**: 1st Edition

Web Resources:

1. https://www.geeksforgeeks.org/digital-image-processing-basics
2. https://www.javatpoint.com/digital-image processing-tutorial

Course outcomes	On completion of this course, students will be able to:
CO1	Understand the fundamental concepts of digital image processing
CO2	Understand various 2D Image transformations
CO3	Understand image enhancement processing techniques and filters
CO4	Understand the classification of Image segmentation techniques
CO5	Understand various image compression techniques

Mapping With Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	2	3
CO2	3	3	3	3	2	3	3	3
CO3	3	2	3	2	3	3	3	2
CO4	3	3	2	3	3	2	2	3
CO5	1	2	3	3	2	3	3	2

Strong (3) **Medium (2)** **Low (1)**

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3
CO2	2	3	3	1	3
CO3	3	3	3	3	3
CO4	3	3	2	3	2
CO5	3	2	3	3	3

RDBMS with PL/SQL Lab

Title of the Course	RDBMS with PL/SQL Lab						
Course Type	CORE - LAB - 6						
Year	III	Semester	VI	Credits	3	Course Code	25UMCAL6
Instructional Hours Per week		Lecture	Tutorial		Lab Practice		Total
		1	-		4		5
Learning Objectives							
LO1	To enable the students to learn the designing of data base systems, foundation on the Relational model of data and normal forms.						
LO2	To understand the concepts of data base management system, design simple Database models						
LO3	To learn and understand to write queries using SQL, PL/SQL.						
LO4	To enable the students to learn DML.						
LO5	To understand the concepts of Cursor						

EXPERIMENTS

1. **DDL Commands**
2. **DML Commands**
3. **TCL Commands**
4. **Fibonacci Series**
5. **Factorial**
6. **String Reverse**
7. **Sum Of Series**
8. **Trigger**
9. **Student Mark Analysis Using Cursor**
10. **Library Management System**

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB /NET/UGC – CSIR/GATE/TNPSC/others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	Coronel, Morris, Rob, "Database Systems, Design, Implementation and Management", Ninth Edition. Nilesh Shah, "Database Systems Using Oracle", 2nd edition, Pearson Education India,2016
Reference Books:	Abraham Silberschatz, Henry F.Korth and S.Sudarshan,"Database System concepts", McGraw Hill International Publication ,VI Edition Shio Kumar Singh , "Database Systems ",Pearson publications , II Edition
Web resources:	Web resources from NDL Library, E-content from open-source libraries

Course outcomes	On completion of this course, students will be able to:
CO1	Understand the various basic concepts of Data Base System. Difference between file system and DBMS and compare various data models.
CO2	Define the integrity constraints. Understand the basic concepts of Relational Data Model, Entity Relationship Model.
CO3	Design database schema considering normalization and relationships within database. Understand and construct database using Structured Query.
CO4	Classify the different functions and various join operations and enhance the Knowledge of handling multiple tables.
CO5	Learn to design data base operations and implement using PL/SQL programs.

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	3	3	2	3	3
CO2	3	3	3	3	2	3	3	3
CO3	3	2	3	1	3	3	3	2
CO4	3	3	2	3	3	2	1	3
CO5	1	2	3	3	2	3	3	2

Strong (3) **Medium (2)** **Low (1)**

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	2	3	1	2
CO3	3	3	3	3	3
CO4	3	3	2	3	2
CO5	1	2	3	3	3

Project with Viva Voce

Title of the Course	Project with Viva Voce						
Course Type	Project - 1						
Year	III	Semester	VI	Credits	3	Course Code	25UMCAP1
Instructional Hours Per week		Lecture	Tutorial		Lab Practice		Total
		-	-		5		5

Students will take a specific problem with a front- end and back-end (involving Database Connectivity) for the project and solve it and submit a report. Further each student will participate in regular project review with project guide/faculty.

