Programme and Course Structure for Masters of Computer Application (MCA)

(2 Years MCA Program)
BATCH-2025-2027

Birla School of Applied Sciences
Birla Global University
Bhubaneswar

Contents

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.

Name of the Programme

Master of Computer Applications

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 have been defined for the MCA programme.

Eligibility Criteria

The Candidate should have passed +3 Examination 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 MCA (2 YEARS)

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

SEMSTER –II						
Sl. No.	**Subject Code**	**Title of Paper**	**L**	**T**	**P**	**Credits**
1	MCAT-2001	Data Structures & Algorithm	3	0	0	3
2	MCAT-2002	Principles of Operating System	3	0	0	3
3	MCAT-2003	Quantitative Techniques	3	0	0	3
4	MCAT-2004	Python Programming	3	0	0	3
5	MCAT-2005	Design Thinking	2	0	0	2
6	MCAT-2006	**Program Elective – I**	3	0	0	3
7	MCAT-2007	Universal Human Values	2	0	0	2

8	MCAL-2001	Data Structure & Algorithms Lab	0	0	2	1
9	MCAL-2004	Python Programming Lab	0	0	2	1
10	MCAS-2007	Seminar	0	0	2	1
TOTAL						**22**

SEMESTER –III						
Sl. No	**Subject Code**	**Title of Paper**	**L**	**T**	**P**	**Credits**
1	MCAT-3001	Computer Networks	3	0	0	3
2	MCAT-3002	Machine Learning Techniques	3	0	0	3
3	MCAT-3003	Cloud Computing	3	0	0	3
4	MCAT-3004	Software Engineering	3	0	0	3
5	MCAT-3005	DSCR (Developing Self for Corporate Readiness)	2	0	0	2
6	MCAT-3006	**Programme Elective-II**	3	0	0	3
7	MCAL-3002	Machine Learning Techniques Lab	0	0	1	1
8	MCAL-3004	Software Engineering Lab	0	0	2	1
9	MCAI-3001	Summer Internship	0	0	4	2
TOTAL						**21**

SEMESTER – IV						
Sl. No.	**Subject Code**	**Title of Paper**	**L**	**T**	**P**	**Credits**
1	MCAT-4001	Soft Computing	3	0	0	3
2	MCAT-4002	**Programme Elective-III**	3	0	0	3
3	MCAP-4003	Major Project	0	0	0	12
4	MCAV-4004	Grand VIVA	0	0	0	2
TOTAL						**20**

Program Elective Bucket

Elective	Subject Name
Elective I	Internet of Things
	Block chain Technology
	Android App Development
	Data Mining and Warehousing
	Computer Vision
Elective II	Real Time Systems
	Cyber security and Privacy
	Data Visualisation
	Edge Computing
	Game Theory
Elective III	Quantum Computing
	High Performance Computing
	Big Data
	R Programming for ML
	Natural language Processing

Bridge Courses Details (Proposed)

These additional courses will be applicable only for non-Computer Science background students joining Master of Computer Application (MCA) program at Birla Global University from 2022-23 sessions onwards Total Credits: 12 Credits

SEMESTER - I

Programming in C

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	I
Course Title	Programming in C
Course Code	MCAT- 1001
Credit	L-T-P-3-0-0 Total 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 Funtions 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	CO1

	statements in C. Operators and Expressions: Expression evaluation: Operator Precedence and Associativity.	
UNIT2	**Control Flow and Decision Making:** 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	CO2
UNIT3	**Arrays and Functions,** 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.	CO3
UNIT4	**Pointers and Memory Management** 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	CO4
UNIT5	**File Handling and Advanced Concepts:** 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)	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Suggested Books:

1. Forouzan, B. A., & Gilberg, R. F. (2007). A structured Programming Approach Using C (3rd ed.). Cengage Publication. ISBN: 9788131503638.Behrouz A.

Reference Books:

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

CO	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	-	2	-	1	2	2	1
CO2	2	2	-	-	-	-	-	-	2	1	-
CO3	2	2	-	-	-	-	-	-	2	1	-
CO4	1	1	-	-	1	-	-	-	2	1	-
CO5	2	2	-	-	-	-	-	1	2	1	-

Computer System Architecture

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	I
Course Title	Computer System Architecture
Course Code	MCAT-1002
Credit	L-T-P-3-0-0 Total Credit-3
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
	40	60

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	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	2	1							1		
CO2		1							1		
CO3	2								1		
CO4	1			1					1		
CO5		1							1		

Discrete Mathematics

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	I
Course Title	Discrete Mathematics
Course Code	MCAT-1003
Credit	L-T-P-3-1-0 Total 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	CO2
	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.	
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
	40	60

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	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	1								1		
CO2		1	1							1	
CO3		1	1						1		
CO4				1						1	
CO5	1			1					1		

Web Technology

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	I
Course Title	Web Technology
Course Code	MCAT- 1004
Credit	L-T-P-3-0-0 Total Credit-3
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, XML, and their importance in web development, Introduction to CSS (Cascading Style Sheets) and its role in web design	CO1
UNIT2	**Front-end Web Development** JavaScript fundamentals: Variables, data types, functions, and control structures, Document Object Model (DOM) manipulation, Introduction to front-end frameworks (e.g., React, Angular, or Vue.js), Responsive web design principles and techniques using CSS frameworks (e.g., Bootstrap)	CO2
UNIT3	**Back-end Web Development** Server-side scripting languages (e.g., PHP, Python, or Node.js), Handling data with databases: MySQL, MongoDB, or SQLite, User authentication and security best practices, RESTful API concepts and implementation	CO3
UNIT4	**Web Application Development:** Developing dynamic web applications using server-side scripting and front-end technologies, Session management and cookies, Uploading and handling files on the server, Introduction to Web Services and their applications	CO4
UNIT5	**Web Deployment and Performance Optimization**	

	Web hosting and server configuration, Deployment strategies and version control (e.g., Git), Performance optimization techniques for faster loading times,Introduction to website analytics and monitoring tools	

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

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	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	1	1	1						1		
CO2								1			
CO3	1								1		
CO4			1								
CO5								1	1		

Database Management System

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	1
Course Title	Database Management System
Course Code	MCAT-1005
Credit	L-T-P-3-0-0 Total 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
	40	60

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	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	2								1		
CO2		\1								1	
CO3			1	1							
CO4	2								1		1
CO5		1	1								

Technical Communications

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	I
Course Title	Technical Communications
Course Code	MCAT-1006
Credit	L-T-P-2-0-0 Total Credit-2
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 impactfully 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** Planning Writing; Steps of Writing; Purpose; Readers & Information; Mind Mapping with Technology; Drafting, Redrafting & Proof reading	CO2
UNIT3	**Writing Formal Messages** 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	CO3
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

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Reference Books:

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

2. Kumar, S. (2016). Communication Skills (2nd ed.). OUP, New Delhi.

3. Raman, M., & Sharma, S. (2016). Technical Communication – Principles and Practices. Oxford University Press, New Delhi.

