Master of Computer Applications (MCA)
(Two-Year, Semester Based, Full Time Program)

Vision

To achieve high quality technical education that provides the skills and attitude to adapt to the global needs of the Information Technology sector, through academic and research excellence.

Mission

The objective is to enhance students' problem-solving abilities and enrich the teaching-learning process through innovative pedagogical techniques, while simultaneously strengthening the knowledge base of both faculty and students by fostering academic excellence and relevant research skills. Additionally, it aims to instill strong moral and ethical values in software engineers and computer application professionals, ensuring their positive contribution to society.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1. To provide students with a solid foundation in computer science and programming concepts.

PEO2. To enable students to design, develop, and implement software applications for various platforms and industries.

PEO3. To equip students with advanced skills in database management, networking, and computer systems administration.

PEO4. To foster analytical and problem-solving skills among students, enabling them to identify and address complex software development and system administration issues.

PEO5. To prepare students for leadership roles in the IT industry, by imparting management and communication skills.

PROGRAMME OUTCOMES(POs)

PO1. Demonstrate basic knowledge in Computer Applications

PO2. Demonstrate the ability to design and conduct experiments, interpret and analyse data, and report results.

PO3. Demonstrate the ability to design and develop software meets contemporary software industry requirement.

PO4. Capacity to analyse a problem, identify, and formulate the computing requirements appropriate to its solution.

PO5. Ability to design and evaluate computing solutions that meet requirements with due regard for health, safety, culture, society, and the environment.

PO6. Demonstrate an understanding of their professional and ethical responsibilities.

PO7. Be able to communicate effectively in both verbal and written forms.

PO8. Should have the confidence to apply engineering solutions in global and societal contexts.

PO9. Should be capable of self-education and clearly understand the value of lifelong learning.

PO10. Awareness of the need for and an ability to engage in continuing professional development.

PROGRAM STRUCTURE: DISTRIBUTION OF CREDITS

Category of courses	**1st Sem**	**2nd Sem**	**3rd Sem**	**4th Sem**	**Credits**	**Course**
Major	13	14	12	0	39	16
Minor	07	03	0	0	10	05
Multidisciplinary Courses (MDC)	03	03	03	0	09	03
Ability Enhancement Courses (AEC)	02	0	02	0	04	02
Skill Enhancement Courses (SEC)	0	03	06	0	09	03
Value Added Courses (VAC)	0	0	0	0	0	0
Internship	0	0	0	14	14	01
Project/Dissertation	0	0	02	0	02	01
Total Credits	**25**	**23**	**25**	**14**	**87**	
Teaching Hours	**30**	**30**	**30**	**0**	**90**	

SEMESTER -I

S. No	Course	Course Name	Periods			Credits	Category
	Code		L	T	P		
1	MCA 501	Database Management System	3	0	0	3	Major
2	MCA 502	Computer Organization and Architecture	3	0	0	3	Major
3	MCA 503	Operating System	3	0	0	3	Major
4	MCA 504	Python Programming	3	0	0	3	Minor
5	MCA 505	Discrete Mathematics	3	0	0	3	MDC
6	MCA 506	Software Engineering	3	0	0	3	Minor
7	MCA 507	Soft Skill -I	2	0	0	2	AEC
8	MCA 501P	Database Management System Lab	0	0	4	2	Major
9	MCA 503P	Operating System Lab	0	0	4	2	Major
10	MCA 504P	Python programming Lab	0	0	2	1	Minor
		Total Credits	**20**	**0**	**10**	**25**	
		Total Contact Hours	**30**				

Eligibility Criteria for MCA Bridge Course:

For students taking admission to the MCA course and who have graduated without specialization in computer science /computer application/computer engineering.
The objective of the MCA Bridge Course is to bridge the gap between subjects studied at the graduation level and subjects they would be studying in Master of Computer Application.

Bridge Course						
S. No	**Course**	**Course Name**	**Periods**			Credits
	Code		**L**	**T**	**P**	
1	MCA-BC101	Introduction to C Programming	2	0	0	0
2	MCA-BC102	Fundamental in Computer Application	2	0	0	0

SEMESTER-II

S. No	Course	Course Name	Periods			Credits	Category
	Code		L	T	P		
1	MCA 508	Object Oriented Programming with Java	3	0	0	3	Major
2	MCA 509	Data Structures and Algorithm	3	0	0	3	Major
3	MCA 510	Machine Learning	3	0	0	3	Major
4	MCA 511	Digital Communication &Networking	3	0	0	3	Minor
5		Elective1(Select any one Subject from Group 1)	2	0	2	3	SEC
6		Elective2 (Select any one Subject from Group 2)	2	0	2	3	MDC
7	MCA 508P	Object Oriented Programming with Java Lab	0	0	4	2	Major
8	MCA 509P	Data Structures and Algorithm Lab	0	0	4	2	Major
9	MCA 510P	Machine Learning Lab	0	0	2	1	Major
		Total Credits	**16**	**0**	**14**	**23**	
		Total Contact Hours	**30**				

SEMESTER III

S. No	Course	Course Name	Periods			Credits	Category
	Code		L	T	P		
1	MCA 601	ASP. NET Using C#	3	0	0	3	Major
2	MCA 602	Big Data and Analytics	3	0	0	3	Major
3	MCA 603	Artificial Intelligence	3	0	0	3	Major
4	MCA 604	Data Encryption and Network Security	3	0	0	3	SEC
5	MCA 605	Enterprise Resource Planning	3	0	0	3	MDC
6		Elective 3(Select any one from Group 3)	3	0	0	3	SEC
7	MCA 606	Soft Skills II	2	0	0	2	AEC
8	MCA 601P	ASP. Net Using C# Lab	0	0	4	2	Major
9	MCA 602P	Big Data and Analytics Lab	0	0	2	1	Major
10	MCA 607P	Minor Project	0	0	4	2	Project
		Total Credits	**20**	**0**	**10**	**25**	
		Total Contact Hours	**30**				

SEMESTER IV

Course Code	Course Name	Periods			Credits	Category
		L	T	P		
MCA208P	Industrial Project	-	-	-	14	Internship

Group 1(Elective) (Cloud Computing, Data Science, Web Technology)						
S. No	Course Code	Course Name	Periods			Credits
			L	T	P	
1	MCA-CDW1	Web Technologies	2	0	2	3
2	MCA-CDW2	Introduction to Statistical Analysis	2	0	2	3
3	MCA-CDW3	Cloud Computing	2	0	2	3
4	MCA-CDW4	Android Programming	2	0	2	3
5	MCA-CDW5	Data Warehouse and Data Mining	2	0	2	3
6	MCA-CDW6	R Programming	2	0	2	3
7	MCA-CDW7	Introduction to Data Science	2	0	2	3
8	MCA-CDW8	Fog and Edge Computing	2	0	2	3

Group 2(Elective2) (Artificial Intelligence, Machine Learning and Robotics)						
S. No	Course Code	Course Name	Periods			Credits
			L	T	P	
1	MCA-AMR1	Natural Language Processing	2	0	2	3
2	MCA-AMR2	Fuzzy Logic and Neural Network	2	0	2	3
3	MCA-AMR3	Evolutionary Computing	2	0	2	3
4	MCA-AMR4	Artificial Neural Network	2	0	2	3
5	MCA-AMR5	Robotics	2	0	2	3
6	MCA-AMR6	Wireless and Mobile Systems	2	0	2	3
7	MCA-AMR7	Deep Learning	2	0	2	3
8	MCA-AMR8	Advanced Computer Networks	2	0	2	3

Group 3(Elective3) (Full Stack, Block Chain, and IOT)						
S. No	**Course**	**Course Name**	**Periods**			**Credits**
	Code		**L**	**T**	**P**	
1	MCA-FBI1	Container Technologies	2	0	2	3
2	MCA-FBI2	Mobile Computing	2	0	2	3
3	MCA-FBI3	Soft Computing	2	0	2	3
4	MCA-FBI4	Internet of Things	2	0	2	3
5	MCA-FBI5	Cyber Law and IPR	2	0	2	3
6	MCA-FBI6	Introduction to Block Chain Technologies	2	0	2	3
7	MCA-FBI7	Front-End Engineering	2	0	2	3
8	MCA-FBI8	Software Verification, Validation and Testing	2	0	2	3

SEMESTER-I

Course: DATABASE MANAGEMENT SYSTEM			**Semester: I**
Course Code: MCA 501	**L T P**	**3 0 0**	**Credits: 3**
OBJECTIVE	This course's objective is to educate students on relational database management systems (RDBMS). It covers theory and practice in designing a relational database management system with the help of MYSQL.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Demonstrate the basic elements of a relational database management system. 2. Design entity-relationship and convert entity-relationship diagrams into RDBM Sand formulate SQL queries. 3. Identify the relevant data models for problems. 4. Apply and create relational database design process with Normalization and De-normalization of data so that data redundancy, data inconsistency, and data loss problems may be resolved. 5. Demonstrate the effect of Transaction Management		

COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**Introduction to Database System** Introduction: Data base System Applications, data base System VS file System, Data Abstraction, Instances and Schemes, data Models: the ER Model, Relational Model& Other Models, Database Languages, database Users and Administrator, data base System Structure, Storage Manager, the Query Processor, Two/Three tier architecture.	**10**
	2	**Entity Relationship model** E-R model: Basic concepts, Design Issues, Mapping Constraints, Attributes and Entity sets, Relationships and Relationship sets, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.	**10**

	3	**Relational Model & SQL** Relational Model: Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra SQL: Form of Basic SQL Query, Nested Queries, Aggregative Operators, NULL values, Logical operators, Outer Joins, Complex Integrity Constraints in SQL.	**10**
	4	**Database Design Concepts** Database Design: Schema refinement, Different anomalies in designing a Database, Decompositions, Problem related to decomposition, Functional Dependency, Normalization using functional dependencies, 1NF, 2NF, 3NF & BCNF, Lossless join decomposition, Dependency preserving Decomposition, Schema refinement in Database Design, Multivalued Dependencies Closer properties of Multivalued dependency, Join dependency, 4NF, 5NF.	**10**
	5	**Transaction & Concurrency** Transaction Management: Transaction-concepts, states, ACID property, schedule, serializability of schedules, concurrency control techniques - locking, timestamp, deadlock handling, recovery-log based recovery, shadow paging.	**5**
		Total Hours:	**45**
	TEXT BOOK	1. Silbers chatz, Korth, Database System Concepts, Mc Graw hill,	
		2. Elmasri Navate, Fundamentals of Database Systems, Pearson Education,	
	REFERENCE BOOK/ SUGGESTED READING	1. C.J.Date, Introduction to Database Systems, Pearson Education,	
		2. Peter Rob & Carlos Coronel, Database Systems design, Implementation, and Management, 7th Edition, 2006.	
		3. Hoffer J.Venkataraman,R. and Topi, H.,Modern Data base Management, Pearson	
		4. BayrossI., SQL, PL/SQL the Programming Language of Oracle, BPB Publications	

Course: COMPUTER ORGANIZATION AND ARCHITECTURE			**Semester: I**
Course Code: MCA 502	**L T P**	**3 0 0**	**Credits: 3**

OBJECTIVE	The students will learn the fundamentals of computer organization and its relevance to classical and modern problems of computer design, for the duration of this course.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Familiarize the students with the fundamentals of computer design 2. Learn about various I/O devices and the I/O interface. 3. Learn about the concept of Pipelining Underset and the theoretical concept of parallel processing and different types of multiprocessor interconnection structures. 4. Familiarize yourself with the memory system. 5. Practicing the concept of Addition and subtraction of signed numbers, design off as tenders, etc.		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**Fundamentals of Computer Design** Basic Structure of Computers: Computer Types; Functional Units; Bus structure; Machine Instructions and Programs: Numbers, Arithmetic Operations and Characters; Memory Location and Addresses; Memory Operations; Instructions and Instruction Sequencing	**8**
	2	**Instruction set, Assembly language and input/output Organization.** Machine Instructions and Programs: Addressing Mode; Assembly Language; Basic input and Output Operations; Stacks and Queues; Subroutines; Encoding of Machine Instructions; Accessing I/O Devices; Interrupts-Interrupt Hardware;	**10**

		Enabling and Disabling Interrupts; Handling Multiple Devices; Controlling Device Requests; Exceptions; Direct Memory Access; Standard I/O Interfaces- PCI Bus, SCSI Bus, USB.	
	3	**Pipelining and Parallel Processing** Introduction to Pipelining; pipeline hazards; Implementation of pipeline; Instruction level parallelism concepts and challenges: Basic compiler techniques for exposing ILP; Reducing branch costs with prediction; Overcoming data hazards with dynamic scheduling;	**10**
	4	**The Memory System.** Basic Concepts: Semiconductor RAM Memories, ROM, speed, size, and cost, cache memories- mapping functions, replacement algorithms, cache performance, cache optimization, Virtual memory; Protection: Virtual memory and virtual machines.	**10**
	5	**Arithmetic for Computers.** Addition and subtraction of signed numbers, design no Face Ideas, multiplication of positive numbers, signed operand multiplication.	**7**
		Total Hours:	**45**
	TEXT BOOK	1. John P. Hayes, Computer Architecture and Organization, McGraw-Hill Education**.**	
		2. M. Morris Mano. Computer System Architecture, Pearson Education	
	REFERENCE BOOK/ SUGGESTED READING	1. John L. Hennessey and David A. Patterson: Computer Architecture, A Quantitative Approach, Elsevier,	
		2. Kai Hwang: Advanced Computer Architecture Parallelism, Scalability, Programmability, Tata McGraw-Hill	

Course: OPERATING SYSTEM			**Semester: I**
Course Code: MCA 503	**L T P**	**3 0 0**	**Credits: 3**
OBJECTIVE	To introduce the fundamental theories and principles of modern operating systems and enable students to apply these concepts through practical implementation.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Understand the fundamental concepts and functions of operating systems, including processes, memory, file, and device management. 2. Analyze and apply process scheduling, synchronization, and deadlock handling techniques. 3. Demonstrate knowledge of memory management techniques such as paging, segmentation, and virtual memory. 4. Understand file system structures, access methods, and directory implementation in modern operating systems. 5. Evaluate and compare various operating systems and their components with respect to performance, security, and resource management.		

COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**Introduction to Operating System.** Introduction: Components of a computer System, Operating system: User view & System view, Evolution of operating system, Single Processor & Multiprocessor systems, Real Time System, Distributed Systems, Multimedia Systems, Handheld Systems. Operating System Structure: Operating System Services, User Operating System Interfaces: Command- Line and GUI, System Calls.	**10**

	2	**Management &Scheduling** Process Management: Process Concept, Process States, Process Transition Diagram, Process Control Block (PCB). CPU Scheduling: Scheduling Concepts, Performance Criteria, Scheduling Queues, And Schedulers, Scheduling Algorithms: Preemptive & Non-Preemptive: FCFS, SJF, Priority, Round- Robin	**10**
	3	**Concurrent Processes & Deadlocks** Concurrent Processes: Principle of Concurrency, Producer / Consumer Problem, Co-operating Processes, Race Condition, Critical Section Problem, Peterson's solution, Semaphores, Classical Problem in Concurrency- Dining Philosopher Problem; Inter Process Communication models and Schemes. Deadlock: System Model, Deadlock Characterization, Prevention, Avoidance and Detection, Recovery from deadlock.	**10**
	4	**Memory Management** Memory Management: Bare machine, Resident monitor, Multiprogramming with fixed partition, Multiprogramming with variable partition, Multiple base register, Paging, Segmentation, Virtual memory concept, Demand paging, Performance, Paged replaced algorithm, Allocation of frames, Cache memory.	**10**
	5	**File Systems& I/O Management** File System: Different types of files and their access methods, various allocation methods. I/O Management and Disk Scheduling: I/O Devices, Organization of I/O functions, Disk Structure, Disk Scheduling (FCFS, SSTF, SCAN, C-SCAN, and LOOK).	**5**
		Total Hours:	**45**
	TEXT BOOK	1. Silberschatz, Galvinand Gagne,Operating Systems Concepts‖, Wiley	
		2. Andrew S. Tanenbaum, Modern Operating Systems, AMD publisher	
	REFERENCE BOOK/ SUGGESTED READING	1. Harvey M. Dietel, An Introduction to Operating System, Pearson Education,	
		2. DMD Hamd, Operating Systems: A Concept based Approach, PHI	

Course: PYTHON PROGRAMMING				**Semester: I**
Course Code: MCA 504	**L T P**	**3 0 0**		**Credits: 3**
OBJECTIVE	Educates students on the practical application of Python programming and introduces them to various core libraries used in Visualization.			
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Understand the basic syntax, data types, and control structures in Python for writing simple programs. 2. Apply functions, modules, and packages to develop modular and reusable code. 3. Implement file handling, exception handling, and data structures such as lists, tuples, dictionaries, and sets in Python 4. Develop object-oriented programs using classes, objects, inheritance, and polymorphism. 5. Design and build real-world applications using Python libraries such as NumPy, Pandas, and Matplotlib.			
COURSE	**Unit No.**	**Topic**		**Hours**

DETAILS	1	**Introduction to Python:** Introduction to Python, Control flow Statements in Python such as If, While Loops, user defined statements, User defined functions, Data structure: Lists, tuples, dictionary, In -built modules and User-Defined Modules.	**10**
	2	**NumPy Library for Arrays:** Introduction, NumPy Array, NumPy Array Size, NumPy Array Shape, NumPy Mathematical Functions, NumPy Trigonometric Functions, NumPy Random, NumPy String Operations.	**10**
	3	**Panda Library for Data Processing:** Pandas Series, Pandas Data Frame, Pandas Read_csv, Pandas Write csv File, Data Cleansing, Pandas Handling Missing Values, Pandas concat(), Pandas join (), Pandas append (), Pandas Group By.	**10**
	4	**Matplotlib for Visualization:** Matplotlib Line Plot, Matplotlib Histogram, Matplotlib Bar Chart, Matplotlib Pie Chart, Matplotlib Scatter Plot, Matplotlib Subplot, Matplotlib Save Figure, Matplotlib Image Show	**10**
	5	Seaborn Library for Visualization: Introduction, Seaborn Line Plot, Seaborn Histogram, Seaborn Bar plot. **SciPy Library for Statistics:** Basic statistics, Parametric and non-parametric techniques for comparing Mean	**5**
		Total Hours:	**45**
	TEXT BOOK	1. Paul Deitel & Harvey Deitel, Intro to Python for Computer Science and Data Science, Pearson Publication	
		2. Bharti Motwani, "Data Analytics Using Python, Wiley publications.	
	REFERENCE BOOK/ SUGGESTED READING	1. Wes McKinney, Python for Data Analysis, O'Reilly	
		2. Sheetal Taneja & Naveen Kumar, Python Programming, A Modular Approach, Pearson Publication.	

Course: DISCRETE MATHEMATICS			**Semester: I**
Course Code: MCA 505	**L T P**	**3 0 0**	**Credits: 3**
OBJECTIVE	Familiarize the students with basic mathematical concepts and numerical methods. To understand the concepts and results in Mathematical logic, Number theory, Group theory and Numerical methods.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Solve an argument using logical notation like prepositional logic and determine if the argument is or is not valid. 2. Illustrate the basic principle of mathematical induction and understand the algebraic structure. 3. Evaluate the problem using recurrence relations and homogeneous and Non homogenous equations. 4. Design and learn about basic concepts of graph theory. 5. To understand the Representation of regular languages and grammars, finite state Machines		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**Proposition and Logic:** Propositions and Compound Propositions, Logical Operations, Truth tables, Tautologies and Contradictions, Logical Equivalence, Algebra of propositions, Conditional and Biconditional Statements Arguments, Logical Implications.	**10**

	2	**Mathematical Induction:** Mathematical Induction, Division Algorithm, Divisibility, Euclidean Algorithm Fundamental theorem of Arithmetic, Congruence relation, Congruence Equations, Semigroups, Groups, Subgroups	**10**
	3	**Recurrence Relations:** Iterations, Homogeneous linear equations with constant coefficients, particular solution,	**5**
	4	**Graph Theory:** Paths, connectivity, subgraphs, isomorphism, trees, complete graphs, bipartite graphs, matching colourability, planarity, digraphs;	**10**
	5	**Classification of Languages:** Overview of Formal Languages, Representation of regular languages and grammars, finite state Machines	**10**
		Total Hours:	**45**
	TEXT BOOK	1. Keneth H Rosen, Discrete Mathematics, Tata McGraw Hill	
		2. Dr. Vinay Kumar, Discrete Mathematics, BPB Publications	
	REFERENCE BOOK/ SUGGESTED READING	1. C L Liu & D P Mohapatra, Elements of Discrete Mathematics, Tata Mc Graw Hill	
		2. D.S. Malik & M.K.Sen, Discrete Mathematics, Cengage Learning.	
		3. Richard Johnsonbaugh, Discrete Mathematics, Pearson Publication	

Course: SOFTWARE ENGINEERING			**Semester: I**
Course Code: MCA 506	**L T P**	**3 0 0**	**Credits: 3**
OBJECTIVE	This course is designed to provide knowledge about Software Engineering (SE) core principles consistent in software construction and maintenance		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Apply the various design models of software engineering, and Implementation of Software Life Cycle Model. 2. Develop proper SRS for software quality assurance. 3. Demonstrate the complexities of software projects at the beginning of the design phase. 4. Estimate the cost and budget of projects and remove the errors and bugs so that re-design of Models can be done. 5. Understand Testing Objectives, Tools & Standards.		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**Introduction:** Introduction to Software Engineering, importance of Software, Software Evolution, Software Characteristics, Software Applications, Software Crisis: Problem and Causes. Software Processes: Software process models (Waterfall, Incremental, and Evolutionary process models and Agile).	**10**
	2	**Software Requirement Analysis and Specifications:** Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Data Flow Diagrams, Data Dictionaries, Entity-Relationship diagrams, Software Requirement and Specifications, Functional and non-Functional requirements, Software Prototyping, Feasibility Study, Information Modeling, Decision Tables, SRS Document, IEEE Standards for SRS, Software Quality Assurance (SQA), SEI-CMM Model.	**10**

	3	**Software Design:** System design principles: levels of abstraction (architectural and detailed design), separation of concerns, information hiding, coupling, and cohesion. Software Measurement and Metrics: Various Size Oriented Measures: Halstead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs	**5**
	4	**Software Project management:** Project Management – Definitions; Factors Influencing Project Management – Project Manager, Project Management Activities, Stakeholders; Project Communication; Project Development Phases; Project Charter; Statement of Work (SoW); Project Management Associations	**10**
	5	**Testing:** Objectives, Testing Tools & Standards. Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Top-Down and Bottom-Up Testing Strategies: Test Drivers and Test Stubs, Path Testing, Structural Testing (White Box Testing), Functional Testing (Black Box Testing).	**10**
		Total Hours:	**45**
	TEXT BOOK	1. R. S. Pressman, Software Engineering A practitioner ‘s approach‖, Mc Graw Hill Education	
		2. Rajib Mall, Fundamentals of Software Engineering, PHI Publication	
	REFERENCE BOOK/ SUGGESTED READING	1. Ian Sommerville, Software Engineering, Addison Wesley,	
		2. James Peter, W Pedrycz, Software Engineering‖, John Wiley & Sons	

Course: SOFT SKILL - I			**Semester: I**
Course Code: MCA 507	**L T P**	**2 0 0**	**Credits: 2**
OBJECTIVE	Enhance the Employability and Career Skills of students. Orient the students towards grooming professionals. Make them Employable. Develop their confidence and help them attend interviews successfully and achieve growth by acquiring professionalism as a habit.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Introduce students to the fundamentals of soft skills and their significance in personal and professional growth. 2. Develop students' ability to deliver an effective self-introduction with clarity, confidence, and professionalism. 3. Highlight the importance of group discussions and equip students with techniques to participate actively and constructively. 4. Educate students on professional etiquette, including social etiquette, interview decorum, appropriate dress code, and effective body language. 5. Prepare students to excel in job interviews by mastering key strategies, frequent questions, and best practices for success.		

COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**Introduction to Soft Skills**– Hard skills & soft skills, employability, and career Skills, Grooming as a professional with values, Time Management, Conflict management, Anger Management Stress Management	**10**
	2	**Self-Introduction-** organizing the material, Written communication, introducing oneself to the audience, introducing the topic, answering questions –, individual presentation practice, presenting the visuals effectively, 5-minute presentations	**5**
	3	**Introduction to Group Discussion**, participating in group discussions, understanding group dynamics, brainstorming the topic, questioning, and clarifying, Group discussion strategies, activities to improve Group discussion skills	**5**
	4	**Social etiquette**, Interview etiquette, dress code, body language	**5**
	5	**Interview:** Types of job interviews: attending job interviews, telephone/online interview, one-to-one interview & panel interview, CV writing, Job application, FAQs related to job interviews	**5**
		Total Hours:	**30**
	TEXTBOOK	1. Nitin Bhatnagar and Mamta Bhatnagar, Effective Communication and soft skills, Pearson	
		2. Rutherford, Publisher, Basic Communication skills for technology Author, Pearson	
	REFERENCE BOOK/ SUGGESTED READING	1. Varinder Kumar, Comprehension and communication skills, Kalyani	
		2. Amit Ganguly, English communication Author, SBPD publication	
		3. PD Chaturvedi Mukesh Chaturvedi, The art and science of business communication, Pearson	

Course: DATABASE MANAGEMENT SYSTEM LAB			Semester: I
Course Code: MCA 501P	L T P	0 0 4	Credits:2

OBJECTIVE	To enable students to design, implement, and query relational databases using SQL, and to apply normalization and transaction management concepts through hands-on practice with real-world data scenarios.

Suggested List of Practicals

1. Implementation of Data Definition language in Query Language.
2. Implementation of Data Manipulation in Query Language.
3. Insertion & updating of records in Data base table
4. Implementation of GROUP functions (avg, count, max, min, Sum)
5. Execution of several types of SET OPERATORS (Union, Intersect, Minus).
6. Apply the several types of Integrity Constraints on the table.
7. Multiplexer: Truth-table verification.
8. Demultiplexer: Truth-table verification.
9. Creation of several types of JOINS.
10. Implementation of Views and Indices in the database.
11. Implementation of foreign key on the database.
12. Modify the database structure and drop their code with the structure.

Course: OPERATING SYSTEM LAB			Semester: I
Course Code: MCA 503P	L T P	0 0 4	Credits: 2

OBJECTIVE	Educates the students about the theories and principles that underlie modern operating systems, and a practical section that relates theoretical principles to operating system implementation

Suggested List of Practicals

1. To study basic & User status Unix/Linux Commands.
2. To Study & use Unix/Linux Commands for changing file permissions.
3. To understand process management using commands ps, top, kill, etc.
4. To write basic shell scripts using variables, input/output.
5. To understand & execute Simple filters: pr, head, tail, cut, paste, nl , sort.
6. To Study & execute Advanced filters: Search for a pattern using grep, egrep, fgrep, uniq. Communication Commands: write, wall
7. Write a shell script that accepts a numerical value N. Then display the Decrementing value of N till it reaches 0.
8. Write a shell script to search for a string and display it.
9. Write a shell script that takes three command-line arguments. The first argument is the name of the destination file and the other two arguments are Names of files to be placed in the destination file.
10. Write a shell script to print contents of file from given line number to next given Number of lines.
11. Write a shell script that accepts any number of arguments and prints them in reverse order.

12. Write a shell script that prints out date information in this order: time, day of The week, day number, year.
13. Write a shell script to Develop a Basic math Calculator using case statement
14. Write a shell script that represents a multiple choice question, gets the user's Answer and report back whether the answer is right, wrong or not one of the choices. 8 Write a shell script that takes a command line argument and reports on Whether it is a directory, a file or something else.

Course: PYTHON PROGRAMMING LAB			**Semester: I**
Course Code: MCA 504P	**L T P**	**0 0 2**	**Credits: 1**

OBJECTIVE	To develop problem-solving skills and implement real-world applications using Python programming constructs and libraries.

Suggested List of Practicals

1. Working with Jupyter notebook. Programs based on loops and conditional statements
2. Programs based on string manipulation. Programs based on the List.
3. Programs based on tuples. Programs based on sets.
4. Programs based on dictionary. Working with user-defined functions.
5. Working with lambda, map, filter and reduce functions.
6. Programs based on recursion. Programs for file handling in Python.
7. Programs for Sorting and searching.
8. Database handling in Python
9. Working with in built and user-defined modules.
10. Working with Object Oriented Programming in Python

MCA BRIDGE COURSE:

Course: INTRODUCTION TO C PROGRAMMING			**Semester: I**
Course Code : MCA-BC101	**L T P**	**2 0 0**	**Credits: 0**

OBJECTIVE	Enhance the Employability and Career Skills of students. Orient the students towards grooming professionals.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Familiarize students with the basics of' 'C' Programming 2. Familiarize students with Control structures in 'C'. 3. Familiarize students with the importance of Arrays, Function & Structures. 4. Familiarize students with Pointers in 'C' and strings. 5. Familiarize students on how to use Bitwise Operator & File Handling.		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**Introduction to 'C': Programming** Language History, Structure of 'C' programming, Function as building block, Language fundamentals, Character set, Tokens, Keywords, Identifiers, Variables, Constant, Data types, Comments. Operators- types of operators, precedence and associativity, Expressions.	**5**
	2	**Introduction to Control Structures:** Control structures: Conditional and loop, break, continue, goto, and exit, Concept of header files,	**5**

		Introduction to C preprocessor.	
	3	**Introduction to Arrays, Functions and Structures:** Basic types of function, Declaration and definition, Function call, Types of function, Parameter passing call by value, and call by reference, Recursion, Storage classes. Definition, Declaration, and initialization of 1-D arrays, Accessing, Displaying, and sorting array elements. Arrays and functions, 2-D arrays, Declaration, and initialization, Accessing and displaying, Definition and declaration of structures, Union, Differentiate between union and structure.	**10**
	4	**Introduction to Pointers and Strings:** Pointers, Definition and declaration, Initialization, Indirection operator, Address of operator, Pointer arithmetic, Dynamic memory allocation, Arrays and pointers, Function, and pointers. Strings: definition, declaration, and initialization of strings.	**5**
	5	**Bitwise Operators and File Handling:** Bitwise Shift operators and bit fields, File handling: definition of file, opening modes of files.	**5**
		Total Hours:	**30**
	TEXT BOOK	1. Balagurusamy, E.; Programming in Ansi C; McGraw-Hill.	
		2. Kanetkar, Y; Letus C; BPB Publication.	
	REFERENCE BOOK/ SUGGESTED READING	1. Ritchie, D. and Kernighan, B. W.; The C Programming Language; PHI.	
		2. Dromey, R.G.; How to solve it by Computer; Pearson Education.	
		3. Forouzan, B. A, Gilberg, R. F., Geetha, B.G, Singharavel, G: Computer Science: A Structured Programming Approach Using C; Cengage Learning.	

Course: FUNDAMENTAL IN COMPUTER APPLICATION			**Semester: I**
Course Code : MCA-BC102	**L T P**	**2 0 0**	**Credits: 0**
OBJECTIVE	The main objective is to introduce Programming in a simple language to all undergraduate students, regardless of their specialization. It will help them to pursue specialized programs leading to technical and professional careers and certifications in the IT industry. The focus of the subject is on introducing skills relating to computer basics, computer applications, programming, interactive medias, Internet basics etc.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. To understand the fundamentals of Computers, Block Diagram of Computer, Computer hardware, Memory Architecture, to perform conversion from one number system to another number system. 2. Introduce students to the distinctions between System Software and Application Software, including their roles and real-world applications. 3. Highlight the significance of MS Word in documentation, formatting, and professional communication. 4. Equip students with foundational skills in MS Excel, covering data organization, basic formulas, and spreadsheet management. 5. Familiarize students with MS PowerPoint, emphasizing effective presentation design, slide creation, and visual communication techniques.		

COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**Introduction to Computers:** Generation of Computer, Hardware Components, Memory Devices, Magnetic Disk, Floppy Disk, Compact Disc/ DVD; Input Devices-Keyboard, Mouse, Scanner, OCR, OMR, MICR.	**5**

		Output Devices- Printer, Types of Printer, Plotter, Monitor: CRT; Central Processing Unit, CPU Arithmetic Logic Unit, Control Unit, Instruction Set, Registers, Processor Speed, Type of Processors; Memory- Main Memory Organization, Main Memory Capacity, RAM, ROM, EPROM, PROM, Cache Memory , Number Systems: Binary, Decimal, Octal, Hexadecimal, Binary Arithmetic, Character Codes(BCD), Excess-3, Gray Code, ASCII	
	2	**System software:** utility packages, compilers, interpreters, Operating Systems, Elementary Commands of DOS, Booting. Application software's– Word-processing, spreadsheet, presentation graphics, Data Base Management Software, Characteristics, Virus-working, features, types of viruses, virus detection prevention and cure	**5**
	3	**MS Word:** Working with Documents-Opening & Saving files, Editing text documents, Inserting, Deleting, Cut, Copy, Paste, Undo, Redo, Find, Search, Replace, Formatting page & setting Margins, Converting files to different formats, Importing & Exporting documents, Sending files to others, Using Tool bars, Ruler, Using Icons, using help, Formatting Documents-Setting Font styles, Font selection-style, size, colour etc., Type face-Bold, Italic, Underline, Case settings, Highlighting, Special symbols, Setting Paragraph style, Alignments, Indents, Line Space, Margins, Bullets & Numbering. Setting Page style-Formatting Page, Page tab, Margins, Layout settings, Paper tray, Border & Shading, Columns, Header & footer, Setting Footnotes & end notes–Shortcut Keys; Inserting manual page break, Column break and line break, Creating sections & frames, Anchoring & Wrapping, Setting Document styles, Table of Contents, Index, Page Numbering, date & Time, Author etc., Creating Master Documents, Web page. Creating Tables-Table settings, Borders, Alignments, Insertion, deletion, Merging, Splitting, Sorting, and Formula.	**5**
	4	**MS Excel:** Spread Sheet & its Applications, Opening Spreadsheet, Menus-main menu, Formula Editing, Formatting, Toolbars, Using Icons, Using help, Shortcuts, Spreadsheet types. Working with Spreadsheets-opening, saving files, setting Margins, converting files to different formats (importing, exporting, sending files to others), Spread sheet addressing-Rows, Columns & Cells, Referring Cells & Selecting Cells–Shortcut Keys. Entering & Deleting Data-Entering data, Cut, Copy, Paste, Undo, Redo, Filling Continuous rows, columns, Highlighting values, Find, Search & replace, Inserting Data, Insert Cells, Column, rows & sheets, Symbols, Data from external files, Frames, Clipart, Pictures, Files etc, Inserting Functions, Manual breaks, Setting Formula-finding total in a column or row, Mathematical operations (Addition, Subtraction, Multiplication, Division, Exponentiation), Using other Formulae. Creating Charts - Drawing. Printing.	**10**
	5	**MS PowerPoint:** Introduction to presentation – Opening new presentation, Different presentation templates, setting backgrounds, selecting presentation layouts. Creating a presentation -Setting Presentation style, Adding text to the Presentation. Formatting Presentation-Adding style, Color, gradient fills, Arranging objects, Adding Header & Footer, Slide Background, Slide layout. Adding Graphics to the Presentation-Inserting pictures, movies, tables etc. into presentation, Drawing Pictures using draw. Adding effects to the Presentation- Setting	**5**

		Animation & transition effect. Printing Handouts, Generating Standalone Presentation viewer.	
		Total Hours:	**30**
	TEXT BOOK	1. Raja Raman V, Fundamentals of Computers, PHI	
		2. Norton's, P, Computing Fundamentals, McGraw-Hill	
	REFERENCE BOOK/ SUGGESTED READING	1. Balagurusamy, E, Fundamentals of Computers; Mc Graw-Hill.	
		2. Williams, B. and Sawyer, S, Using Information Technology, McGraw-Hill.	
		3. Curtain, D. and Sen, K. and Foley, K., Information Technology; Mc Graw-Hill	

Semester-II

Course: OBJECT ORIENTED PROGRAMMING WITH JAVA				**Semester: I I**
Course Code: MCA 508	**LTP**	**3 0 0**		**Credits: 3**

OBJECTIVE	This course aims to improve the analytical skills of object-oriented programming, Overall development of problem solving and critical analysis
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. To understand the concepts of features of object-oriented programming. 2. The skills to apply OOP in Java programming in problem solving 3. To understand the concept of polymorphism and inheritance. 4. To understand the creation of user-defined packages and interfaces. 5. To learn Java's exception handling mechanism, multithreading,

COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**Introduction to Java:** Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java.	**5**
	2	**Objects and Classes:** Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, String Buffer, File, this reference.	**7**
	3	**Inheritance and Polymorphism :** Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, UTIL package.	**9**
	4	**Event and GUI programming :** Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Introduction to swing.	**12**
	5	**I/O programming and Multi threading in java :** Text and Binary I/O, Binary I/O classes, Object I/O, Random Access Files. Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try-catch-finally, Collections in java, Introduction to Java Beans and Network Programming.	**12**

		Total Hours	**45**
	TEXT BOOK	1. E. Balagursamy, Programming with java, Mc Grawhill 2. Herbert Schildt , Java The Complete Reference, ,Oracle	
	REFERENCE BOOK/ SUGGESTED READING	3. Horstmann, C. S., & Cornell, G.,*Core Java Fundamentals* , Prentice Hall., 4. Kathy Sierra & Bert Bates Head , First Java, O'Reilly Media	

Course: DATA STRUCTURES & ALGORITHM			**Semester: II**
Course Code:	**MCA 509**	**LTP 3 0 0**	**Credits: 3**

OBJECTIVE	To become familiar with different types of Data structures and their applications.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Implement basic data structures and solve problems using fundamental algorithms. 2. Implement various searching and sorting techniques. 3. Analyse the complexity of algorithms, to provide justification for that selection, and to implement the algorithm in a particular context. 4. Analyse, evaluate and choose appropriate data structure and algorithmic technique to solve real-world problems. 5. Understand basic Graph theory.		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**Introduction and Array**: Definition of data structure, data structure operations. Linear arrays, Representation of linear arrays in memory, Address calculation of using row and column major ordering, Traversing linear arrays, Inserting and Deleting, Multidimensional arrays: Representation of Two-Dimensional arrays in memory. Sorting & Searching: Introduction to Algorithm, Analysis of Time complexity of Selection, Bubble, Merge, Quick, Heap Sort, and Sequential Search & Binary Search.	**9**
	2	**Stacks:** Introduction, Array representation of stacks, Linked representation of stacks, Polish notation, Evaluation of a Postfix Expression, Transforming Infix Expressions into Postfix Expressions. Linear List: Linked Lists, Representation of Linear Lists in memory, Traversing a Linked List, Searching a linked List, Insertion into a linked list, Deletion from linked list, Circular linked lists, Doubly linked lists and Header linked lists.	**9**
	3	**Queues:** Definition, Array representation of Queues, Linked representation of Queues, Circular queues, Priority Queue and D-Queue.	**7**
	4	**Trees:** Introduction and Definition of Trees, Tree Terminology, Binary Tree, Representing Binary Tree in Memory, Traversing Binary Tree: Preorder, In-order, Post-ordered traversal, Manipulation of Binary trees and Binary Search Tree.	**11**
	5	**Graphs:** Introduction, Graph theory terminology: Graph and multigraphs, Directed Graphs, Matrix representation of Graphs, Sequential representation of graphs: Adjacent matrix, traversing a graph: Breadth- First search, Depth First search and Spanning Tree.	**9**
		Total hours	**45**
TEXT BOOK	1. A. M. Tenenbaum, Langsam, Moshe J. Augentem, Data Structures using C PHI 2. Schaum's outline series , Data structures, TMH.		
REFERENCE BOOK/ SUGGESTED READING	1. Horowitz and Sahani, Fundamentals of Data Structures, Galgotia Publication 2. Robert Kruse, Data Structures and Program Design in C, PHI.. 3. Willam J. Collins, Data Structure and the Standard Template library, TMH		

Course: MACHINE LEARNING			**Semester: II**
Course Code: MCA 510	**LTP 3 0 0**		**Credits: 3**
OBJECTIVE	To provide foundational knowledge of machine learning concepts and equip students to identify and apply suitable techniques for solving real-world problems.		
COURSE OUTCOMES	**After studying this course, the students would gain enough knowledge.** 1. To Understand the concept of machine leaning. 2. Understand the various types, technologies and standard involve in machine learning. 3. Able to use different machine learning techniques for classification and regression problems. 4. Understand the applications of the various machine learning techniques. 5. Able to analyse the various Classification Methods		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**Machine Learning and applications**: Intelligent Systems, Types of Learning: Supervised, Unsupervised, and Reinforcement Learning, Applications of ML: social network analysis, web mining, natural language processing, online fraud detection, speech recognition, product recommendations	**9**
	2	**Supervised Learning:** Supervised Machine Learning Algorithms: Support Vector Machines, Linear and Non-linear SVM; Linear and Non-linear Regression, Multiple Regression, , Regression trees, Random forest. Unsupervised Learning: Types of Unsupervised Learning, Challenges in Unsupervised Learning, Partitioning algorithms: Clustering: Distance measures, Different clustering methods (Distance, Density, Hierarchical),	**9**
	3	**Genetic Algorithm and Applications**: evolutionary strategies, differential evolution, co-evolution, multi-objective GA (MOGA), Neuro-Genetic hybrid algorithm; Swarm Intelligence: Introduction, Swarm Based versus Population based techniques, Particle Swarm Optimization, Ant Colony Optimization.	**9**
	4	**Machine Learning with python:** Collab Notebook, NumPy, SciPy, matplotlib, pandas, Keras, Classifying Iris dataset, Model Evaluation and Improvement: Cross-Validation, Cross-Validation in scikit-learn, Benefits of Cross-Validation, Stratified k-Fold Cross-Validation and Other Strategies, Grid Search, Overfitting the Parameters and the Validation Set, Grid Search with Cross-Validation, Evaluation Metrics and Scoring: Metrics for Binary Classification, and Multiclass Classification, Regression Metrics	**9**
	5	**Classification Methods:** Instance-Based Classification, Linear Discriminant Analysis, Logistic Regression, Large Margin Classification, Kernel Methods, Support Vector Machines, Multi-class Classification, Classification and Regression Trees. Neural Networks: Non-linear Hypotheses, Neurons and the Brain, Model Representation, Multi-layer Networks, Back-propagation, Multi-class Discrimination, Training Procedures, Localized Network Structure, Deep Learning	**9**
		Total hours	**45**
TEXT BOOK	1. Tom Mitchell, Machine Learning, Mc Graw Hill, 2. Ethem Alpaydin, Introduction to Machine Learning, PHI,		
REFERENCE BOOK/ SUGGESTED READING	1. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2. Stephen Marsland, Machine Learning: An Algorithmic Perspective, CRC Press,		

Course: DIGITAL COMMUNICATION & NETWORKING			**Semester: II**
Course Code: MCA 511	**LTP 300**		**Credits: 3**

OBJECTIVE	To provide students with a foundational understanding of communication systems, their strengths, and key challenges in information and network management.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Demonstrate broad knowledge of fundamental principles and technical standards underlying. 2. Understand basic of telecommunication, networking and information technologies 3. Continuously improve their technology knowledge and communication skills. 4. Anticipate the way technological change and emerging technologies might alter the assumptions underlying architectures and systems. 5. Understand basic of Wireless Links & Networks characteristics		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**Physical Layer & Media:** Analog and Digital, Periodic analog signals, Digital signals, Transmission of Digital Signals, Transmission impairment, Data rate limits, performance. Digital Transmission: Digital-to-digital conversion, analog-to-digital conversion, transmission modes Parallel Transmission Serial Transmission Analog Transmission: Digital-to-analog conversion, Analog-to-analog conversion Bandwidth Utilization: Multiplexing & Spreading: Multiplexing spread spectrum	**9**
	2	**Transmission Media**: Guided media, unguided media, Circuit-switched networks: Circuit-Switched Networks, Datagram networks, virtual-circuit networks, Data Link Layer: Error Detection and Correction, Introduction, Block Coding, Linear block codes, cyclic codes, Checksum.	**9**
	3	**Introduction to Network Layer:** Packet switching at network layer, Network Layer Services, Logical Addressing, IPV4 addresses: classful and classless, Routing, Structure of a Router and switching techniques, Network Layer Protocols like ARP, RARP, ICMP etc. Unicast Routing Protocol: RIP, OSPF, BGP, Multicast Routing Protocol.	**9**
	4	**Transport Layer:** Introduction, Transport-Layer Services and Principles, Multiplexing and Demultiplexing Applications, Connectionless Transport: UDP, Principles of Reliable of Data Transfer, Connection-Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control.	**9**
	5	**Wireless & Mobile Networks:** Introduction: Wireless Links & Networks characteristics, Wi-Fi, Cellular Internet Access, Mobility Management, Mobile IP, Managing mobility in cellular networks, Wireless & mobility. Application Layer: Introduction, Network application architecture, process communication, HTTP, File Transfer: FTP, Electronic Mail in the Internet, SMPP, DNS	**9**
		Total hours	**45**
TEXT BOOK	1. Behrouz Forouzan, Data Communications, and Networking,Tata McGraw-Hill; 2. James F. Kurose and Keith W. Ross, Computer Networking, A Top-Down Approach		
REFERENCE BOOK/ SUGGESTED READING	1. Andrews S. Tanenbaum, David J Wetherall; Computer Networks; Pearson Education; 2. Peterson, Larry L, and Bruce S. Davie, Computer networks: a systems approach, Elsevier,		

Course: OBJECT ORIENTED PROGRAMMING WITH JAVA LAB			Semester: II
Course Code : MCA 508P	LTP	004	Credits: 2

OBJECTIVE	To enable students to develop robust, reusable, and efficient object-oriented applications using Java and apply core OOP principles in real-world software solutions.

Suggested List of Practicals

1. Program to define a structure of a basic JAVA program
2. Program to define the data types, variable, operators, arrays and control structures.
3. Program to define class and constructors. Demonstrate constructors .
4. Program to define class, methods and objects. Demonstrate method overloading.
5. Program to define inheritance and show method overriding.
6. Program to demonstrate Packages.
7. Program to demonstrate Exception Handling.
8. Program to demonstrate Multithreading.
9. Program to demonstrate I/O operations.
10. Program to demonstrate Network Programming.
11. Program to demonstrate Applet structure and event handling.
12. Program to demonstrate Layout managers.

Course: DATA STRUCTURES & ALGORITHM LAB			Semester: II
Course Code : MCA 509P	L T P	0 0 4	Credits: 2

OBJECTIVE	To develop students' ability to design, implement, and analyze efficient data structures and algorithms for solving computational problems.

Suggested List of Practicals

1. Program to find GCD using recursive function.
2. Program to display Pascal Triangle using binomial function.
3. Program to generate N Fibonacci numbers using recursive function.
4. Program to implement Towers of Hanoi.
5. Program to implement dynamic array, find smallest and largest element of the array.
6. Program to Sort the given list using Insertion Sort technique.
7. Program to Search an element using Binary Search technique.
8. Program to Implement Simple Queue.
9. Program to Implement Linear Linked List.
10. Program to display Traversal of a Tree.

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Course: MACHINE LEARNING LAB			Semester: II
Course Code : MCA 510P	L T P	0 0 2	Credits: 1
OBJECTIVE	This course is designed to provide knowledge about basic concepts of Machine Learning, identify machine learning techniques suitable for a given problem		

Suggested List of Practicals

1. The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school days in a week, the probability that it is Friday is 20 %. What is the probability that a student is absent given that today is Friday? Apply Baye's rule in python to get the result. (Ans: 15%)
2. Extract the data from database using python.
3. Implement k-nearest neighbours classification using python
4. Implement linear regression using python.
5. Implement multiple linear regression using python .
6. Implement Naïve Bayes theorem to classify the English text.
7. Implement an algorithm to demonstrate the significance of genetic algorithm
8. Calculate the probability of a student being absent given that it is Friday using Bayes' Rule in Python.
9. Extract structured data from a SQL/NoSQL database (e.g., MySQL, SQLite) using Python libraries like pymysql or sqlite3.
10. Implement k-NN from scratch or using scikit-learn to classify the Iris dataset.