Sample Projects

- E-commerce platform where a customer can register and buy a product
- Bus/Train Reservation system
- Store/Insurance Management system Courier service system
- Library Management system etc.,

Project with Viva voce- Individual or group of maximum three members-Project report should be submitted for external evaluation.

Internal 50 marks, External 50 marks.

Robotics and Its Applications

Title of the Course	**Robotics and Its Applications**						
Course Type	**Elective - VII**						
Year	**III**	**Semester**	**VI**	**Credits**	**3**	**Course Code**	**25UECA61**
Instructional Hours per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		2	**2**		**-**	**4**	

Learning Objectives	
LO1	To understand the robotics fundamentals.
LO2	To understand the sensors and matrix methods
LO3	To understand the Programming language ROS
LO4	To study about the applications of robotics
LO5	To learn about the future trends of robotics

UNIT	CONTENTS
I	**Introduction to Robotics:** Definition and history of robotics - Types of robots (industrial, mobile, service, etc.) - Key components of a robot: sensors, actuators, controllers - Overview of applications in various industries.
II	**Robotic Hardware:** Actuators: electric motors, servos, and pneumatic systems - Sensors: types and applications (proximity, vision, tactile, etc.) - Microcontrollers and processors in robotics - Design and construction of robotic systems.
III	**Robot Programming:** Programming languages for robotics: Python, C++, ROS (Robot Operating System) - Basics of ROS: nodes, topics, services - Writing and executing basic robot programs - Simulation tools: Gazebo, V-REP
IV	**Applications of Robotics:** Industrial automation and manufacturing - Robotics in healthcare: surgery, rehabilitation, assistive robots - Service robotics: domestic robots, logistics, customer service - Robotics in entertainment: animatronics, gaming, VR.
V	**Ethics and Future Trends:** Ethical considerations in robotics - Legal and societal implications - Future trends: AI in robotics, collaborative robots (cobots), swarm robotics - Case studies of emerging robotic technologies.

Extended Professional Component (is a part of internal component only, Not to be included inthe External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	1. Introduction to Robotics: Mechanics and Control, John J. Craig 2. Robotics: Modelling, Planning and Control, Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, and Giuseppe Oriolo 3. Robot Programming: A Guide to Controlling Autonomous Robots, Cameron Hughes and Tracey Hughes
Reference books:	Learning ROS for Robotics Programming, Enrique Fernandez, Aaron Martinez, and Luis Sanchez
Web Resources	https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.m https://www.geeksforgeeks.org/robotics-introduction/

Course outcomes: CO	On completion of this course, the students will be able to:
CO1	Understand the basics of Robotics.
CO2	Know about the robotics hardware.
CO3	Develop the basic robot programs.
CO4	Learn the areas where the robotics can be used.
CO5	Know the future trends of the robotics.

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	2	3
CO2	3	3	3	3	2	3	3	3
CO3	3	2	3	2	3	3	3	2
CO4	3	3	2	3	3	2	2	3
CO5	1	2	3	3	2	3	3	2

Strong (3) **Medium (2)** **Low (1)**

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3
CO2	3	2	3	1	2
CO3	3	3	3	3	3
CO4	2	3	2	3	2
CO5	3	2	3	3	3

Computer Networks

Title of the Course	Computer Networks						
Course Type	Elective - VII						
Year	III	Semester	VI	Credits	3	Course Code	25UECA62
Instructional Hours per week	Lecture	Tutorial		Lab Practice	Total		
	2	2		-	4		
Learning Objectives							
LO1	To learn the basic concepts of Data communication and Computer network						
LO2	To learn about wireless Transmission						
LO3	To learn about networking and data link layer.						
LO4	To study about Network communication.						
LO5	To learn the concept of Transport layer						

UNIT	CONTENTS
I	**Introduction:** Data communications – networks - layers in OSI model – TCP/IP protocol suite – addressing – guided media – Unguided media.
II	**Data Link Layer:** Switching – Circuit switched networks – datagram networks – virtual circuit networks – Framing – Flow and Error control.
III	**Network Layer:** Network layer – IP V4 addressing – IPV6 addressing – ICMP – IGMP – unicast and multicast routing protocols.
IV	**Transport layer:** Process to process delivery – UDP -TCP - Congestion – congestion control – QoS.
V	**Application Layer:** Domain name system – name space – domain name space – distribution of name space – DN Sin the internet – remote logging email – file transfer - SNMP Protocol.