4. Mitra, B. (2012). Personality Development and Soft Skills. OUP, New Delhi.

	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	1								1		
CO2		1	1							1	
CO3		1	1						1		
CO4				1						1	
CO5	1			1					1		

Programming in C Lab

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	I
Course Title	Programming in C Lab
Course Code	MCAL-1001
Credit	L-T-P-0-0-2 Total Credit-1
Course Type	
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
	60	40

Text Books:

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

CO	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	2		1						2		
CO2		2							2	2	
CO3		1				1			3	2	
CO4	1	1		1					3		
CO5	1	2									1

Web Technology Lab

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	I
Course Title	Web Technology Lab
Course Code	MCAL-1004
Credit	L-T-P-0-0-2 Total Credit-1
Course Type	
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
	60	40

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	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	1	1	1						1		
CO2								1			
CO3	1								1		
CO4			1								
CO5								1	1		

Database Management Systems Lab

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	I
Course Title	Database Management Systems Lab
Course Code	MCAL-1005
Credit	L-T-P-0-0-2 Total 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).	**CO5**

	▪ Create a hypothetical situation to undo the changes in a table via Trigger (Max credit limit reached/ Balance insufficient etc.).	
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
	60	40

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	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	2		1						1		
CO2	1	2									
CO3	1	2		1						1	
CO4	1										
CO5		1		1					1		

Technical Communications Lab

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	I
Course Title	Technical Communications Lab
Course Code	MCAL-1006
Credit	L-T-P-0-0-2 Total Credit-1
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 impactfully 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

LAB PLAN

ACTIVIITES	**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
	40	60

Reference Books:

1. Mukherjee, S., & Hory, S. (2016). Business Communication: Connecting Work (2nd ed.). OUP, New Delhi.
2. Kumar, S. (2016). Communication Skills (2nd ed.). OUP, New Delhi.
3. Raman, M., & Sharma, S. (2016). Technical Communication – Principles and Practices. Oxford University Press, New Delhi.
4. Mitra, B. (2012). Personality Development and Soft Skills. OUP, New Delhi.

	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	1								1		
CO2		1	1							1	
CO3		1	1						1		
CO4				1						1	
CO5	1			1					1		

SEMESTER - II

Data Structures & Algorithms

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	II
Course Title	Data Structures & Algorithms
Course Code	MCAT-2001
Credit	L-T-P-3-0-0 Total 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	CO2

	queue; Priority queue; Singly Linked list- Operation 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
	40	60

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	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	2	2							1		
CO2		1								1	
CO3		1								1	
CO4		1		1					1		
CO5	1					1					

Principles of Operating System

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	II
Course Title	Principles of Operating System
Course Code	MCAT -2002
Credit	L-T-P-3-0-0 Total 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. **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.	CO2
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
	40	60

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.

.

CO	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	2		1						1		
CO2	1	2									
CO3	1	2		1						1	
CO4	1										
CO5		1		1					1		

Quantitative Techniques

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	II
Course Title	Quantitative Techniques
Course Code	MCAT- 2003
Credit	L-T-P-3-0-0 Total 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:**	CO3

	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.	
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
	40	60

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.

2. Burden, R. L., & Faires, J. D. (2004). Numerical Analysis (8th ed.). Brooks Cole.

3. Atkinson, K., & Han, W. (2004). Elementary Numerical Analysis (3rd ed.). John Wiley & Sons.

CO	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	1	1	1						1		
CO2								1			
CO3	1								1		
CO4			1								
CO5											

Python Programming

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	II
Course Title	Python Programming
Course Code	MCAT-2004
Credit	L-T-P-3-0-0 Total Credit-3
Course Type	Core Course
Course Objective	The course will enable students to: 1. Learn the syntax and semantics of Python Programming Language 2. Write Python functions to facilitate code reuse and manipulate strings. 3. Illustrate the process of structuring the data using lists, tuples and dictionaries. 4. Demonstrate the use of built-in functions to navigate the file system. 5. Appraise the need for working on web scraping
Course Outcome (COs)	Upon successful completion of this course, student will be able to CO1: Demonstrate the concepts of control structures in Python. CO2: Implement Python programs using functions and strings. CO3: Implement methods to create and manipulate lists, tuples and dictionaries. CO4: Apply the concepts of file handling and regEx using packages. CO5: Illustrate the working of scraping websites with CSV.

Course Outline

Unit	Description	CO Mapping
UNIT 1	**Introduction** Introduction, Python Basics: Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program. Flow control: Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit().	CO1
UNIT 2	**Functions** Functions: def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling. Lists: The List Data Type, Working with Lists, Augmented Assignment Operators, Methods. Dictionaries and Structuring Data: The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things. Manipulating Strings - Working with Strings, Useful String Methods	CO2
UNIT 3	**Pattern Matching with Regular Expressions** Pattern Matching with Regular Expressions: Finding Patterns of Text without Regular Expressions, Finding Patterns of Text with Regular Expressions, More Pattern Matching with Regular Expressions, Greedy and Nongreedy Matching, The findall() Method, Character Classes, Making Your Own Character Classes, The Caret and Dollar Sign Characters, The Wildcard Character, Review of Regex Symbols, Case-Insensitive Matching, Substituting Strings with the sub() Method, Managing Complex Regexes, Combining re.IGNORECASE, re .DOTALL, and re .VERBOSE.	CO3
UNIT 4	**Files** Reading and Writing Files: Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables with the pprint.pformat() Function. Organizing Files: The shutil Module, Walking a Directory Tree, Compressing Files with the zipfile	CO4
UNIT 5	**Web Scraping**	CO5

	Web Scraping: Project: MAPIT.PY with the web browser Module, Downloading Files from the Web with the requests Module, Saving Downloaded Files to the Hard Drive, HTML. Working with Excel Spreadsheets: Excel Documents, Installing the openpyxl Module, Reading Excel Documents, Project: Reading Data from a Spreadsheet, Writing Excel Documents, Project: Updating a Spreadsheet, Setting the Font Style of Cells, Font Objects, Formulas, Adjusting Rows and Columns,	

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

T1: Al Sweigart, “Automate the Boring Stuff with Python”, William Pollock, 2015. ISBN: 978-1593275990

Reference Books:

R1: Allen B. Downey, "Think Python: How to Think Like a Computer Scientist”, 2nd Edition, Green Tea Press, 2015, ISBN: 978-9352134755.

