Netaji Subhas University

School of IT

SYLLABUS

MCA
(Master of Computer Application)

(2 Years MCA Program)

With Effect From:- 2025

Vision:

"To be a premier and globally recognized MCA program that nurtures excellence in computer application education, research, and industry collaboration, producing graduates who contribute to technological advancements and societal well-being."

Mission:

"To empower students with comprehensive knowledge, skills, and proficiency in the field of Computer Applications, fostering their holistic development as competent professionals, innovative problem solvers, and ethical leaders in the dynamic world of technology."

Objectives of Program:

- Academic Excellence: To provide a rigorous and contemporary curriculum that covers the fundamental concepts and advanced developments in computer applications, ensuring academic excellence and fostering a thirst for lifelong learning.

- Skill Development: To equip students with hands-on practical skills, problem-solving abilities, and critical thinking capabilities, empowering them to develop innovative solutions to real-world challenges.

- Industry Relevance: To align the MCA program with industry needs and trends, enabling graduates to seamlessly integrate into the ever-evolving technology landscape and meet the demands of the global job market.

- Ethical Values: To instill strong ethical values and professional integrity in students, encouraging them to be responsible and socially-conscious professionals who make positive contributions to society.

- Research and Innovation: To foster a culture of research and innovation, providing opportunities for students and faculty to engage in cutting-edge research, publish scholarly work, and contribute to advancements in computer applications.

- Industry Collaboration: To establish and nurture collaborations with industries, businesses, and technology leaders, facilitating internships, projects, and guest lectures that bridge the gap between academia and the corporate world.

- Entrepreneurship and Leadership: To inspire entrepreneurship and leadership skills in students, encouraging them to be visionary and impactful leaders in the tech industry and beyond.

- Global Perspective: To promote a global outlook by encouraging international exposure, collaborations, and cultural exchanges, fostering students' adaptability and intercultural understanding.

- Continuous Improvement: To continually assess and enhance the MCA program, incorporating feedback from students, alumni, and industry partners, and ensuring it remains at the forefront of computer application education.

- Alumni Engagement: To establish a strong and supportive alumni network, creating a sense of belonging and encouraging lifelong connections and contributions to the growth and development of the MCA program.

Description of the Programme

The Master of Computer Applications (MCA) program is designed to provide students with a comprehensive understanding of the field of computer science and its applications in various industries. MCA program aims to transform the Indian education system and promote holistic development among students.

MCA program is structured to equip students with the necessary knowledge and skills in computer science, programming, software development, and information technology. It offers a blend of theoretical concepts and practical training, enabling students to apply their learning to real-world scenarios.

- The Programme will be of 2 years duration. Bachelor's Degree (Honors). Can take entry in second year.

- The total credits for 2-year MCA will be minimum 80 credits.

- The relevant multidisciplinary courses are designed to address the learning interests of the students across the schools.

- 20% of the courses may be offered online from SWAYAM.

- Academic Bank of Credits (ABC) will be established to facilitate Transfer of Credits. The credits earned at various levels will get credited into a digitalized ABC.

Pedagogy for MCA Program

The pedagogy for the MCA (*Master of Computer Applications*) program should be designed to provide a holistic and enriching learning experience for students, catering to both theoretical knowledge and practical skills in the field of computer applications. Here are some key aspects of an effective pedagogy for the MCA program:

1. Blended Learning Approach: Implement a blended learning approach that combines traditional classroom teaching with technology-enabled learning methods. This may include interactive lectures, group discussions, multimedia presentations, online learning platforms, and virtual labs.

2. Hands-on Practical Training: Emphasize hands-on practical training to give students real-world exposure to various programming languages, tools, and technologies. Practical sessions, coding exercises, and projects should be an integral part of the curriculum.

3. Industry-Relevant Projects: Incorporate industry-relevant projects into the coursework, allowing students to work on real-life challenges and solutions. Collaborate with companies and organizations to provide students with industry exposure and internships.

4. Case Studies and Problem-Solving: Utilize case studies and problem-solving exercises to stimulate critical thinking and decision-making skills among students. These activities help students apply theoretical concepts to real-life scenarios.

5. Workshops and Seminars: Organize workshops, seminars, and guest lectures by industry experts and academicians to broaden students' perspectives and keep them updated with the latest trends and advancements in the field.

6. Research and Innovation: Encourage students and faculty to engage in research and innovation projects, fostering a culture of continuous learning and discovery.

7. Peer Learning and Collaboration: Promote peer learning and collaboration through group projects, discussions, and team-based activities. This nurtures teamwork, communication skills, and fosters a supportive learning environment.

8. Assessments and Feedback: Conduct regular assessments to gauge students' progress and understanding. Provide constructive feedback to help them improve and excel in their studies.

9. Personalized Learning: Recognize and cater to individual learning styles and pace. Provide additional support and resources to students who need it, ensuring inclusive learning.

10. Faculty Development: Invest in faculty development programs to enhance teaching methodologies, stay updated with industry trends, and inspire effective teaching practices.

11. Mentorship and Counseling: Offer mentorship and counseling support to students, guiding them in academic and personal matters and fostering a sense of belonging and well-being.

12. Practical Exposure through Internships: Facilitate internships and industry interactions to give students hands-on experience and a deeper understanding of real-world work environments.

By implementing a pedagogy that combines theory with practical application, fosters innovation, and prepares students to face real-world challenges, the MCA program can produce skilled professionals who are ready to make a positive impact in the dynamic world of computer applications.

Outcome Based Approach to Education (OBE)

As per the National Higher Education Qualification Frameworks (NHEQF), students are expected to possess the quality & characteristics of the graduate of a Programme of the study, including learning outcomes relating to the disciplinary areas, learning generic outcomes that are expected to be acquired by a graduate on completion of the Programme.

OBE is an educational model that forms the base of a quality education system. There is no specified style of teaching or assessment in OBE. All educational activities carried out in OBE should help the students to achieve the set goals. The faculty may adapt the role of an instructor, trainer, facilitator, and/or mentor based on the outcomes targeted. OBE enhances the traditional methods and focuses on what the institute provides to the students. It shows the success by making or demonstrating outcomes using statements 'able to do' in favour of students. It provides clear standards for observable and measurable outcomes.

Four Levels of Outcomes from OBE

1. Programme Educational Objectives (PEOs)
2. Programme Outcomes (POs)
3. Programme Specific Outcomes (PSOs)
4. Course Outcomes (COs)

Graduate Attributes

The graduate attributes include the learning outcomes that are specific to disciplinary areas relating to the chosen field(s) of learning within the broad multidisciplinary & interdisciplinary learning outcomes that graduates of all Programmes should acquire & demonstrate.

Graduate Attributes	
1.	Disciplinary Knowledge
2.	Critical Thinking & Problem Solving
3.	Creativity & Innovation
4.	Effective Communication
5.	Research-related skills
6.	Cooperation & Team Work
7.	Global/Multicultural Competence
8.	Ethics & Human Values
9.	Lifelong Learning
10.	Leadership Readiness
11.	Community Engagement & Social Responsibilities
12.	Digital literacy

Program Educational Objectives (PEOs)

Program Educational Objectives (PEOs) are defined for the aspiring students about what they will achieve once they join the Program. PEOs are about professional and career accomplishment after 2 years of postgraduation. PEOs are the written statements taken from different aspects like Knowledge, Skills & Ethics with focus on Career, Competency and Behaviour. Three PEOs are recommended for MCA program

Program Educational Objectives (PEOs)	
PEO1.	**Professional Excellence**: Student will excel as competent professionals in the field of Computer Applications, demonstrating expertise in programming, software development, and IT project management. They will effectively analyze, design, and implement innovative solutions to real-world challenges, meeting industry requirements and contributing to technological Advancements.
PEO2.	**Lifelong Learning and Adaptability:** Student will possess a thirst for continuous learning, staying abreast of the latest developments in the field of computer applications and adapting to rapidly evolving technologies. They will actively engage in research, professional development, and self-improvement, becoming adaptable and versatile professionals who can thrive in diverse work environments.
PEO3.	**Ethical Leadership and Social Responsibility:** Student will lead with integrity, demonstrating ethical behavior, and upholding professional values in their work. They will recognize the societal impact of technology and actively contribute to the betterment of society, considering ethical, legal, and social implications in their decision-making.

Programme Outcomes (PSOs)

A Programme outcome is broad in scope and defines what the students will be able to do at the end of the Programme. POs are defined line with the graduate attributes as specified in the UGC. POs are to be specific, measurable and achievable. In the syllabus book given to students, there is a clear mention of course objectives and course outcomes along with the CO-PO mapping matrix for all the courses.

Programme Outcomes (POs)	
PO1	**Disciplinary Knowledge**: Understand the concepts of core subjects and have the hands-on skills to demonstrate competency in the domain of computer science.
PO2	**Critical Thinking and Problem Solving:** Define, identify, analyze, design, interpret, evaluate, and provide the solution using computer domain knowledge.
PO3	**Global/Multicultural Competence:** Identify and analyse global demand for computer technologies to provide a solution to all.
PO4	**Leadership & Teamwork:** The ability to perform effectively as a leader and perform excellently with a variety of teams in a multidisciplinary environment.
PO5	**Effective Communication:** Ability to communicate effectively with various stakeholders in the field of computer science.
PO6	**Ethics and Human Values:** Perform ethical and professional practice by using computer technology.
PO7	**Community Engagement and Social Responsibilities:** Help the community and society grow an advanced health system, promote economic growth, and provide a sustainable solution to society.
PO8	**Research Related Skills:** Students will develop conceptual clarity and be enabled to analyze a situation and provide sustainable solutions.

Program Specific Outcomes (PSOs)

Programme Specific Outcomes (PSOs) are statements that describe what the graduates of a specific Programme should be able to do. A list of 3 PSOs have been defined for the MCA programme.

Program Specific Outcomes (PSOs)	
PSO1.	Apply advanced programming concepts and software development methodologies to design, develop, and deploy robust and scalable software solutions for complex real-world problems..
PSO2.	Analyze, design, and implement efficient algorithms and data structures to solve computational problems, leveraging their knowledge of computer science principles.
PSO3.	Demonstrate proficiency in utilizing contemporary tools, technologies, and frameworks to develop and manage database systems, ensuring data integrity, security, and efficient retrieval.

Programme Specific Outcomes (PSOs) are statements that describe what the graduates of a specific Programme should be able to do. A list of 3 PSOs has been defined for the MCA programme.

Eligibility Criteria

The Candidate should have passed +3 Examinations in Arts / Science / Commerce or equivalent. having Mathematics/Business Mathematics or Statistics in +2 or three-year Diploma in Engineering Examination conducted by State Council of Technical Education and Training, Orissa.

Mapping of PEOs with POs

MAPPING OF PEO WITH PO								
PEO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
PEO1	H	H	H	M	M	M	M	H
PEO2	H	H	L	M	M	L	M	H
PEO3	H	M	L	H	M	M	H	H
PEO4	H	M	L	L	M	H	L	H
PEO5	H	M	H	L	H	M	L	H
Level of correlation: 3-High, 2-Medium, 1-Low								

Syllabus Structure

SEMESTER - I

Sl. No.	Subject Code	Title of Paper	L	T	P	Internal	External	Credits
1	MCAT-1001	Programming in C	3	0	0	30	70	3
2	MCAT-1002	Computer System Architecture	3	0	0	30	70	3
3	MCAT-1003	Discrete Mathematics	3	1	0	30	70	4
4	MCAT-1004	Web Technology	3	0	0	30	70	3
5	MCAT-1005	Database Management System	3	0	0	30	70	3
6	MCAT-1006	Technical Communications	2	0	0	30	70	2
7	MCAL-1001	Programming in C Lab	0	0	2	15	35	1
8	MCAL-1004	Web Technology Lab	0	0	2	15	35	1
9	MCAL-1005	Database Management System Lab	0	0	2	15	35	1
10	MCAL-1006	Technical Communications Lab	0	0	2	15	35	1
		TOTAL						22

SEMSTER -II

Sl. No.	Subject Code	Title of Paper	L	T	P	Internal	External	Credits
1	MCAT-2001	Data Structures & Algorithm	3	0	0	30	70	3
2	MCAT-2002	Principles of Operating System	3	0	0	30	70	**3**
3	MCAT- 2003	Quantitative Techniques	3	0	0	30	70	**3**
4	MCAT-2004	Python Programming	3	0	0	30	70	**3**
5	MCAT-2005(A/B)	Program Elective – I	3	0	0	30	70	**3**
6	MCAT-2006	Universal Human Values and Ethics	1	0	0	30	70	**1**
7	MCAL- 2001	Data Structure & Analysis of Algorithms Lab	0	0	2	15	35	**1**
8	MCAL-2002	Operating System Lab	0	0	2	15	35	**1**
9	MCAL- 2004	Python Programming Lab	0	0	2	15	35	**1**
10	MCAS-2007	Seminar	0	0	2	15	35	**1**
		TOTAL						**20**

SEMESTER -III

Sl. No	Subject Code	Title of Paper	L	T	P	Internal	External	Credits
1	MCAT-3001	Computer Networks	3	0	0	30	70	3
2	MCAT-3002	Machine Learning Techniques	3	0	0	30	70	3
3	MCAT-3003	Cloud Computing	3	0	0	30	70	3
4	MCAT-3004	Software Engineering	3	0	0	30	70	3
5	MCAT-3005(A/B)	**Programme Elective-II**	3	0	0	30	70	3
6	MCAT-3006 (A/B)	**Programme Elective-III**	3	0	0	30	70	3
7	MCAL-3004	Software Engineering Lab	0	0	1	15	35	1
8	MCAL-3002	Machine Learning Techniques Lab	0	0	2	15	35	1
9	MCAP-3007	Minor Project / Industrial Internship-I	0	0	4	100		2
		TOTAL						22

SEMESTER - IV

Sl. No.	Subject Code	Title of Paper	L	T	P	Credits
1	MCAP-4001	Industrial Internship / Major Project and Grand Viva	0	0	0	12
2	MCAV-4002	**Grand VIVA**	0	0	0	4
		TOTAL				16

Elective Subject List		
Subject Code	**Subject Name**	**Elective**
MCAT-2005(A)	Block chain Technology	Elective I (Applicable for Semester II)
MCAT-2005(B)	Data Mining and Warehousing	
MCAT-3005 (A)	Cyber security and Privacy	Elective II and Elective III (Applicable for Semester III)
MCAT-3005 (B)	Data Visualization	
MCAT-3006 (A)	Big Data	
MCAT-3006 (B)	Natural Language Processing	

SEMESTER - I

MCAT-1001: Programming in C

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	I
Course Title	**Programming in C**
Course Code	MCAT-1001
Credit	3
Course Type	Core Course
Course Objective	The subject aims to provide the student with: 1. An understanding of basic concepts of computer programming. 2. An introduction to the fundamentals of C language. 3. An understanding of problem solving programs.
Course Outcome (COs)	After completion of this course students will be able to: CO1: Explain the needs of computer, classification & Algorithms. CO2: Explain the working and implementation of Array. CO3: Demonstrate the benefits and use of Functions and Pointers. CO4: Explain the working File. CO5: Explain Sorting and Searching Techniques.