Semester III

Course: ASP. NET USING C#			Semester: III
Course Code: MCA 601	L T P	3 0 0	Credits: 3

OBJECTIVE	To enable students to design and develop dynamic web applications using ASP.NET with C# programming.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Understand the Microsoft .NET Framework and ASP.NET page structure. 2. Design web applications with a variety of controls. 3. Access the data using inbuilt data access tools. 4. Use Microsoft ADO.NET to access data in web Application. 6. Configure and deploy Web Application		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**Introduction to .NET Framework:** NET framework, MSIL, CLR, CLS, CTS, Namespaces, Assemblies the Common Language Implementation, Assemblies, Garbage Collection, The End to DLL Hell, Managed Execution. C#, The Basics and Console Applications in C#: Name Spaces, Event & Delegate, Get & Post Method, Constructor and Destructors, Function Overloading & Inheritance, Operator Overloading, Modifiers, Property and Indexers , Attributes & Reflection API, When to use Console Applications , Generating Console Output, Processing Console Input.	**9**
	2	**C#.NET:**	**9**

		Language Features and Creating .NET Projects, Namespaces Classes and Inheritance, Namespaces Classes and Inheritance , C, Exploring the Base Class Library, Debugging and Error Handling, Data Types, Exploring Assemblies and Namespaces, String Manipulation ,Files and I/O ,Collections. Visual Inheritance in C#.NET: Apply Inheritance techniques to Forms, Creating Base Forms, Programming Derived Forms. Mastering Windows Forms: Printing Handling Multiple Events, GDI+, Creating Windows Forms Controls.	
	3	**String Handling:** Exception Handling and Generic Programming: String Handling APIs: String, Immutable String, Methods of String Class, String Buffer, StringBuilder, String Tokenizer. Exceptions: Dealing with Errors, Catching Exceptions, Guidelines for Using Exceptions,	**9**
	4	**Exceptions and Assertions:** Exception overview, exception class hierarchy and exception types, propagation of exceptions, using try catch and finally for exception handling, usage of throw and throws, handling multiple exceptions using multi-catch, auto close resources with try-with resources statement, creating custom exceptions, testing invariants by using assertions	**9**
	5	**Advanced in .NET**: Introduction to MVC3, The Model, View, Controller Pattern, Differences between MVC and Web Forms Applications. Building a Simple MVC Application with Visual Studio, Working with Controllers and Actions, Creating MVC Models, Data and Business Rules in MVC. Applications, Creating a Custom Data Model, Using MVC Views, Views in ASP.NET MVC. Introduction to Windows Presentation Foundation (WPF), Window Communication Foundation and its Application.	**9**
		Total hours	**45**
TEXT BOOK	1. Jeffrey Richter, Applied Microsoft .Net Framework Programming, Microsoft 2. Fergal Grimes, Microsoft .Net for Programmers, SPD		
REFERENCE BOOK/ SUGGESTED READING	1. Shibi Panikkar and Kumar Sanjeev, C# with .NET Frame Work, Firewall Media. 2. Matthew MacDonald, The Complete Reference ASP.NET, Tata McGraw-Hill. 3. Tony Baer, Jan D. Narkiewicz, Kent Tegels, Chandu Thota, Neil Whitlow,Understanding the .Net Framework,SPD		

Course: BIG DATA AND ANALYTICS			**Semester: III**
Course Code: MCA 602	**L T P**	**30 0**	**Credits:3**

OBJECTIVE	This course acquaints students with various statistical methods and cultivates statistical thinking among students by giving hands-on experience in data analysis platforms .		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Identify Big Data and its Business Implications. 2. List the components of Hadoop and Hadoop Eco-System. 3. Access and Process Data on Distributed File System. Manage Job Execution in Hadoop Environment 4. Develop Big Data Solutions using Hadoop Eco System. Analyze Infosphere Big Insights Big Data Recommendations. 5. Apply Machine Learning Techniques		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**Introduction to big data and Hadoop:** Types of Digital Data, Introduction to Big Data, Big Data Analytics, History	**8**

		of Hadoop, Apache Hadoop, Analyzing Data with Unix tools, Analyzing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere Big Insights and Big Sheets.	
	2	**HDFS(Hadoop Distributed File System):** The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.	**9**
	3	**Map Reduce:** Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.	**8**
	4	**Hadoop Eco System Pig :** Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive : Hive Shell, Hive Services, Hive Meta store, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL: Introduction	**10**
	5	**Data Analytics with R Machine Learning**: Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR.	**10**
		Total hours	**45**
TEXT BOOK	1. Rajaraman, A., Ullman, J. D., Mining of Massive Datasets, Cambridge University Press, United Kingdom 2.Bermann, .J., Principles of Big Data: Preparing, Sharing and Analyzing Complex Information, Morgan Kaufmann		
REFERENCE BOOK/ SUGGESTED READING	1. Barlow, M., Real-Time Big Data Analytics: Emerging Architecture, O Reilly, 2. Baesens, B, Analytics in a Big Data World, Wiley 3. Bell, J, Machine Learning for Big Data, Wiley 4. Pete Warden, Big Data Glossary, O'Reily		

Course: ARTIFICIAL INTELLIGENCE			**Semester: III**
Course Code: MCA 603	**L T P**	**3 0 0**	**Credits: 3**

OBJECTIVE	The course is proposed to teach concepts of Artificial Intelligence. The subject will provide the foundations for AI problem solving techniques and knowledge representation formalisms.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Identify and formulate appropriate AI methods for solving a problem. 2. Apply AI algorithms. 3. Compare different AI algorithms in terms of design issues, computational complexity, and assumptions. 4. Utilize the concepts of AI for real world problem solving. 5. Identify real world problems related to Reinforcement Learning.		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**Introduction-** Definitions, Intelligent Agents, Problem solving and Search- Uninformed Search, Informed Search, Minimax Search, Constraint Satisfaction Problem, A*, Best Search, DFS, BFS.	**9**
	2	**Prolog-Introduction to Prolog**, Syntax and Meanings of Prolog Programs, Operators and Arithmetic, Prolog for Artificial Intelligence.	**9**
	3	**Knowledge Representation**- Introduction, Approaches and Issues in Knowledge Representation, Propositional Logic and Inference, First-Order	**9**

		Logic and Inference, Unification and Resolution, Expert Systems	
	4	**Reasoning- Introduction**, Types of Reasoning, Probabilistic Reasoning, Probabilistic Graphical Models, Certainty factors and Rule Based Systems, Introduction to Fuzzy Reasoning	**9**
	5	**Planning and Learning**- Introduction to Planning, Types-Conditional, Continuous, Multi-Agent. Introduction to Learning, Categories of Learning, Inductive Learning, Supervised and Unsupervised & Reinforcement Learning, Basic Introduction to Neural Net Learning	**9**
		Total hours	**45**
TEXT BOOK	1. Stuart J. Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson Education India 2. Elaine Rich, Kevin Knight and Shivashankar B. Nair, Artificial Intelligence, McGraw-Hill Education;		
REFERENCE BOOK/ SUGGESTED READING	1. Ivan Bratko, "Prolog Programming for Artificial Intelligence", Pearson Education Asia 2. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", PHI Learning, 3. Nils J. Nilsson, "Artificial Intelligence-A New Synthesis", Morgan Kaufmann Publishers, Inc.; 1st edition		

Course: DATA ENCRYPTION AND NETWORK SECURITY			**Semester: III**
Course Code: MCA 604	**L T P**	**300**	**Credits: 3**

OBJECTIVE	This course will cover the concept of security, types of attacks experienced, encryption and authentication for dealing with attacks, what Network Perimeter Security is, Access Control Lists and Virtual Private Networks.		
COURSE OUTCOMES	**At the end of the course, the student will be able to:** 1. Understand the significance of authentication process using digital signature. 2. Understand the significance of hash functions in data security. 3. Understand the concept of IP security and significance of Access control lists in network security. 4. Understand the concept of Communication Model, Network Perimeter Security Lists and Virtual Private Networks. 5. Manage external data storage and develop database-driven applications.		
COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**Symmetric & Asymmetric Key Cryptography:** Algorithm types & Modes, Substitution and Transposition Ciphers, User Authentication Mechanism: Authentication basics, Passwords, Authentication tokens, Certificate based & Biometric authentication, Digital Signatures: Digital Signatures, authentication protocols, digital signature standards (DSS), proof of digital signature algorithm	**10**
	2	**Message Authentication and Hash Function:** Approaches to Message Authentication, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions and MACS, MD5 message digest algorithm, secure hash algorithm (SHA). Authentication Applications: Kerberos and X.509, directory authentication service,	**8**

		electronic mail security-pretty good privacy (PGP), S/MIME	
	3	**IP Security:** Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management. Network Perimeter Security Fundamentals: Introduction to Network Perimeter, Multiple layers of Network Security, Security by Router.	**9**
	4	**Access Control Lists:** Ingress and Egress Filtering, Types of Access Control Lists, ACL types: standard and extended, ACL commands. Firewalls: Firewall Basics, Types of Firewalls, Network Address Translation Issues.	**10**
	5	**Virtual Private Networks:** VPN Basics, Types of VPN, IPsec Tunneling, IPsec Protocols. VLAN: introduction to VLAN, VLAN Links, VLAN Tagging, VLAN Trunk Protocol (VTP).	**8**
		Total Hours	**45**
TEXTBOOK	1. Forouzan, B.A,Cryptography & Network Security‖, Tata McGraw-Hill Education 2. Stallings, Cryptography and Network Security- Principles and Practice‖, Pearson Ed		
REFERENCE BOOK/ SUGGESTED READING	1. Kahate, A,Cryptography and Network Security‖, McGraw-Hill Higher 2. Godbole, N,Information Systems Security: Security Management, Metrics, Frameworks and Best Practices‖ John Wiley & Sons India,		

Course: ENTERPRISE RESOURCE PLANNING			**Semester: III**
Course Code : MCA 605	**L T P**	**3 0 0**	**Credits: 3**

OBJECTIVE	To introduce the fundamentals of ERP systems, including their business modules, implementation challenges, popular ERP products, and emerging trends shaping the future of enterprise solutions.		
COURSE OUTCOMES	**At the end of the course, the student will be able to:** 1. To know the basics of ERP 2. To understand the key implementation issues of ERP 3. To know the business modules of ERP 4. To be aware of some popular products around ERP 5. To appreciate the current and future trends in ERP		
COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**Introduction**: Overview of enterprise systems – Evolution - Risks and benefits - Fundamental technology - Issues to be considered in planning design and implementation of cross functional integrated ERP systems.	**8**
	2	**ERP Solutions and Functional Modules**: Overview of ERP software solutions- small, medium and large enterprise vendor solutions, BPR and best business practices - Business	**9**

		process Management, Functional modules.	
	3	**ERP Implementation**: Planning Evaluation and selection of ERP systems - Implementation life cycle - ERP implementation, Methodology and Frame work- Training – Data Migration - People Organization in implementation-Consultants, Vendors and Employees.	**8**
	4	**Post Implementation**: Maintenance of ERP- Organizational and Industrial impact; Success and Failure factors of ERP Implementation.	**10**
	5	**Emerging Trends in ERP**: Extended ERP systems and ERP add-ons -CRM, SCM, Business analytics - Future trends in ERP systems-web enabled, Wireless technologies, cloud computing.	**10**
		Total Hours	**45**
TEXT BOOK	1. Alexis Leon, ERP demystified, Tata McGraw-Hill 2. Sinha P. Magal and Jeffery Word, Essentials of Business Process and Information System, Wiley India		
REFERENCE BOOK/ SUGGESTED READING	1. Mahadeo Jaiswal and Ganesh Vanapalli, ERP Macmillan India, 2. Vinod Kumar Grag and N.K. Venkatakrishnan, ERP- Concepts and Practice, PHI,		

Course: SOFT SKILLS- II			**Semester: III**
Course Code : MCA 606	**L T P**	**2 0 0**	**Credits: 2**

OBJECTIVE	Objective of this course is to Empower students for success in Quantitative Aptitude and Analytical Ability		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Understand the basic concepts of Verbal reasoning Skills 2. Explaining Non-Verbal Reasoning. 3. Illustrate varied problems on Number Systems, LCM and HCF, Decimal Fractions, Simplification, Square Roots and Cube Roots Average. 4. Analyze the concept of Problems on Ages, Surds & Indices, Percentages, Problems on Numbers. 5. Evaluate trends of Logarithm, Permutation and Combinations, Probability, Profit and Loss, Simple and Compound Interest.		
COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**Verbal Reasoning :** Analogy, classification, coding-decoding, blood relation, Venn diagram, calendar, clocks, direction and distance, decision-making, input-output, puzzles .	**6**

	2	**Non Verbal Reasoning :** Analogy, classification, series, Image and Figure Counting, Cube and Dice. Embedded Figure Paper Folding and cutting, Mirror Image, Water Image, Pattern Completion	**6**
	3	**Quantitative Ability (Basic Mathematics):** Number Systems, LCM and HCF, Decimal Fractions, Simplification, Square Roots and Cube Roots Average, Problems on Ages, Surds & Indices, Percentages, Problems on Numbers.	**6**
	4	**Quantitative Ability (Applied & Engineering Mathematics):** Logarithm, Permutation and Combinations, Probability, Profit and Loss, Simple and Compound Interest, Time,Speed and Distance ,Time& Work, Ratioand Proportion, Area, MixturesandAllegation.	**6**
	5	**Data Interpretation :** Data Interpretation, Tables , Column Graphs ,Bar Graphs, Line Charts, Pie Chart, Venn Diagrams, Seating Arrangement, Syllogism, Mathematical Operations.	**6**
		Total Hours	**30**
TEXT BOOK	1. RS AGARWAL ,A Modern Approach To Verbal & Non-Verbal Reasoning ", S. Chand Publishing 2. Analytical Reasoning, MK Pandey, BPB		
REFERENCE BOOK/ SUGGESTED READING	1. RS AGARWAL ,"Quantative Aptitude , S. Chand Publishing 1. Arihant Experts, How to Crack Test of Reasoning, Arihant Publications.		

Course: ASP. NET USING C# LAB			**Semester: III**
Course Code : MCA 601P	**L T P**	**0 0 4**	**Credits: 2**
OBJECTIVE	To enable students to develop robust, reusable, and efficient object-oriented applications using Java and apply core OOP principles in real-world software solutions.		

Suggested List of Practicals

1. Write a C# program to read a set of strings into the rows of a two-dimensional array and then print the string having a greater number of vowels.
2. Write a C# program to demonstrate the concepts of Structures and Enumerations.
3. Write a C# program to demonstrate the concepts of Label, Text Box and Button controls
4. Create a Windows application in C# for registration form and fill in the details and when you click the submit button it displays the details in the message box.
5. Create a Windows application in C# for registration form and fill in the details and when you click the submit button it displays the details in the message box.
6. Write a C# program to demonstrate the concepts of Delegates.
7. Write a C# program to demonstrate the concepts of Combo Box and List Box controls.
8. Develop the Static Web pages using HTML and some validations along with Java Script.

9. Develop a Registration Form with all Validation Controls.
10. Create a Web Service for all Arithmetic operations.
11. Write a C# program to implement Multi threading and Thread Synchronization

Course: BIG DATA & ANALYTICS LAB			**Semester: III**
Course Code : MCA 602P	**L T P**	**0 0 2**	**Credits: 1**
OBJECTIVE	To assess students' practical understanding of Big Data tools and techniques by implementing real-world data processing, analytics, and visualization tasks using Hadoop, Spark, NoSQL, and machine learning frameworks.		

Suggested List of Practicals

1. Downloading and installing Hadoop; Understanding different Hadoop modes. Startup scripts, Configuration files.
2. Hadoop Implementation of file management tasks, such as Adding files and directories, retrieving files and Deleting files
3. Implement of Matrix Multiplication with Hadoop Map Reduce
4. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
5. Installation of Hive along with practice examples.
6. Installation of HBase, Installing thrift along with Practice examples
7. Practice importing and exporting data from various
8. Practice importing and exporting data from various databases. Software Requirements: Cassandra, Hadoop, Java, Pig, Hive and HBase
9. Write queries to sort and aggregate the data in a table using Hive QL.
10. Develop a Map Reduce program to find the frequency of books published each year and find in which year maximum number of books were published using the following data.
11. Title Author Published year Author country Language No of pages
12. Write a C# program to implement Multi threading and Thread Synchronization.