R2: Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014.

R3: Wesley J Chun, “Core Python Applications Programming”, 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365.

R4: Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, “Data Structures and Algorithms in Python”, 1st Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126562176.

R5: Reema Thareja, “Python Programming using problem solving approach”, Oxford University press, 2017. ISBN-13: 978-0199480173

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	2	-	-	-	-	-	-	1
CO2	3	3	3	2	3	-	-	-	-	-	-	2
CO3	3	3	3	2	3	-	-	-	-	-	-	2
CO4	3	2	3	2	3	-	-	-	-	-	-	1
CO5	3	3	2	2	3	1	-	-	-	-	-	2

Design Thinking

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	II
Course Title	Design Thinking
Course Code	MCAT-2005
Credit	L-T-P- 2-0-0 Total Credit - 2
Course Type	
Course Objective	1. Inculcate the fundamental concepts of design thinking 2. Develop the students as a good designer by imparting creativity and problem solving ability 3. Conceive, conceptualize, design and demonstrate innovative ideas using prototypes
Course Outcome (COs)	After the completion of this course, students will be able to CO1. Demonstrate the critical theories of design, systems thinking, and design methodologies CO2. Produce great designs, be a more effective engineer, and communicate with high emotional and intellectual impact CO3. Understand the diverse methods employed in design thinking and establish a workable design thinking framework to use in their practices CO4. Conceive, organize, lead and implement projects in interdisciplinary domain and address social concerns with innovative approaches CO5. Demonstrate teamwork, ethical responsibility, and sustainability awareness in collaborative design projects, integrating reflective practices and effective communication.

Unit	**Description**	**CO Mapping**
UNIT 1	**Introduction to Design Thinking:** Definition and Principles, History and Evolution, Importance in Engineering and Computer Science **Design Thinking Process:** Empathize, Define, Ideate, Prototype, Test **Empathize** User Research Techniques, Interviews and Observations, Creating Empathy Maps	CO1
UNIT 2	**Define:** Problem Statement, Point of View (POV), Defining User Needs and Insights **Ideate:** Brainstorming Techniques, Creative Thinking, Idea Generation Tools **Prototype:** Prototyping Methods, Rapid Prototyping, Low-fidelity vs. High-fidelity Prototypes	CO2
UNIT 3	**Test:** Usability Testing, Gathering Feedback, Iterative Design	CO3

	Tools and Techniques: Software Tools (e.g., Sketch, Figma, Adobe XD), Physical Prototyping Tools, Storyboarding **Application in Computer Science:** Case Studies, Design Thinking in Software Development, User-Centered Design in Technology Projects	
UNIT 4	**Teamwork and Collaboration:** Collaborative Design Techniques, Team Dynamics and Roles, Communication Skills **Real-world Projects:** Project-based Learning, Industry Collaborations, Capstone Project **Evaluation and Reflection:** Reflective Practices, Self and Peer Assessment, Continuous Improvement	CO4
UNIT 5	**Ethics and Social Responsibility:** Ethical Considerations in Design, Impact of Design on Society, Sustainability in Design **Final Project:** Problem Identification, Design Process Documentation, Presentation and Demonstration	CO5

Text books:

1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins Publishers Ltd.
2. IdrisMootee, Design Thinking for Strategic Innovation,2013, John Wiley & Sons Inc

Reference Books:

1. Brenda Laurel Design Research methods and perspectives MIT press 2003
2. Terwiesch, C. & Ulrich, K.T., 2009. Innovation Tournaments: creating and identifying Exceptional Opportunities, Harvard business press.
3. Ulrich &Eppinger, Product Design and Development, 3rd Edition, McGraw Hill, 2004
4. Stuart Pugh, Total Design: Integrated Methods for Successful Product Engineering, BjarkiHallgrimsson, Prototyping and model making for product design, 2012, Laurence King Publishing Ltd
5. Kevin Henry, Drawing for Product designers, 2012, Laurence King Publishing Ltd

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	-	-	-	-	-	-	-	-	1
CO2	1	3	2	1	-	-	-	1	1	1	-	2
CO3	1	3	3	1	-	-	-	-	2	1	-	2
CO4	1	3	3	2	1	-	-	-	2	1	1	2
CO5	1	3	3	2	1	1	1	1	3	1	2	3

Universal Human Values

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	II
Course Title	Universal Human Values
Course Code	MCAT-2007
Credit	L-T-P- 2-0-0 Total Credit - 2
Course Type	
Course Objective	This course envisions to impart to students to: 1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education. 2. To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession. 3. To help students understand the meaning of happiness and prosperity for a human being. 4. To facilitate the students to understand harmony at all the levels of human living, and live accordingly. 5. To facilitate the students in applying the understanding of harmony in existence in them profession and lead an ethical life.
Course Outcome (COs)	After the completion of this course, students will be able to CO1. Understand the significance of value inputs in a classroom, distinguish between values and skills, CO2. Understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society CO3. Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body. CO4. Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious Society CO5. Understand the harmony in nature and existence, and work out their mutually fulfilling participation in the nature. CO6. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

Course Outline

Unit	**Description**	**CO Mapping**

UNIT 1	Course Introduction - Need, Basic Guidelines, Content and Process for Value Education Understanding the need, basic guidelines, content and process for Value Education, Self- Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.	CO1
UNIT 2	Understanding Harmony in the Human Being – Harmony in Myself Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.	CO2
UNIT 3	Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship Understanding harmony in the Family- the basic unit of human interaction, understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in societyUndivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family!	CO3
UNIT 4	Understanding Harmony in the Nature and Existence – Whole existence as Co-existence Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.	CO4

UNIT 5	Implications of the above Holistic Understanding of Harmony on Professional Ethics Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations.	CO5

Evaluation:

Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	60	40

Text books:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

References Books:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	-	3	-	-	-	1
CO2	-	-	-	-	-	3	-	3	1	1	-	2
CO3	-	-	-	-	-	2	-	3	-	-	-	1
CO4	-	-	-	-	-	3	-	3	3	2	-	1
CO5	-	-	-	-	-	2	3	1	-	1	-	1
CO6	-	-	-	-	-	3	1	3	1	1	-	2

Data Structure and Algorithms Lab

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	II
Course Title	**Data Structure and Algorithms** 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
	60	40

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	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	1	1							1		
CO2				1						1	
CO3	1								1		
CO4				1						1	
CO5		1								1	

Python Programming Lab

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	II
Course Title	Python Lab
Course Code	MCAL-2004
Credit	L-T-P- 0-0-2 Total Credit - 1
Course Type	
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	**CO5**
	Additional Topics (optional): Regular expressions, working with databases, Hands-on exercises and problem-solving tasks, Encouraging creativity and independent thinking	

Evaluation:

Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	60	40

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	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	2								1		
CO2		1	1						1		
CO3	2			1						1	
CO4	2							1			1
CO5	2								1		

SEMESTER - III

Computer Networks

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	III
Course Title	Computer Networks
Course Code	MCAT-3001
Credit	L-T-P- 3-0-0 Total 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	CO1

	Devices, Classification of Computer Networks, Network Protocol Stack (TCP/IP and ISO-OSI),Network Standardization and Examples of Networks. Data Transmission Concepts, Analog and Digital Data Transmission, Communication media, Digital modulation techniques (FDMA,TDMA,CDMA).	
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
	40	60

Text Books:

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

CO	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	1								1		
CO2		1	1							1	
CO3		1	1						1		
CO4				1						1	
CO5	1			1					1		

Machine Learning Techniques

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	III
Course Title	Introduction to Machine Learning
Course Code	MCAT-3002
Credit	L-T-P- 3-0-0 Total 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

Course Outline

Unit	Description	CO 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
	40	60

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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	2		1			1			1		
CO2		1		1							
CO3			1	1				1		1	
CO4		2		2		1			1		1
CO5	1						1				

Cloud Computing

School	Birla School of Applied Sciences
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
	40	60

Suggested Books:

1. Sosinsky, B. (2010). Cloud Computing Bible. Wiley-India.
2. ., 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	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	2		1								1
CO2		1								1	
CO3			1					1			
CO4				1			2	1	2		
CO5		1	1								

Software Engineering

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	III
Course Title	Software Engineering
Course Code	MCAT-3004
Credit	L-T-P- 3-0-0 Total Credit - 3
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. 3. An understanding of Object-oriented design and UML. 4. An introduction to Architectural Design. 5.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
	40	60

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	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	2								1		
CO2			1			1	1	1			
CO3		2	1							1	
CO4		1					1	1			
CO5					1				1		

Machine Learning Techniques Lab

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	III
Course Title	Machine Learning Techniques Lab
Course Code	MCAL-3002

Credit	L-T-P- 0-0-2 Total Credit - 1
Course Type	
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
	60	40

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	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	2		1			1			1		
CO2		1		1							
CO3			1	1				1		1	
CO4		2		2		1			1		1
CO5	1						1				

Software Engineering Lab

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	III
Course Title	Software Engineering Lab
Course Code	MCAL-3004
Credit	L-T-P- 0-0-2 Total 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
	40	60

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.

CO	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	2		1			1			1		
CO2		1		1							
CO3			1	1				1		1	

CO4		2		2		1			1		1
CO5	1						1				

7.

SEMESTER – IV

Soft Computing

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	IV
Course Title	Soft Computing
Course Code	MCAT-4001
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	Core Course
Course Objective	The subject aims to provide the student with: 1. Artificial Intelligence, Various types of production systems, characteristics of production systems. 2. Neural Networks, architecture, functions and various algorithms involved. 3. Fuzzy Logic, Various fuzzy systems and their functions. 4. Genetic algorithms, its applications and advances.
Course Outcome (COs)	After completion of this course students will be able to: CO1. Learn about soft computing techniques and their applications. CO2. Analyze various neural network architectures. CO3. Understand perceptrons and counter propagation networks. CO4. Define the fuzzy systems CO5. Analyze the genetic algorithms and their applications.

Course Outline

Unit	Description	CO Mapping
UNIT1	**Soft Computing**: Introduction to soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing, Prepositional and predicate logic, monotonic and non monotonic, reasoning, forward Reasoning, backward reasoning, Weak & Strong Slot & filler structures, NLP.	CO1

UNIT2	**Neural Network:** Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference b/w ANN and human brain, characteristic and applications of ANN, single layer network.	CO2
UNIT3	**Perceptron:** Perceptron training algorithm, Linear separability, Widrow & Hebb's learning rule/Delta rule, ADALINE, MADALINE, AI v/s ANN. Introduction of MLP, different activation functions, Error back propagation algorithm, derivation of BBPA, momentum, limitation, characteristics and application of EBPA. ounter propagation network: architecture, functioning & characteristics of counter Propagation network, Hop field/ Recurrent network, configuration, stability constraints, associative memory, and characteristics, limitations and applications. Hopfield v/s Boltzman machine.	CO3
UNIT4	**Fuzzy Logic:** Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, Fuzzy systems: crisp logic, fuzzy logic, introduction & features of membership functions. **Fuzzy rule base system**: Fuzzy propositions, formation, decomposition & aggregation of fuzzy Rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making & Applications of fuzzy logic.	CO4
UNIT5	**Genetic algorithm:** Fundamental, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator ,Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional methods.	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Suggested Books:

1. S.N. Sivanandam & S.N. Deepa, Principles of Soft Computing, Wiley Publications, 2nd Edition, 2011.

2. S, Rajasekaran & G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications, PHI Publication, 1st Edition, 2009.

Reference Books:

1. N.K.Bose, Ping Liang, Neural Network fundamental with Graph, Algorithms & Applications, TMH, 1st Edition, 1998.
2. Bart Kosko, Neural Network & Fuzzy System, PHI Publication, 1st Edition, 2009.
3. Rich E, Knight K, Artificial Intelligence, TMH, 3rd Edition, 2012.
4. George J Klir, Bo Yuan, Fuzzy sets & Fuzzy Logic,Theory &Applications, PHI Publication, 1st Edition, 2009.
5. Martin T Hagen, Neural Network Design, Nelson Candad, 2nd Edition, 2008.