Course Outline

Unit	Description	CO Mapping
UNIT1	**Introduction to Programming: Computers Fundamentals:** Recap of Classification of Computers, Application of Computers, Basic organization of computer, Input and Output Devices, Binary Number System, Computer memory, Computer Software, operating system, compilers etc. Idea of Algorithm: Steps to solve logical and numerical problems. Representation of Algorithm: Algorithm /Flowcharts / Pseudocode, Generation of Programming Languages. Introduction to Language: Structure of C Program, Life Cycle of Program from Source code to Executable, Compiling and Executing C Code, Keywords, Identifiers, Primitive Data types in C, variables, constants, input/output statements in C. Operators and Expressions:	CO1

		Expression evaluation: Operator Precedence and Associativity.	
UNIT2	**Control Flow and Decision Making:**		CO2
	Conditional statements: if, else if, and else, Switch-case statements for multi-choice decision making, Loops: while, do-while, and for loops for iterative tasks, Nesting loops, Break and continue statements for loop control		
UNIT3	**Arrays and Functions,**		CO3
	Understanding arrays and their declaration, accessing array elements and array manipulation, String Functions, Functions: defining, calling, and returning values, Parameters passing: call by value and call by reference, Recursive functions, Recursion vs Iteration. Example programs, such as Finding Factorial, Fibonacci series.

Pointers: Idea of pointers, Defining pointers, Use of Pointers in Inter-function communication via arrays, matrices. Reading, writing and manipulating Strings, understanding computer memory, accessing via pointers, pointers to arrays, dynamic allocation, drawback of pointers. Dynamic memory allocation: Memory Layout Implicit vs. Explicit Allocation; Static vs. Dynamic Allocation; Motivation for Dynamic Allocation. | | |
UNIT4	**Pointers and Memory Management**		CO4
	Introduction to pointers and their significance, Pointer arithmetic and accessing memory addresses, Dynamic memory allocation using malloc and free, Pointer to functions and its use cases, Handling arrays and strings using pointers		
UNIT5	**File Handling and Advanced Concepts:**		CO5
	File operations: opening, reading, writing, and closing files, Working with text and binary files in C, Preprocessor directives and their applications, Advanced concepts: Structures, unions, and enumerations, Introduction to C++ and Object-Oriented Programming (brief overview)		

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	30	70

Reference Books:
1. Gottfried, B. (2017). Schaum's Outline of Programming with C (3rd ed.). McGraw-Hill Book.
2. National Programme on Technology Enhanced Learning (n.d.). Course Title. Retrieved Month Day, Year, from URL

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3
CO1	Explain the needs of computer, classification & Algorithms.	3	2	1	1	-	2	-	1	2	2	1
CO2	Explain the working and implementation of Array.	2	2	-	-	-	-	-	-	2	1	-
CO3	Demonstrate the benefits and use of Funtions and Pointers.	2	2	-	-	-	-	-	-	2	1	-
CO4	Explain the working File.	1	1	-	-	1	-	-	-	2	1	-
CO5	Explain Sorting and Searching Techniques.	2	2	-	-	-	-	-	1	2	1	-

MCAT-1002: Computer System Architecture

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	I
Course Title	**Computer System Architecture**
Course Code	MCAT-1002
Credit	2
Course Type	Core Course
Course Objective	The subject aims to provide the student with: 1. 1. Understand the basic organization of a computer system and its functional units 2. Analyze different number systems such as binary, decimal, octal and hexa, and apply arithmetic algorithms. 3. Examine memory hierarchy, CPU memory interaction, cache memory, and related mapping, 4. Evaluate different parallel processing techniques 5. Analyze characteristics of multiprocessors, interconnection structures, interprocessor arbitration, interprocessor communication.
Course Outcome (COs)	After completion of this course students will be able to: CO1. Understand the functional units of a computer system and describe the instruction codes and cycles involved in computer instructions. CO2. Perform arithmetic operations using different number systems CO3. Explain the memory hierarchy and the interaction between CPU and memory CO4. Understand parallel processing and pipelining, including arithmetic pipelining, instruction pipeline. CO5. Understand the characteristics of multiprocessors, including interconnection structures

Course Outline

Unit	Description	CO Mapping
UNIT 1	**Basic Computer Organization:** functional units of computer system, Instruction codes, Computer instructions, Instruction Cycles	CO2
UNIT 2	**Computer Arithmetic:** Number System (Binary, Decimal, Octal, Hexa), Number conversion Addition & Subtraction, Multiplication Algorithms, Division Algorithms, Booth Algorithm.	CO3
UNIT 3	**Memory and I/O Systems:** Peripheral Devices, I/O Interface, Data Transfer Schemes, Program Control, Interrupt, DMA Transfer, I/O Processor. Memory Hierarchy, Processor vs. Memory Speed, High-Speed Memories, Cache Memory, Cache memory, Cache memory mapping policies, Cache updating schemes, Virtual memory, Page replacement techniques, I/O subsystems.	CO4
UNIT 4	**Processor and Control Unit:** Hardwired vs. Micro programmed Control Unit, General Register Organization, Stack Organization, Instruction Format, Data Transfer & Manipulation, Program Control, RISC, CISC, Pipelining – Pipelined data path and control – Handling Data hazards & Control hazards.	CO5
UNIT 5	**Parallelism:** Instruction-level-parallelism – Parallel processing challenges –Flynn's classification – Hardware multi-threading – Multi-core processors, UMA, NUMA, Distributed Memory Architecture, Array Processor, Vector Processors.	CO6

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	30	70

Text Books:

1. Mano, M. (2017). Computer System Architecture.
2. Stallings, W. (2016). Computer Organization & Architecture. PHI.
3. Hayes, J. P. (2016). Computer Architecture and Organization. McGraw Hill.

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	Understand the functional units of a computer system and describe the instruction codes and cycles involved in computer instructions.	2	1							1		
CO2	Perform arithmetic operations using different number systems		1							1		
CO3	Explain the memory hierarchy and the interaction between CPU and memory .	2								1		
CO4	Understand parallel processing and pipelining, including arithmetic pipelining, instruction pipeline	1			1					1		
CO5	Understand the characteristics of multiprocessors, including interconnection		1							1		

MCAT-1003 : Discrete Mathematics

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	I
Course Title	**Foundations in Discrete Mathematics**
Course Code	MCAT-1003
Credit	4
Course Type	Core
Course Objective	This course is aimed to provide an advance understanding to the sets and propositions, relations and functions, permutation and combination, graphs, groups and rings.
Course Outcome (COs)	After completion of this course students will be able to: CO1: A knowledge on Sets and propositions. CO2: An understanding of Relations and Functions. CO3: An understanding of Number Theory. CO4: A knowledge of Discrete Numeric Functions. CO5: An understanding of Algebric systems.

Course Outline

Unit	Description	CO Mapping
UNIT1	**Sets and Propositions:** Sets, Un-countably infinite sets, Principle of inclusion and exclusion, multisets, propositions, Conditional propositions. Logical connectivity, Propositional, calculus, Universal and existential quantifiers, Normal forms, methods of proofs, Mathematical induction.	CO1
UNIT2	**Relations and Functions:** Functions, Composition of function, invertible functions, Discrete properties of binary relations, closure of relations, Warshall's algorithm, Equivalence relations and partitions, Ordered Sets and Lattices: Introduction, Ordered set, Hasse diagram of partially ordered set, Consistent enumeration, Isomorphic ordered set, well ordered set, Lattices, Properties of lattices, Bounded lattices, Distributive lattices, and Complemented lattices. Chains, and Anti-chains.	CO2

UNIT3	**Number Theory:** Counting: Basic counting principles, factorial notation, Binomial coefficients, Ordered and unordered partitions. Permutations and combinations: Rule of sum and Product, Permutations, Combination, Algorithms for Generation of Permutations and Combination, The Pigeonhole principle, Fundamental theorem of arithmetic, Congruence relation, Congruence Equations.	CO3
UNIT4	Discrete Numeric Functions and Generating functions, Simple Recurrence relation with constant coefficients, Linear recurrence relations without constant coefficients, Asymptotic behavior of functions.	CO4
UNIT5	Algebraic systems, Group, Semi-groups, Monoid,Subgroups. Cyclic group, Permutation groups, Homomorphism, Isomorphism and Automorphism of groups.	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	30	70

Suggested Books:

1. "Tremblay, J. P., & Manohar, R. (Year). Discrete Mathematical Structures. Tata McGraw Hill.

2. Liu, C. L., & Mohapatra, D. P. (2013). Discrete Mathematics: A Computer Oriented Approach (4th ed.). New Delhi: McGraw-Hill Education (India) Private Limited.

Reference Books:

1. Rajaraman, V. Fundamentals of Computer (4th ed.). Prentice Hall India.
2. Bartec, T. Digital Computer Fundamentals (6th ed.). Tata McGraw Hill.

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	A knowledge on Sets and propositions	1								1		
CO2	An understanding of Relations and Functions		1	1							1	
CO3	An understanding of Number Theory		1	1						1		
CO4	A knowledge of Discrete Numeric Functions.				1						1	
CO5	An understanding of Algebric systems.	1			1					1		

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	3
Course Title	**Web Technologies**
Course Code	MCAT-1004
Credit	2
Course Type	Core Course
Course Objective	The subject aims to provide the student with: 1. An understanding of competency in planning a website. 2. An ability to incorporate social media aspects, web–design principles like text, and navigation etc 3. An understanding of Hosting / launching a website
Course Outcome (COs)	After completion of this course students will be able to: CO1. Understand the fundamental concepts of the World Wide Web, its evolution, and the client-server model. CO2. Acquire proficiency in JavaScript, including variables, data types, functions, and control structures. CO3. Develop skills in server-side scripting languages such as PHP, Python, or Node.js. CO4. Create dynamic web applications using a combination of server-side scripting and front-end technologies. CO5. Learn about web hosting and server configuration. Understand different deployment strategies and version control using tools like Git.

Course Outline

Unit	Description	CO Mapping
UNIT1	**Introduction to Web Technology** Understanding the World Wide Web and its evolution, Web Architecture: Client-server model, HTTP protocol, and Web browsers, Markup languages: HTML Elements, HTML Attribute, Different Tags, Styling , Formatting, Table, List, Block level and inline Level, Favicon, image, link, iframe, Layout, HTML Media , Form and their importance in web development, Introduction to CSS (Cascading Style Sheets) and its role in web design	CO1
UNIT2	**Front-end CSS** Introduction of CSS, Selector , Different ways to Styling , Box Model, Background Properties , color Properties, CSS Icon, Display properties , Position properties , Z index , Overflow, opacity , Navigation Bar, Flex Properties , Grid, CSS Responsive Media Query	CO2
UNIT3	**Java Script** Introduction to Java Script, Variables (let,var,const), Operator ,Data type ,Condition Statement, Control Statement, Function, High order Function, Object properties and Its Method, Array , String , DOM properties and Its Method.	CO3
UNIT4	**React & Node JS** Introduction of React & Node-JS, React ES6, React Render, JSX , Components, Props, Event, Conditionals, Lists , Router, Form, Hook, useState ,useEffect ,useContext **Node JS :** Introduction To Node-JS, Node Module, HTTP Module, File system, URL Module, NPM , Event, Upload File, Email, MySQL Node- JS Connectivity	CO4

UNIT5	**Web Deployment and Project**
	Mini Project Using React , Node –JS & MySQL
	   I. ToDo List –
	  II. E-commerce clone
	III. Portfolio
	IV. Food Recipe (Restaurant)	

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	30	70

Text Books:

1. Kogent Solution Inc. Java Server Programming Java EE6 (J2EE 1.6) Black Book.

2. Bayross, I.. Web Enabled Commercial Application Using HTML, DHTML, JavaScript, Perl, CGI. BPB Publication.

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	Understand the fundamental concepts of the World Wide Web, its evolution, and the client-server model.	1	1	1						1		
CO2	Acquire proficiency in JavaScript, including variables, data types, functions, and control structures.								1			
CO3	Develop skills in server-side scripting languages such as PHP, Python, or Node.js.	1								1		
CO4	Create dynamic web applications using a combination of server-side scripting and front-end technologies.			1								
CO5	Learn about web hosting and server configuration. Understand different deployment strategies and version control using tools like Git.								1	1		

MCAT-1005: Database Management System

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	I
Course Title	**Database Management System**
Course Code	MCAT-1005
Credit	3
Course Type	Core Course
Course Objective	The subject aims to provide the student with: 1. An understanding of basic concepts of DBMS. 2. An introduction to the Entity Relationship Models. 3. An understanding of SQL and query statements. 4. An induction to security in database. 5. An introduction to SQL and Pl/SQL.
Course Outcome (COs)	After completion of this course students will be able to: CO1: Explain the needs of DBMS. CO2: Explain the working of ER models. CO3: Understand the concept of Normalization CO4: Demonstrate the use of SQL query statements. CO5: Demonstrate the concepts of Transaction management and Concurrency control

Course Outline

Unit	Description	CO Mapping
UNIT1	**Introductory concepts of DBMS:** Introduction and applications of DBMS, Purpose of data base, Data, Independence, Database System architecture- levels, Mappings, Database, users and DBA **Relational Model:** Structure of relational databases, Domains, Relations, Relational algebra – fundamental operators and syntax, relational algebra queries, tuple relational calculus	CO1

UNIT2	**Entity-Relationship Model:** Basic concepts, Design process, constraints, Keys, Design issues, E-R diagrams, weak entity sets, extended E-R features – generalization, specialization, aggregation, reduction to E-R database schema.	CO2
UNIT3	**Relational Database Design:** Functional Dependency – definition, trivial and non-trivial FD, closure of FD set, closure of attributes, irreducible set of FD, Normalization – 1NF, 2NF, 3NF, Decomposition using FD-dependency preservation, BCNF, Multi- valued dependency, 4NF, Join dependency and 5NF.	CO3
UNIT4	**SQL Concepts:** Basics of SQL, DDL, DML, DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, IN operator Functions - aggregate functions, Built-in functions –numeric, date, string functions, set operations, sub-queries, correlated sub-queries, Use of group by, having, order by, join and its types, Exist, Any, All, view and its types. transaction control commands – Commit, Rollback, Save point Distributed Data Base concepts. PL/SQL Concepts: Cursors, Stored Procedures, Stored Function, Database Triggers.	CO4
UNIT5	**Transaction management and Concurrency control** Transaction management: ACID properties, Transaction States, Types of Schedule, serializability, Precedence Graph, Recoverable Schedule, Cascade less Schedule. Concurrency control Protocol: Lock based concurrency control (2PL, Deadlocks), Timestamp based methods, Optimistic methods. Database recovery system.	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	30	70

Text Book:

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill

References:

1 "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer science Press.