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	1. Data communications and networking – Behrouz A Forouzan McGraw Hill 4thRep
Reference books:	1. Computer Networks – Tenenbaum -Pearson -2022 2. Computer networking –Kurose James F, Ross Keith W - Pearson – 2017 3. Data and computer communications – William Stallings – Pearson 2017 4. Computer networks and Internet – Douglas E Comer – Pearson – 2018
Web Resources	1. https://nptel.ac.in/courses/106105080 2. https://www.tutorialspoint.com/computer-networks/ind.ex.asp 3. https://www.javatpoint.com/computer-network-tutorial

Course outcomes: CO	**On completion of this course, the students will Be able to:**
CO1	Understand fundamental underlying principles of computer networking.
CO2	Understand details and functionality of layered network architecture.
CO3	Apply mathematical foundations to solve computational problems.
CO4	Analyze and evaluate performance of various communication protocols.
CO5	Compare and create new

Mapping With Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	2	3
CO2	3	3	3	3	2	3	3	3
CO3	3	2	3	2	3	3	3	2
CO4	3	3	2	3	3	2	2	3
CO5	1	2	3	3	2	3	3	2

Strong (3) **Medium (2)** **Low (1)**

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3
CO2	2	2	3	1	2
CO3	3	3	3	3	3
CO4	2	3	2	3	2
CO5	3	2	3	3	3

Introduction to Data Science

Title of the Course	**Introduction to Data Science**						
Course Type	**Elective - VIII**						
Year	**III**	**Semester**	**VI**	**Credits**	**3**	**Course Code**	**25UECA63**
Instructional Hours per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		2	**2**		**-**	**4**	
Pre-requisite							
Learning Objectives							
LO1	To learn about the basics of Data Science and Big data.						
LO2	To learn about overview and building process of Data Science.						
LO3	To learn about various Algorithms in Data Science.						
LO4	To learn about Hadoop Framework.						
LO5	To learn about case study about Data Science.						

UNIT	CONTENTS
I	**Introduction:** Benefits and uses – Facts of data – Data science process – Big data ecosystem and data science
II	**The Data science process:** Overview – research goals - retrieving data - transformation – Exploratory Data Analysis – Model building
III	**Algorithms:** Machine learning algorithms – Modeling process – Types – Supervised – Unsupervised - Semi-supervised
IV	**Introduction to Hadoop:** Hadoop framework – Spark – replacing Map Reduce – No SQL – ACID – CAP – BASE – types
V	**Case Study:** Prediction of Disease - Setting research goals - Data retrieval – preparation - exploration - Disease profiling - presentation and automation

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	1. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, "Introducing Data Science", manning publications 2016 2. Roger Peng, "The Art of Data Science", lulu.com 2016.
Reference books:	1. Murtaza Haider, "Getting Started with Data Science – Making Sense of Data with Analytics", IBM press, E-book. 2. Davy Cielen, Arno D.B. Meysman, Mohamed Ali, "Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools", Dreamtech Press 2016. 3. Annalyn Ng, Kenneth Soo, "Numsense! Data Science for the Layman: No Math Added", 2017, 1st Edition. 4. Cathy O'Neil, Rachel Schutt, "Doing Data Science Straight Talk from the Frontline", O'Reilly Media 2013.\ 5. Lillian Pierson, "Data Science for Dummies", 2017 II Edition
Web Resources	1 https://www.w3schools.com/datascience/ds_introduction.asp 2 https://www.geeksforgeeks.org/introduction-to-data-science/ 3 https://www.javatpoint.com/data-science

