Himachal Pradesh University, Shimla
(‘A’ Grade, NAAC Accredited)

Scheme of Examination and Syllabus of

Master of Computer Applications (MCA)(CBCS)

DEPARTMENT OF COMPUTER SCIENCE

CBCS CURRICULUM (2025-26)

Program Name: Master of Computer Applications (MCA)(CBCS)

(For the Batches Admitted 2025 Onwards)

DEPARTMENT OF COMPUTER SCIENCE

HIMACHAL PRADESH UNIVERSITY, SHIMLA

VISION

Pursue conducive advancement towards nurturing globally competent and ethically conscientious professionals and entrepreneurs in agile computing technologies and allied spheres for unceasing evolution of nations IT affiliated commercial and research endeavours.

MISSION

Thrive to establish a strong foundation for technical competency in spheres concordant to software oriented design and development. Nurture skills and competency for administering expertise gained in computing discipline to a wide horizon of interdisciplinary application domains, thus supporting sustainable development of the society. Habituate the students to strive for technological innovations and successful endeavours ethically, supported by sustained learning continuance and problem solving proficiency that may promote nations welfare in terms of economic acceleration leading to the growth of society.

NAME OF THE PROGRAMME: MASTER OF COMPUTER APPLICATIONS
DURATION : TWO YEARS

PROGRAMME OUTCOMES (POs)	
PO1	Knowledge Capable of demonstrating comprehensive disciplinary knowledge gained during course of study.
PO2	Research Aptitude Capability to ask relevant/appropriate questions for identifying, formulating and analyzing the research problems and to draw conclusion from the analysis.
PO3	Communication Ability to communicate effectively on general and scientific topics with the scientific community and with society at large.
PO4	Problem Solving Capability of applying knowledge to solve scientific and other problems.
PO5	Individual and Team Work Capable to learn and work effectively as an individual, and as a member or leader in diverse teams, in multidisciplinary settings.
PO6	Investigation of Problems Ability of critical thinking, analytical reasoning and research based knowledge including design of experiments, analysis and interpretation of data to provide conclusions.
PO7	Modern Tool usage Ability to use and learn techniques, skills and modern tools for scientific practices.
PO8	Science and Society Ability to apply reasoning to assess the different issues related to society and the consequent responsibilities relevant to the professional scientific practices.
PO9	Life-Long Learning Aptitude to apply knowledge and skills that are necessary for participating in learning activities throughout life.
PO10	Ethics Capability to identify and apply ethical issues related to one's work, avoid unethical behaviour such as fabrication of data, committing plagiarism and unbiased truthful actions in all aspects of work.
PO11	Project Management Ability to demonstrate knowledge and understanding of the scientific principles and apply these to manage projects.

PROGRAMME SPECIFIC OUTCOMES (PSOs)	
PSO1	Develop competency to administer knowledge and awareness in the computing discipline along with learning aptitude for lifelong endurance in professional realm.
PSO2	Develop proficiency to adapt to contemporary technologies, skills and models for computing practice.
PSO3	Acquire expertise to adopt skills realized during research, experimentation and trending technology cognizance to solve industrial problems.
PSO4	Promote professional competence to aspire careers in Commercial/ Government Sectors, Academics/ consultancy/ Research and Development for technological innovations, and collateral fields related to Computer Science and Information Technology.
PSO5	Foster analytical skills for programming and adept computer based designing of systems in the domains concordant to Algorithm Design, System Software, Web and Application Designing, Data Science & Analytics, Artificial Intelligence & Machine Intelligence, Graphics and Visualization, and Networking Services.

Duration: 2 Years (4 Semesters)

Eligibility: Bachelor of Computer Applications (BCA) /B.Sc.(Computer Science)/ B.Sc. (IT)/ B.Sc. (Physical Sciences – Physics, Chemistry & Mathematics)/ BA(Computer Science)/ BA (IT) OR any Graduate with minimum 20 credits in the subjects of computer OR any graduate with minimum of 6 courses of computer studied in graduation (in case of degree not in credit system) with at least 50% marks (45% in case of SC/ST) from a university established by law in India.

Or

Any examination, of university in foreign country, recognized as equivalent for the above purpose by equivalence committee of its own or on recommendation of Association of Indian Universities with 55% marks (50% marks for SC/ST).

Age Limit: Maximum age limit for admission to MCA course is 26 years for general category, 29 years for SC/ST category and 28 years for girl candidates, as on the 1st July of the year concerned. The Vice-Chancellor may permit age relaxation up to a maximum of six months.