2 "Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, Pearson Education

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	Explain the needs of DBMS.	2								1		
CO2	Explain the working of ER models.		1								1	
CO3	Understand the concept of Normalization			1	1							
CO4	Demonstrate the use of SQL query statements.	2								1		1
CO5	Demonstrate the concepts of Transaction management and Concurrency control		1	1								

MCAT-1006: Technical Communications & Lab

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	I
Course Title	**Technical Communications & Lab**
Course Code	MCAT-1006
Credit	3
Course Type	Core Course
Course Objective	The course will enable the students: 1. To develop effective communication skills to be able to speak & write clearly and impact fully in the professional contexts. 2. To develop adequate knowledge on grammar, vocabulary, and other writing techniques to construct resume, emails and reports 3. To develop LSRW skills required for effective communication
Course Outcome (COs)	CO1: Understand the principles & process of communication CO2: Plan, execute and revise messages CO3: Write various types of messages that include resume/online resume & technical reports CO4: Present their ideas orally with effective body language and visually appealing ways CO5: Communicate strategically in GD & PI Co6: Use correct phonetics, grammar & vocabulary

Course Outline

Unit	Description	CO Mapping
UNIT1	**Communication: Principles & Practice** Fundamentals of Communication; What is Technical Communication; 7 C's of Communication; Barriers to Effective Communication; Ways to Overcome Barriers; Interpersonal Communication; Intercultural Sensitivity in a Diverse World; Communication in an Organization; Horizontal & Vertical	CO1

UNIT2	**Planning, Drafting & Revising**	CO2
	Planning Writing; Steps of Writing; Purpose; Readers & Information; Mind Mapping with Technology; Drafting, Redrafting & Proof reading	
UNIT3	**Writing Formal Messages**	CO3
	Understanding different types of messages; Writing with Different Formats; Strategies to Write & Respond to Types of Messages; Writing an Email, Preparing & Planning for a Technical Report; Analysing & Organising Data; Preparing an Outline & Structuring; Writing an Abstract, Structuring the Main Body, Back Matter of a Technical Report; Style & Tone; Unity, Punctuation & Grammatical Errors	
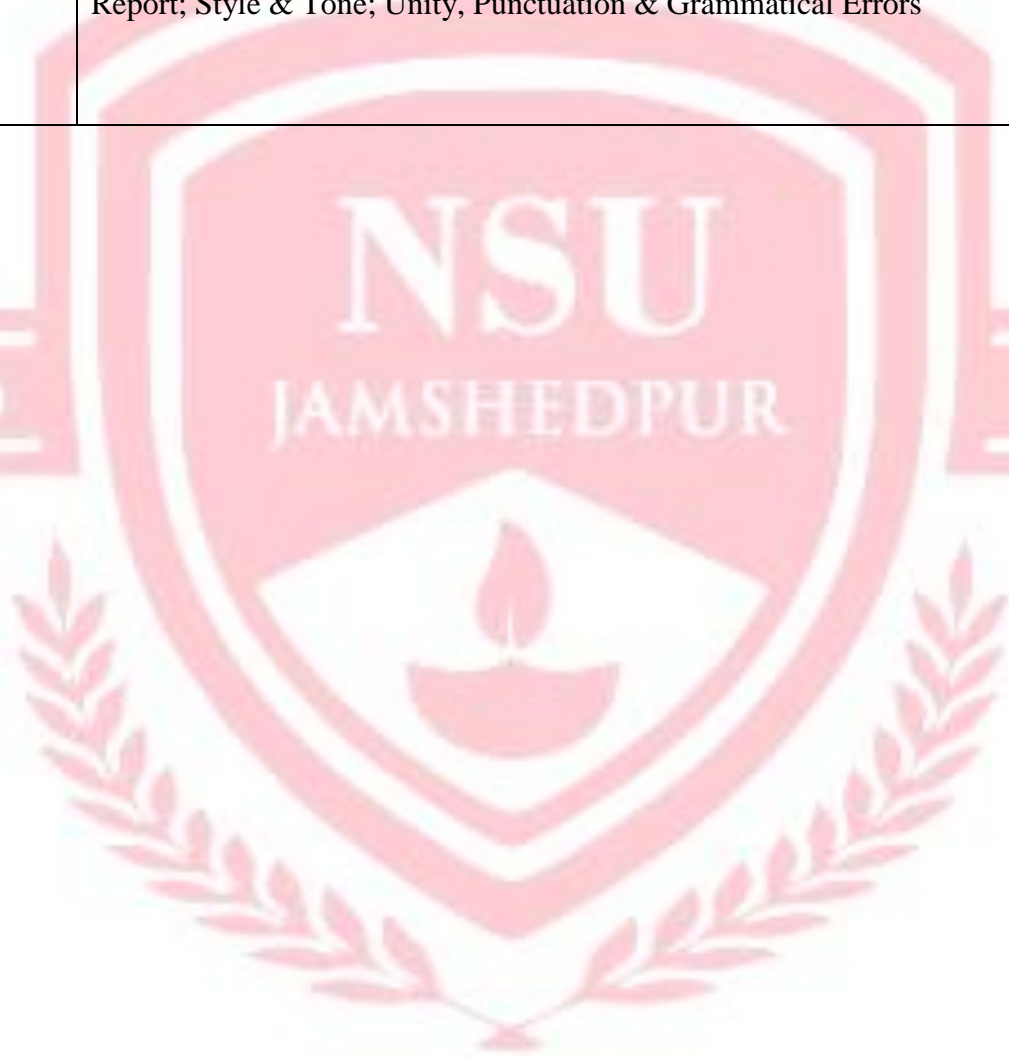
UNIT4	**Technical & Impactful Presentation** Planning & Preparation; Presentation; Styles & Methods; Creating Visually Appealing Slides; Clarity of Substance; Overcoming Stage Fear; Audience Analysis & Retention of Audience Interest; Responding to Questions: Having the Final Word	CO4
UNIT5	**GD & Interview Skills** Why GD is Important; Communication Skills for Effective Functional Roles in GD; Initiating & Summarizing; Language Functions; How to Plan & Prepare for Interview; Communicating Strategically & Responding to FAQs during Interview; Behavioural & Stress Interview.	CO5

LAB PLAN

Session 1: Writing a Paragraph
Session 2: Writing a business correspondence & an Email
Session 3: Writing a report
Session 4: Writing a report
Session5: Revising, Proof reading & Formatting
Session 6: Improving Listening Skills Score with IELTS
Session 7: Improving Reading Skills Score with IELTS
Session8: Learning IPA Vowels IPA Consonants
Session 9: Phonetics Drilling
Session 10: Improving Grammar

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	30	70

Reference Books:

1. Mukherjee, S., & Hory, S. (2016). Business Communication: Connecting Work (2nd ed.). OUP, New Delhi.

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	Understand the principles & process of communication	1								1		
CO2	Plan, execute and revise messages		1	1							1	
CO3	Write various types of messages that include resume/online resume & technical reports		1	1						1		
CO4	Present their ideas orally with effective body language and visually appealing ways				1						1	
CO5	Communicate strategically in GD & PI and Use correct phonetics, grammar & vocabulary	1			1					1		

MCAL-1001: Problem Solving using C Lab

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	I
Course Title	**Problem Solving using C Lab**
Course Code	MCAL-1001
Credit	1
Course Type	CC
Course Objective	1. Introduce the essential skills for a logical thinking to problem solving 2. Introduce the essential skills in programming for problem solving using computer.
Course Outcome (COs)	*After completion of this course students will be able to:* CO1. Use of environment, use the primitive data types and data structures of "C". CO2. State and use of sequence control statements of "C'. CO3. Write programs functions (both in-built as well as user defined) CO4. Explain the usage of arrays, pointers, structure, and union in "C". CO5. Explain the commands of File Management in "C" and implement it in program.

Course Outline

Unit	Description	CO Mapping
Lab-1	Familiarity with IDE Programs on arithmetic expressions, data type limits, operators and precedence.	CO1
Lab-2	Programs on Conditional Branching.	CO2
Lab-3	Programs on Loops.	CO2
Lab-4	Programs on single dimensional array. Programs on two-dimensional array.	CO2
Lab-5	Programs on String operations (with and without library functions)	CO2
Lab-6	Programs on Functions (including searching and sorting). Programs on Recursive Functions	CO3
Lab-7	Programs on Pointers. Programs on Dynamic Memory Allocation.	C04
Lab-8 -9	Programs on Structure & Union. Programs on File Handling	CO4, CO5
Lab-10-12	Programs on Searching and Sorting	CO2, CO3

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	15	35

Text Books:

1. Kernighan, B. W., & Ritchie, D. M. (2015). C Programming Language (2nd ed.). Pearson Education.

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	Use of environment, use the primitive data types and data structures of "C".	2		1						2		
CO2	State and use of sequence control statements of "C'.		2							2	2	
CO3	Write programs functions (both in-built as well as user defined)		1				1			3	2	
CO4	Explain the usage of arrays, pointers, structure, and union in "C".	1	1	1						3		
CO5	Explain the commands of File Management in "C" and implement it in program.	1	2									1

MCAL-1004: Web Technology Lab

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	I
Course Title	**Web Technology Lab**
Course Code	MCAL-1004
Credit	1
Course Type	CC
Course Objective	1. To introduce students to HTML and its various elements and their usage. 2. To enable students to create static web pages using HTML and frames. 3. To teach students the basics of cascading style sheets and their implementation in web pages. 4. To familiarize students with JavaScript and its usage for validating forms. 5. To introduce students to XML and its usage for data representation and exchange.
Course Outcome (COs)	CO1. Understand the concept of HTML and its various elements to create lists in a webpage. CO2. Demonstrate the ability to create hyperlinks and navigate between pages or sections of a webpage. CO3. Demonstrate the ability to create a timetable using tables and apply appropriate styling. CO4. Understand the concept of frames and create a static home page using frames. CO5. Demonstrate the ability to create a static registration form and validate it using JavaScript.

Course Outline

Lab	Description	CO Mapping
Lab :1	Write a HTML program for the demonstration of Lists. Unordered List , Ordered List, Definition List, Nested List	**CO1**
Lab :2	Write a HTML program for demonstrating Hyperlinks. • Navigation from one page to another. • Navigation within the page	**CO2**
Lab :3	Write a HTML program for time-table using tables.	**CO3**

Lab :4	• Write a HTML program to develop a static Home Page using frames. • Write a HTML program to develop a static Registration Form. • Write a HTML program to develop a static Login Page	**CO4**
Lab :5	• Write a HTML program to develop a static Web Page for Catalog. • Write a HTML program to develop a static Web Page for Shopping Cart.	**CO5**
Lab :6	• Write HTML for demonstration of cascading stylesheets. • Embedded stylesheets. • External stylesheets. • Inline styles.	**CO1, CO2**
Lab :7	Write a javascript program to validate USER LOGIN page.	**CO1, CO3**
Lab :8	Write a javascript program for validating REGISTRATION FORM	**CO1, CO4**
Lab :9	• Write a program for implementing XML document for CUSTOMER DETAILS. • Write an internal Document Type Definition to validate XML for CUSTOMER DETAILS?	**CO2, CO4**
Lab :10	Write a JSP that reads parameters from user login page.	**CO2, CO3**
Lab :11	Write a JSP that reads a value, creates a cookie and retrieves it.	**CO2, CO3**
Lab :12	Write a servlet that connects to the database and retrieves the data and displays it.	**CO3, CO4**

Evaluation:

Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	15	35

Reference Materials:

1. Holzner, S. (Year). HTML Black Book. Publisher.
2. Naughton, P., & Schildt, H. (Year). The Complete Reference Java 2 (5th ed.). TMH.

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	Understand the concept of HTML and its various elements to create lists in a webpage.	1	1	1						1		
CO2	Demonstrate the ability to create hyperlinks and navigate between pages or sections of a webpage.								1			
CO3	Demonstrate the ability to create a timetable using tables and apply appropriate styling.	1								1		
CO4	Understand the concept of frames and create a static home page using frames.			1								
CO5	Demonstrate the ability to create a static registration form and validate it using JavaScript.								1	1		

MCAL-1005: Database Management Systems Lab

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	I
Course Title	Database Management Systems Lab
Course Code	MCAL-1005
Credit	1
Course Type	CC
Course Objective	The subject aims to provide the student with: 1. An understanding of basic concepts of DBMS. 2. An introduction to the Entity Relationship Models. 3. An understanding of Relational Algebra. 4. An induction to constraints, View and SQL. 5. An introduction to Transactions.
Course Outcome (COs)	After completion of this course students will be able to: CO1. Acquire a good understanding of database systems concepts. CO2. Create and maintain tables using PL/SQL. CO3. Application development using PL/SQL & front end tools CO4. Understand the use of structured query language and its syntax. CO5. Demonstrate an understanding of the relational data model.

Course Outline

Unit	Description	CO Mapping
Lab 1-2	• Introduction to basic DDL, DML and DCL commands and domain types in SQL. • DDL statements to create, drop, alter, view and rename the Database.	CO1, CO2, CO5
Lab 3	• Write DML statements to insert the values into the tables. Use variants to insert values such as insert multiple records and insert records resulting from a select query. • Write statements to add and delete a column in a table which is pre-existent. • Write DML statements to update a table for single and multiple field updation. • Write DML statements to delete single or multiple record(s) from a table.	CO1, CO2, CO5

Lab 4-5	• Practice SELECT query with following options: Distinct, order by, between, top/max/min and other aggregation keywords, group by, having, wild card matching, exists • Nested subqueries	**CO3, CO4, CO5**
Lab 6	• Practice SELECT query with following options: Distinct, order by, between, top/max/min and other aggregation keywords, group by, having, wild card matching, exists • Nested subqueries	**CO4, CO5**
Lab 7	• Write a query to create INNER JOIN / LEFT JOIN / RIGHT JOIN / FULL JOIN in two tables.	**CO4, CO5**
Lab 8	• Add primary key constraint to a pre-existent table. • Add NOT NULL / UNIQUE constraint to a pre-existent column. • Define the foreign key constraint. Show the errors returned by Database when: • a) FK constraint is violated • b) A referenced item is deleted • Define and demonstrate cascading effect in foreign key referenced tables. • Define, add and drop the check/default constraint. • Define auto increment arguments/attributes of a table.	**CO2, CO4, CO5**
Lab 9	• Write a query to create/delete VIEW from two tables including some selection criteria. • Write a query to create and delete clustered/non-clustered index for a table.	**CO5**

Lab 10-11	• To implement the concept of trigger in database:
	  ▪ How to apply database triggers
	  ▪ Types of database triggers
	  ▪ Create/delete database triggers
	  ▪ Create trigger to demonstrate magic tables (INSERTED and DELETED).
	  ▪ Create a hypothetical situation to undo the changes in a table via Trigger (Max credit limit reached/ Balance insufficient etc.).
		CO5

Lab 12-13	• Write some stored procedures to cover the following problems:
	  ▪ Demonstrate Control structures
	  ▪ Swap two numbers
	  ▪ Find the sum of digits
	  ▪ Calculate grades etc.
	• Define Transaction, demonstrate the Commit and Rollback operations using hypothetical situations.
		CO4, CO5

Evaluation:

Mode of Evaluation	Practical	
Weightage	Continuous Evaluation	End Semester Examination
	15	35

Text Book:

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill

References:

1 "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer science Press.