Course: MINOR PROJECT			**Semester:III**
Course Code: MCA 607P	**LTP**	**004**	**Credits: 2**
OBJECTIVE	Acquire practical knowledge within the chosen area of technology for project development. Identify, analyze, formulate and handle programming projects with a comprehensive and systematic approach.		
COURSE OUTCOMES	On successful completion of the course, students will be able to: Identify a suitable problem making use of the technical and engineering knowledge gained from previous courses with the awareness of impact of technology on the society and their ethical responsibilities		

SEMESTER IV

Course: INDUSTRIAL PROJECT			**Semester: IV**
Course Code: MCA 208PR	**LTP**	**0 0 0**	**Credits: 14**
OBJECTIVE	In this course, the learners will be able to develop working expertise of solving complex computing problems through project based learning approach using real world case studies by implementing		

	the concepts studied in the theory courses of this semester.
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Identify the problem and describing it. 2. Understand the requirements of the chosen project. 3. Apply the collected requirements to define the describe the project in a systematic and comprehensive approach. 4. Analyze the technical aspects of the chosen project to find the possible solutions for development of the project. 5. Evaluate the effective reports and documentation for all project related activities and solutions.

GUIDELINES FOR PROJECT FILE

- Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.
- Research is genuine exploration of the unknown that leads to new knowledge, which often warrants publication. But whether or not the results of a research project are publishable ,the project should be communicated in the form of a research report written by the student.
- Sufficient time should be allowed for satisfactory completion of reports, taking into account that initialdraftsshouldbecritiquedbythefacultyguideandcorrectedbythestudentateachstage.
- The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- Ashortaccountoftheactivitiesthatwereundertakenaspartoftheproject;
- Astatementabouttheextenttowhichtheprojecthasachieveditsstatedgoals.
- A statement about the outcomes of the evaluation and dissemination processes engaged inas part of the project;
- Any activities planned but not yet completed as part of the project ,or as a future initiative directly resulting from the project;
- Anyproblemsthathavearisenthatmaybeusefultodocumentforfuturereference.

Report Layout
There port should contain the following components
- File should be in the following specification
- A4size paper
- Font: Arial (10 points) or Times New Roman (12points)
- Linespacing:1.5
- Top & bottom margins:1inch/2.5cm
- Left & right margins:1.25 inches/3cm

Report Layout: There port should contain the following components
- Front Page
- Table of Contents
- Acknowledgement
- Student Certificate
- Company Profile
- Introduction Chapters
- Appendices
- References/Bibliography

Title or Cover Page or Front Page
The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

Table of Contents
Titles and subtitles are to correspond exactly with those in the text.

Acknowledgement
Acknowledgment to any advisory or financial assistance received in the course of work may be given.

Student Certificate
Given by the Institute.

Company Certificate &Profile
This is a certificate, which the company gives to the students. A Company Profile corresponds to a file with company-specific data. Company data can best there and included in a booking when needed.

Introduction
Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

Chapters
All chapters and sections must be appropriately numbered, titled and should neither be too long nor too short in length. The first chapter should be introductory in nature and should outline the background of the project, the problem being solved, the importance, other related works and literature survey. The other chapters would form the body of the report. The last chapter should be concluding in nature and should also discuss the future prospect of the project.

Appendices
The Appendix contains material which is of interest to there but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

References/Bibliography
This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognized system.

GROUP 1(Electives)

Course:	**WEB TECHNOLOGIES**			**Semester: II**
Course Code:	**MCA-CDW1**	**LTP**	**2 0 2**	**Credits: 3**

OBJECTIVE	To introduce PHP language for server-side scripting.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. To introduce PHP language for server-side scripting. 2. Understand server-side scripting with PHP language. 3. Understand what is XML and how to parse and use XML Data with Java. 4. To introduce React.js 5. Understand Node.js		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**HTML Common Tags**: List, Tables, images, forms, Frames; Cascading Style sheets; XML: Introduction to XML, Defining XML tags, their attributes and values, Document Type Definition, XML Schemes, Document Object Model, XHTML Parsing XML Data – DOM and SAX Parsers in java.	5
	2	**Introduction to PHP**: Declaring variables, data types, arrays, strings, operators, expressions, control structures, functions, Reading data from web form controls like text boxes, radio buttons, lists etc., Handling File Uploads. Connecting to database (MySQL as reference), executing	10

		simple queries, handling results, Handling sessions and cookies File Handling in PHP: File operations like opening, closing, reading, writing, appending, deleting etc. on text and binary files, listing directories.	
	3	**Introduction to Servlets**: Common Gateway Interface (CGI), Life cycle of a Servlet, deploying a servlet, The Servlet API, Reading Servlet parameters, Reading Initialization parameters, Handling Http Request & Responses, Using Cookies and Sessions, connecting to a database using JDBC.	10
	4	**Introduction to React js:** Templating using JSX ,Components, State and Props, Lifecycle of Components, Rendering List and Portals ,Error Handling Routers, Redux and Redux Saga ,Immutable.js ,Service Side Rendering, Unit Testing ,Webpack	10
	5	**Node js, Overview:** Node js - Basics and Setup, Node js Console Node js Command Utilities, Node js Modules, Node js Concepts Node js Events, Node js with Express js, Node js Database Access	10
		Total hours	45
TEXT BOOK	1. The Joy of PHP Programming: A Beginner's Guide to Programming Interactive Web Applications with PHP and MySQL. Alan Forbes, Fifth Edition, Plum Island. 2. Mastering Reactby Adam Horton, Ryan Vice		
REFERENCE BOOK/ SUGGESTED READING	1. Jon Duckett ,Beginning Web Programming, WROX 2. Dan Woods and Gautam Guliani ,Open Source for the Enterprise: Managing Risks, Reaping Rewards, O'Reilly, Shroff Publishers and Distributors,		

Course: INTRODUCTION TO STATISTICAL ANALYSIS			**Semester: II**
Course Code: MCA-CDW2		**LTP 202**	**Credits: 3**
OBJECTIVE	The course discusses about the concept of various discrete and continuous probability distribution for solving various day-to-day life problems		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Understand algorithms for various computing problems. 2. Implement various searching and sorting techniques. 3. Analyze the complexity of algorithms, to provide justification for that selection, and to implement the algorithm in a particular context. 4. Analyze, evaluate and choose appropriate data structure and algorithmic technique to solve real-world problems. 5. Understand Principle of least Square.		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**Analysis of Statistical Data:** Frequency distribution; Measure of central tendency and dispersion. Random Variables and probability distributions: Basic concepts of probability and its properties; Additive and multiplicative theorem of probability; Conditional probability and independent events; Random variable, Notion of sample space; distribution functions; Mathematical expectation, Binomial, Poisson, Rectangular, Exponential and Normal distributions.	**10**
	2	**Sampling distributions:**	**10**

		Notion of random sample and sampling distributions; Parameter and statistics; Standard error; Chi-square, t, F distributions; Basic ideas of testing of hypothesis; Testing of significance based on normal, Chi-square, t and F distributions; Analysis of variance, One way ANOVA and two way ANOVA with fixed effect; interval estimation.	
	3	**Floating-Point Numbers:** Floating-point representation; Rounding, Chopping; Error analysis; Condition and Instability. Non-Linear Equations: Bisection, Secant, Fixed-point iteration and Newton – Raphson methods; Order of convergence.	**10**
	4	**Linear Systems of equations:** Gauss Elimination and LU- decomposition methods; Jacobi and Gauss-Seidel methods.	**10**
	5	**Interpolation:** Newton form of polynomials; Finite differences, Newton's Forward,; Introduction to Spline. Principle of least Square: Curve fitting; correlation and regression coefficients (two variables only); Rank correlation.	**5**
		Total hours	**45**
TEXT BOOK	1. Rigdon, S. E., Fricker, R. D., & Montgomery, D. C. Introduction to probability and statistics for data science. 2. Hastie, T., Tibshirani, R., & Friedman, J. The elements of statistical learning, Data mining, inference and prediction .		
REFERENCE BOOK/ SUGGESTED READING	1. Levine, D. M., Stephan, D. F., Szabat, K. A,*Statistics for managers using Microsoft Excel*, Pearson. 2. Bluman, A. G. ,*Elementary statistics: A step by step approach* ,McGraw-Hill Education.		

Course: CLOUD COMPUTING			**Semester: II**
Course Code: MCA-CDW3		**LTP 202**	**Credits: 3**
OBJECTIVE	This course is designed to teach students the basic concepts and terminology of cloud computing.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Elaborate cloud computing its service and deployment models. 2. Formulate the importance of virtualization, multi-tenancy in the cloud environment. 3. Define and examine different cloud computing services. 4. Categorize the different security threats and challenges faced by cloud provider, and demonstrate the different types of business cloud and its uses. 5. Understand Cloud Security		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**Overview of cloud computing and Distributed Computing:** What is a cloud, Definition of cloud, Definition of cloud, characteristics of cloud, Traditional vs. Cloud Computing, Importance of Cloud Computing, Cloud service models (IaaS, PaaS & SaaS). Cloud deployment models (Public, Private, Hybrid and Community Cloud), Benefits and Challenges of Cloud Computing. Introduction, Examples of distributed computing, Concurrent Programming, Characteristics & Properties of Distributed Systems, client-server model, centralized vs distributed computing, Resource Sharing and the Web Challenges, security issues.	**10**
	2	**Private Cloud**: Concept of Hypervisor, Basics of virtualization, Virtualization technologies, Server virtualization, VM migration techniques, Role of virtualization in Cloud Computing. Business cases for the need of Cloud	**10**

		computing environment, Concept of Private Cloud, Characteristics of Private Cloud, Private Cloud deployment models, Private Cloud Vendors, Virtual Private Cloud. Multitenancy, Types of tenancy, Application programming interfaces (API), Billing and metering of services.	
	3	**Public Cloud**: Concept of Public Cloud, Importance of Public Cloud, when to opt for Public Cloud, Public Cloud Service Models, and Public Cloud players. Infrastructure as a Service Offerings, IaaS Vendors, PaaS offerings, PaaS vendors, Software as a Service. Implementing public cloud AWS, Introduction, Service Offered, Creation of EC2 instance, Microsoft Azure: Introduction, Service Offered, Creation of DB instance. Implementing Security in public Cloud, Comparison of Public Cloud Vendors (AWS, Microsoft, Google, IBM, Salesforce).	**10**
	4	**Multi-Cloud**: Concept of multi-cloud management, Challenges in managing heterogeneous clouds, benefits of multi-cloud management systems. Case study on Multi-Cloud Management System (Right Scale Cloud Management System). Business Clouds: Cloud Computing in Business, Various Biz Clouds focused on industry domains (Retail, Banking and Financial sector, Life Sciences, Social networking, Telecom, Education).	**10**
	5	**Cloud Security**: Cloud security reference model, Principal security dangers/risks to cloud computing, Internal security breaches, Data corruption, Malicious Insiders, Data Loss or Leakage, Account or Service Hijacking, Unknown Risk Profile, Steps to reduce cloud security breaches, Identity management: Detection and forensics, Identity management: Detection and Identity management, Benefits of identity, Encryption techniques, Encryption & Encrypting data, Attacks on VM, Abuse and Nefarious Use of Cloud Computing.	**5**
		Total hours	**45**
TEXT BOOK	1.R. Buyya, C. Vecchiola, S. T. Selvi, Matering Cloud Computing, PHI 2.B. Sosinsky, Cloud computing Bible, Ed. , Reprint Willy India Pvt. Ltd		
REFERENCE BOOK/ SUGGESTED READING	1. M. Miller, Cloud Computing, Pearson education in South Asia 2. Buyya, Rajkumar, James Broberg, and Andrzej M. Goscinski, eds. Cloud computing: Principles and paradigms. John Wiley & Sons 3. Carlin, Sean, and Kevin Curran. "Cloud computing security, Pervasive and Ubiquitous Technology Innovations for Ambient Intelligence Environments, IGI Global,		

Course: ANDROID PROGRAMMING			**Semester: II**
CourseCode: MCA-CDW4	**LTP**	**2 0 2**	**Credits: 3**

OBJECTIVE	To help students to gain basic understanding of Android application development

COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. To identify various concepts of mobile programming that make it unique from programming for other platforms 2. To Create, test and debug Android application by setting up Android development. 3. To Demonstrate methods in storing, sharing and retrieving data in Android applications. 4: To Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces 5: To Create interactive applications in android using databases with multiple activities including audio, video and notifications and deploy them in marketplace

COURSE DETAILS	Unit No.	Topic	Hours
	1	**Mobile Platform And Applications:** Mobile Device Operating Systems — Special Constraints & Requirements — Commercial Mobile Operating Systems — Software Development Kit: iOS, Android, BlackBerry, Windows Phone —M Commerce — Structure — Pros & Cons — Mobile Payment System — Security Issues	**8**
	2	**Introduction To Android:** Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.	**7**
	3	**Android Application Design Essentials:** Anatomy of Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.	**10**
	4	**Android User Interface Design & Multimedia:** User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation. Playing Audio and Video, Recording Audio and Video, Using the Camera to Take and Process Pictures	**10**
	5	**ANDROID APIs:** Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.	**10**
		Total Hours	**45**

TEXT BOOK	1. Lauren Darcey and Shane Conder, Android Wireless Application Development, Pearson Education 2. Google Developer Training, Android Developer Fundamentals Course – Concept Reference, Google Developer Training Team
REFERENCE BOOK/ SUGGESTED READING	1. Prasanth Kumar Pattnaik,Rajib Mall, Fundamentals of Mobile Computing,PHI Learning Pvt.Ltd,New Delhi 2. Reto Meier, Professional Android 2 Application Development, Wiley India Pvt Ltd, 3. Mark L Murphy, Beginning Android, Wiley India Pvt Ltd,

Course: DATA WAREHOUSE & DATAMINING			**Semester: II**
CourseCode: MCA-CDW5	**LTP**	**2 0 2**	**Credits: 3**

OBJECTIVE	This course will covers the basic concepts of Data Warehouse and Data Mining techniques, Examine the types of the data to be mined and apply pre-processing methods on raw data.
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Explain and evaluate the various data mining algorithms 2. Discover and measure interesting patterns from different kinds of databases. 3. Apply the techniques of clustering, classification, association finding, 4. Apply techniques for feature selection and visualization to real world data. 5. An understanding of Cluster Analysis

COURSE DETAILS	Unit No.	Topic	Hours
	1	**Overview:** Motivation (for Data Mining), Data Mining-Definition & Functionalities. Data Warehousing: Overview, Definition, Delivery Process, Difference between Database System and Data Warehouse, Multi Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations, Concept hierarchy, Process Architecture, 3 Tier Architecture, Data Marting. ROLAP, MOLAP, HOLAP.	**10**
	2	**Data Cleaning**: Missing Values, Noisy Data,(Binning, Clustering, Regression, Inconsistent Data, Data Integration and Transformation. Data Reduction: Data Cube Aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction, Clustering, Discretization and Concept hierarchy generation	**12**
	3	**Concept Description:** Definition, Data Generalization, Analytical Characterization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases. Measuring Central Tendency, Measuring Dispersion of Data, Apriori Algorithm, Mining Multilevel Association rules from Transaction Databases	**10**
	4	**Classification:** What is Classification, Issues regarding Classification, Decision tree, Bayesian Classification, Classification by Back propagation	**8**
	5	**Cluster Analysis:** Data types in cluster analysis, Partitioning methods. Hierarchical Clustering- CURE and Chameleon, Density Based Methods-DBSCAN, OPTICS, Grid Based Methods STING, CLIQUE, Outlier Analysis	**5**
		TotalHours	**45**

TEXT BOOK	1. Jiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, Elsevier
REFERENCE BOOK/ SUGGESTED READING	1. Margaret H.Dunham, Data-Mining: Introductory & Advanced Topics, Pearson Education, India

Course: R PROGRAMMING			**Semester: II**
CourseCode: MCA-CDW6	**LTP**	**2 0 2**	**Credits: 3**
OBJECTIVE	The objective of this course is to develop a broad perspective about the R programming and its applications to solve basic mathematical problems, statistical manipulations and scientific tasks such as data science and machine learning.		

COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Apply the basic functionalities of R programming to solve basic mathematical problems. 2. Apply the R programming for preprocessing the real-life datasets. 3. Understand and analyze the descriptive statistics for a given dataset. 4. Implement some classical machine learning models using R programming. 5. Understand types of machine Learning models.		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**Introduction of R**.: Basic Features of R, Limitations of R, R Framework setup, R packages, Use R like calculator, Reading and Writing data into R: combine or concatenate command, scan command, alternative commands for reading data, R constant and variables, operators and expression.	**10**
	2	**R data types and objects**: Number and Text, Vector, Matrix, Factor, Array, List Data Frame, Manipulating Objects. Control structures, looping, scoping rules, Operations on Dates and Times, functions, debugging tools. R built-in packages and functions.	**8**
	3	**Dataset**: Import/export bigger datafile (csv, text, excel, table, url, etc.), Identify and handle missing values, data formatting, Data Standardization, Data Normalization and Scaling, Data visualization, Binning, Multimedia datasets: text dataset, image dataset, audio dataset, video dataset.	**12**
	4	**Central tendency**, Dispersion variance, standard deviation, shape skewness, kurtosis, percentiles, five-point summary, boxplots, histograms, bar plot, pie chart, scatter plot, two-way tables, covariance, correlation, Chi-Square test for two-way tables.	**8**
	5	**Introduction to machine learning**, types of machine Learning, supervised learning using R- regression, decision tree, KNN, SVM, Unsupervised learning using R- Clustering: K-means, hierarchical, frequent itemset, dimensionality reduction.	**7**
		Total Hours	**45**

TEXT BOOK	1.Kabacoff, R. I. , *R in action: Data analysis and graphics with R* ,Manning Publications. **2 .**Matloff, N. ,*The art of R programming: A tour of statistical software design*, No Starch Press.
REFERENCE BOOK/ SUGGESTED READING	1. Crawley and Michael, , The R book, John Wiley & Sons 2. Mark Gardener , Beginning R: The statistical programming language, John Wiley & Sons.

Course: INTRODUCTION TO DATA SCIENCE			**Semester: II**
Course Code: MCA-CDW7	**LTP**	**2 0 2**	**Credits: 3**

OBJECTIVE	This course serves as an introduction to the data science principles required to tackle real-world, data-rich problems in business and academia, including: Data acquisition, cleaning, and aggregation.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. An understanding of problems solvable with data science and an ability to attack them from a statistical perspective. 2. An understanding of when to use supervised and unsupervised statistical learning methods on labeled and unlabeled data-rich problems 3. The ability to create data analytical pipelines and applications in Python. . 4. Apply the various tools needed to continue developing as a data scientist. 5. An understanding of Data Modeling		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**Computer Science/Statistics/Linear Algebra Short Review** What is data science? Brief review of prerequisite knowledge for studying data science. Basics of computer science; data structures/types, program control flow, and syntax in Python. Basics of statistics; probability and probability distributions. Basics of linear algebra; matrices, vectors using Python programming language	10
	2	**Exploratory Data Analysis (Eda) And Visualization Design** E-R model: Basic concepts, Design Issues, Mapping Constraints, Attributes and Entity sets, Relationships and Relationship sets, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended ER features.	**8**
	3	**Data Modeling: Supervised/Unsupervised Learning** Two basic kinds of statistical models used for prediction. Supervised Learning algorithm: Linear Regression and Logistic Regression. Unsupervised Learning algorithm: K-Means clustering. Advanced supervised learning algorithms like linear support vector machines, decision trees, and random forest models for regression and classification. Advanced unsupervised learning algorithm like DBSCAN.	**12**
	4	**Data Modeling: Feature Selection, Engineering, And Data Pipelines** Curse of dimensionality and Dimensionality reduction. Feature selection and feature extraction. Principal Component Analysis/Independent Component Analysis and regularization. Construct complete data pipelines, going from data ingestion, preprocessing to model construction and evaluation	**7**
	5	**Data Modeling: Model Evaluation And Project Presentations** Exploration of more sophisticated model evaluation approaches like cross-validation and bootstrapping with the goal of making the model as generalizable as possible. Presentation of students‘ project and sharing learning experience.	**8**
		TotalHours	**45**
TEXT BOOK	1. Cathy O‘Neil and Rachel Schutt, Doing Data Science, Straight Talk from the Frontline, O‘Reilly 2. Jiawei Han, Micheline Kamber and Jian Pei Silberschatz, Korth, Data Mining: Concepts and Techniques, TMH		

REFERENCE BOOK/ SUGGESTED READING	1. Mohammed J. Zaki and Wagner MieraJr, Data Mining and Analysis: 2.Fundamental Concepts and Algorithms, Cambridge University Press.

Course: FOG & EDGE COMPUTING			**Semester: II**
Course Code:MCA- CDW8	**LTP**	**2 0 2**	**Credits: 3**

OBJECTIVE	To implement the concepts of fog and cloud computing and expose students to modern tools and API to deploy relevant infrastructures.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Become familiar with the concepts of Fog. 2. Understand the architecture and its components and working of components and its performance. 3. Explore Fog on security, multimedia and smart data. 4. Model the fog computing scenario. 5. Understanding IoT Architecture and Core IoT modules.		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**EDGE COMPUTING:** Fog computing requirements when applied to IoT: Scalability, Interoperability, Fog IoT architectural model, Challenges on IoT Stack Model via TCP/IP Architecture, Data Management, filtering, Event Management, Device Management, cloudification, virtualization, security and privacy issues. Integrating IoT, Fog, Cloud Infrastructures: Methodology , Integrated C2F2T Literature by Modelling Technique	**8**
	2	**FOG COMPUTING IN HEALTH MONITORING**: Exploiting Fog Computing in Health Monitoring: An Architecture of a Health Monitoring IoT-Based System with Fog Computing, Fog Computing Services in Smart E-Health Gateways, Discussion of Connected Components. Fog Computing Model for Evolving Smart Transportation Applications: Introduction, Data-Driven Intelligent Transportation Systems.	**7**
	3	**FOG COMPUTING APPLICATION** Software Defined Networking and applications in Fog Computing: Open Flow Protocol, Open Flow Switch, SDN in Fog Computing, Home Network using SDN. Security and Privacy issues: Trust and privacy issues in IoT Network, web Semantics and trust Management for Fog Computing,	**12**

	4	**INTRODUCTION TO EDGE COMPUTING** Introduction to Edge Computing Scenarios and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog, and M2M.	**12**
	5	**IOT ARCHITECTURE AND CORE IOT MODULES** IoT Architecture and Core IoT Modules-A connected ecosystem, IoT versus machine-to-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with the examples- Edge computing with RaspberryPi, Industrial, and Commercial IoT and Edge, and Edge computing and solutions.	**6**
		Total Hours	**45**
TEXT BOOK	1. Assad Abbas, Samee U. Khan, Albert Y. Zomaya, Fog Computing: Theory and Practice, John Wiley & Sons, Inc 2. Rajkumar Buyya and Satish Narayana Srirama ,Fog and Edge Computing: Principles and Paradigms ,Wiley Series		
REFERENCE BOOK/ SUGGESTED READING	1. Flavio Bonomi, Rodolfo Milito, Jiang Zhu, Sateesh Addepalli, Fog Computing and Its Role inthe Internet of Things, ACM 2. Shanhe Yi, Cheng Li, Qun Li,A Survey of Fog Computing: Concepts, Applications and Issues, ACM		

GROUP 2(ELECTIVES)

Course: NATURAL LANGUAGE PROCESSING			**Semester:** II
Course Code:MCA-AMR1	**LTP**	**2 0 2**	**Credits: 3**

OBJECTIVE	Introduction to some of the problems and solutions of NLP and their relation to linguistics and statistics.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Show sensitivity to linguistic phenomena and an ability to model them with formal grammars. 2. Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems 3. Able to manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods. 4. Able to design, implement, and analyze NLP algorithms 5. Able to design different language modeling Techniques.		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**Introduction:** History of NLP, Generic NLP system, levels of NLP , Knowledge in language processing , Ambiguity in Natural language , stages in NLP, challenges of NLP ,Applications of NLP.	**6**
	2	**Word Level Analysis:** Morphology analysis –survey of English Morphology, Inflectional morphology & Derivational morphology, Lemmatization, Regular expression, finite automata , finitestate transducers (FST) ,Morphological parsing with FST , Lexicon free FST Porter stemmer. N –Grams- N-gram language model,	**7**

	3	**Syntax analysis** Part-Of-Speech tagging(POS)- Tag set for English (Penn Treebank) , Rule based POS tagging, Stochastic POS tagging, Issues – Multiple tags & words, Unknown words. Introduction to CFG, Sequence labeling: Hidden Markov Model (HMM), Maximum Entropy	**8**
	4	:**Semantic Analysis** Lexical Semantics, Attachment for fragment of English- sentences, noun phrases, Verb phrases, prepositional phrases, Relations among lexemes & their senses –Homonymy, Polysemy, Synonymy, Hyponymy, Robust Word Sense Disambiguation (WSD), Dictionary based approach	**12**
	5	**Sentiment Analysis and Opinion Mining** Sentiment Analysis introduction , Sentiment Analysis - Affective lexicons, Learning affective lexicons, Computing with affective lexicons, Aspect based sentiment analysis	**12**
		Total Hours	**45**

TEXT BOOK	1. Daniel M. Bikel and Imed Zitouni, Multilingual natural Language Processing Applications: From Theory to Practice , Pearson Publication 2. Tanvier Siddiqui, Natural Language Processing and Information Retrieval,PHI
REFERENCE BOOK/ SUGGESTED READING	1. Dan Jurafsky and James Martin., "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall. 2. Chris Manning and Hinrich Schütze., "Foundations of Statistical Natural , Language Processing, MIT Press, Cambridge. 3. Nitin Indurkhya and Fred J Damerau, "Handbook of natural language processing, Chapman and Hall/CRC.

Course: FUZZY LOGIC AND NEURAL NETWORK			**Semester:II**
Course Code:MCA-AMR2	**LTP**	**2 0 2**	**Credits: 3**

OBJECTIVE	The course will facilitate the students to learn the fundamentals of Fuzzy Logic and Neural Networks.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Understanding the concepts of Fuzzy Logic. 2. Applying different fuzzy operations and functions. 3. Understanding the concepts of Neural Network. 4. Understanding and implement different Activation Functions. 5. Understanding Self Organizing Network		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**

	1	Introduction to Soft Computing: Concept of computing systems, "Soft" computing versus "Hard" computing, Characteristics of Soft computing. Fuzzy Computing, Neural Computing, Applications of Soft computing techniques.	**6**
	2	Fundamentals of Fuzzy Logic: Basic Concepts: Fuzzy Set Theory, Basic Concepts of Crisp sets and fuzzy set, complements, union, intersection, combination of operations, general aggregation operation, fuzzy relations, fuzzy proposition, fuzzy implication, compatibility relation. Fuzzy membership function, Defuzzification Techniques.	**10**
	3	Introduction to Neural Networks: Introduction to Biological Neural Network, Artificial Neural Network. Activation Functions, Basic Learning Rules, Hebb's rule, Biases and Threshold, Perceptron, Convergence Theorem, Delta Rule, Hyper parameter, Cost Function, Applications of Artificial Neural Networks.	**11**
	4	Neural Network Techniques: Gradient Descent, Stochastic Gradient Descent, Back Propagation, Multi-Layer Perceptron, Feed Forward Networks, Convolution Neural Network, Recurrent Neural Networks, Bayesian Network, Hopfield Network, Radial Basis Network.	**10**
	5	Advanced Neural Networks: Architecture of Cognitron and Neocognitron, Auto Encoders, Gated Recurrent Unit, Long Short-Term Memory, Kohonen Self Organizing Network, Modular Neural Network.	**8**
		Total Hours	**45**
TEXT BOOK	1. T1. Kliryvan, Fuzzy System & Fuzzy logic ,Prentice Hall of India 2. Lawrence Fussett, fundamental of Neural network ,Prentice Hall		
REFERENCE BOOK/ SUGGESTED READING	1. Bart Kosko,, Neural network and Fuzzy System‖ , Prentice Hall 2. J.Klin and T.A.Folger, Fuzzy sets‖ University and information, Prentice Hall 3. J.M.Zurada, Introduction to artificial neural systems‖-Jaico, Publication house,Delhi 4. VallusuRao and HayagvnaRao , C++ Neural network and fuzzy logic‖-BPB and Publication,		

Course: EVOLUTIONARY COMPUTING			**Semester:II**
Course Code: MCA-AMR3	**LTP**	**2 0 2**	**Credits: 3**
OBJECTIVE	The course seeks to find out the solution for complex computing problems using Darwinian laws as its basic motivation in order to find better solutions to certain problems.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Understand the fundamentals of evolution based learning algorithms, advanced searching and optimization techniques. 2. Analyze and Understand the concepts of genetic algorithms. 3. Apply swarm intelligence and Ant Colony Optimization. 4. Create algorithms evolutionary computing based algorithms for solving problem. 5. Understand the fundamental of Evolutionary Robotics		

COURSE DETAILS	Unit No.	Topic	Hours
	1	Introduction, Optimization Problems, Problem Domains, Global Optimization and Techniques of Global Optimization: Branch and Bound, Clustering Methods, Hybrid Methods, Darwinian Evolution, Genetics, What is an Evolutionary Algorithm, Components of Evolutionary Algorithms, Competitive Learning, Working of an Evolutionary Algorithm, Evolutionary Computing and Global Optimization.	**10**
	2	Genetic Algorithm: Introduction, Representation of Individuals, Mutation, Recombination, Population Models, Parent Selection, Survivor Selection, Age-Based Replacement, Fitness Based Replacement, Evolutionary Strategies, Example Applications. Genetic Programming: Introduction, Representation, Mutation, Recombination, Parent Selection, Survivor Selection, Initialization,	**12**
	3	Swarm Intelligence: Introduction, key principles (e.g., self-organization, stigmergy), natural and artificial examples, computational and real-time SI, Ant System (AS), the first combinatorial optimization algorithm based on ant trail/following principles, Travel Salesman Problem (TSP).	**10**
	4	Multimodal problems, need for diversity, implicit measures, explicit diversity maintenance, multi objective evolutionary algorithms.	**6**
	5	Evolutionary Robotics, Evolutionary Neural Networks, Dynamic Landscapes, Parallel EC, Multi-objective EC.	**7**
		Total Hours	**45**
TEXT BOOK	1. A.E.Eiben & J.E.Smith, Introduction to Evolutionary Computing., Springer-Verlag Berlin Heidelberg,		
REFERENCE BOOK/ SUGGESTED READING	1. S. Sumathi &T.Hamsapriya&P.Surekha, Evolutionary Intelligence, An Introduction to theory and applications with Matlab Springer, Verlag Berlin Heidelberg, 2. Kenneth A. De Jong, Evolutionary Computation, A unified Approach , The MIT Press Cambridge		

Course:ARTIFICIAL NEURAL NETWORK			**Semester: I I**
Course Code:MCA-AMR4	**LTP**	**2 0 2**	**Credits: 3**

OBJECTIVE	On completion of this course the students will be able to expose themselves towards intelligence systems and knowledge based systems. It also provides knowledge of learning networks.
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Understand the difference between biological neuron and artificial neuron 2. Understand the application areas of neural networks 3. Understand building blocks of Neural Networks. 4. Develop neural network models 5. Design and develop applications using neural networks.