Basis of Admission:

The admission to MCA course will be made on the basis of merit of the Entrance Examination (written test) conducted by H.P. University.

Written Test 100 Marks
Duration 1:30 hours

The written test will consist of one paper of 100 marks and of 1:30 hour's duration and shall include the following three sections:

Section	Contents	Marks
A	General logical Ability &Aptitude	20
B	Mathematics of +2 level	20
C	Computer Awareness	60
Total		100

The minimum qualifying marks in the Entrance Examination (written test) for subsidized as well as non-subsidized seats will be 40% i.e. 40 marks, (35% i.e. 35 marks for SC and ST) out of total of 100 marks.

No. of Seats:

Subsidized Seats : 30
Non-Subsidized Seats : 90
Supernumerary Seats : As per University Rules.

Reservation for MCA:

For both Subsidized and Non-Subsidized seats, 120 Points Roster will be followed as per the HPU Hand Book of Information (HBI).

Scheme of Examination:

English shall be the medium of instruction and examination. The pass marks in each course shall be 40% in each written paper and in the internal assessment separately, and 40% in viva-voce, project work and semester course and 50% in the aggregate subject to the conditions that aggregate shall be determined at the end of the examination. Other rules shall be as per the rules of the university.

Attendance:

In order to be eligible to appear in the university examination, the candidate should have secured 75% attendance in each of the concerned subjects (Theory as well as Practical).

Theory Papers:

Each paper will be of 100 marks (75 marks for theory exam and 25 marks for internal assessment) and duration of each paper will be 3 hours. In respect of theory papers 25 marks in each paper shall be reserved for award of

internal assessment based on evaluation procedure for internal assessment marks as Two Mid Term Test should be conducted by the concerned teacher each of 10 marks. Five marks may be given by the concerned teacher on the basis of performance during the course (Seminar/ assignments/ interactions/ attendance etc.).

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

Practical Examination:

Each paper will be of 100 marks (75 marks for theory exam and 25 marks for internal assessment) and duration of each paper will be 3 hours.

The marks awarded by the teacher on account of internal assessment as mentioned above shall be submitted to the office of the Chairperson.

Conduct: Practical exam will be conducted by the external examiner from the panel submitted by the Chairperson, Department of Computer Science, Himachal Pradesh University and duly approved by the university authority/evaluation branch, Himachal Pradesh University, Shimla.

Winter Training / Internship:

Winter Training / Internship will be held immediately after *3rd SemesterExamination* / *During Winter Vacations* and will be having a minimum duration of 45 days and maximum duration of 50 days. Students have to submit the Winter Training / Internship Report latest by 01st March of the year concerned. Evaluation of the Report and Viva-Voce shall be held during 4thSemester. The Evaluation and Viva-Voce shall be held by one External and one Internal examiner.

Project Work:

In 2nd year (fourth semester) the student has to develop one project (in-house), which will be evaluated by the external examiner from the panel submitted by the Chairperson, Department of Computer Science, Himachal Pradesh University, and duly approved by the university authority/evaluation branch, Himachal Pradesh University, Shimla and coordinator.

In fourth semester, the Chairman/Head of the Department will assign a guide/supervisor, to each candidate for his/her project work. Each student is required to submit three copies of his/her project reports in the Department after completion of the project work which will be evaluated by external examiner.

Credits / Evaluation:

The credits for the first year are 52 (26+26) and for the second year are 56 (26+30). Total credits of the course will be 52+56 = 108.

HIMACHAL PRADESH UNIVERSITY, SHIMLA
SCHEME OF EXAMINATIONS FOR
MASTER OF COMPUTER APPLICATIONS
CHOICE BASED CREDIT SYSTEM (CBCS)
W. E. F. ACADEMIC SESSION 2025-26