2 "Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, Pearson Education

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	Acquire a good understanding of database systems concepts.	2		1						1		
CO2	Create and maintain tables using PL/SQL.	1	2									
CO3	Application development using PL/SQL & front end tools	1	2		1						1	
CO4	Understand the use of structured query language and its syntax.	1										
CO5	Demonstrate an understanding of the relational data model		1		1					1		

SEMESTER - II

SEMSTER -II

Sl. No.	Subject Code	Title of Paper	L	T	P	Internal	External	Credits
1	MCAT- 2001	Data Structures & Algorithm	3	0	0	30	70	3
2	MCAT-2002	Principles of Operating System	3	0	0	30	70	3
3	MCAT- 2003	Quantitative Techniques	3	0	0	30	70	3
4	MCAT-2004	Python Programming	3	0	0	30	70	3
5	MCAT-2005(A/B)	Program Elective – I	3	0	0	30	70	3
6	MCAT-2006	Universal Human Values and Ethics	1	0	0	30	70	1
7	MCAL- 2001	Data Structure & Analysis of Algorithms Lab	0	0	2	15	35	1
8	MCAL-2002	Operating System Lab	0	0	2	15	35	1
9	MCAL- 2004	Python Programming Lab	0	0	2	15	35	1
10	MCAS-2007	Seminar	0	0	2	15	35	1
		TOTAL						**20**

MCAT-2001: Data Structures & Algorithms

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	II
Course Title	Data Structures & Algorithms
Course Code	MCAT-2001
Credit	3
Course Type	Core Course
Course Objective	The subject aims to provide the student with: 1. An understanding of basic concepts of data structures. 2. An introduction to the stacks and queues. 3. An understanding of Tree in Data Structures. 4. An understanding of Algorithms and its design. 5. An introduction to Graphs

Course Outcome (COs)	After completion of this course students will be able to:
	CO1: Explain the needs of data structures and its types.
	CO2: Explain the working of Stack, queues and Linked list.
	CO3: Explain the concepts of Trees.
	CO4: Demonstrate the algorithm design for real time problems.
	CO5: Explain the need and working of Graphs in data structures.

Course Outline

Unit	Description	CO Mapping
UNIT1	**Introduction of Data Structure:** Basic terminologies; introduction to basic data Structures: Arrays, linked list, trees, stack, queue, Graph; Data structure operations; Algorithm complexity: definition, types and notations.	CO1
UNIT2	**Stacks, Queues and Recursion:** Stacks; Array representation of stack; Linked representation of stack; Various polish notation's-Prefix, Postfix, infix; Evaluation of a postfix & Prefix expression; Conversion from one another; Application of stack; Recursion; Towers of Hanoi; Implementation of recursive procedures by stacks; Queues; Linked representation of queues; Dequeues; Circular queue; Priority queue; Singly Linked list- Operation	CO2

		on it; Doubly linked list- Operation on it; Circular linked list.	
UNIT3	**Trees:** Binary trees; Representation of binary tree in memory; Traversing binary tree; Traversing using stack; Header nodes; Binary search trees; Searching and inserting in binary search trees; Deleting in a binary search tree; AVL search trees; Insertion and deletion in binary search trees; m-way search trees: searching, insertion, deletion; B trees: searching, insertion, deletion; Heap..		CO3
UNIT4	**Algorithm Design techniques:** Divide and Conquer, Greedy, Dynamic programming, back Tracking. Searching algorithm: linear search, binary search; Sorting algorithms: Bubble sort, Insertion sort, Selection sort, Quick Sort, Merge sort and Heap sort, Hashing, Hash function.		CO4
UNIT5	**Graphs:** Terminology & representation; Linked representation of graph; Operation on graph; Traversing a graph. Depth First Search, BFS, Warshall algorithm, Dijkstara algorithm, Minimum spanning tree; Kruskal & Prim's algorithm.		CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	30	70

Text Books:

1. Gilberg, R., & Forouzan, B. (2016). Data Structures: A Pseudocode Approach with C (2nd ed.). Cengage.

2. Kruse, R.L., & Leung, C. T. (2008). Data Structures and Program Design in C (2nd ed.). Pearson.

Reference Books:

1. Langsam, Y., Augenstein, M. J., & Tanenbaum, A. M. (2009). Data Structures Using C (3rd ed.). Pearson.

2. Mehlhorn, K., & Sanders, P. (2010). Algorithms and Data Structures: The Basic Toolbox. Springer.

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	Explain the needs of data structures and its types.	2	2							1		
CO2	Explain the working of Stack, queues and Linked list.		1								1	
CO3	Explain the concepts of Trees.		1								1	
CO4	Demonstrate the algorithm design for real time problems.		1		1					1		
CO5	Explain the need and working of Graphs in data structures	1				1						

MCAT-2002: Principles of Operating System

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	II
Course Title	**Principles of Operating System**
Course Code	MCAT-2002
Credit	3
Course Type	Core Course
Course Objective	The subject aims to provide the student with: 1. An understanding of basic concepts of Operating System. 2. An introduction to Process Scheduling. 3. An understanding of Memory Management by OS. 4. An understanding of File System. 5. Understanding of I/o Systems.
Course Outcome (COs)	After completion of this course students will be able to: CO1: Explain the needs of OS in computer system. CO2: Explain the working of Process scheduling. CO3: Understand the concept of Synchronization. CO4: Explain the concept of deadlock and memory management CO5: Explain concept of Threads and File System

Course Outline

Unit	Description	CO Mapping
UNIT1	**Overview:** Introduction, operating system operations, process management, memory management, storage management, protection and security, distributed systems. **Operating Systems Structures**: Operating system services and systems calls, system programs, operating system structure, operating systems generations.	CO1
UNIT2	**Process Scheduling:** **Process Management:** Process concepts, process state, process control block, scheduling queues, process scheduling, multithreaded programming, threads in UNIX, comparison of UNIX and windows.	CO2

UNIT 2	**Process synchronization:** Process synchronization, Race Condtion, critical section problem, Peterson's solution, synchronization hardware, semaphores, classic problems of synchronization, readers and writers problem, dining philosophers problem, monitors, synchronization examples(Solaris), atomic transactions. Comparison of UNIX and windows.	
UNIT3	**Concurrency and Synchronization**: Process synchronization, critical section problem, Peterson's solution, synchronization hardware, semaphores, classic problems of synchronization, readers and writers problem, dining philosophers problem, monitors, synchronization examples(Solaris),	CO3
UNIT4	**Deadlocks:** System model, deadlock characterization, deadlock prevention, detection and avoidance, recovery from deadlock banker's algorithm. **Memory Management:** Swapping, contiguous memory allocation, paging, structure of the page table, segmentation, virtual memory, demand paging, page-replacement algorithms, allocation of frames, thrashing, case study - UNIX. Disk Scheduling and different algorithms	CO4
UNIT5	**Threads and File System:** Threads, Kernel level thread, User-level thread. Concept of a file, access methods, directory structure, file system mounting, file sharing, protection. File system implementation: file system structure, file system implementation, directory implementation, allocation methods, free-space management, efficiency and performance, comparison of UNIX and windows**.**	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	30	70

Suggested Books:

1. Silberschatz, A., Galvin, P. B., & Gagne, G. (2009). Operating System Concepts (8th ed.). Wiley-India.

2. Stallings, W. (2010). Operating Systems: Internals and Design Principles (6th ed.). PHI Learning Pvt. Ltd.

Reference Books:

1. Deitel, H. M., Deitel, P. J., & Choffnes, D. R. (2003). Operating Systems (3rd ed.). Pearson Education.

2. Tanenbaum, A. S. (2014). Modern Operating Systems (4th ed.). Pearson Education.

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CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	Explain the needs of OS in computer system.	2		1						1		
CO2	Explain the working of Process scheduling.	1	2									
CO3	Understand the concept of Synchronization.	1	2	1							1	
CO4	Explain the concept of deadlock and memory management	1										
CO5	Explain concept of Threads and File System		1		1					1		

MCAT-2003 : Quantitative Techniques

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	II
Course Title	Quantitative Techniques
Course Code	MCAT-2003
Credit	3
Course Type	Core Course

Course Objective	The subject aims to provide the student with:
	      1. An understanding of floating point numbers.
	      2. An introduction to non-linear equations.
	      3. An understanding of linear systems and eigen values.
	      4. Understanding of Interpolation and Approximation.
	      5. Understanding of Numerical Integration.
	      6. An introduction to Differential Equation.

Course Outcome (COs)	After completion of this course students will be able to: CO1: Explain the Floating points and represent it. CO2: Explain the working of important software and their use to perform any computational activities. CO3: Demonstrate the use of Internet and explain its different components. CO4: Explain the working of cloud computing and its different technologies.

Course Outline

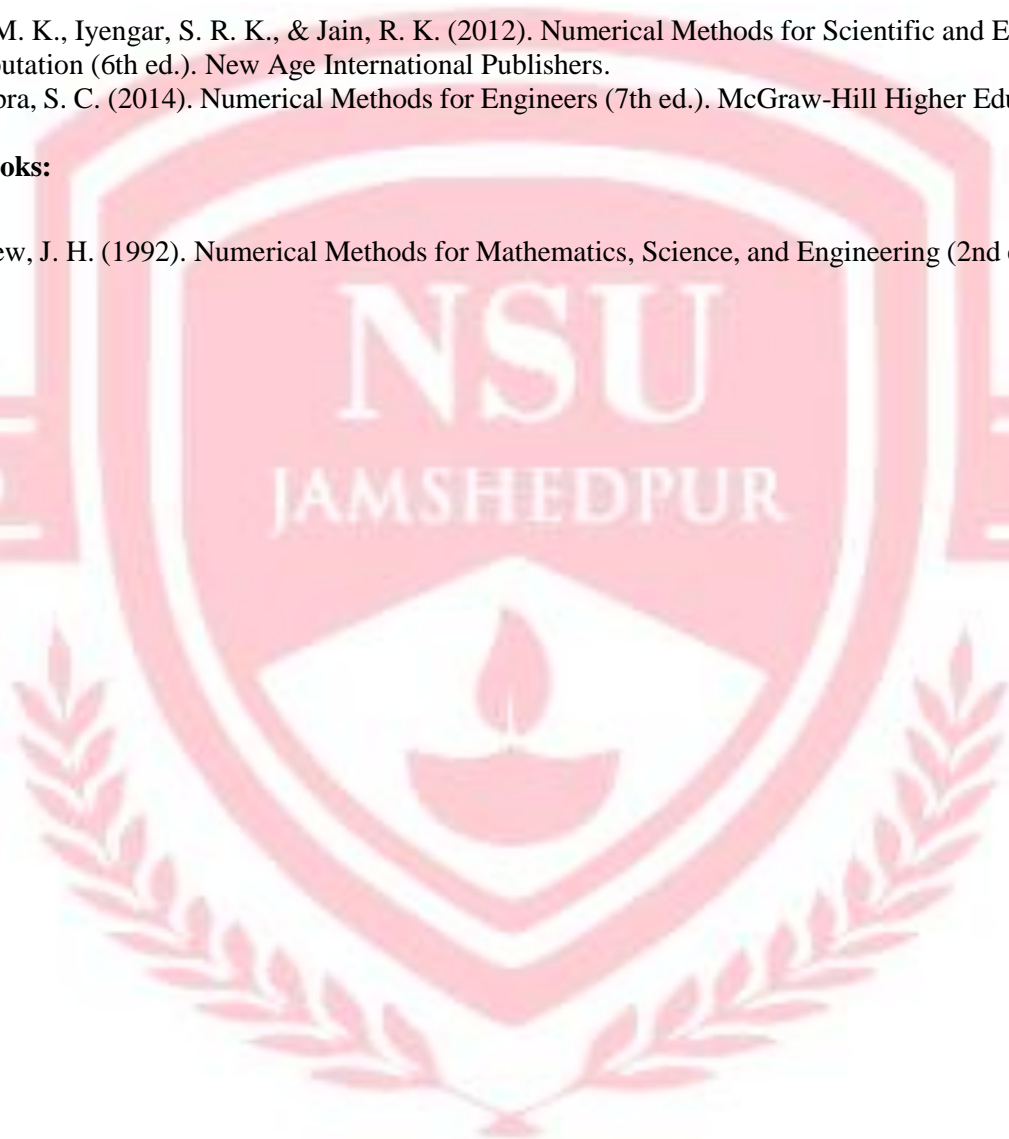| Unit	Description	CO Mapping
UNIT1	**Floating-Point Numbers:** Floating-point representation, rounding, chopping, error analysis, conditioning and stability.	CO1
UNIT2	**Non-Linear Equations:** Bisection, secant, fixed-point iteration, Newton method for simple and multiple roots, their convergence analysis and order of convergence.	CO2
UNIT3	**Linear Systems and Eigen-Values:** Gauss elimination method using pivoting strategies, LU decomposition, Gauss-Seidel and successive-over-relaxation (SOR) iteration methods and their convergence, ill and well-conditioned systems, Rayleigh's power method for eigen-values and eigen-vectors.	CO3
UNIT4	**Interpolation and Approximations:** Finite differences, Newton's forward and backward interpolation, Lagrange and Newton's divided difference interpolation formulas with error analysis, least square approximations.	CO4
UNIT5	**Numerical Integration:** Newton-Cotes quadrature formulae (Trapezoidal and Simpson's rules) and their error analysis, Gauss-Legendre quadrature formulae.	CO5
UNIT6	**Differential Equations:** Solution of initial value problems using Picard, Taylor series, Euler's and Runge-Kutta methods (up to fourth-order), system of first-order differential equations. Laboratory Work: Lab experiments will be set in consonance with materials covered in the theory. Implementation of numerical techniques using MATLAB/any other programming language.	CO6

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	30	70

Suggested Books:

1. Jain, M. K., Iyengar, S. R. K., & Jain, R. K. (2012). Numerical Methods for Scientific and Engineering Computation (6th ed.). New Age International Publishers.
2. Chappra, S. C. (2014). Numerical Methods for Engineers (7th ed.). McGraw-Hill Higher Education.