CO	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	2								1		
CO2			1			1	1	1			
CO3		2	1							1	
CO4		1					1	1			
CO5					1				1		

Program Elective -I

Internet of Things

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	
Course Title	Internet of Things
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	
Course Objective	The subject aims to provide the student with: 1. An understanding of basic concepts of IoT and M2M communication. 2. An introduction to the fundamentals of M2M and IoT. 3. An understanding of architecture of IoT. 4. An introduction to IoT Reference architecture. 5. An introduction to automation.
Course Outcome (COs)	After completion of this course students will be able to: CO1: Explain the needs of IoT and M2M communications. CO2: Explain the fundamental concepts of M2M and IoT. CO3: Demonstrate the architecture of IoT. CO4: Explain the architecture of IoT reference. CO5: Explain automation.

Course Outline

Unit	Description	CO Mapping
UNIT1	**FUNDAMENTALS OF IoT** Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects	CO1
UNIT2	**M2M and IoT Technology Fundamentals:** Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management.	CO2
UNIT3	**IoT Architecture:** State of the Art – Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model	CO3
UNIT4	**IoT Reference Architecture:** Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control. Industrial Automation- Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, Commercial Building,	CO4
UNIT5	**Design and development:** Design Methodology – Embedded computing logic – Microcontroller, System on Chips – IoT system building blocks – Arduino – Board details, IDE programming – Raspberry Pi – Interfaces and Raspberry Pi with Python Programmin.	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Suggested Books:

1. Holler, J., Tsiatsis, V., Mulligan, C., Avesand, S., Karnouskos, S., & Boyle, D. (2014). From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence (1st ed.). Academic Press.
2. Madisetti, V., & Bahga, A. (2014). Internet of Things: A Hands-on Approach (1st ed.). VPT.

Reference Books:

1. daCosta, F. (2013). Rethinking the Internet of Things: A Scalable Approach to Connecting Everything (1st ed.). Apress Publications.
2. Cirani, S., Ferrari, G., Picone, M., & Veltri, L. (2019). Internet of Things: Architecture, Protocol, and Standards (1st ed.). Willy Publishers.
3. Kellmereit, D. (2013). Designing the Internet of Things. Wiley Publishers.

CO	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	2								1		
CO2	2		1			1	1	1			
CO3		2	1							1	
CO4		1					1	1			
CO5	2				1				1		

Block Chain Technology

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	
Course Title	Block Chain Technology
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	
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, including the process of mining and transaction validation. CO4. Analyze the current and potential applications of blockchain technology in various industries, including finance, supply chain management. CO5. Understand the security and privacy issues in the blockchain eCourse Objectives system, including potential attacks and the role of cryptography in ensuring security.

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
	40	60

Text Books:

1. Antonopoulos, A. (2014). Mastering Bitcoin: Unlocking Digital Cryptocurrencies. O'Reilly Media.
2. 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: Architecture, Consensus, and Future Trends. In IEEE International Congress on Big Data (pp. 557-564). IEEE.

CO	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3
CO1	1								2		
CO2		1								2	
CO3		1	1	1							
CO4							1	1			
CO5			1				1	1			2

Android App Development

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	
Course Title	Android App Development
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	
Course Objective	The subject aims to provide the student with: 1. To facilitate students to understand android SDK 2. To help students to gain a basic understanding of Android application development

	3. To inculcate working knowledge of Android Studio development tool
Course Outcome (COs)	After completion of this course students will be able to: CO1. Identify various concepts of mobile programming that make it unique from programming for other platforms, CO2. Critique mobile applications on their design pros and cons, CO3. Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces, CO4. Program mobile applications for the Android operating system that use basic and advanced phone features, CO5. Deploy applications to the Android marketplace for distribution.

Course Outline

Unit	Description	CO Mapping
UNIT1	**Introduction to Android**: Android Platform, Android SDK, Eclipse and Android Installation, Building First Android application, Anatomy of Android Application	CO1
UNIT2	**Android Application Design Essentials**: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions	CO2
UNIT3	**Android User Interface Design Essentials:** User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.	CO3
UNIT4	Testing and Publishing Android application, Usage and Management of Android preferences, Hierarchy of Application resources and working with various types of resources	CO4
UNIT5	**Using Common Android APIs**: Using Android Data and Storage APIs, managing data using Sqlite, Sharing Data between Applications with Content Providers, Usage of Android Networking APIs, Android Web APIs, Android Telephony APIs, and Deploying Android Application to the World.	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

1. Lauren Darcey and Shane Conder, (2011) "Android Wireless Application Development", Pearson Education, 2nd ed.

Reference Books:

1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd
3. Android Application Development All in one for Dummies by Barry Burd, Edition: I

CO	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	2	1						1	1		
CO2		1									
CO3		1	1		1					1	
CO4							1	1			
CO5						1		1			1

Data Mining & Warehousing

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	
Course Title	Data Mining & Data Warehousing
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	
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:** 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.	CO2
UNIT3	**Association Rule Mining:** 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.	CO3
UNIT4	**Classification and Prediction:** Rule Based Classification, Classification by Decision Tree, Introduction Bayesian Classification, Classification by ANN using	CO4

	Back propagation, Support Vector Machines, Lazy Learners, Prediction Accuracy and Error Measures, Ensemble Methods.	
UNIT5	**Applications of Data mining:** 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.	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Reference Books:

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

CO	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	2								1		
CO2		1	1						1		
CO3	2			1						1	
CO4	2							1			1
CO5	2								1		

Computer Vision

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	

Course Title	Computer Vision
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	
Course Objective	The subject aims to provide the student with: 1 The intent of this course is to familiarize the students on the fundamental concepts of Computer Vision and Image Processing. 2 This course covers the basis of image formation in a camera and camera calibration under different environment. 3 The course covers detection of various image features and matching them across images for practical applications such as image stitching, motion estimation and object tracking. 4 The course introduces few deep learning architectures that form the backbone for real world computer vision applications.
Course Outcome (COs)	After completion of this course students will be able to: **CO1**: Understand the formation of an image in the camera and apply projective transformations, calibration algorithms to model a camera in the real world. **CO2**: Understand stereo, multi view geometry concepts and apply algorithms for depth estimation. **CO3**: Apply Feature Detection, Descriptors and Matching methods on images. **CO4**: Analyze the performance of basic deep learning architectures for computer vision applications. **CO5**: Explain morphological operations in computer vision-based applications.