Paper Code	Nomenclature of Paper	Credits	Workload Per Week (Hrs.)	Exam Time (Hrs.)	External Marks		Internal Marks		Total Marks	Pass Marks
					Max.	Pass	Max.	Pass		
First Semester										
MCA-25-11	Programming in C	4	4	3	75	30	25	10	100	40
MCA-25-12	Data Structures & Algorithms Analysis	4	4	3	75	30	25	10	100	40
MCA-25-13	Computer Organization & Architecture	4	4	3	75	30	25	10	100	40
MCA-25-14	Software Engineering	4	4	3	75	30	25	10	100	40
MCA-25-15	Operating Systems	4	4	3	75	30	25	10	100	40
MCA-25-16	S/W Lab – I Based on MCA-25-11	3	6	3	75	30	25	10	100	40
MCA-25-17	S/W Lab – II Based on MCA-25-12	3	6	3	75	30	25	10	100	40
	Total	**26**	**32**		**525**		**175**		**700**	
Second Semester										
MCA-25-21	Programming with Python	4	4	3	75	30	25	10	100	40
MCA-25-22	Data Base Management Systems	4	4	3	75	30	25	10	100	40
MCA-25-23	Data Communication &Computer Networks	4	4	3	75	30	25	10	100	40
	Elective-I	4	4	3	75	30	25	10	100	40
	Elective-II	4	4	3	75	30	25	10	100	40
MCA-25-26	S/W Lab – III Based on MCA-25-21	3	6	3	75	30	25	10	100	40
MCA-25-27	S/W Lab – IV Based on MCA-25-22	3	6	3	75	30	25	10	100	40
	Total	**26**	**32**		**525**		**175**		**700**	
Elective – I										
MCA-25-24(i)	Information Security	4	4	3	75	30	25	10	100	40
MCA-25-24(ii)	Computer Graphics	4	4	3	75	30	25	10	100	40
Elective – II										
MCA-25-25(i)	Theory of Computation	4	4	3	75	30	25	10	100	40
MCA-25-25(ii)	Security in Computing	4	4	3	75	30	25	10	100	40
Third Semester										
MCA-25-31	OOPs with Java	4	4	3	75	30	25	10	100	40
MCA-25-32	Web Technologies	4	4	3	75	30	25	10	100	40
MCA-25-33	Artificial Intelligence	4	4	3	75	30	25	10	100	40
	Elective-III	4	4	3	75	30	25	10	100	40
	Elective-IV	4	4	3	75	30	25	10	100	40
MCA-25-36	S/W Lab – V Based on MCA-25-31	3	6	3	75	30	25	10	100	40
MCA-25-37	S/W Lab –VI Based on MCA-25-32	3	6	3	75	30	25	10	100	40

Paper Code	Nomenclature of Paper	Credits	Workload Per Week (Hrs.)	Exam Time (Hrs.)	External Marks		Internal Marks		Total Marks	Pass Marks
					Max.	Pass	Max.	Pass		
	Total	**26**	**32**		**525**		**175**		**700**	
Elective – III										
MCA-25-34(i)	Data Mining using R	4	4	3	75	30	25	10	100	40
MCA-25-34(ii)	Cloud Computing	4	4	3	75	30	25	10	100	40
Elective – IV										
MCA-25-35(i)	Cyber Security	4	4	3	75	30	25	10	100	40
MCA-25-35(ii)	Digital Marketing	4	4	3	75	30	25	10	100	40
Fourth Semester										
MCA-25-41	Linux and Shell Programming	4	4	3	75	30	25	10	100	40
MCA-25-42	Advanced Web Technologies	4	4	3	75	30	25	10	100	40
	Elective-V	4	4	3	75	30	25	10	100	40
	Elective-VI	4	4	3	75	30	25	10	100	40
MCA-25-45	PROJECT	4	4	3	75	30	25	10	100	40
MCA-25-46	S/W Lab – VII Based on MCA-25-41	3	6	3	75	30	25	10	100	40
MCA-25-47	S/W Lab – VII Based on MCA-25-42	3	6	3	75	30	25	10	100	40
MCA-25-48	Winter Training / Internship (Industry Based)	4	-	Viva Voce	75	30	25	10	100	40
	Total	**30**	**32**		**600**		**200**		**800**	
	Grand Total	**108**	**128**		**2175**		**725**		**2900**	
Elective – V										
MCA-25-43(i)	Soft Computing	4	4	3	75	30	25	10	100	40
MCA-25-43(ii)	Software Quality & Testing	4	4	3	75	30	25	10	100	40
MCA-25-43(iii)	Machine Learning	4	4	3	75	30	25	10	100	40
Elective – VI										
MCA-25-44(i)	Digital Image Processing	4	4	3	75	30	25	10	100	40
MCA-25-44(ii)	Internet of Things	4	4	3	75	30	25	10	100	40
MCA-25-44(iii)	Evolutionary Algorithms	4	4	3	75	30	25	10	100	40

MCA-25-11 Programming in C L:4 T:0 P:0

Course Objectives: This is an introductory course and covers the key features of the C language and its usage. The first unit help in thoroughly understanding the C syntax and basic programming paradigms. The remaining chapters focus on more complex concepts of the C language. This course will briefly touch upon some miscellaneous features and the mechanism used in the implementation of the same.