Reference Books:

1. Mathew, J. H. (1992). Numerical Methods for Mathematics, Science, and Engineering (2nd ed.). Prentice Hall.

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	Explain the Floating points and represent it.	1	1	1						1		
CO2	Explain the working of important software and their use to perform any computational activities.								1			
CO3	Demonstrate the use of Internet and explain its different components.	1								1		
CO4	Explain the working of cloud computing and its different technologies.			1								

MCAT-2004: Python Programming	
School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	II
Course Title	**Python Programming**
Course Code	MCAT-2004
Credit	2
Course Type	Core Course
Course Objective	The subject aims to provide the student with: 1. To read and write simple Python programs. 2. To develop Python programs with conditionals and loops. 3. To use Python data structures lists, tuples, dictionaries. 4. To do input/output with files in Python.

Course Outcome (COs)	After completion of this course students will be able to: CO1: Develop algorithmic solutions to simple computational problems CO2: Read, write, execute by hand simple Python programs. CO3: Structure simple Python programs for solving problems using functions. CO4: Represent compound data using Python lists, tuples, dictionaries. CO5: Read and write data from/to files in Python Programs.

Course Outline

Unit	Description	CO Mapping
UNIT1	**DATA, EXPRESSIONS, STATEMENTS:** Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.	CO1
UNIT2	**CONTROL FLOW, FUNCTIONS:** Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.	CO2
UNIT3	**OOPS CONCEPTS IN PYTHON:** Class, Objects, Polymorphism, Encapsulation, Inheritance, Data Abstraction	CO3
UNIT4	**LISTS, TUPLES, DICTIONARIES:** List operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.	CO4
UNIT5	**FILES, MODULES, PACKAGES:** Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	30	70

Suggested Books:

1. Downey, A. B. (2016). Think Python: How to Think Like a Computer Scientist (2nd ed., Updated for Python 3). Shroff/O'Reilly Publishers.

2. van Rossum, G., & Drake Jr, F. L. (2011). An Introduction to Python – Revised and Updated for Python. Network Theory Ltd.

Reference Books:

1. Guttag, J. V. (2013). Introduction to Computation and Programming Using Python (Revised and Expanded Edition). MIT Press.

2. Lambert, K. A. (2012). Fundamentals of Python: First Programs. CENGAGE Learning.

3. Budd, T. A. (2015). Exploring Python. Mc-Graw Hill Education (India) Private Ltd.

0.00		CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
CO	**STATEMENT**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	Develop algorithmic solutions to simple computational problems	2		1			1			1		
CO2	Read, write, execute by hand simple Python programs.		1		1							
CO3	Structure simple Python programs for solving problems using functions.			1	1				1		1	
CO4	Represent compound data using Python lists, tuples, dictionaries.		2		2		1			1		1
CO5	Read and write data from/to files in Python Programs	1						1				

MCAL-2001: Data Structure using C Lab

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	II
Course Title	**Data Structure using C Lab**
Course Code	MCAL-2001
Credit	L-T-P- 0-0-2 Total Credit - 1
Course Type	CC
Course Objective	1. To develop skills to design and analyze simple linear and nonlinear data structures. 2. To strengthen the ability to the students to identify and apply the suitable data structure for the given real world problem. 3. To enables them to gain knowledge in practical applications of data structures.
Course Outcome (COs)	After completion of this course students will be able to: CO1. Student understands design and analyze the time and space efficiency of the data structure. CO2. Implement the Stack, Queue and their applications. CO3. Implement various types of linked lists and their applications CO4. Perform basic operations on BST CO5. Implement different sorting and searching algorithms.

Course Outline

Unit	Description	CO Mapping
Lab 1	Implementations of pointers and arrays (As a prerequisite)	CO1
Lab 2	Implementation of Stack using Array	CO2
Lab 3	Implementation of Queue using Array	CO2
Lab 4	Creation of Linked list	CO3
Lab 5	Different operations on Linked list	CO3
Lab 6	Implementation of Stack using Linked list	CO2, CO3
Lab 7	Implementation of Queue using Linked list	CO3
Lab 8	Implementation and different operations on Doubly Linked list	CO3
Lab 9	Implementation and different operations on Circular Linked list	CO3

Lab 10	Implementation of Binary Search Tree and its Traversals	CO5
Lab 11	Implementation of Linear search, Binary search	CO5

Evaluation:

Mode of Evaluation	Practical	
Weightage	Continuous Evaluation	End Semester Examination
	15	35

Reference Books:
1. Langsam, Y., Augenstein, M. J., & Tanenbaum, A. M. (2009). Data Structures Using C (3rd ed.). Pearson.
2. Mehlhorn, K., & Sanders, P. (2010). Algorithms and Data Structures: The Basic Toolbox. Springer.

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	Student understands design and analyze the time and space efficiency of the data structure.	1	1							1		
CO2	Implement the Stack, Queue and their applications.				1						1	
CO3	Implement various types of linked lists and their applications	1								1		
CO4	Perform basic operations on BST				1						1	
CO5	Implement different sorting and searching algorithms.		1								1	

MCAL-2002 : Operating Systems-Lab

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	II
Course Title	**Operating Systems-Lab**
Course Code	MCAL-2002
Credit	1
Course Type	SEC
Course Objective	1. To make student learn how to write shell scripts in linux. 2. To make student understand the concept of system calls and how they are used. 3. To make student understand the concept of inter-process communication. 4. To make student understand the various CPU scheduling algorithms and differentiate between them. 5. To make student understand the solution of critical section problem using semaphores.
Course Outcome (COs)	CO1. Demonstrate proficiency in using basic Unix commands. CO2. Use the Unix shell to manipulate files and directories, and understand functions. CO3. Write shell scripts using variables, loops (for, while), and
	conditional statements (if else, case), and understand how to use shell variables, arguments to shell procedures, the test command. CO4. Develop programs in C to implement various Unix system calls such as stat, ls, creating and displaying process identification numbers, CO5. Understand memory allocation strategies (First-Fit, Next- Fit, Best-Fit, and Worst-Fit) and page replacement algorithms (FIFO, Optimal, LRU)

Course Outline

Lab	Description	CO Mapping
Lab :1	Basic Unix Commands: Testing the use of LINUX commands such as date, clear, chmod, man, mail, passwd, pwd, cat, ls, mv, mkdir, cd, rm, rmdir, wc etc, introduction to Vi editor.	CO1
Lab :2	UNIX shell: Illustration of shell function such as wild cards, redirection, pipes, sequencing, grouping, background processing, command substitution, sub shells.	CO2
Lab :3	Shell programming: Write shell scripts with the help of variables, loops (for, while), and conditional statements (if else, case). Shell variables, arguments to shell procedure, test command, arithmetic with EXPR command, interactive shell procedures with read. Write a shell script to • Find largest of two numbers • Display numbers from 1 to 10 • To find factorial of a number	CO3
Lab :4	• Write a program to copy the content of one file to another file using system calls. • Write a program to append contents of one file to another file.	CO3
Lab :5	• Write C program to illustrate the following Commands using system Calls: stat and ls • Write a program to create a process and display its process identification number and parent process identification number. • Write a program to print process identification numbers of parent process and ten of its child processes.	CO2
Lab :6	• Write a program to implement who | wc –l. • Write a program to implement ls | sort | wc. • Write a program to implement (ls | sort) > file.	CO2
Lab :7	• Write a program in 'C' to implement FCFS CPU scheduling algorithm. • Write a program in 'C' to implement FCFS CPU scheduling algorithm when process arri`val time is given.	CO4
Lab :8	• Write a program in 'C' to implement SJF CPU scheduling algorithm (preemptive and non-preemptive). • Write a program in 'C' to implement round robin CPU scheduling algorithm (preemptive and non-preemptive).	CO4

Lab :9	Write programs in 'C' to show solution of producer consumer problem and Readers-Writer Problem using semaphore.	**CO5**
Lab :10	Write a program in 'C' to implement Bankers algorithm for deadlock avoidance.	**CO5**
Lab :11	Write a program in 'C' to illustrate memory allocation strategies (First-Fit, Next-Fit, Best-Fit and Worst-Fit).	**CO5**
Lab :12	Write a program in 'C' to illustrate page replacement algorithms (FIFO, Optimal, LRU)	**CO5**

Evaluation:

Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	15	35

Reference Materials:

1. Sumitabha Das, "Unix concepts and applications, IV editon", TMH.
2. Maurice J. Bach, "Design of the UNIX Operating System", PHI.
3. Silberschatz, P. Galvin and Greg Gagne, "Operating System Concepts", Wiley.
4. Brain W.Kernigham and Rob Pike, UNIX Programming Environment.
5. W. Richard Stevens, "UNIX network programming (volume II)", Pearson education.

MCAL-2004 : Python Lab

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	II
Course Title	**Python Lab**
Course Code	MCAL-2004
Credit	1
Course Type	CC
Course Objective	1. Introduce the essential skills for a logical thinking to problem solving through python language. 2. Develop critical thinking and problem-solving skills.
Course Outcome (COs)	CO1. Students will gain a strong foundation in python language implementation. CO2. Students will learn how to identify and apply appropriate logic for solving real-world problems. CO3. Able to solve problems using list, tuples and Dictionaries CO4. Students will able to handle various functions and modules using python. CO5. Students will able to handle object oriented concepts using python

Course Outline

Lab	Description	CO Mapping
Lab :1	Introduction to Python: Installation and setup, instructions. Questions related to variable assignment and naming conventions	**CO1**
Lab :2	Basic python programs with data,, expressions and statements	**CO1**
Lab :3	Questions on control flow and loops: Conditional statements	**CO2**
Lab :4	Questions on control flow and loops: Conditional statements	**CO2**
Lab :5	Questions related to List, Tuples and Dictionaries	**CO2**
Lab :6	Questions related to List, Tuples and Dictionaries	**CO3**
Lab :7	Questions related to Functions	**CO3**

Lab :8	Questions related to Functions and modules	**CO4**
Lab :9	Questions on File Handling	**CO4**
Lab :10	Questions related Object-Oriented Programming	**CO5**
Lab :11 -12	Questions related Object-Oriented Programming Additional Topics (optional): Regular expressions, working with databases, Hands-on exercises and problem-solving tasks, Encouraging creativity and independent thinking	**CO5**

Evaluation:

Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	15	35

Suggested Books:

1. Downey, A. B. (2016). Think Python: How to Think Like a Computer Scientist (2nd ed., Updated for Python 3). Shroff/O'Reilly Publishers.

2. van Rossum, G., & Drake Jr, F. L. (2011). An Introduction to Python – Revised and Updated for Python. Network Theory Ltd.

Reference Books:

1. Guttag, J. V. (2013). Introduction to Computation and Programming Using Python (Revised and Expanded Edition). MIT Press.

2. Lambert, K. A. (2012). Fundamentals of Python: First Programs. CENGAGE Learning.

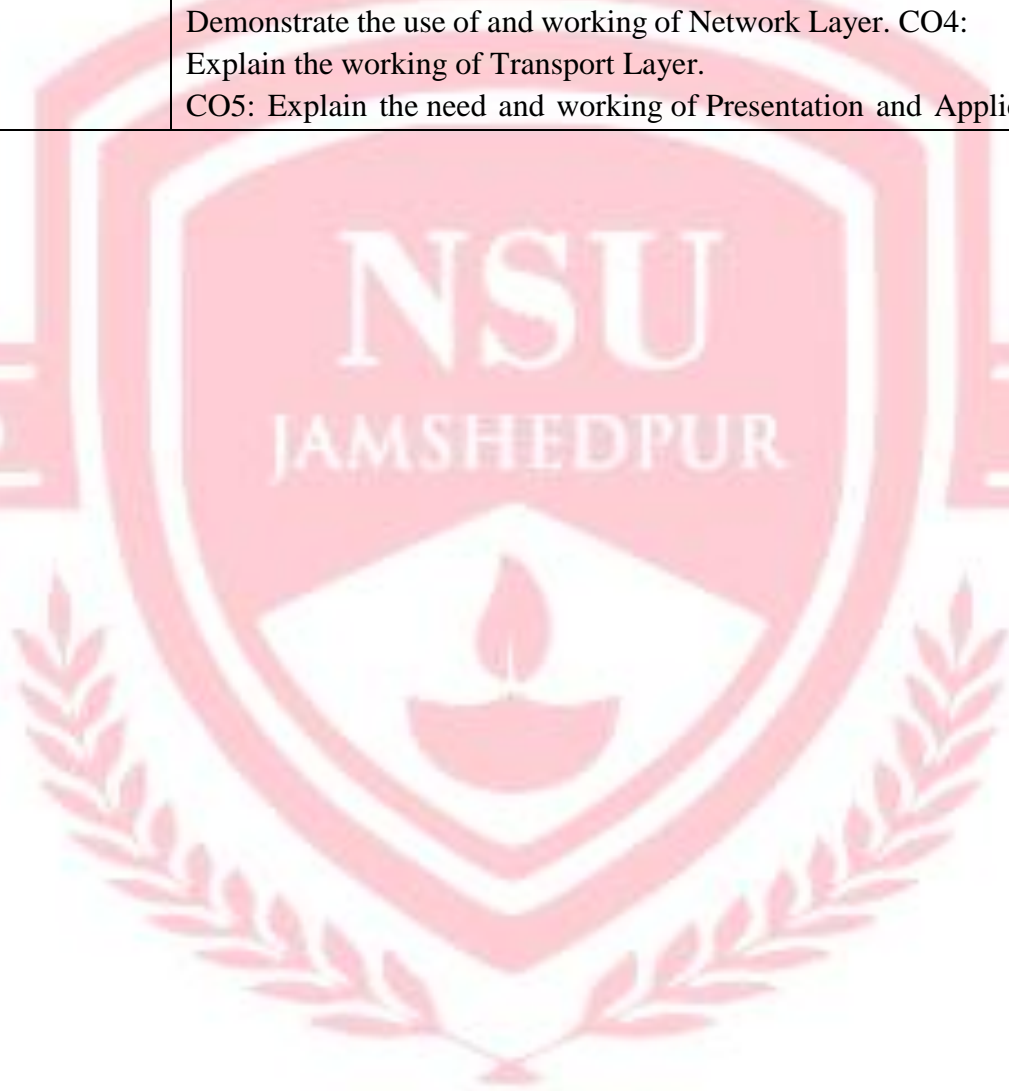| CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	Develop proficiency in Python for data mining: Students will gain a strong foundation in Python and its data mining libraries	2								1		
CO2	problems: Students will learn how to identify and apply appropriate data mining techniques for solving real-world problems.		1	1						1		
CO3	Evaluate and interpret mining results: Students will develop the ability to evaluate and interpret the results of data mining algorithms.	2			1						1	
CO4	Develop critical thinking and problem-solving skills: Through the process of designing and implementing data mining solutions, students will develop critical thinking	2							1			1
CO5	Collaborate effectively in a team: Students will have opportunities to work collaboratively in small groups on data mining projects	2								1		

SEMESTER - III

SEMESTER -III

Sl. No	Subject Code	Title of Paper	L	T	P	Internal	External	Credits
1	MCAT-3001	Computer Networks	3	0	0	30	70	3
2	MCAT-3002	Machine Learning Techniques	3	0	0	30	70	3
3	MCAT-3003	Cloud Computing	3	0	0	30	70	3
4	MCAT-3004	Software Engineering	3	0	0	30	70	3
5	MCAT-3005(A/B)	**Programme Elective-II**	3	0	0	30	70	3
6	MCAT-3006 (A/B)	**Programme Elective-III**	3	0	0	30	70	3
7	MCAL-3004	Software Engineering Lab	0	0	1	15	35	1
8	MCAL-3002	Machine Learning Techniques Lab	0	0	2	15	35	1
9	MCAP-3007	Minor Project / Industrial Internship-I	0	0	4	100		2
		TOTAL						**22**

MCAT-3001: Computer Networks

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	III
Course Title	**Computer Networks**
Course Code	MCAT-3001
Credit	3
Course Type	Core Course

Course Objective	The subject aims to provide the student with:
	    1. An understanding of basic concepts of computer networks.
	    2. An introduction to Data Link Layer.
	    3. An understanding of Network Layer.
	    4. An introduction to Transport Layer.
	    5. An introduction to Presentation and Application Layer.