COURSE DETAILS	Unit No.	Topic	Hours
	1	Introduction to Artificial Neural Networks : Introduction, Artificial Neural Networks, Historical Development of Neural Networks, Biological Neural Networks, Comparison Between them and the Computer, Comparison Between Artificial and Biological Neural Network Basic Building Blocks of Artificial Neural Networks, Artificial Neural Network (ANN) terminologies.	**10**
	2	Fundamental Models of Artificial Neural Networks : Introduction, McCulloch - Pitts Neuron Model, Learning Rules, Hebbian Learning Rule Perceptron Learning Rule, Delta Learning Rule (Widrow-Hoff Rule or Least Mean Square(LMS)Rule, Competitive Learning Rule, Out Star Learning, Boltzmann Based Learning, Hebb Net. Perceptron Networks : Introduction, Single Layer Perceptron, Brief Introduction to Multilayer Perceptron Networks.	**12**
	3	Associative Memory Networks: Introduction, Algorithms for Pattern Association, Hetero Associative Memory Neural Networks, Auto Associative Memory Network, Bi- directional Associative Memory.	**8**
	4	Feedback Networks: Introduction, Discrete Hopfiled Net, Continuous Hopfiled Net, Relation between BAM and Hopfiled Nets. Feed Forward Networks: Introduction, Back Propagation Network (BPN), Radial Basis Function Network (RBFN).	**8**
	5	Self Organizing Feature Map : Introduction, Methods Used for Determining the Winner, Kohonen Self Organizing Feature Maps, Learning Vector Quantization (LVQ),Max Net, Maxican Hat, Hamming Net	**7**
		Total Hours	**45**
TEXT BOOK	1. Sivanandam, S Sumathi, S N Deepa; ,Introduction to Neural Networks, TATA McGraw HILL : 2. Simon Haykin, Neural networks A comprehensive foundations, Pearson Education		
REFERENCE BOOK/ SUGGESTED READING	1. B Yegnanarayana, "Artificial neural networks", Prentice Hall of India P Ltd, 2. Li Min Fu, Neural networks in Computer intelligence, Pearson		

Course: ROBOTICS			**Semester: I I**
Course Code:MCA-AMR5	**LTP**	**2 0 2**	**Credits: 3**
OBJECTIVE	The course will facilitate the students to learn the fundamentals, Techniques used in Robotics .		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Understating of how to keep robots in modern industries. 2. Applying robots in different areas (space, medical, manufacturing etc.) 3. Understating different components of robots system and their working principle. 4. Creating robot using robot lego robotics kit. 5. Understanding Multi-robot representations and Task Planning		

COURSE DETAILS	Unit No.	Topic	Hours
	1	**Introduction to Soft Computing**: Concept of computing systems, "Soft" computing versus "Hard" computing, Characteristics of Soft computing. Fuzzy Computing, Neural Computing, Applications of Soft computing techniques	**7**
	2	**Actuators:** Characteristics of Actuating Systems, Actuating Devices and Control. Sensors: Sensor Characteristics, Description of Different Sensors, Touch sensors, Tactile sensor, Proximity and range sensors, Robotic vision sensor, Force sensor, Light sensors, Pressure sensors.	**8**
	3	**Concepts of AI**: AI Problems, techniques, Characteristics & Applications, AI versus Natural Intelligence, Problem representation in AI, Problem-solution Techniques. Elements of Knowledge Representation: Logic, Production Systems, Semantic Networks, Expert Systems. Defining the Problem as State Space Search, Production Systems, Production Systems, Issues in the Design of Search Programs, DFS & BFS Techniques	**10**
	4	**Introduction to lego robotics kits**: Introduction to robot manipulation. Forward and inverse kinematics of robots and some case studies. Manipulator dynamics. Basics of robot control. Task planning with emphasis on computational geometry methods for robot path finding, robot arm reachability, grasp planning. Overview of robot vision and Parallel robots.	**10**
	5	**Multi-robot representations and Task Planning**: Task-Level Programming, Uncertainty, Configuration Space, Gross-Motion Planning, Grasp Planning, Fine Motion Planning, Task Planning Problem.: control architectures, simulation environments, and test beds. Integration of assorted sensors (IR, Potentiometer, strain gages etc.), micro controllers and ROS (Robot Operating System) in a robotic system.	**10**
		Total Hours	**45**
TEXT BOOK	1. Fundamentals of Robotics Analysis and Control, Robert J Schilling, PHI, 2. Introduction to Robotics Analysis, Systems, Applications by Saeed B. Niku, Prentice Hall,		
REFERENCE BOOK/ SUGGESTED READING	1. Michael Wooldridge, An Introduction to Multi Agent Systems , Wiley, 2. J J Craig, Introduction to Robotics: Mechanics, PHI		

Course:WIRELESS AND MOBILE SYSTEMS			Semester:II
Course Code: MCA-AMR6	LTP	2 0 2	Credits: 3

OBJECTIVE	This course aims to provide students a comprehensive overview of different types of wireless and mobile systems with a detailed focus on architecture of modern-day cellular systems.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Understand evolution of Wireless systems 2. Understand various radio propagation mechanisms 3. Understand cellular concepts, multiple division techniques and channel allocation techniques. 4. Understand Mobile Communication System Architecture 5. Understand Wireless MANS, LANS and PANS.		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	History of wireless systems. Introduction to various types of wireless and mobile systems.	**5**
	2	Types of Radio Waves, Propagation Mechanisms, Free Space Propagation, Land Propagation, Path loss and Fading, Doppler Effect, Delay Spread and Inter symbol Interference.	**12**
	3	Cellular Concept, Cell Area, Signal Strength and Cell parameters, Capacity of a cell, Frequency reuse, How to form a cluster, Co-channel Interference, Cell Splitting and Cell Sectoring, Multiple division Techniques, Concepts and Models of Multiple Divisions (FDMA, TDMA, etc.), Channel Allocation, Static Allocation versus Dynamic Allocation, Fixed Channel Allocation, Dynamic Channel Allocation, Hybrid Channel Allocation, Allocation in specialized System Structure.	**15**
	4	Mobile Communication Systems, Cellular System Infrastructure, Registration, Handoff and Roaming Support, Multicasting, Security and Privacy.	**8**
	5	Wireless MANs, LANs and PANs, Wireless Metropolitan Area Networks (4G systems), Wireless Local Area Networks (IEEE 802.11x), Wireless Personal Area Network (Bluetooth Networks), Case Studies of all these types of networks.	**5**
		Total Hours	**45**
TEXT BOOK	1. D.P. Agrawal and Q. Zeng ,Introduction to Wireless and Mobile Systems,PHI 2.Theodore S. Rappaport **,**Wireless and Mobile Systems**,** Pearson Education		
REFERENCE BOOK/ SUGGESTED READING	1. T.S. Rappaport, Wireless Communications: Principles and Practice, Pearson 2. Iti Saha Misra ,Wireless Communication and Networks: 3G and Beyond, McGraw Hill Education		

Course: DEEP LEARNING	Semester: II

Course Code: MCA-AMR7	LTP	2 0 2	Credits: 3

OBJECTIVE

The objective of this course is to cover the fundamentals of neural networks as well as some advanced topics such as recurrent neural networks, long short term memory cells and convolutional neural networks.

COURSE OUTCOMES

Upon completion of the course student should be able to

1. Understand the concept of artificial neural networks, convolutional neural networks, and recurrent neural networks
2. Discuss how to speed up neural networks along with regularization techniques to reduce overfitting.
3. Understand the concept of Feed Forward Networks
4. Implement deep learning algorithms, and learn how to train deep networks.
5. Understand the concept of generative models

COURSE DETAILS

Unit No.	Topic	Hours
1	**Biological Neuron**, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, linear Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for perceptron Learning Algorithm.	**10**
2	**Feed Forward Networks** Multilayer Perceptron, Gradient Descent, Backpropagation, Empirical Risk Minimization, regularization, autoencoders	**7**
3	**Feed Forward Networks** Deep Neural Networks: Difficulty of training deep neural networks, Greedy layerwise training. Better Training of Neural Networks: Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), second order methods for training, Saddle point problem in neural networks, Regularization methods (dropout, drop connect, batch normalization).	**12**
4	**Recurrent Neural Networks** Recurrent Neural Networks: Back propagation through time, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs , Convolutional Neural Networks: LeNet, AlexNet.	**8**
5	**Generative Models** Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines, Recent trends: Variational Autoencoders, Generative Adversarial Networks, Multitask Deep Learning, Multi-view Deep Learning, Applications: Vision, NLP, Speech and Deep Learning Tools.	**8**
	Total Hours	**45**

TEXT BOOK	1. Ian Goodfellow and YoshuaBengio and Aaron Courville, Deep Learning, MIT Press 2.François Chollet Deep Learning with Python, Manning Publications
REFERENCE BOOK/ SUGGESTED READING	1.Raul Rojas, Neural Networks, A Systematic Introduction, Springer-Verlag, Berlin, New-York 2. Christopher Bishop, Pattern Recognition and Machine Learning, McGraw Hill Education

Course: ADVANCED COMPUTER NETWORKS			**Semester:II**
Course Code:MCA-AMR8	**LTP**	**2 0 2**	**Credits: 3**

OBJECTIVE	This course is designed to provide knowledge about some of the advanced concepts of Computer Network like network design, switching and routing design, wireless LAN standards, stochastic processes and queueing concepts, and network security.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Understand and explain the concepts of network designs. 2. Understand various switching and routing techniques. 3. Understand wireless LAN standards. 4. Understand stochastic processes, queueing systems and network security and management. 5. Understanding Network Security and Management Design Hacking.		
COURSE DETAILS	**Unit No.**	**Topic**	**Hours**
	1	**Unit 1: Network Design** Design Principles, Determining Requirements, Analysing the Existing Network, Preparing the Preliminary Design, Completing the Final Design Development, Deploying the Network, Monitoring and Redesigning, Maintaining, Design Documentation, Cisco PDIOO Model, Modular Network Design, Hierarchical Network Design.	**8**
	2	**Unit 2: Switching and routing** Switching Design: Switching Types, Layer 2 and 3 Switching, Multilayer Switching, Cisco Express Forwarding, Switching Security, Multi-Protocol Label, Switching (MPLS), MPLS Architecture and related protocols..IPv4 Routing Design: IPv4 Address Design, Private and Public Addresses, NAT, Subnet Masks, Hierarchical IP Address Design, Deploying IPv6 in Campus Networks. Router Design: Configuring a Router, Routing Protocols.	**11**
	3	Wireless LANs: Wireless Technology Overview, Wireless Standards, Wireless Components, Wireless Security, Wireless Design Considerations, IEEE 802.11 standards, Cellular Networks, Mobile IP, Wireless Mesh Networks (WMNs), QoS Models: IntServ, DiffServ, QoS Tools, Policing and Shaping, Congestion Avoidance, Congestion.	**11**
	4	Stochastic Processes & Queuing Systems. Stochastic Processes: The Poisson Process, Birth Death Process, Markov Chains. Single Station Queuing System: Kendall‘s Notation, Performance Measures, The M/M/1 Queue, The M/M/ Queue, The M/M/m Queue.	**8**

	5	Unit 5: Network Security and Management Design Hacking: Vulnerabilities, Threats: Reconnaissance Attacks, Access Attacks, Information Disclosure Attacks, Denial of Service Attacks, Threat Defence Secure Communication, Network Security Best Practices, SAFE Campus Design. ISO Network Management Standard: Protocols and Tools, SNMP, MIB, RMON, Cisco NetFlow, Syslog, Network Management Strategy: SLCs and SLAs, IP Service Level Agreements, Content Networking Design.	**7**
		Total Hours	**45**
TEXT BOOK	1. Diane Tiare and Catherine Paquet, Campus Network Design Fundamentals‖, Pearson Education 2. Arnold O. Allen, Probability Statistics, and Queuing Theory with Computer Science Application, Academic Press		
REFERENCE BOOK/ SUGGESTED READING	1. Craig Zacker, ―The Complete Reference: Upgrading and Troubleshooting Networks‖, Tata McGrawHill 2. Gunter Bolch, Stefan Greiner, Hermann de Meer, Kishor S. Trivedi, Queueing Networks and Markov Chains,John Wiley & Sons, Inc. Publication		

GROUP 3(ELECTIVES)

Course: CONTAINER TECHNOLOGY			**Semester: III**
Course Code: MCA FBI1	**L T P**	**2 0 2**	**Credits:3**
OBJECTIVE	This course is designed to teach students the basic concepts and terminology of cloud computing. After establishing the definition of cloud computing. This course describes the basics of container technologies used in cloud computing, dockers, concept of Orchestration and kurbernetes		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Elaborate the container technology 2. Formulate and Design containers using Docker. 3. Categorize and demonstrate the concept of containerization using Docker files and Compose 4. Categorize and design an Orchestration of nodes. 5. Understand how objects interact to manage containerized applications.		

COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**Introduction Container Technology:** Containerization, History of Containers, Namespaces and C-groups, Containers vs Virtual Machines, Types of Containers. Docker: Overview, Installing Docker on Linux, Installation, Hub, Images, Containers, Features of Docker, Components of Docker.	**5**
	2	**Creating Containerized Services:** Working with Containers, Architecture, Container & Hosts, Configuring, Containers & Shells, File, Building Files, Public Repositories, Managing Ports, Private Registries, Building a Web Server Docker File	**10**
	3	**Managing Containers:** Instruction Commands, Container Linking, Storage, Networking, Setting Node.js, Setting MongoDB, Setting	**10**

		NGINX, Toolbox, Setting ASP.Net, Docker Cloud, Logging, Docker – Compose, Docker - Continuous Integration.	
	4	**Orchestration in Docker:** Create and run multi-container applications using Docker Compose and manage clusters of Docker nodes using Docker Swarm. Topics: Docker Compose, Docker Swarm, Docker Service, Placement Rolling Update and Rollback Docker Stack, deploy a Multi-container Application using Compose, Running Docker in Swarm mode, deploying a Service in Swarm Scale, Services, Service Placement, Rolling Updates and Rollbacks Docker Stack.	**10**
	5	**Introduction to Kubernetes**: Understanding Kubernetes architecture, Introduction to Kubernetes objects, using basic Kubernetes objects, Using the Kubec'll command, Leveraging Kubernetes.	**10**
		Total Hours	**45**
TEXTBOOK	1. Antonopoulos, Nick, and Lee Gillam, Cloud computing. London, Springer 2. Comer, Douglas E. The Cloud Computing Book, The Future of Computing Explained, Chapman and Hall/CRC		
REFERENCE BOOK/ SUGGESTED READING	1. Foster, Ian, and Dennis B. Gannon, Cloud computing for science and engineering, MIT Press 2. Chaudhary, Sanjay, Gaurav Somani, and Rajkumar Buyya, eds. Research advances in cloud computing, Springer Singapore 3. Turnbull, James. The Docker Book, Containerization is the new virtualization, James Turnbull		

Course: MOBILE COMPUTING			**Semester: III**
Course Code: MCA-FBI2	**L T P**	**2 0 2**	**Credits: 3**

OBJECTIVE	These objectives equip students with both theoretical knowledge and hands-on experience in mobile computing technologies.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Understand the fundamental concepts of mobile computing, wireless communication, and network architectures such as GSM, GPRS, and LTE. 2. Analyze and evaluate various mobile communication protocols including MAC, TCP/IP, and wireless transport protocols. 3. Implement mobile application development techniques using Android, iOS, or cross-platform frameworks. 4. Examine mobility management, handoff strategies, and security mechanisms in mobile networks. 5. Explore emerging trends in 5G, IoT, mobile cloud computing, and ubiquitous computing for future advancements..		
COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**WIRELESS COMMUNICATION FUNDAMENTALS** Cellular systems- Frequency Management and Channel Assignment- types of handoffs and their characteristics, dropped call rates & their evaluation -MAC – SDMA – FDMA –TDMA – CDMA – Cellular Wireless Networks.	**8**
	2	**TELECOMMUNICATION NETWORKS & WIRLESS LAN** Telecommunication systems – GSM – GPRS - Satellite Networks, Wireless LAN – IEEE 802.11 - Architecture – services – MAC – Physical layer – IEEE 802.11a -802.11b standards – HIPERLAN – Blue Tooth.	**8**
	3	**MOBILE NETWORK LAYER & TRANSPORT LAYER Mobile IP** Dynamic Host Configuration Protocol - Routing – DSDV – DSR – Alternative Metrics. Traditional TCP, Mobile TCP	**9**
	4	**APPLICATION LAYER** WAP Model- Mobile Location based services -WAP Gateway –WAP protocols – WAP user agent profile- caching model-wireless bearers for WAP - WML – WML Scripts.	**10**
	5	**DATABASE ISSUES** Database Issues: Hoarding techniques, caching invalidation mechanisms, client server computing with adaptation, power-aware and context-aware computing, transactional models, query processing, recovery, and quality of service issues.	**10**
		Total Hours	**45**
TEXTBOOK	1. J. Schiller ,Mobile Communications, Pearson education 2. W. Stallings ,Wireless Communications and Networks, Pearson education publishing		
REFERENCE BOOK/ SUGGESTED READING	1.Mazliza Othman, Principles of Mobile Computing and Communication, AUERBACH 2. Reza B'Far and Roy T. Fielding, Mobile Computing Principles: Designing and Developing Mobile Applications with UML ,PHI		

Course: SOFT COMPUTING			**Semester: III**
Course Code: MCA FBI3	**L T P**	**2 0 2**	**Credits:3**
OBJECTIVE	These outcomes ensure a strong foundation in intelligent computing methods for solving complex computational problems.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Understand the fundamental concepts of soft computing techniques, including fuzzy logic, neural networks, and evolutionary algorithms. 2. Apply fuzzy logic for reasoning and decision-making in uncertain and imprecise environments. 3. Implement artificial neural networks (ANNs) for pattern recognition, classification, and predictive modeling. 4. Utilize genetic algorithms and swarm intelligence to solve optimization and search problems efficiently. 5. Integrate soft computing techniques in real-world applications such as robotics, image processing, and expert systems.		

COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**FUZZY SET THEORY** Introduction to Neuro – Fuzzy and Soft Computing – Fuzzy Sets – Basic Definition and Terminology – Set theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules and Fuzzy Reasoning – Extension Principle and Fuzzy Relations – Fuzzy If-Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models – Input Space Partitioning and Fuzzy Modeling..	**10**
	2	**OPTIMIZATION** Derivative-based Optimization – Descent Methods – The Method of Steepest Descent – Classical Newton's Method – Step Size Determination – Derivative-free Optimization – Genetic Algorithms – Simulated Annealing – Random Search – Downhill Simplex Search.	**8**
	3	**NEURAL NETWORKS** Supervised Learning Neural Networks – Perceptron's - Adaline – Backpropagation Muti layer Perceptron's – Radial Basis Function Networks – Unsupervised Learning Neural Networks – Competitive Learning Networks – Kohonen Self-Organizing Networks – Learning Vector Quantization – Hebbian Learning.	**9**
	4	**NEURO FUZZY MODELING** Adaptive Neuro-Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – Learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling – Framework Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.	**8**
	5	**APPLICATIONS OF COMPUTATIONAL INTELLIGENCE** Printed Character Recognition – Inverse Kinematics Problems –	**10**

		Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction	
		Total Hours	**45**
TEXTBOOK	1. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI 2. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y.,		
REFERENCE BOOK/ SUGGESTED READING	1. 1. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 2. S. Rajasekaran and G.A.V.Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI, 3. R.Eberhart, P.Simpson and R.Dobbins, "Computational Intelligence PC Tools", AP Professional, Boston,		

Course: INTERNET OF THINGS			**Semester: III**
Course Code: MCA-FBI4	**L T P**	**2 0 2**	**Credits: 3**
OBJECTIVE	The objective of this course is to provide both conceptual and hands-on knowledge to students for IoT systems. Students will learn how to build and use end-to-end IoT systems, perform analytics on the data collected and understand security aspects of an IoT system.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Understanding fundamental concepts and building blocks of an IoT system. 2. Understand and implement IoT prototypes using system-on-chip devices. 3. Understanding and develop end-to-end systems by syncing with Cloud 4. Understand security aspects of an IoT system. 5. Understanding RESTFUL API.		

COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**INTRODUCTION** Definition& Characteristics of IoT, Physical design of IoT, Things in IoT, IoT protocols, logical Design of IoT, IoT Functional Blocks, IoT Communication Model and IoT Communication APIs, IoT Enabling Technologies, Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT Levels and Deployment Templates, Levels 0, Levels 1, Levels 2, Levels 3, Level 4, Level 5, IOT Applications	**8**

	2	**APPLICATION OF IOT** Application of IoT, Home Automation, Cities, Industry, Health & Lifestyle, Discuss Health , Lifestyle problem, M2M, Architecture of M2M, SDN, Architecture of SDN, NFV for IOT, Architecture of NFV, IoT System Management, Advantages of IoT system management, Need for IoT , Systems Management, Disadvantages of IoT system management, Simple Network Management Protocol, Limitations of SNMP, Network Operator, Requirements	**9**

	3	**INTRODUCTION ABOUT IOT PROTOCOLS** Infrastructure, 6LowPAN, Architecture of 6LowPAN, Ipv6, Architecture of Ipv6, Comms / Transport, Wi-Fi, Bluetooth, mDNS , Discovery, Physical Web, DNS-SD, Data Protocols MQTT, Examples of MQTT, Difference between MQTT and HTTP, CoAP, AMQP, Types of CoAP, Request and Response methods, Pros and Cons of CoAP, Semantic, JSON- LD	**8**
	4	**IOT PLATFORMS DESIGN METHODOLOGY** Purpose & Requirements, process model specification, domain model specification, Information model specifications, service specifications, Iot level specifications, Functional view specifications, operational view specifications. Device & component Integration, Application development, IoT System for Weather Monitoring, Purpose & Requirements, process model specification, domain model specification, Information model specifications, service Specifications, Iot level specifications, Device & component Integration, Application development, IoT System for Agriculture, Purpose & Requirements, process model specification, domain model specification, Information model specifications, service specifications, Iot level specifications, Functional view specifications, operational view specifications. Device & component Integration, Application development, Introduction to Cloud Storage Models, Arduino, Rasbery pi, Explanation of raspberry pi pin diagram, Introduction to Cloud Storage Communication APIs, Python Web Application Framework, Django Architecture Design of Weather Monitoring using Django, Starting Development with Django Toolkit	**10**
	5	**INTRODUCTION ABOUT RESTFUL API** Designing a RESTful Web API, Amazon Web Services, Amazon Web Services for IoT, Creating a ID in Amazon, EC2, Implementation of EC2, Autoscaling, Implementation of Autoscaling, S3, Implementation of S3, RDS, Implementation of RDS, DynamoDB, Implementation of DynamoDB, Kinesis, Implementation of Kinesis, Case studies – Environment, IoT systems for weather Reporting Bot, Air Pollution Monitoring System, Forest Fire Detection, Case studies - IoT system for Energy, Smart grid, Renewable Energy Systems	**10**
		Total Hours	**45**

TEXTBOOK	1. Arshdeep Bahga and Vijay Madisetti, Internet of Things - A Handson Approach, Universities Press, 2. Dieter Uckelmann et.al, Architecting the Internet of Things, Springer,
REFERENCE BOOK/ SUGGESTED READING	1.Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things, Wiley 2. HonboZhou , The Internet of Things in the Cloud: A Middleware Perspective , CRC Press 3. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", Wiley,

Course : CYBER LAW AND IPR			**Semester: III**
Course Code: MCA-FBI5	**L T P**	2 0 2	**Credits: 3**

OBJECTIVE	To study the fundamental concepts of Cyber Laws, Cyber Crimes, Contractual aspects, IT Acts and regulations and sections for digital services.
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Concepts, classification, need for protection, History, Recent Development of IP , WIPO, TRIPS, National IPR policy & Govt initiatives. 2. Understand the different cyber laws, crimes, and offences. 3. Identify the contractual aspects with respect to cyber laws. 4. Acquire information about regulations and sections for digital services. 5. Gain knowledge on IT Acts**.**

COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	Cyber Law: Introduction, Definition, Nature & Scope of Cyber Laws. Sociolegal Implications of Computer Science and Cyber Laws. Cyber Crimes: Definition & Kinds of Cyber Crimes. International and Foreign Developments. Common Cyber Offences: Pheakering, Internet Frauds, Hackers, Stalking, E-Mail, Security Invasion, Money Laundering, Data Diddling, Theft of Information.	**5**
	2	Contractual Aspects: Hardware Contracts: User Requirement Specification, Negotiation, Sales & Leases, Delivery & Payment, Seller's Obligations, Buyer's Remedies. Software Contract: Selecting Software, Types of Software, Software License, Principal Commercial Terms, Warranties, Software Maintenance; Liability: Contractual Liability, Strict Liability, Negligence, Criminal. Miscellaneous (Briefly); Copyright & Patent Protection, Evidence, Protecting Confidential Information.	**10**
	3	The Information Technology Act, 2000: Introduction: Definition, A Brief Summary of the Act. Digital Signature & Electronic Governance (Sections 3 to 10) Secure Electronic Records & Secure Digital Signatures (Sections 14 to 16).	**10**
	4	Regulation of Certifying Authorities (Sections 17 to 34). Digital Signature Certificates (Sections 35 to 39). Duties of Subscribers (Sections 40 to 42). Penalties, Adjudication Offences (Sections 45 to 47 & Sections 65 to 78). Cyber Regulations Appellate Tribunal (Sections 48 to 64).	**10**
	5	Patents: Meaning of a Patent – Characteristics/ Features. Patentable and Non-Patentable Invention. Types of Patent applications in India and outside India. Procedure for obtaining Patent. Surrender of Patent, revocation &restoration of Patents, Infringement of Patents and related remedies (penalties). Different prescribed forms used in Patent Act. Patent agents-qualifications and disqualifications	**10**
		Total Hours	**45**

TEXTBOOK	1. Shah, S. N. ,*IPR and Cyber Laws*. Himalaya Publishing House.. 2. Gangwar, M., & Singh, S. (2024). *Cyber law & intellectual property rights*. Scholars' Press..

REFERENCE BOOK/ SUGGESTED READING	1. Shirke-Pansambal, S. (2024). *Cyber laws and IPR* (T.Y. B.Sc., Sem. 6). Tech-Knowledge Publication. 2. Mittal D.P., Law of Information Technology (2000): Taxmann's

Course: INTRODUCTION TO BLOCK CHAIN TECHNOLOGIES			**Semester: III**
Course Code: MCA-FBI6	**L T P**	**202**	**Credits: 3**

OBJECTIVE	This course objective is to explain basic components of a blockchain (types, mechanics: transaction, block, block header, chain and terminology) its operations (processes, verification, validation, and consensus model) underlying algorithms, and essentials of trust to understand how blockchain systems (mainly Bitcoin and Ethereum)		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Recognize foundational concepts of blockchain and learn about the decentralized peer-to-peer network. 2. Understand the formal definition of distributed consensus and apply these concepts on the blockchain. 3. Assess Blockchain applications in a structured manner. 4. Understand the meaning and properties of crypto economics: cryptography and economics 5. Understanding of Crypto currency.		
COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	Distributed Systems Blockchain architecture, Basic components (blocks, nodes, etc.), Distinction between public and private blockchains, benefits and drawbacks, Fundamental traits and characteristics, Distributed Database, CAP theorem, the Byzantine Generals Problem and Fault Tolerance.	**8**
	2	Cryptography in Blockchain Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Blockchain Network, Mining Mechanism.	**9**
	3	Consensus Distributed Consensus, Merkle Patricia Tree, Gas Limit, Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof, Transactions and Fee.	**8**
	4	Blockchain Design Principal Consensus, Security, and Operating Protocols, Blockchain Design Principle, Public and Private DLTs, Alternative Consensus Mechanisms to Bitcoin's Proof-of-Work, Proof-of-Stake, Proof-of-Burn, Voting Based Consensus Algorithms, and Federated Consensus, Sybil Attack, Energy Utilization.	**10**
	5	Crypto economics (6L) Property of crypto economics: cryptography and economics, Integration of cryptography and pseudo anonymity in public blockchains, crypto economics with respect to distributed systems fundamentals (liveness, safety, data availability).	**10**

		Total Hours	**45**
TEXTBOOK	1.Kube N. Daniel Drescher: Blockchain basics: a non-technical introduction in 25 steps 2. Singhal, B., Dhameja, G., & Panda, P. S, Beginning Blockchain: A beginner's guide to building blockchain solutions , Apress		
REFERENCE BOOK/ SUGGESTED READING	1. Vyas, S., Shukla, V. K., Gupta, S., & Prasad, A.Blockchain Technology. CRC Press. 2. Kumar, S., & Saxena, A. (Year). Blockchain Technology: Concepts and Applications. Wiley-India.		

Course: FRONT-END ENGINEERING			**Semester: III**
Course Code: MCA-FBI7	**L T P**	**202**	**Credits: 3**

OBJECTIVE	To become familiar with components of front-end web application development: User interfaces, Event and State handling, Languages/tools such as HTML, CSS, JavaScript.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Understand the concept of technology used to design a simple web page. 2. Demonstrate the use of script and events handling on a web page. 3. Demonstrate the process of connecting to the server. 4. Design an application to store data in a remote location and access it. 5. Explore about node JS technology		
COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**UNIT 1: Introduction to HTML** HTML Basics, Elements, Attributes, Styles, Forms, Form Elements, Input Element Types, Input Attributes, File Paths, Script tag, HTML & XHTML.	**8**
	2	**Introduction to CSS** CSS Introduction, Syntax, Selectors, Styling, Pseudo class, Pseudo Elements, CSS Tables, CSS Box Models, CSS Opacity, CSS Navigation Bar, Dropdowns.	**8**
	3	**Introduction to JavaScript** JavaScript Statements, Keywords, Functions, JavaScript Programs, Operators, Functions, Function Parameters, Function Return Types, Dat	**9**
	4	**NodeJS and Application Design** Introduction to Node JS: Introduction to Node JS, Advantages of Node JS, What is Node JS, Node.js Process Model, Traditional Web Server Model, Node JS modules: Functions, Buffer, Uni, Modules Types, Core Modules, Local Modules, Modules Exports, Node Package Manager: What is NPM, Installing Packages Locally, Installing package globally, Adding dependency in package Json, Updating packages, Creating Web Server: Creating Web Server, Sending Requests, Handling http requests, File System: reading, writing, updating files, and the concept of chunks, buffers, and uploading files synchronously and asynchronously.	**10**

	5	**Introduction to MongoDB** Overview of MongoDB, Design Goals for MongoDB Server and Database, MongoDB tools, Understanding the following: Collection, Documents and Key/ Values, etc., Schema Design and Data Modelling Goal: Manage Data Model in MongoDB. Skills, Understand Data Modelling Schem as, Design Data Model relationships and tree structures, Apply Data Modelling in various real-time contexts, CRUD Operations.	**10**
		Total Hours	**45**
TEXTBOOK	1. Mark Sapp, Front-end Web Developer (Careers in Technology Series): JavaScript, HTML5 and CSS3, 2. Bruno Joseph D'Mello, Mithun Satheesh, Jason Krol, Web Development with MongoDB and Node, Pact Publishing,		
REFERENCE BOOK/ SUGGESTED READING	1. Julie Meloni, Jennifer Krynin, Sams Teach Yourself HTML, CSS and JavaScript All in One, Pearson 2. Jennifer Robbins, Learning Web Design: A Begginer's Guide to HTML, CSS JavaScript and Web Graphics, O'Reilly		

Course: SOFTWARE VERIFICATION, VALIDATION AND TESTING			**Semester: III**
Course Code: MBA-FBI8	**L T P**	**202**	**Credits: 3**

OBJECTIVE	This course provides a comprehensive understanding of **s**oftware testing principles, methodologies, test case design techniques, levels of testing, test management, and test automation.		
COURSE OUTCOMES	**Upon completion of the course student should be able to** 1. Understand the fundamentals of software testing, 2. Perform requirements-based, domain, and random testing. 3. Implement regression, compatibility, and testing. 4. Manage test processes, reporting, and defect tracking. 5. Implement automated test scripts for regression and performance testing.		
COURSE DETAILS	**Unit No**	**Topic**	**Hours**
	1	**INTRODUCTION** Testing as an Engineering Activity – Testing as a Process – Testing Maturity Model - Testing axioms – Basic definitions – Software Testing Principles – The Tester's Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design – Defect Examples – Developer / Tester Support of Developing a Defect Repository .	**10**
	2	**TEST CASE DESIGN** Test case Design Strategies – Using Black Box Approach to Test Case Design –Boundary Value Analysis – Equivalence Class Partitioning – State based testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing – Random Testing – Requirements based testing –Using White Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing –	**8**

		Coverage and Control Flow Graphs – Covering Code Logic – Paths – code complexity testing – Additional White Box Testing Approaches - Evaluating Test Adequacy Criteria.	
	3	**LEVELS OF TESTING** The need for Levels of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Testing OO systems – Usability and Accessibility testing – Configuration testing – Compatibility testing – Testing the documentation – Website testing.	**9**
	4	**TEST MANAGEMENT** People and organizational issues in testing – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results –Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group – The structure of Testing Group – The Technical Training Program.	**8**
	5	**TEST AUTOMATION** Software test automation – skill needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics.	**10**
		Total Hours	**45**
TEXTBOOK	1. Paul Jorgense , Software Testing: A Craftsman's Approach , John Wiley & Sons 2. Rajib Mall, Fundamentals of Software Engineering , PHI		

REFERENCE BOOK/ SUGGESTED READING	1. Glanford J. Myers, The Art of Software Testing, John Wiley & Sons, Inc. 2. Lisa Crispin, Janet Gregorym, Agile Testing: A Practical Guide , Addison-Wesley Professional