UNIT – I

Programming Tools: Problem analysis, Program constructs (sequential, decision, loops), Algorithm, Flowchart, Pseudo code, Decision table, Modular programming, Top Down and Bottom up approaches, Concept of High Level Languages, Low Level Languages, Assembly Languages, Assembler, Compiler, Interpreter, Type of errors.

Introduction: What is C, getting started with C, the first C program, compilation and execution, receiving input, C instructions, control instructions in C. Decision Control Structure- if statement, if-else statement, use of logical operators, conditional operators.

Loop Control Structure: loops, while loop, for loop, odd loop, break statement, continue statement, do-while loop, Case Control Structure- decisions using switch, switch vs if-else ladder, goto keyword.

UNIT – II

Functions and Pointers: what is a function, passing values between functions, scope rule of functions, calling convention, one dicey issue, function declaration and prototypes, call by value and call by reference, an introduction to pointers, pointer notation, back to function calls, recursion, recursion and stack, adding functions to the library.

Data Types Revisited: integers, long and short; integers, signed and unsigned; chars, signed and unsigned; float and double, storage classes in C.

C Preprocessor: features, macro expansion, file inclusion, conditional compilation, #if and #elif directives, miscellaneous directives.

UNIT – III

Arrays: what are arrays, array initialization, bounds checking, passing array elements to a function, pointers and arrays, two dimensional arrays, array of pointers, three dimensional array.

Strings: what are strings, more about strings, pointers and strings, standard library string functions, two-dimensional array of characters, array of pointers to strings, limitation of array of pointers to strings.

Structures: declaring a structure, accessing structure elements, how structure elements are stored, array of structures, additional features of structures, uses of structures.

UNIT – IV

Console Input/Output: Types of I/O, console I/O functions.

File Input/Output: data organization, file operations, counting characters, tabs, spaces, file opening modes, string I/O in files, record I/O in files, text files and binary files, using argc and argv.

Miscellaneous Features: Enumerated data type, renaming data types with typdef, typecasting, bit fields, pointers to functions, functions returning pointers, functions with variable number of arguments, unions.

Text Books:

1. Yashwant Kanetkar, “Let us C”, BPB Publications.

Reference Books:

1. Mullis Cooper, “Spirit of C”, Jacob Publications.
2. Kerninghan B.W. & Ritchie D. M., “The C Programming Language”, PHI Publications.
3. Yashwant Kanetkar, “Pointers in C”, BPB Publications.
4. Gotterfied B., “Programming in C”, Tata McGraw Hill Publication.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Able to implement the algorithms and draw flowcharts for solving Mathematical and Engineering problems.

CO2: Demonstrate an understanding of computer programming language concepts.

CO3: Able to develop C programs and run them.

CO4: Analyse abd ubteroret the concept of pointers, declarations, initialization and operations on pointers and their usage.

CO5: Able to define structure, union and enumeration user defined data types.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-12 Data Structures & Algorithms Analysis L:4 T:0 P:0

Course Objectives: The objective of this course is to provide basic to advance level of knowledge to student regarding various types of data structures and to provide knowledge regarding various problem solving techniques like greedy, divide and conquer, dynamic and backtracking.

UNIT – I

Data Structures: Arrays and their Applications; Sparse Matrix, Stacks, Application of stacks (converting arithmetic expression from infix notation to polish and their subsequent evaluation, quick sort technique to sort an array, recursion),Queues, Priority Queues, Linked Lists(traversal, insertion, deletion),type(linear, circular, doubly linked, inverted), Trees, Binary Tree, Binary Search Tree, AVL Tree, Hashing.

UNIT – II

Performance Analysis of Algorithms and Recurrences: Time and Space Complexities; Asymptotic Notation, Recurrence Relations.
Divide and Conquer: The General Method, Merge Sort, Quick Sort, Selection sort.
The Greedy Method: The General Method Knapsack Problem, Job Sequencing With Deadlines, Huffman Coding.

UNIT – III

Graph Algorithms: Breadth-First Search, Depth-First Search, Shortest Paths, Minimum Spanning Trees(Kruskal's Algorithm, Prim's Algorithm).
Dynamic Programming: The General Method Multistage Graphs, All Pairs Shortest Paths, Optimal Binary Search Trees, 0/1 Knapsack, Traveling Salesperson Problem.