Course Outcome (COs)	After completion of this course students will be able to: CO1: Explain the needs of Computer Networks. CO2: Explain the working and need of Data Link Layer. CO3: Demonstrate the use of and working of Network Layer. CO4: Explain the working of Transport Layer. CO5: Explain the need and working of Presentation and Application Layer.

Course Outline

Unit	Description	CO Mapping
UNIT1	**Introduction:** Goal and application Network Hardware and Software , Protocol hierarchies, Design Issue of the layers, Interfaces and services, Connection oriented and connection less services, Service Primitives, Reference Models – The OSI Reference model, The TCP/IP Reference Model ,Types of computer Network :LAN,MAN,WAN, Topologies, Transmission mode Networking Devices, Classification of Computer Networks, Network Protocol Stack (TCP/IP and ISO-OSI),Network Standardization .	CO1
UNIT2	**Data Link Layer:** Data Link Layer design issues, Framing, Flow control, Error Detection and Correction DLL Protocol: Stop and Wait Protocol, Sliding window protocol, A Simplex protocol for noisy channel, Medium access sublayer: Channel allocation –static and dynamic, Multiple access protocol FDDI, Data Link Layer in the Internet – SLIP, PPP.	CO2
UNIT3	**Network Layer:** The Network Layer Design Issue, comparison of virtual circuits and datagram subnets, connectionless internetworking, Tunnelling, Internetwork routing, Routing algorithm, Fragmentation, The Network Layer in the Internet – The IP Protocol, IP Address, subnets, Internet control protocols, internet multicasting.	CO3
UNIT4	**Transport Layer:** The Transport layer services, the concept of client and server in terms of socket addressing Quality, of service, Transport service primitives and buffering, Multiplexing, Crash Recovery. The Internet Transport Protocols (TCP/IP) – The TCP Service Model, The TCP protocol, The TCP segment header, TCP connection management, TCP transmission policy, TCP congestion control, TCP timer management, UDP.	CO4
UNIT5	**Presentation and Application Layer:** Presentation Layer-Design issues, Data compression techniques, cryptography - TCP - Window Management. Application Layer: Application Layer: File Transfer, Access and Management, Electronic mail, Virtual Terminals, Other application. Example Networks - Internet and Public Networks.	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	30	70

Text Books:

1. Forouzan, B. A. (2007). Data Communications and Networking (2nd ed.). TMH.
2. Tanenbaum, A. S. (2013). Computer Networks. Pearson Education.

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	Explain the needs of Computer Networks.	1									1	
CO2	Explain the working and need of Data Link Layer.		1	1								1
CO3	Demonstrate the use of and working of Network Layer.		1	1						1		
CO4	Explain the working of Transport Layer.				1						1	
CO5	Explain the need and working of Presentation and Application Layer.	1			1					1		

MCAT-3002: Machine Learning Techniques

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	III
Course Title	**Introduction to Machine Learning**
Course Code	MCAT-3002
Credit	3
Course Type	Core Course
Course Objective	The subject aims to provide the student with: 1. An understanding of basic concepts of Machine Learning. 2. An introduction to the fundamentals of Supervised Learning. 3. An understanding of SVM. 4. An introduction to Evaluation. 5. An introduction to Unsupervised Learning. 6. An introduction to Deep Networks.
Course Outcome (COs)	After completion of this course students will be able to: CO1: Explain Machine Learning as well as its needs. CO2: Explain Supervised Learning and its usage. CO3: Demonstrate the use of SVM. CO4: Explain the working of Unsupervised Learning. CO5: Explain the Neural Networks and Deep Learning

		Mapping
UNIT1	**Introduction:** Learning theory, Hypothesis and target class, Inductive bias and bias-variance tradeoff, Occam's razor, Limitations of inference machines, Approximation and estimation errors.	CO1
UNIT2	**Supervised Learning:** Linear separability and decision regions, Linear discriminants, Bayes optimal classifier, Linear regression, Standard and stochastic gradient descent, Lasso and Ridge Regression, Logistic regression, Support Vector Machines, Perceptron, Back propogation, Artificial Neural Networks, Decision Tree Induction, Overfitting, Pruning of decision trees, Bagging and Boosting, Dimensionality reduction and Feature selection.	CO2
UNIT3	**Support Vector Machines:** Structural and empirical risk, Margin of a classifier, Support Vector Machines, Learning nonlinear hypothesis using kernel functions.	CO3
UNIT4	**Unsupervised learning:** K-Means clustering: Concepts and implementation. Hierarchical clustering: Agglomerative and divisive approaches. Dimensionality reduction techniques: Principal Component Analysis (PCA), t-Distributed Stochastic Neighbor Embedding (t-SNE).	CO4
UNIT5	**Neural Networks and Deep Learning:** Introduction to Artificial Neural Networks (ANN) and their components. Activation functions and backpropagation algorithm. Convolutional Neural Networks (CNN) for image analysis. Recurrent Neural Networks (RNN) for sequential data.	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	30	70

Suggested Books:

1. Alpaydin, E. (2006). Introduction to Machine Learning. Prentice Hall of India.

2. Hastie, T., Tibshirani, R., & Friedman, J. (2009). The Elements of Statistical Learning: Data Mining,

Inference, and Prediction (2nd ed.). Springer.

Reference Books:

3. Bishop, C. M. (2010). Pattern Recognition and Machine Learning. Springer.

4. Duda, R. O., Hart, P. E., & Stork, D. G. (2012). Pattern Classification. John Wiley and Sons.

0.00		CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
CO	**STATEMENT**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	Explain Machine Learning as well as its needs.	2		1			1			1		
CO2	Explain Supervised Learning and its usage.		1		1							
CO3	Demonstrate the use of SVM.			1	1				1		1	
CO4	Explain the working of Unsupervised Learning. CO5: Explain the Neural Networks and Deep Learning		2		2	1				1		1
CO5	Explain Machine Learning as well as its needs.	1						1				

MCAT-3003 : Cloud Computing

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	III
Course Title	**Cloud Computing**
Course Code	MCAT-3003
Credit	3
Course Type	Core Course
Course Objective	The subject aims to provide the student with:
	1. An understanding of basic concepts of cloud computing. 2. An introduction to the architecture of cloud computing. 3. A look through case studies. 4. A introduction on service management in cloud computing. 5. Knowledge on security.
Course Outcome (COs)	After completion of this course students will be able to: CO1. Explain the needs of cloud computing. CO2. Explain the architecture of cloud computing. CO3. Explain the working of service management in cloud computing. CO4. Explain the security paradigms in cloud computing. CO5. Demonstrate the case studies which showcased the usage of cloud computing.

Course Outline

Unit	Description	CO Mapping
UNIT1	**Overview of Computing Paradigm:** Recent trends in Computing: Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing. Introduction to Cloud Computing: Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers, Benefits and limitations of Cloud Computing.	CO1
UNIT2	**Cloud Computing Architecture:** Comparison with traditional computing architecture (client/server), Services provided at various levels, Service Models-Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), How Cloud Computing Works, Deployment, Models- Public cloud, Private cloud, Hybrid cloud, Community cloud, Case study of NIST architecture.	CO2
UNIT3	**Service Management in Cloud Computing:** Service Level Agreements (SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of Scaling.	CO3
UNIT4	**Cloud Security:** Infrastructure Security- Network level security, Host level security, Application level security, Data security and Storage- Data privacy and security Issues, Jurisdictional issues raised by Data location, Authentication in Cloud Computing.	CO4
UNIT5	**Case Studies:** Case Study of Service, Model using Google App Engine Microsoft Azure, Amazon EC2.	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	30	70

Suggested Books:

1. Sosinsky, B. (2010). Cloud Computing Bible. Wiley-India.

2. Buyya, R., Broberg, J., & Goscinski, A. M. (2011). Cloud Computing Principles & Paradigms. Wiley.

Reference Books:

1. Marinescu, D. C. (2013). Cloud Computing: Theory and Practice. Elvesier.
2. Hurwitz, J. S., Kirsch, D. (2020). Cloud Computing for Dummies. Wiley.

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	Explain the needs of cloud computing.	2		1								1
CO2	Explain the architecture of cloud computing.		1								1	

MCAT-3004 : Software Engineering

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	III
Course Title	**Software Engineering**
Course Code	MCAT-3004
Credit	2
Course Type	Core Course

Course Objective	The subject aims to provide the student with:
	    1. An understanding of basic concepts of Software Engineering.
	    2. An introduction to the fundamentals of Requirement Engineering.
	    2. An understanding of Object-oriented design and UML.
	    3. An introduction to Architectural Design.
	    4. An introduction to Project Management.

Course Outcome (COs)	After completion of this course students will be able to: CO1: Explain the needs of Software Engineering. CO2: Explain the working and importance of Requirement Engineering. CO3: Demonstrate the use of object-oriented design and UML. CO4: Explain the flow of Architectural Design. CO5: Explain the need of Project Management.

Course Outline :

Unit	Description	CO Mapping
UNIT1	**Introduction:** Introduction to Software Development processes, Software Crisis, Software Processes, Software life cycle models: Waterfall, Prototype, Evolutionary and Spiral models, Overview of Quality Standards like ISO 9001, SEI-CMM Agile software development: Agile methods,	CO1
UNIT2	**Software Project Planning:** Cost estimation, static, Single and multivariate models, COCOMO model, Putnam Resource Allocation Model, Risk management. **Software Requirement Analysis and Specifications:** Problem Analysis, Data Flow Diagrams, Data Dictionaries, Entity-Relationship diagrams, Software Requirement and Specifications, Behavioural and non-behavioural requirements, Software Prototyping.	CO2
UNIT3	**Software Design:** Cohesion & Coupling, Classification of Cohesiveness & Coupling, Function Oriented Design, Object Oriented Design, User Interface Design. **Software Reliability:** Failure and Faults, Reliability Models: Basic Model, Logarithmic Poisson Model, Calender time Component, Reliability Allocation.	CO3
UNIT4	**Software Testing:** Manual and Automation testing, Manual Testing: White Box Testing, Black Box Testing, Grey Box Testing, White Box Testing: Path testing, Loop testing, Condition testing, Black Box Testing: Functional Testing: Unit Testing, Integration Testing, System Testing , Non-function Testing: Performance Testing, Usability Testing, Compatibility Testing, Integration Testing and System testing	CO4
UNIT5	**Software Maintenance:** Management of Maintenance, Maintenance Process, Maintenance Models, Reverse Engineering, Software Re-engineering, Configuration Management, Documentation Introduction to Advanced Software Engineering concepts: Software reuse, Component-based software engineering, Distributed software engineering, Service-oriented architecture, Embedded software,	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	30	70

Suggested Books:

1. Mall, R. (2018). Fundamentals of Software Engineering (5th ed.). PHI.

2. Sommerville, I. (2017). Software Engineering (10th ed.). Pearson Education.

Reference Books:

1. Suman, U. (2013). Software Engineering: Concepts & Practices (1st ed.). Cengage Learning publications.

2. Aggarwal, K. K., & Singh, Y. (Year). Software Engineering. New Age International.

3. Pressman, R. S., & Maxim, B. R. (2019). Software Engineering: A Practitioner's Approach (8th ed.). McGraw-Hill International Editions.

4. Jalote, P. (2019). An Integrated Approach to Software Engineering (3rd ed.). Narosa Publishing House.

5. Mall, R. (2018). Fundamentals of Software Engineering (5th ed.). PHI.

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	Explain the needs of Software Engineering.	2								1		
CO2	Explain the working and importance of Requirement Engineering.			1			1	1	1			
CO3	Demonstrate the use of object-oriented design and UML.		2	1							1	
CO4	Explain the flow of Architectural Design.		1					1	1			
CO5	Explain the need of Project Management					1				1		

MCAL-3004: Software Engineering Lab

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	III
Course Title	**Software Engineering Lab**
Course Code	MCAL-3004
Credit	1
Course Type	Core Course
Course Objective	The subject aims to provide the student with: 1. To develop SRS document, design documents such as ER Diagrams, DFDs, UML Diagrams etc. for some given software project. 2. To develop efficient codes for some given software projects and test the developed code using different tools. 3. To implement different software project management techniques. 4. To use different computer aided software engineering (CASE) tools.
Course Outcome (COs)	After completion of this course students will be able to: CO1: Develop SRS document, design documents such as ER Diagrams, DFDs, UML Diagrams etc. for a given software project. CO2: Develop efficient codes for a given software project using appropriate coding standards and guidelines and test the developed code using different tools. CO3: Implement different software project management techniques such as FP, COCOMO, CPM, PERT etc. CO4: Know the use of different computer aided software engineering (CASE) tools in the development, maintenance and reuse of software systems.