Course Outline

Unit	**Description**	**CO Mapping**
UNIT1	**Introduction**: Introduction, Image Formation – geometric primitives and transformations, photometric image formation, projective geometry, Camera Geometry, Sensor and Image Model, Camera Extrinsics and Intrinsics, Homogeneous Coordinates, DLT and	CO1

	Camera Calibration. Implementation of camera calibration algorithm using checker board.	
UNIT2	Stereo Geometry – Geometry of the Image Pair, Epipolar Geometry, Fundamental matrix and Essential Matrix, Direct Solution for Fundamental and Essential Matrix. Depth estimation from Stereo geometry, Multi-View geometry, Pose estimation. Feature Detection- points and patches, Förstner Operator, edges, lines, corners	CO2
UNIT3	Morphological Image Processing: Overview, Boundary extraction, Region filtering, Connected component extraction, Convex hull, Thinning; Thickening; skeletons; pruning; Image segmentation	CO3
UNIT4	Color Image Processing: Color models, Color transformation and segmentationImage Compression: Fundamentals, Models, Error free and lossy compression, Standards.	CO4
UNIT5	Feature Descriptors and Matching – SIFT Features and RANSAC, Feature-Based Alignment – Image Stitching, Dense motion estimation – Optical flow, Kalman Filter. Deep Learning Architectures for computer vision: AlexNet on ImageNet, VGGNet on ImageNet, GoogleNet on ImageNet	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Book:

1 *Szeliski R. "Computer Vision: Algorithms and Applications", Springer. New York. 2010.*
2 *David A. Forsyth, "Computer Vision: A Modern Approach", 2nd edition, 2012.*
3 *Dr.Adrian Rosebrock, "Deep learning for computer vision with python", PYIMAGESEARCH, 2017.*

Reference(s)

1. *Hartley and A. Zisserman, "Multiple View Geometry in computer vision," Cambridge University Press, 2000.*
2. *Amin Ahmadi Tazehkandi, "Hands-On Algorithms for Computer Vision: Learn how to use the best and most practical computer vision algorithms using OpenCV",Packt Publishing, 2018.*

	CORRELATION WITH PROGRAM OUTCOMES	CORRELATION WITH PROGRAM SPECIFIC OUTCOMES

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3
CO1	2								1		
CO2		1	1						1		
CO3	2			1						1	
CO4	2							1			1
CO5	2								1		

Cyber Security and Privacy

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	
Course Title	Cyber Security and Privacy
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	
Course Objective	The subject aims to provide the student with: 1. Understand the importance of cybersecurity 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. 4. Develop information security policies and procedures, incident response planning and management, security awareness and training,

	and physical security considerations to ensure the security of organizational assets. 5. Stay up-to-date with emerging cybersecurity threats and trends, advances in cybersecurity technologies, and ethical considerations in cybersecurity to ensure preparedness for the future.
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 Cybersecurity and its definition, Cybersecurity threats and attacks, Overview of Cybersecurity 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	CO4

	training, Physical security considerations, Compliance and regulatory requirements	
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
	40	60

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	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3
CO1	2								2		
CO2		1	1							2	
CO3							1	1			
CO4				1	2			1			
CO5				2			1				2

Data Visualization

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	

Course Title	Data Visualization
Course Code	
Credit	3
Course Type	
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
	40	60

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	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	2	2							2		
CO2			2	1						2	
CO3		1			1	2					
CO4		1				2		2			
CO5							1				2

High Performance Computing

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	
Course Title	High Performance Computing
Course Code	
Credit	L-T-P- 3-1-0 Total Credit - 4
Course Type	
Course Objective	The subject aims to provide the student with: 1. Define and explain the concept of high-performance computing, its historical development. 2. Understand the components of high-performance computing systems and their roles. 3. Identify different types of parallel computing architectures and programming paradigms. 4. Explore the architecture and types of high-performance computing clusters. 5. Acquire knowledge of high-performance computing platforms and tools, including their evaluation and analysis.
Course Outcome (COs)	After completion of this course students will be able to: CO1. Understand the fundamental concepts of High Performance Computing. CO2. Identify different types of parallel computing and understand the parallel computing architecture and parallel processing models. CO3. Analyze cluster architecture, cluster types and topologies. CO4. Utilize various high-performance computing platforms and tools. CO5. Apply High Performance Computing in scientific and engineering applications, artificial intelligence and machine learning, big data analytics, and cloud computing.

Unit	Description	CO Mapping
UNIT1	**Introduction to High Performance Computing** Definition and concepts of High Performance Computing, Historical development of High Performance Computing, Components of High	CO1

	Performance Computing systems, Applications of High Performance Computing	
UNIT2	**Parallel Computing** Types of Parallel Computing, Parallel Computing Architecture, Parallel Processing Models, Parallel Programming Paradigms	CO2
UNIT3	**High Performance Computing Clusters** Cluster Architecture, Cluster Types and Topologies, Parallel Programming in Clusters, Job Scheduling and Resource Management in Clusters	CO3
UNIT4	**High Performance Computing Platforms and Tools** High Performance Computing Platforms, Performance Evaluation and Analysis, High Performance Computing Tools and Libraries MPI and OpenMP Programming Models	CO4
UNIT5	**Applications of High Performance Computing** Scientific and Engineering Applications, Artificial Intelligence and Machine Learning Applications, Big Data Analytics, Cloud Computing and High Performance Computing, Future of High Performance Computing.	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

1. Sterling, T., et al. (2018). High Performance Computing: Modern Systems and Practices. Morgan Kaufmann Publishers

Reference Books:

1. Dongarra, J., et al. (2011). High Performance Computing: From Grids and Clouds to Exascale. Elsevier Science.
2. Wilkinson, B., & Allen, M. (2019). Parallel Programming: Concepts and Practice. Morgan Kaufmann Publishers.
3. Gropp, W., et al. (2014). Using MPI: Portable Parallel Programming with the Message-Passing Interface. MIT Press

CO	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	2		1						1		
CO2	2										
CO3	1									1	
CO4				2							
CO5	2					1	1	1	1		

Big Data

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	
Course Title	Big Data
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	
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
	40	60

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	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	1										
CO2		1	1							2	
CO3				2	1			1			1
CO4			1	1							
CO5				2		1	1		2		

R Programing for ML

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	
Course Title	R Programing for ML
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	
Course Objective	The subject aims to provide the student with: 1. To introduce students to the R programming language: 2. To teach students how to preprocess and wrangle data in R: 3. To equip students with knowledge of supervised learning algorithms. 4. To teach students about unsupervised learning algorithms: 5. To teach students about model evaluation and deployment in R:
Course Outcome (COs)	After completion of this course students will be able to: CO1. Understand the fundamentals of R programming language: Students will gain a solid understanding of the basics of R programming. CO2. Develop skills in data preprocessing and wrangling: Students will learn how to clean and preprocess data using R. CO3. Gain proficiency in supervised learning algorithms: Students will learn about popular supervised learning algorithms such as linear regression, logistic regression, decision trees, random forests, and support vector machines. CO4. Learn about unsupervised learning algorithms: Students will gain knowledge of unsupervised learning algorithms such as clustering and principal component analysis (PCA) CO5. Understand model evaluation and deployment in R.