Course outcomes: CO	**On completion of this course, the students will Be able to:**
CO1	Understand the basics in Data Science and Big data.
CO2	Understand overview and building process in Data Science.
CO3	Understand various Algorithms in Data Science.
CO4	Understand Hadoop Framework in Data Science
CO5	Case study in Data Science

Mapping With Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**3**	**3**	**3**	3	3	3	**3**	3
CO 2	3	3	2	3	2	3	3	2
CO 3	3	2	3	3	3	1	2	3
CO 4	2	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	3	3	1

S-Strong (3) M-Medium (2) L-Low (1)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Data Mining and Warehousing

Title of the Course	**Data Mining and Warehousing**						
Course Type	**Elective - VIII**						
Year	**III**	**Semester**	**VI**	**Credits**	**3**	**Course Code**	**25UECA64**
Instructional Hours per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		2	**2**		**-**	**4**	

Learning Objectives	
LO1	To provide the knowledge on Data Mining and Warehousing concepts and techniques.
LO2	To study the basic concepts of Data Mining, Architecture and Comparison.
LO3	To study a set of Mining Association Rules, Data Warehouses.
LO4	To study about Classification and Prediction, Classifier Accuracy.
LO5	To study the basic concepts of cluster analysis, Cluster Methods.

UNIT	**CONTENTS**
I	Introduction: Data mining – Functionalities – Classification – Introduction to Data Warehousing – Data Pre-processing: Pre-processing the Data – Data cleaning –Data Integration and Transformation – Data Reduction.
II	Data Mining, Primitives, Languages and System Architecture: Data Mining – Primitives – Data Mining Query Language, Architecture of Data mining Systems. Concept Description, Characterization and Comparison: Concept Description, Data Generalization and Summarization, Analytical Characterization, Mining Class Comparison – Statistical Measures.
III	Mining Association Rules: Basic Concepts – Single Dimensional Boolean Association Rules From Transaction Databases, Multilevel Association Rules from transaction databases – Multi dimension Association Rules from Relational Database and Data Warehouses.
IV	Classification and Prediction: Introduction – Issues – Decision Tree Induction – Bayesian Classification – Classification of Back Propagation. Classification based on Concepts from Association Rule Mining – Other Methods. Prediction – Introduction – Classifier Accuracy.
V	Cluster Analysis: Introduction – Types of Data in Cluster Analysis, Petitioning Methods – Hierarchical Methods-Density Based Methods – GRID Based Method – Model based Clustering Method.

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	Han and M. Kamber, "Data Mining Concepts and Techniques", 2001, Harcourt India Pvt. Ltd, New Delhi.
Reference books:	1. K.P. Soman, Shyam Diwakar, V. Ajay "Insight into Data Mining Theory and Practice ",Prentice Hall of India Pvt. Ltd, New Delhi 2. Parteek Bhatia, 'Data Mining and Data Warehousing: Principles and Practical Techniques', Cambridge University Press, 2019
Web Resources	1. https://www.topcoder.com/thrive/articles/data-warehousing-anddatamining#:~:text=Data%20warehousing%20is%20a%20method, compiled%20in%2 0the%20data%20warehouse. 2. https://www.javatpoint.com/data-mining-cluster-vs-data-warehousing Ghttps://www.tutorialspoint.com/Data-Warehousing-and-Data-Mining

Course outcomes: CO	**On completion of this course, the students will Be able to:**
CO1	Understand the basic concepts and the functionality of the various data mining and data warehousing component
CO2	Know the concepts of Data mining system architectures
CO3	Analyze the principles of association rules
CO4	Get analytical idea on Classification and prediction methods
CO5	Gain knowledge on Cluster analysis and its methods.