Course Outline

Unit	Description	CO Mapping
Expt 1	Prepare the SRS document for a given problem, such as the below mentioned problems. You should identify the appropriate requirements for the given problem; Draw the E-R Diagram using any available tool, Draw the DFD for the given problem using any available tool, Draw the Use Case diagram, Domain Models, and Class Diagram, Sequence Diagrams and Collaboration Diagrams for each Use Case, State Chart Diagram and Activity Diagram, (if necessary) using any available tool; Develop the corresponding software using any programming language such as Java, Python, etc. with an interactive GUI and appropriate Database. a) Develop software to automate the bookkeeping activities of a 5 star hotel b) The local newspaper and magazine delivery agency wants to automate the various clerical activities associated with its business. Develop a software for this. c) A small automobile spare parts shop sells the spare parts for vehicles of several makes and models. Each spare part is typically manufactured by several small industries. To streamline the sales and supply ordering, the shop owner wants to automate the activities associated with his business. Develop a software for this. d) Develop a software for the automation of the dispensary of your college. e) Develop a software for automating various activities of the Estate Office of your college. f) Develop a word processing software with some limited number of facilities such as making bold italics, underline, cut, copy and paste etc. g) Develop a graphics editor software package, using which one can create / modify several common types of graphics entities. h) Develop a software for automating various activities of the departmental offices of your college.	CO1
Expt 2	a) Estimate the size of a given software using Function Point Metric. b) Write a C function for searching an integer value from a large sorted sequence of integer values stored in array of size 100, using the binary search method. Build the control flow graph (CFG) of this function using any compiler writing tool. Write a program in Java to determine its cyclomatic complexity. Identify the linearly independent paths and generate the test cases using path coverage based strategy.	CO2

Expt 3	a) To perform various testing operations using the available testing tools for a given system. b) Write a program in Java to determine the number of defects still remaining after testing, using error seeding methodology.	CO3
Expt 4	a) Draw the GANT chart for a given software project using any available tool such GanttProject.	CO4
Expt 5	a) Draw the network diagram, find out the critical path and critical activities, and calculate the project duration for a given problem using CPM. You may use any available tool for this such as Ganttproject, ProjectLibre etc. b) Draw the network diagram, find out the critical path and critical activities, and calculate the project duration for a given problem using PERT. You may use any available tool for this such as Ganttproject, ProjectLibre etc.	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	30	70

Suggested Books:

1. Mall, R. (2018). Fundamentals of Software Engineering (5th ed.). PHI.

2. Sommerville, I. (2017). Software Engineering (10th ed.). Pearson Education.

Reference Books:

1. Suman, U. (2013). Software Engineering: Concepts & Practices (1st ed.). Cengage Learning publications.

2. Aggarwal, K. K., & Singh, Y. (Year). Software Engineering. New Age International.

3. Pressman, R. S., & Maxim, B. R. (2019). Software Engineering: A Practitioner's Approach (8th ed.). McGraw-Hill International Editions.

4. Jalote, P. (2019). An Integrated Approach to Software Engineering (3rd ed.). Narosa Publishing House.

5. Mall, R. (2018). Fundamentals of Software Engineering (5th ed.). PHI.

6. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw-Hill Education (India), New Delhi.

MCAL-3002: Machine Learning Techniques Lab

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	III
Course Title	**Machine Learning Techniques Lab**
Course Code	MCAL-3002
Credit	1
Course Type	IDC
Course Objective	The subject aims to provide the student with: 1. An understanding of basic concepts of Machine Learning. 2. An introduction to the fundamentals of Supervised Learning. 3. An understanding of Support Vector Machine. 4. An introduction to Evaluation. 5. An introduction to Unsupervised Learning. 6. An introduction to Deep Networks.
Course Outcome (COs)	After completion of this course students will be able to: CO1. Understand the import and export of data using python. CO2. Demonstrate the various data pre-processing and dimension reduction methods CO3. Demonstrate the linear regression model and implement the different classification techniques CO4. Understanding the concept of Deep Neural Networks and Convolution Neural Network CO5. Understanding the concept and implementation of Genetic Algorithms

Course Outline

Lab	Description	CO Mapping
Lab :1	Write a python program to import and export data using Pandas library functions	CO1
Lab :2	Demonstrate various data pre-processing techniques for a given dataset	CO2
Lab :3	Implement Dimensionality reduction using Principle Component Analysis (PCA) method.	CO2
Lab :4	Write a Python program to demonstrate various Data Visualization Techniques.	CO3
Lab :5	Implement Simple and Multiple Linear Regression Models.	CO3
Lab :6	Develop Logistic Regression Model for a given dataset.	CO3
Lab :7	Develop Decision Tree Classification model for a given dataset and use it to classify a new sample.	CO4
Lab :8	Implement Naïve Bayes Classification in Python	CO5
Lab :9	Build KNN Classification model for a given dataset.	CO4
Lab :10	Build Artificial Neural Network model with back propagation on a given dataset.	CO4
Lab :11	Build CNN Model on given data set	CO4
Lab :12	Implementation of Genetic Algorithm	CO5

Evaluation:

| Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	15	35

Reference Books:

1. C. M. Bishop, (2010) Pattern Recognition and Machine Learning, Springer.

2. R. O. Duda, P. E. Hart, and D.G. Stork, (2012) Pattern Classification, John Wiley and Sons.

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	Understand the import and export of data using python.	2		1			1			1		
CO2	Demonstrate the various data pre-processing and dimension reduction methods		1		1							
CO3	Demonstrate the linear regression model and implement the different classification techniques			1	1				1		1	

| CO4 | Understanding the concept of Deep Neural Networks and Convolution Neural Network | | 2 | | 2 | | 1 | | | 1 | | 1 |
| CO5 | Understanding the concept and implementation of Genetic Algorithms | 1 | | | | | | | 1 | | | | |

SEMESTER – IV
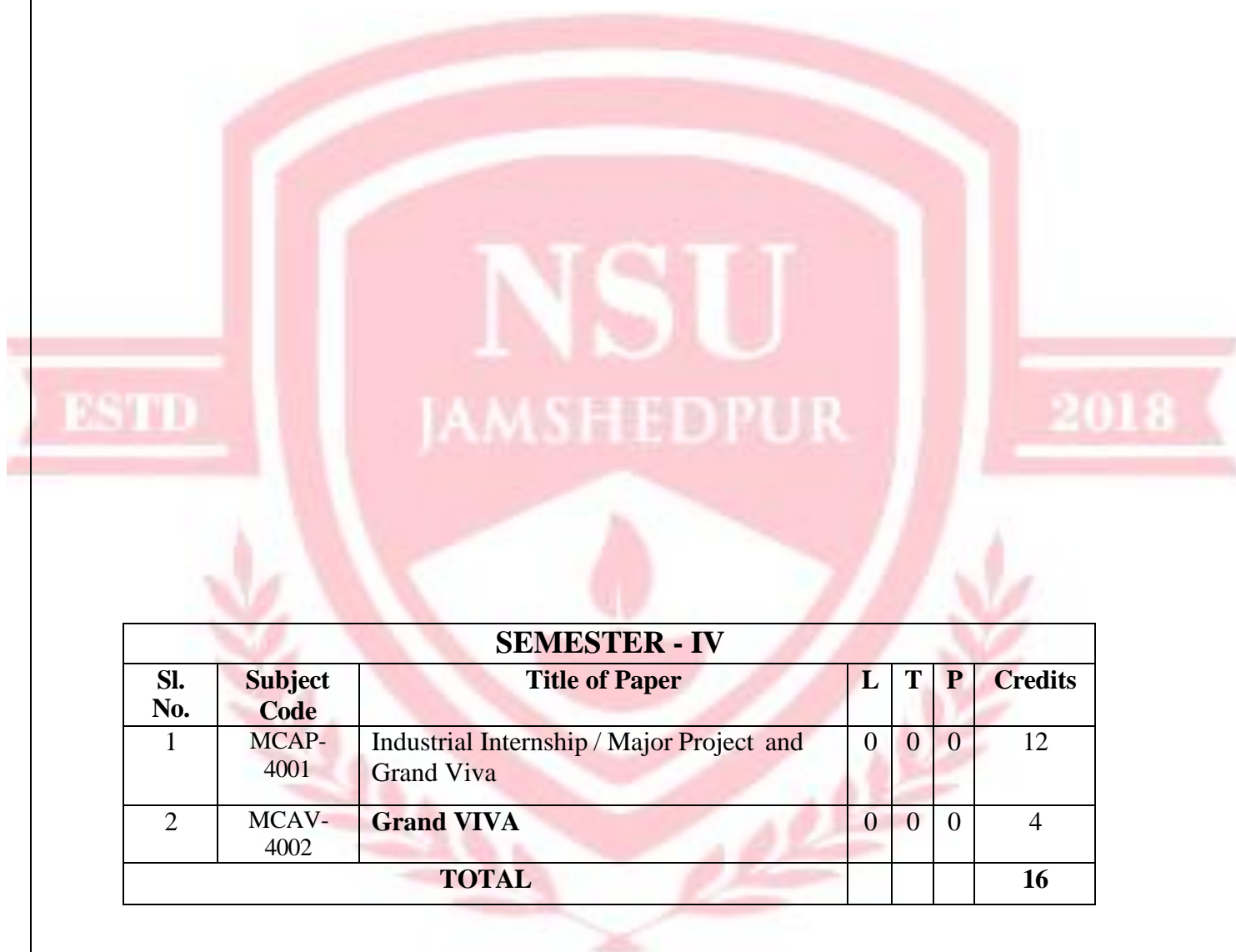
SEMESTER - IV						
Sl. No.	Subject Code	Title of Paper	L	T	P	Credits
1	MCAP-4001	Industrial Internship / Major Project and Grand Viva	0	0	0	12
2	MCAV-4002	**Grand VIVA**	0	0	0	4
		TOTAL				**16**

MAJOR PORJECT

Program Elective -I

Block Chain Technology

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	II
Course Title	**Block Chain Technology**
Course Code	MCAT-2005(A)
Credit	L-T-P- 3-1-0 Total Credit - 4
Course Type	CC
Course Objective	The subject aims to provide the student with: 1. Define blockchain technology and explain its history. 2. Understand blockchain architecture, including nodes, blocks, transactions, and smart contracts. 3. Discuss cryptocurrencies such as Bitcoin, Ethereum, Litecoin, and others, and explain how they relate to blockchain. 4. Identify blockchain applications in various industries, including finance, supply chain management, healthcare, and others. 5. Describe security issues and potential attacks on the blockchain, including cryptography and blockchain security.
Course Outcome (COs)	After completion of this course students will be able to: CO1. Understand the fundamental concepts of blockchain technology, including its history, key features, and types of blockchains. CO2. Analyze the architecture of blockchain, including nodes, blocks, transactions. CO3. Evaluate the relationship between cryptocurrencies and blockchain

Course Outline

Unit	Description	CO Mapping
UNIT1	**Introduction to Blockchain Technology:** History and definition and of blockchain technology, Key features of blockchain technology: Decentralization, immutability, transparency, security. Different Types of blockchain	CO1
UNIT2	**Blockchain Architecture and Consensus Mechanisms**: Blockchain architecture: Nodes, blocks, transactions, and smart contracts **Consensus mechanisms**: Proof of Work (PoW), Proof of Stake (PoS), and others Forks and their impact on the blockchain eCourse Objective system	CO2
UNIT3	**Cryptocurrencies and their relation to Blockchain:** Understanding cryptocurrencies: Bitcoin, Ethereum, Litecoin, and others **Mining and transaction validation in the cryptocurrency** eCourse Objectives system, Smart Contracts and Decentralized Applications (DApps)	CO3
UNIT4	**Blockchain Applications**: Blockchain applications in finance, supply chain management, healthcare, and other industries Case studies of successful blockchain implementations Potential future applications of blockchain technology	CO4
UNIT5	**Blockchain Security and Privacy:** Security issues and potential attacks on the blockchain, Cryptography and blockchain security Privacy concerns in the blockchain e-Course Objective system	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	30	70

Text Books:

1. Antonopoulos, A. (2014). Mastering Bitcoin: Unlocking Digital Cryptocurrencies.

   O'Reilly Media. Narayanan, A., Bonneau, J., Felten, E., Miller, A., & Goldfeder, S.

   (2016). Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction.

   Princeton University Press.

Reference Books:

1. Tapscott, D., & Tapscott, A. (2016). Blockchain Revolution: How the Technology Behind Bitcoin Is

   Changing Money, Business, and the World. Penguin.

2. Zheng, Z., Xie, S., Dai, H., Chen, X., & Wang, H. (2017). An Overview of Blockchain Technology:

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3
CO1	Understand the fundamental concepts of blockchain technology, including its history, key features, and types of blockchains.	1								2		
CO2	Analyze the architecture of blockchain, including nodes, blocks, transactions.		1								2	
CO3	Evaluate the relationship between cryptocurrencies and blockchain, including the process of mining and transaction validation.		1	1	1							
CO4	Analyze the current and potential applications of blockchain technology in various industries, including finance, supply chain management.							1	1			
CO5	Understand the security and privacy issues in the blockchain eCourse Objectives system, including potential attacks and the role of cryptography in ensuring security.			1				1	1			2

Data Mining & Warehousing

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	II
Course Title	**Data Mining & Data Warehousing**
Course Code	MCAT- 2005(B)
Credit	3
Course Type	Core Course
Course Objective	The subject aims to provide the student with: 1. An understanding of basic concepts of Data Mining and Data Warehousing. 2. An introduction to Data Warehousing Modeling. 3. An understanding of Association Rule Mining and its applications. 4. An understanding of Classification and Prediction. 5. An introduction to applications of Data Mining.
Course Outcome (COs)	After completion of this course students will be able to: CO1: Explain the needs of Data Warehousing and Data Mining. CO2: Explain the working of Data Warehousing Modeling and its procedures. CO3: Demonstrate the use of Association Rule Mining with its use cases. CO4: Explain the working of Classification and Prediction Modeling. CO5: A better understanding of data mining`s applications.