Course Outline

Unit	**Description**	**CO Mapping**
UNIT1	**Introduction to R Programming:** Overview of R programming language, Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes R Programming Structures: Data types and data structures in R, R packages and libraries, Basic data manipulation in R	CO1

UNIT2	**Pre-processing and Data Wrangling with R**: Data cleaning and pre-processing in R, Data visualization with ggplot2, Feature selection and engineering	CO2
UNIT3	**Supervised Learning Algorithms with R**: Linear regression, Logistic regression, Decision trees, Random forests, Support vector machines using R	CO3
UNIT4	**Unsupervised Learning Algorithms with R**: Clustering, Principal Component Analysis (PCA)	CO4
UNIT5	**Model Evaluation and Deployment with R**: Model evaluation and validation techniques, Model deployment in R, Best practices for reproducibility and collaboration in R programming	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Book

1. Wickham, H., & Grolemund, G. (2017). *R for Data Science*. O'Reilly Media.
2. Boehmke, B. C. (2016). *Data Wrangling with R*. Springer International Publishing.

Reference Book

1. Rodríguez Pacheco, E. (2020). Unsupervised Learning with R. Packt Publishing.
2. Kuhn, M. & Johnson, K. (2013). Applied Predictive Modeling. Springer.
3. James, G., Witten, D., Hastie, T., & Tibshirani, R. (2017). *An Introduction to Statistical Learning with Applications in R.* Springer.

	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	2										
CO2		1	1	2						2	
CO3	2			2							
CO4							1	1	2		
CO5		1	1	2							1

Natural Language Processing

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	
Course Title	Natural Language Processing
Course Code	
Credit	L-T-P- 3-0-0 Total Credit – 3
Course Type	
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	CO1

	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	
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
	40	60

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)

	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PSO 1	PSO 2	PSO 3

CO1	2										1
CO2		1	1								
CO3		1		1						1	
CO4	1										
CO5				2		1			2		

Edge Computing

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	
Course Title	Edge Computing
Course Code	
Credit	L-T-P- 3-0-0 Total Credit – 3
Course Type	
Course Objective	The subject aims to provide the student with: 1. Edge computing for cyber-physical systems, including its design, implementation, and evaluation. 2. Various applications of edge computing in cyber-physical systems, enabling them to gain practical knowledge in the field. 3. A solid understanding of edge computing and its role in the emerging field of cyber-physical systems. 4. Understand the characteristics of real-time systems in the context of cyber-physical systems (CPS) and differentiate between general-purpose operating systems and real-time operating systems (RTOS) in CPS. 5. Explore the design considerations, scheduling algorithms, task synchronization, communication mechanisms, memory management, and protection in RTOS for CPS, as well as real-time file systems and device drivers.

Course Outcome (COs)	After completion of this course students will be able to: CO1: To illustrate the .Edge Computing use cases and outline Edge computing hardware architecture. CO2: Make use of IoT architecture and implementation use cases. CO3: Analyzing the layout and interface, configure of Rasberry Pi. CO4: List out the relationships of edge computing with Rasberry Pi, with cloud protocols, industrial and commercial IoT and Edge Computing. CO5: **Evaluate Edge Use Cases va**rious domains, such as healthcare monitoring, smart transportation, industrial automation, and autonomous vehicles, to meet specific performance requirements.

Course Outline

Unit	Description	CO Mapping
UNIT1	**IoT AND EDGE COMPUTING DEFINITION AND USE CASES:** Introduction to Edge Computing Scenario's and Use cases- Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Modles-Edge, Fog and M2M.	CO1
UNIT2	**IoT ARCHITECTURE AND CORE IoT MODULES** A Connected ecosystem, IoT versus machine-to-machine versus, SCADA, The value of Network and Metcalfe's and Beckstroms's laws, IoT and Edge Architecture, Role of an architect, Understanding Implementations with examples-Example use case and deployment, Case study-Telemedicine palliative care, Requirements, Implementation, Use case retrospective.	CO2
UNIT3	**RASBERRYPi** RasberryPi: Introduction to RasberryPi, About RasberryPi Board, Hardware Layout and Pin outs, Operating systems on RasberryPi, Configuring RasberryPi, Programming RasberryPi, Connecting RasberryPi via SSH, Remote access tools, Interfacing DHT Sensor with Pi, Pi as Webserver, Pi Camera, Image & Video Processing using Pi.	CO3
UNIT4	**INTERFACING RASBERRYPi & MQTT** Implementation of Microcomputer RasberryPi and device Interfacing, Edge to Cloud Protocols-Protocols, MQTT, MQTT publish-subscribe, MQTT Architecture details, MQTT state transitions, MQTT packet structure, MQTT data types, MQTT communication formats, MQTT 3.1.1 working example	CO4
UNIT5	**EDGE COMPUTING WITH RASBERRYPi** Edge Computing with RasberryPi, Industrial and Commercial IoT and Edge, Edge Computing and solutions.	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

1. IoT Edge Computing for Architects –Second Edition, by Perry Lea, Publisher: Packet Publishing, 2020, ISBN: 9781839214806.
2. Raspberry Pi Cookbook, 3rd Edition, by Simon Monk, Publisher: O'Reilly Media, Inc 2019, ISBN: 978149204322.