Mapping With Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	2	3
CO2	3	3	3	3	2	3	3	3
CO3	3	2	3	2	3	3	3	2
CO4	3	3	2	3	3	2	2	3
CO5	1	2	3	3	2	3	3	2

Strong (3) **Medium (2)** **Low (1)**

CO/P3O	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3
CO2	3	2	3	1	2
CO3	3	3	3	3	3
CO4	2	3	2	3	2
CO5	3	2	3	3	3

MongoDB

Title of the Course		MongoDB					
Course Type		Ability Enhancement Course - IV					
Year	III	Semester	VI	Credits	2	Course Code	25UACA61
Instructional Hours per week		Lecture	Tutorial		Lab Practice		Total
		2	--		--		2

Learning Objectives	
LO1	Understand the fundamental concepts of Mongo DB and its advantages over traditional relational databases.
LO2	Understand the structure and purpose of collections in Mongo DB.
LO3	Comprehend the concept and importance of indexing in Mongo DB
LO4	Understanding the Query Optimizer and Identifying and Implementing Various Index Types
LO5	Understand the concept of replication and its significance in ensuring data availability and redundancy.

UNIT	CONTENTS
I	Mongo DB Overview-Advantages-Mongo DB Environment-Common Terms in Mongo DB- Create and Drop Database.
II	Collections-Create and Drop Collections- Mong DB Data Types-Insert Command- Mongo DB Query Document-Update Command-Delete Command-Projection-Limit Record-Sort Record-Aggregation.
III	Indexing- Compound Indexes -Indexing Objects and Arrays -Index Cardinality -Using explain () and hint ().
IV	The Query Optimizer-Types of Indexes-Unique Indexes -Sparse Indexes -Index Administration -Identifying Indexes-Changing Indexes.
V	Replication: Overview –Components of Replica sets Shading: Overview – Understanding the Components of Cluster.

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.
Recommended Texts:	
1	Kristina Chodorow "Mongo DB the definitive guide", Second Edition,, O'Reilly Media Inc.
References Books:	
1	Rick Copeland, 2013, "Mongo DB Applied Design Patterns", First Edition, O'Reilly Media Inc.
Web Resources:	
1	https://www.tutorialspoint.com/mongodb

Course outcomes	On completion of this course, students will be able to:
CO1	Articulate the benefits of using Mongo DB in various applications.
CO2	Manage collections and documents efficiently and Implement CRUD operations to manipulate data.
CO3	Optimize query performance using appropriate indexing strategies.
CO4	Performance Optimization, Index Management Proficiency, and Analytical Skills in Mongo DB.
CO5	Implement replication to enhance data reliability and fault tolerance.

Mapping With Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	2
CO4	3	3	2	3	3	3	1	3
CO5	3	2	3	3	2	3	3	2

Strong (3) **Medium (2)** **Low (1)**

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3
CO2	2	3	3	1	3
CO3	3	3	3	3	3
CO4	3	3	2	3	2
CO5	3	2	3	3	3

Blue Print – End Semester Examinations Semester – I to VI

Class: U.G. **Time: 3 Hours** **Max. Marks: 75**

Section A **(10 x 1 = 10)**

Answer all questions.
Choose the correct answer. (With four options)

	Unit I	Unit II	Unit III	Unit IV	Unit V
Question Nos.	1 & 2	3 & 4	5 & 6	7 & 8	9 & 10

Section B **(5 x 5 = 25)**

Answer all questions choosing either (a) or (b).
Answer should not exceed 250 words

	Unit I	Unit II	Unit III	Unit IV	Unit V
Question Nos.	11 (a) & 11 (b)	12 (a) & 12 (b)	13 (a) & 13 (b)	14 (a) & 14 (b)	15 (a) & 15 (b)

Section C **(5 x 8 = 40)**

Answer all questions choosing either (a) or (b).
Answer should not exceed 500 words

	Unit I	Unit II	Unit III	Unit IV	Unit V
Question Nos.	16 (a) & 16 (b)	17 (a) & 17 (b)	18 (a) & 18 (b)	19 (a) & 19 (b)	20 (a) & 20 (b)