UNIT – IV

Back Tracking: The General Method, The 8 Queens Problem, Sum Of Subsets, Graph Coloring, And Hamiltonian Cycles.
Complexity Theory: P and NP Class Problems; NP-completeness and Reducibility.

Text Books:

1. Seymour Lipschutz, "Data Structures", McGraw Hill Education.

Reference Books:

1. Parag H. Dave, Himanshu B. Dave, Design and Analysis of Algorithms, Pearson Education (2007).
2. Jean Paul Tremblay & Paul G. Sorenson, "An Introduction to Data Structures with Applications", Tata McGraw Hill Publications.
3. Robert L. Kruse,"Data Structures & Program Design", PHI Publications.
4. T. H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, Introduction to Algorithms, Prentice-Hall of India, 2006.
5. J. Kleinberg and E.Tardos, Algorithms Design, Pearson Education, 2006.

Course Outcomes:

By the end of the Course, Student will be able to:
CO1: Implement different types of data structures.
CO2: Differentiate between various types of problem solving techniques.
CO3: Calculate the complexity of a problem.
CO4: Differentiate between N and NP problems.
CO5: Solve problems related to graph theory.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-13 Computer Organization & Architecture L:4 T:0 P:0

Course Objectives: To introduce the fundamental concepts of digital computer organization and architecture. To develop a basic understanding of the building blocks of a digital computer system. To enable understanding of how these building blocks are organized together to architect a digital computer system. To enable understanding of how various functional units of a digital computer system interacts to meet the processing requirements of the user.

UNIT – I

Digital Logic Circuit: Digital Computers, Logic Gates, Boolean Algebra, Map Simplification, Combinational Circuits, Flip Flops, Sequential Circuits.

Digital Components & Data Representation: Decoders, Multiplexers, Registers, Shift Registers, Binary Counters, Memory Units, Data Types, Complements, Fixed Point Representation, Floating Point Representation, Other Binary Codes, Error Correction Codes.

UNIT – II

Register Transfer and Micro-operations: Register Transfer Language, Register transfer, Bus and Memory Transfer –Three State Bus Buffer, Memory Transfer; Arithmetic Micro-operations – Binary Adder, Binary Adder-Subtractor, Binary Incrementer, Arithmetic Circuit; Logic Micro-operations, Shift Micro-operations, Arithmetic Logic Shift Unit.

Basic Computer Organization: Instruction codes – Stored Program Organization, Indirect Address; Computer Registers – Common Bus System; Computer Instructions – Instruction Set Completeness; Timing and Control; Instruction Cycle – Fetch and Decode, Determine the Type of Instruction, Register-Reference Instructions; Memory Reference Instructions; Input-Output and Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic

UNIT – III

Programming the Basic Computer: Machine Language, Assembly Language, Introduction to Assembler, Program Loops, Programming Arithmetic and Logic Operations.

Micro programmed Control: Control Memory, Address Sequencing – Conditional Branching, Mapping of Instructions, Subroutines, Micro program Example – Computer Configuration, Microinstruction Format, Symbolic Microinstructions, Fetch Routine, Symbolic Micro program, Binary Micro program, Design of Control Unit – Micro program Sequencer.

Central Processing Unit: Introduction, General Register Organization, Stack Organization – Register Stack, Memory Stack, Reverse Polish Notation, Evaluation of Arithmetic Expressions, Instruction Formats – Three-, Two-, One- and Zero-Address MCA (2 year) Page 11 of 25 Instructions, Addressing Modes, Data Transfer and Manipulation, Program Control – Status Bit Conditions, Conditional Branch Instructions, Subroutine Call and Return, Program Interrupt, Types of Interrupt, RISC & CISC Characteristics, Overlap Register Window

UNIT – IV

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors.

Computer Arithmetic: Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating Point Arithmetic Operations, Decimal Arithmetic Unit and Operations.

Input-Output Organization: Peripheral Devices, Input-Output Interface, Modes of Transfer – Programmed I/O, Interrupt-Driven I/O, Priority Interrupt, Direct Memory Access (DMA), Input-Output Processor (IOP), Serial Communication.