Course Outline

Unit	Description	CO Mapping
UNIT1	**Introduction:** The knowledge discovery process, Data Mining: Steps in Data mining, Data Mining Functionalities, Architecture of a Typical Data Mining Systems, Classification of Data Mining Systems. Data Pre-processing: Data Cleaning Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation.	CO1

UNIT2	**Data Warehouse Modelling:**	CO2
	Data Cube and Online Analytical Processing (OLAP), Data Warehouse Schemas: Data Cube A Multidimensional Data Model, Stars, Snowflakes, and Fact Constellations Schemas, Major Data Mining Techniques, Data warehouses and Data marts, OLAP operations: Drill-down and roll-up, slice and dice or rotation. MOLAP vs ROLAP models, Data Warehousing and Business Analysis: Data warehousing Components, Data Warehouse Architecture, ETL: Data Extraction, Cleanup, and Transformation Tools, Metadata, Reporting, Query tools and Applications. OLAP and Multidimensional Data Analysis.	
UNIT3	**Association Rule Mining:**	CO3
	Efficient and Scalable Frequent Item set Mining Methods Mining Various Kinds of Association Rules Association Mining to Correlation Analysis Constraint Based Association Mining. Types of Data, Proximity measures, Major Clustering Methods: Partitioning Methods Hierarchical methods: Agglomerative versus Divisive Hierarchical Clustering, BIRCH, DBSCAN clustering. Measuring Clustering Quality, Cluster Analysis.	
UNIT4	**Classification and Prediction:**	CO4
	Rule Based Classification, Classification by Decision Tree, Introduction Bayesian Classification, Classification by ANN using Back propagation, Support Vector Machines, Lazy Learners, Prediction Accuracy and Error Measures, Ensemble Methods.	
UNIT5	**Applications of Data mining:**	CO5
	Financial Data Analysis, Retail and Telecommunication Industries, Intrusion Detection, Recommender Systems. Web Mining: Page Rank Algorithm, HITS Algorithm, Text Mining: Classification based on Sentiment Phrases, Opinion Mining.	

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	30	70

Reference Books:

1. Berson, A., & Smith, S. J. (2007). Data Warehousing, Data Mining & OLAP (Tenth Reprint). Tata

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	Explain the needs of Data Warehousing and Data Mining.	2								1		
CO2	Explain the working of Data Warehousing Modeling and its procedures.		1	1						1		
CO3	Demonstrate the use of Association Rule Mining with its use cases.	2			1						1	
CO4	Explain the working of Classification and Prediction Modeling.	2							1			1
CO5	A better understanding of data mining`s applications	2								1		

Program Electives- II & III

Cyber Security

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	III
Course Title	Cyber Security
Course Code	MCAT-3005(A)
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	Multidisciplinary Courses
Course Objective	The subject aims to provide the student with: 1. Understand the importance of cyber security and the impact of cyber-attacks on organizations and individuals. 2. Recognize different types of cyber threats and attacks, such as malware, viruses, and ransomware, and understand how to mitigate them. 3. Identify and evaluate various cybersecurity technologies and tools, including intrusion detection and prevention systems, security information and event management, endpoint protection tools, and vulnerability assessment and penetration testing.
Course Outcome (COs)	After completion of this course students will be able to: CO1. Understand the definition of Cybersecurity and the importance of protecting digital assets. CO2. Recognize various types of Cybersecurity threats and attacks, and apply risk management principles to assess and mitigate potential vulnerabilities. CO3. Explain basic Cryptography and encryption concepts, network security, firewalls, and identify security tools used in Cybersecurity. CO4. Develop Information Security policies and procedures, incident response planning, and management, and evaluate compliance with regulatory requirements. CO5. Analyze emerging Cybersecurity threats and trends, evaluate the latest Cybersecurity technologies, and understand ethical considerations in Cybersecurity.

Course Outline

Unit	Description	CO Mapping
UNIT1	**Introduction to Cybersecurity** Importance of Cyber security and its definition, Cyber security threats and attacks, Overview of Cyber security frameworks and standards, Its Basic principles	CO1
UNIT2	**Network Security** Fundamentals of network security, Types of network security threats, Network security protocols and technologies, Network security best practices	CO2
UNIT3	**Cybersecurity Technologies and Tools** Intrusion detection and prevention systems (IDS/IPS), Security Information and Event Management (SIEM), Endpoint protection tools, Vulnerability assessment and penetration testing, Security Operations Center (SOC) tools	CO3
UNIT4	**Cybersecurity Policies and Procedures** Information security policies and procedures, Incident response planning and management, Security awareness and training, Physical security considerations, Compliance and regulatory requirements	CO4
UNIT5	**Future of Cybersecurity** Emerging Cybersecurity threats and trends, Advances in Cybersecurity technologies, Ethical considerations in Cybersecurity	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	30	70

Suggested Books:

1. Ciampa, M. (2021). Security+ guide to network security fundamentals. Cengage Learning.

Reference Books:

1. Pfleeger, C. P., & Pfleeger, S. L. (2018). Security in computing. Pearson

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3
CO1	Understand the definition of Cyber security and the importance of protecting digital assets.	2								2		
CO2	Recognize various types of Cybersecurity threats and attacks, and apply risk management principles to assess and mitigate potential vulnerabilities.		1	1							2	
CO3	Explain basic Cryptography and encryption concepts, network security, firewalls, and identify security tools used in Cybersecurity.							1	1			
CO4	Develop Information Security policies and procedures, incident response planning, and management, and evaluate compliance with regulatory requirements.				1	2		1				
CO5	Analyze emerging Cybersecurity threats and trends, evaluate the latest Cybersecurity technologies, and understand ethical considerations in Cybersecurity.				2		1					2

Data Visualization Techniques

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	III
Course Title	**Data Visualization Techniques**
Course Code	MCAT-3005(B)
Credit	3
Course Type	CC
Course Objective	The subject aims to provide the student with: 1. Understand the principles of data visualization: 2. Develop skills in data preparation for visualization:
	3. Create effective visualizations and to incorporate visual cues for data interpretation with clarity and accuracy of visualizations. 4. Learn about interactive data visualization: Students will be introduced to interactive data visualization, including tools and libraries for interactive visualization. .
Course Outcome (COs)	After completion of this course students will be able to: CO1. Understand the importance and purpose of data visualization, and the role it plays in data analysis and decision-making. CO2. Gain proficiency in a range of data visualization tools and technologies, and learn how to choose the appropriate tool for a given data set and task. CO3. Develop skills in a variety of visualization techniques for exploring and communicating different types of data, including distributions, correlations, and multivariate relationships. CO4. Apply design principles and best practices to create effective charts, graphs, and infographics that accurately and clearly communicate insights and findings from data. CO5. Develop an ethical and critical understanding of the challenges and limitations of data visualization, including issues of bias, representation, and interpretation.

Course Outline

Unit	Description	CO Mapping
UNIT1	**Introduction to Data Visualization**: Data Visualization introduction and its Principles, Types of charts and graphs, Selecting suitable chart for different types of data, Introduction to data interpretation	CO1
UNIT2	**Pre-processing of Data for Visualization**: Data Preparation for Visualization, Importance of data preparation, Data cleaning and filtering techniques, Transforming and aggregating data, Handling missing values	CO2
UNIT3	**Effective Visualizations**: Creating and Designing Effective Visualizations, Best practices for creating charts and graphs, Integrating visual cues for data interpretation, Enhancing the clarity and accuracy of visualizations	CO3
UNIT4	**Interactive Data Visualization**: Introduction to interactive data visualization, Using tools and libraries for interactive visualization, Adding interactivity to static visualizations, Designing interactive dashboards	CO4
UNIT5	**Data Interpretation and Communication**: Interpretation and analysis of visualized data, Communicating data insights effectively, Storytelling with data, Ethical considerations in data visualization and communication	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	30	70

Text Books:

1. Wilkinson, L. (2012). *The grammar of graphics* (pp. 375-414). Springer Berlin Heidelberg.

2. Campbell A (2022). *Data Visualization: Ultimate Guide to Data Mining and Visualization.*

Reference Books:

1. Knaflic, C. N. (2015). Storytelling with data: A data visualization guide for business professionals. John Wiley & Sons

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	Understand the importance and purpose of data visualization, and the role it plays in data analysis and decision-making.	2	2							2		
CO2	Gain proficiency in a range of data visualization tools and technologies, and learn how to choose the appropriate tool for a given data set and task.			2	1						2	
CO3	Develop skills in a variety of visualization techniques for exploring and communicating different types of data, including distributions, correlations, and multivariate relationships.		1			1	2					
CO4	Apply design principles and best practices to create effective charts, graphs, and infographics that accurately and clearly communicate insights and findings from data.		1				2		2			
CO5	Develop an ethical and critical understanding of the challenges and limitations of data visualization, including issues of bias, representation, and interpretation.							1				2

Introduction to Big Data

School	School of IT
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	III
Course Title	**Introduction to Big Data**
Course Code	MCAT-3006(A)
Credit	L-T-P- 3-1-0 Total Credit - 4
Course Type	CC
Course Objective	The subject aims to provide the student with: 1. Explain the concept and importance of Big Data and its characteristics 2. Understand the Hadoop framework, including its architecture and components, and use MapReduce programming to process large amounts of data stored in HDFS. 3. Explore the Apache Spark platform, including its architecture, components, and programming model, and use RDDs and DataFrames to process and analyze large-scale datasets. 4. Evaluate various types of NoSQL databases, including MongoDB and Cassandra, and design data models suitable for storing and processing Big Data. 5. Analyze data warehousing architecture, understand the concept of business intelligence, and visualize and analyze data to gain insights into large datasets. 6. Interpret and communicate data effectively: Students will learn how to interpret and analyze visualized data and communicate data insights effectively.

Course Outcome (COs)	After completion of this course students will be able to: CO1. To introduce students to the concept of Big Data and its significance in today's world. CO2. To familiarize students with the different tools and technologies used in Big Data processing. CO3. To teach students how to design and implement Big Data solutions using Hadoop and Spark. CO4. To provide an understanding of NoSQL databases and data warehousing. CO5. To equip students with the skills needed to analyze and visualize large datasets.

Course Outline

Unit	Description	CO Mapping
UNIT1	**Introduction to Big Data**: Introduction to Big Data and its Processing, Definition and Characteristics of Big Data, Importance of Big Data in different industries, Challenges in processing of Big Data, Presentation on 4 V's of Big Data Applications	CO1
UNIT2	**Big Data Overview**: Drivers of Big Data, Big Data Attributes, Data Structures, Big Data Ecosystem, Examples of Data Analytics **Trends of Computing for Big Data**: High-performance Computing (Supercomputers and Clusters), Grid Computing, Cloud Computing, Mobile Computing	CO2
UNIT3	**Hadoop and MapReduce:** Introduction to Hadoop, Hadoop Architecture and components, MapReduce Programming Model, Hadoop Distributed File System (HDFS) **Apache Spark**: Introduction to Spark, Spark Architecture and its components, Spark Programming Model, Spark RDDs and DataFrames	CO3
UNIT4	**NoSQL Databases:** Introduction to NoSQL databases, Different types of NoSQL databases, MongoDB and Cassandra databases, Data modelling in NoSQL databases	CO4
UNIT5	**Data Warehousing and Analytics:** Introduction to Data Warehousing, Data Warehousing Architecture, Introduction to Business Intelligence, Data Visualization and Analysis	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	30	70

Textbook:

1. Nair, P., & Patil, M. R. (2015). *Big Data Processing with Hadoop*. Packt Publishing Ltd.
2. Marz, N., & Warren, J. (2015). *Big Data: Principles and Best Practices of Scalable Realtime Data Systems*. Manning Publications.

Reference Book:

1. Karau, H., Konwinski, A., Wendell, P., & Zaharia, M. (2015). *Learning Spark: Lightning-Fast Big Data Analysis.* O'Reilly Media.
2. Sadalage, P. J., & Fowler, M. (2012). *NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence*. Addison-Wesley Professional.

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	To introduce students to the concept of Big Data and its significance in today's world.	1										
CO2	To familiarize students with the different tools and technologies used in Big Data processing.		1	1							2	

CO	Course Outcome												
CO3	To teach students how to design and implement Big Data solutions using Hadoop and Spark.			2	1		1					1	
CO4	To provide an understanding of NoSQL databases and data warehousing.		1	1									
CO5	To equip students with the skills needed to analyze and visualize large datasets.			2		1	1		2				

School	School of IT
Programme	MCA
Batch	2024-26
Branch/Discipline	MCA
Semester	III
Course Title	**Natural Language Processing**
Course Code	MCAT-3006(B)
Credit	4
Course Type	CC
Course Objective	The subject aims to provide the student with: 1. Understand the definition and scope of NLP and the challenges involved in NLP such as ambiguity, syntax, semantics, and pragmatics. 2. Gain knowledge about various applications of NLP such as language translation, sentiment analysis, chatbots, and information retrieval. 3. Learn text preprocessing techniques such as tokenization, stemming, lemmatization, POS tagging, NER, and stop word removal. 4. Understand different text representation models such as bag-of-words, n-gram, vector space model, and word embeddings. 5. Gain knowledge about language modeling, probability theory, n-gram language models.
Course Outcome (COs)	After completion of this course students will be able to: CO1. Understand the fundamental concepts and challenges in Natural Language Processing. CO2. Demonstrate proficiency in text preprocessing techniques, including word and sentence tokenization, stemming and lemmatization, part-of-speech (POS) tagging, named entity recognition (NER), and stop word removal. CO3. Analyze and represent text data using various models. CO4. Develop proficiency in language modeling using probability theory. CO5. Demonstrate an understanding of syntax and semantics.

Course Outline

Unit	Description	CO Mapping
UNIT1	**Introduction to NLP** Definition and scope of NLP, NLP tasks in syntax, semantics, and pragmatics. Applications such as information extraction, question answering, and machine translation. The problem of ambiguity. The role of machine learning. Brief history of the field. **Applications of NLP:** language translation, sentiment analysis, chatbots, information retrieval	CO1
UNIT2	**Text Pre-processing in NLP** Tokenization: word and sentence tokenization, Stemming and Lemmatization, Part-of-Speech (POS) tagging, Named Entity Recognition (NER), Stop word removal Feature engineering for text data	CO2
UNIT3	**Text Representation** Bag-of-words model, Simple N-gram model, Vector space model, Document-term matrix, TF-IDF weighting, Word embedding: word2vec and GloVe	CO3
UNIT4	**The Role of Language Modelling** Probability theory and language modelling, N-gram language models, Perplexity as evaluation metric, Smoothing techniques: Laplace smoothing, Good-Turing smoothing, Kneser-Ney smoothing,	CO4
UNIT5	**Syntax and Semantics** Context-Free Grammars (CFGs), Parsing techniques: top-down and bottom-up parsing, Dependency parsing, Sentiment analysis: classification, lexicon-based methods, Named entity recognition and disambiguation	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	30	70

Text Books:

1. Steven Bird, Ewan Klein, Edward Loper,(2018) Natural Language Processing with Python Analyzing Text with the Natural Language Toolkit (O'Reilly 2009)

2. Dipanjan Sarkar, (2016) Text Analytics with Python (Apress/Springer)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	Understand the fundamental concepts and challenges in Natural Language Processing.	2										1
CO2	Demonstrate proficiency in text pre-processing techniques, including word and sentence tokenization, stemming and lemmatization, part-of-speech (POS) tagging, named entity recognition (NER), and stop word removal.		1	1								
CO3	Analyse and represent text data using various models.		1		1						1	
CO4	Develop proficiency in language modelling using probability theory.	1										
CO5	Demonstrate an understanding of syntax and semantics.				2	1				2		