REFERENCE BOOKS:

1. Fog and Edge Computing: Principles and Paradigms by Rajkumar Buyya, Satish Narayana Srirama, Wiley Publication, 2019, ISBN: 9781119524984.
2. David Jensen, "Beginning Azure IoT Edge Computing: Extending the Cloud to the Intelligent. Edge, Microsoft Azure

CO	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	2										1
CO2		1	1								
CO3		1		1						1	
CO4	1										
CO5				2		1			2		

Game Theory

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	
Course Title	Game Theory
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	
Course Objective	The subject aims to provide the student with: 1. Familiarize the students with the fundamental aspects of Game Theory. 2. understand the possible advantage of moving first, the credibility of threats, the strategic importance of having a last encounter, and the mechanisms to keep cooperation alive. 3. Recognize strategic environments and use Game Theory to gain better understanding of interactions and outcomes within them.
Course Outcome (COs)	After completion of this course students will be able to: CO1. Formulate different real-life situations as games and learn to predict the optimal strategies of the players. CO2. Analyze the possible outcomes of situations ranging from card games and sports to strategic price fixing, negotiation, group cooperation. CO3.

Course Outline

Unit	Description	CO Mapping
UNIT1	**Introduction to Game Theory:** What is game theory? Strategic interaction, payoff functions, and utility functions, Players, Strategies, and Payoffs: Understanding the components of a game. Dominance: Strict and weak dominance. Nash Equilibrium: The concept of Nash equilibrium in pure strategies. Mixed Strategy Nash Equilibrium: Computing and understanding mixed strategies. Iterated Elimination of Strictly Dominated Strategies: Solving games by sequentially removing dominated strategies. Two-Person Zero-Sum Games: Formulating and solving such games as linear programming problems	CO1
UNIT2	Game Trees: Representing games with sequential moves using game trees. Information Sets: Understanding imperfect information in extensive-form games. Subgame Perfection: Defining and computing subgame perfect Nash equilibria to ensure sequential rationality. Real-world Applications: Examples of sequential decision-making, such as bargaining or entry into a market	CO2

UNIT3	**Incomplete Information Games** Bayesian Nash Equilibrium: Introducing incomplete information and Bayesian settings. Applications: Analyzing situations with information asymmetry, such as auctions, moral hazard, and signaling. Contracts: Game-theoretic perspectives on contract design.	CO3
UNIT4	**Coalitional Games**: Concepts like imputation, core, nucleolus, and Shapley value. Mechanism Design: Designing rules and incentives for collective decision-making. Algorithmic Game Theory: The intersection of game theory and computer science. Economic Applications: Market design, internet economics, and reputation. Behavioral Game Theory: Incorporating psychological insights into game theory models.	CO4
UNIT5	**Design Strategic Mechanisms:** Evaluate and propose mechanisms, algorithms, or protocols that achieve desired outcomes in multi-agent systems, such as designing fair auction mechanisms or effective incentive schemes for rational agents.	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

1. Osborne, An Introduction to Game Theory, Oxford University Press, 2014.

2. M. J. Osborne and A. Rubinstein, A Course in Game Theory, MIT Press, 1994.

Reference Books:

1. M. Maschler, E. Solan, and S. Zamir, Game Theory, Cambridge University Press, 2020.

2. M. Osborne, An Introduction to Game Theory, Oxford University Press, 2003.

3. v. Krishna, Auction Theory, Academic Press, 2009.

	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	2										
CO2		1	1	2						2	
CO3	2			2							
CO4							1	1	2		
CO5		1	1	2							1

Quantum Computing

School	Birla School of Applied Sciences
Programme	MCA
Batch	2025-27
Branch/Discipline	MCA
Semester	
Course Title	Quantum Computing
Course Code	
Credit	L-T-P- 3-0-0 Total Credit – 3
Course Type	
Course Objective	The subject aims to provide the student with: 1. The objective of this course is to provide a strong foundation in quantum computing theory and practical applications. 2. It introduces the basic principles of quantum mechanics, qubits, circuit model of quantum computing etc and provides a hands-on experience on programming quantum computer using IBM Qiskit. 3. It also includes an introduction to quantum machine learning
Course Outcome (COs)	After completion of this course students will be able to: CO1: The objective of this course is to provide a strong foundation in quantum computing theory and practical applications. CO2: It introduces the basic principles of quantum mechanics, qubits, and the circuit model of quantum computing. CO3: It provides hands-on experience in programming quantum computers using IBM Qiskit. CO4: It also includes an introduction to quantum machine learning. CO5: It provides hands-on experience in programming quantum machine learning algorithms using IBM Qiskit.

Course Outline

Unit	Description	CO Mapping
UNIT1	**Quantum Computation:** History & Overview, Review of linear algebra: Dirac notation, Hilbert spaces, Unitary, Hermitian, and Normal matrices, Inner product, Outer product, Tensor product, Postulates of Quantum Mechanics, Stern and Gerlach experiment, Qubit, Bloch Sphere	CO1
UNIT2	**Circuit model of Quantum Computing:** Quantum gates and Circuit, Entanglement: Bell state, Quantum Teleportation, Superdense coding, Phase kickback, No-cloning theorem, Quantum parallelism, Deutsch-Jozsa algorithm, Bernstein Vazirani algorithm, Grover search algorithm	CO2

UNIT3	**Qiskit programming:** Introduction to Qiskit, building and running quantum circuits, practical examples of implementing basic algorithms on Qiskit.	CO3
UNIT4	**dvanced Quantum Algorithms and Error Correction:** Quantum Fourier Transform, Quantum Phase Estimation, Shor's algorithm, Quantum Error Correction, Gottesman-Knill Theorem, Surface codes	CO4
UNIT5	**Quantum Machine Learning**: Data encoding – Basis encoding, Amplitude encoding, Hamiltonian Encoding, Swap test, Q-means clustering.	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

1. David McMahon, "Quantum Computing Explained", Wiley-IEEE Computer Society Press, 2007.
2. Maria Schuld, Francesco Petruccione, "Machine Learning with Quantum Computers", Springer International Publications, 2021.
3. Venkateswaran Kasirajan, "Fundamentals of Quantum Computing -Theory and Practice", Springer, 2021.

REFERENCE BOOKS:

1. Nielsen MA, Chuang IL. "Quantum computation and quantum information".Cambridge university press;2010 Dec 9.
2. Eleanor Rieffel and Wolfgang Polak, "Quantum Computing: A Gentle Introduction",2011 Edition, MIT Press.
3. Chris Bernhardt, "Quantum Computing for Everyone (The MIT Press)",2019.

CO	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	2										1
CO2		1	1								
CO3		1		1						1	
CO4	1										

CO5				2		1			2		