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware

Text Books:

1. Computer System Architecture, by M. Morris Mano, Third Edition. 2007. Low Price Edition. Pearson Education.

Reference Books:

1. Computer Architecture and Organization, by John P. Hayes. Third Edition. 2017. McGraw Hill Publication.
2. Computer Organization and Architecture: Designing for Performance, by William Stallings. Tenth Edition. 2016. Pearson Education India.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Explain the working of arithmetic, logic and shift units in a computer system.

CO2: Elucidate the role of instruction set and instruction cycle in program execution.

CO3: Explain concept of interrupts and their handling.

CO4: Explain various mode of data transfer between memory and I/O devices.

CO5: Elucidate organization and operation of main memory, auxiliary memory, associative memory and cache memory.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-14 Software Engineering L:4 T:0 P:0

Course Objectives: Introduce students to software development life cycle and models for developing and effective and efficient software. Identify software requirements for manual or automated real-world systems. Compare and contrast software process models and software development methodologies. Provide the student with the opportunity to practice software development skills. Provide students with opportunities to develop basic computing skills with respect to preparation of documents and also to be able to check the correctness of a software design.

UNIT – I

Evolving Role of Software, Software Engineering, Changing nature of Software, Software Myths, Terminologies, Role of management in software development Software Process Models: Software Process, Generic Process Model –Framework Activity, Process Lifecycle, Project Management, Phases in Software Development.

Software Life Cycle Models: WaterFall Model, Prototyping Model, Iterative model, Incremental Process Model, Spiral model, V-model, Agile, Comparison of Models, Other Software Processes.

UNIT – II

Software Requirements Analysis & Specifications (SRS): Role of SRS Requirements Engineering, Types of Requirements, Characteristics of SRS, Feasibility Studies, Requirements Elicitation, Developing Use Cases, Requirements - Analysis Documentation, Software Requirement and Specification (SRS) Document, Validation and Management.

Software Quality: McCall's Quality Model, Boehm's Quality Model, ISO 9126 Quality Model, Quality Control, Quality Assurance, Risk Management, Risk Mitigation, Monitoring; Software Reliability.

UNIT – III

Software Project Planning: project planning, project control, project organization, metrics Size estimation, Cost Estimation: Uncertainty in Cost Estimation, COCOMO Model, Project Scheduling and Staffing, Software Configuration Management: Configuration Identification, Configuration Control, Software Risk Management.

System Design: Design principles, Top-Down and Bottom-Up Strategies, Module level Concepts: Coupling, Cohesion, Design Methodologies: Object Oriented Approach, Functional vs. Object Oriented Approach, Design Review, Detailed Design: Process Design Language (PDL), Logic/Algorithm Design, Design Verification: Design Walkthroughs, Critical Design Review, Consistency Checker.

UNIT – IV

Software Testing: Verification and Validation; Error, Fault, Bug and Failure; Levels of Testing, Unit and Integration Testing; White-box and Black-box Testing; Basis Path Testing, Control Structure Testing, Alpha and Beta Testing; Regression Testing, Performance Testing, Stress Testing, smoke testing, acceptance testing, Deriving Test Cases.

Software Configuration Management: Change Control and Version Control; Software Reuse, Software Re-engineering, Reverse Engineering.

Text Books:

1. P. Jalote, An Integrated Approach to Software Engineering (3rd ed.), Narosa Publishing House, 2005.

Reference Books:

1. R. S. Pressman, Software Engineering: A Practitioner's Approach (6th ed.), McGraw-Hill, 2006.
2. K. K. Aggarwal and Y. Singh, Software Engineering (revised 2nd ed.), New Age International Publishers, 2006.
3. Sommerville, Software Engineering (6th ed.), Pearson Education, 2004 Douglas Bell.
4. Software Engineering for Students (4th ed.), Addison-Wesley, 2005.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Describe the software development life cycle as well as describing the various software development model.
CO2: Illustrate the software requirement specification, and system design.
CO3: Understand the advantages and disadvantages of each model.
CO4: Learn project planning and can apply in course projects.
CO5: Understand type of testing and enhance skills in the field of software testing.
CO6: Design high quality software products.
CO7: Learn skill of software requirement specification and software quality assurance techniques.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-15 Operating Systems L:4 T:0 P:0

Course Objectives: The objective of this course is to provide basic as well as advance knowledge of functions of operating system. The entire course is divided into four parts; first unit covers the various types of operating system. Second unit is about process management where student can get the knowledge of basic to advance level of the process management. The third unit will clear the functional concept of memory management. Fourth unit is about file structure of the operating system.

UNIT – I

Introduction: Definition Of The Operating System, Functions Of An Operating System, Different Types Of Systems - Simple Batch System, Multi-Programmed Batched System, Time Sharing System, Personal Computer Systems, Parallel Systems, Distributed Systems, Real Time Systems, Computer System Structureoperation, I/O structure, storage structure, hardware protection, Operating System Services.

UNIT – II

Process Management: Process- Process Concept, Process Scheduling, Operation On Processes, Cooperating Processes, Threads, Inter-Process Communication, CPU Scheduling–scheduling criteria, scheduling algorithms – FCFS, SJF, priority scheduling, round robin scheduling, multilevel queue scheduling, multilevel feedback queue scheduling, multiple processor scheduling, real time scheduling. *Process Synchronization:* The Critical Section Problem, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions.

Deadlocks: Deadlock Characterization, Methods For Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery From Deadlock.

UNIT – III

Memory Management: Logical & physical address space, Swapping, Continuous Allocation (single partition, multiple partition), internal , external fragmentation, Paging, Segmentation, Segmentation With Paging, Virtual Memory, Demand Paging, Performance Of Demand Paging, Page Replacement, Page Replacement Algorithms– FIFO, optimal, LRU, LRU approximation algorithms, counting algorithms Thrashing, Demand Segmentation.

File System Interface: File Concept, Access Methods–sequential, direct, index, Directory Structure–single-level, two–level, tree-structured, acyclic-graph, general graph.

UNIT – IV

File System Implementation: File System Structure, Allocation Methods-contiguous allocation, linked allocation, indexed allocation, Free Space Management-bit vector, linked list, grouping, counting, Directory Implementation–linear list, hash table, Efficiency And Performance, Recovery– consistency checking, backup and restore.

*Secondary Storage Structure:*Disk Structure, Disk Scheduling, FCFS, SSTF, SCAN, C-SCAN, Look Scheduling, Selection of A Scheduling Algorithm, Disk Managementdisk formatting, boot block, bad blocks.

Security: Problem, authentication–passwords, program threats, system threatsworms, viruses, threat monitoring, encryption.

Text Books:

1. Silberschatz, Galvin, “Operating System Concepts”, Addison Wesley Publishing Company, 1989.

Reference Books:

1. William Stallings, “Operating Systems”, Macmillan Publishing Company.
2. Deitel H.M., “An Introduction To Operating System”, Addison Wesley Publishing Company, 1984.
3. Tanenbaum, A.S., “Modern Operating System”, Prentice Hall of India Pvt. Ltd.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Student will be able to differentiate between various types of operating system.
CO2: Gain in depth knowledge of process basics and scheduling.
CO3: Able to deal with situation of dead lock and how to overcome form it.
CO4: Gain in depth knowledge of various page replacement techniques.
CO5: Know about various types of storages media(s).
CO6: Know about disk Scheduling.
CO7: Know about threads and security of operating system.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-21 Programming with Python L:4 T:0 P:0

Course Objectives: The course is designed to provide basic knowledge of Python and course leads students from the basics of writing and running Python scripts to more advanced features such as file operations, regular expressions, working with binary data, and using the extensive functionality of Python modules. Extra emphasis is placed on features unique to Python, such as tuples, array slices, and output formatting.

UNIT – I

Introduction to Python: Installation and Working with Python, Understanding Python variables, Python basic Operators, Understanding python blocks, Basic data types of Python, Conditional blocks using if, else and elseif, Simple for loops in python, For loop using ranges, string, list and dictionaries, Use of while loops in python, Loop manipulation using pass, continue, break and else.

UNIT – II

Python Functions and Data Structures: Function Specifications, Global Variables, Modules, Passing parameters to Functions, Recursive functions, System functions and Parameters, importing modules, Lambda function in python, Python String, List, Tuple, Set, And Dictionary Manipulations, Programming using string, list, tuple, set and dictionary in built functions.

UNIT – III

File Handling: Opening a file, Understanding read functions: read(), readline() and readlines(), Understanding write functions: write() and writelines(), appending data to a file, closing files, Manipulating file pointer using seek, Programming using file operations.
Python Object Oriented Programming: Oops Concept of class, object and instances, Constructor, class attributes and destructors, Method overloading in python, Operator overloading, Inheritance.

UNIT – IV

Python Regular Expression and Exception Handling: Special symbols and characters for Regular expressions, Pattern matching and searching, Pattern searching using regex, Validation using regular expressions, What is exception, Handling an exception, try…except…else, try-finally clause, Argument of an exception, Python standard exception, Raising an exception, User-defined exceptions.
Python Database Connectivity: Introduction, SQL Database connection using python, creating and searching tables, Reading and storing config information on database, Programming using database connections.

Text Books:

1. Think Python 2nd Edition by Allen B. Downey.

Reference Books:

1. Learning Python, 5th Edition, by Mark Lutz, Released June 2013, Publisher(s): O'Reilly Media, Inc.
2. Python Programming, A modular approach: Naveen Kumar Sheetal Taneja 2017 Edition, Pearson. education India.
3. Tanenbaum, A.S., “Modern Operating System”, Prentice Hall of India Pvt. Ltd.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Build problem solving and programming capability, Master the fundamentals of writing Python scripts.

CO2: Learn core Python scripting elements such as variables and flow control structures, Discover how to work with lists and sequence data.

CO3: Write Python functions to facilitate code reuse, Use Python to read and write files and make their code robust by handling errors and exceptions properly.

CO4: Work with the Python standard library.

CO5: Implement Python's object-oriented features, Search text using regular expressions.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-22 Data Base Management Systems L:4 T:0 P:0

Course Objectives: The goal of this course is to teach the fundamentals of the database systems at master level. A variety of topics will be covered that are important for modern databases in order to prepare the students for real life applications of databases. The course aims to impart knowledge of the concepts related to database and operations on databases. It also gives the idea how database is managed in various environments with emphasis on security measures as implemented in database management systems.

UNIT – I

*Basic Concepts:*File Systems vs. DMBS, Characteristics of the Data Base Approach, Abstraction and Data Integration, Database users, Advantages and Disadvantages of a DBMS.

Data Base Systems Concepts and Architecture: Schema and Instances, DBMS architecture and Data Independence, Data Base languages and Interfaces, DBMS functions and component modules, Centralized and Client/Server Architectures for DBMS, Data Models.

Entity Relationship Model: Entity Types, Entity Sets, Attributes & keys, Relationships, Relationships Types, Roles and Structural Constraints, Design issues, E-R Diagrams, Design of an E-R Database Schema, Reduction of an E-R schema to Tables.

Relational Data Model: Relational model concepts, Integrity constraints over Relations, Relational Algebra– Basic Operations, Relational Calculus, Codd Rules.

UNIT – II

SQL: Data Definition and Data Types, Components of SQL: DDL, DML, and DCL, Schema Change Statement in SQL, Views, Joins& Queries in SQL, Specifying Constraints & Indexes in SQL, Database Triggers, SQL Injection.

Relational Data Base Management System: RDBMS, Basic structure, Date Base Structure & its manipulation in an RDBMS, Storage Organization.

Conventional Data Models: An overview of Network and Hierarchical Data Models.

UNIT – III

Relational Data Base Design: Functional Dependencies, Decomposition, Normal forms based on primary keys (1 NF, 2 NF, 3 NF, & BCNF), Multi-valued Dependencies, 4 NF, Join dependencies, 5 NF, Algorithms for Query Processing and Optimization.

Transaction Processing Concepts: Introduction to Transaction Processing, Transaction & System Concepts, Properties of Transaction, Schedules and Recoverability, Serializability of Schedules.

Concurrency Control Techniques: Locking Techniques, Time stamp ordering, Multiversion Techniques, Optimistic Techniques, Granularity of Data items.

UNIT – IV

Recovery Techniques: Recovery concepts, Recovery Techniques in centralized DBMS, Object and Object-Relational Databases; Database Security and Authorization. Data Base Security: Introduction to Data base Security issues. *Enhanced Data Models:* Temporal Database Concepts, Multimedia Databases, Deductive Databases, XML and Internet Databases; Mobile Databases, Geographic Information Systems, Genome Data Management, Distributed Databases and ClientServer Architectures.

Text Books:

1. Elmasri And Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson. ISBN-10: 0-13-397077-9. ISBN-13: 978-0-13-397077-7.

Reference Books:

1. Bipin C. Desai: An Introduction to Database System, Galgotia Publication, N. Delhi.
2. Raghu Rama krishnan& Johannes Gehrke: Database Management Systems, 2 nd edition, Mcgraw Hill International Edition.
3. Peter Rob, Carlos Colonel: Database system Design, Implementation, and Measurement, Cengage Learning, 2nd Ed.
4. C.J. Date: An Introduction to Data Bases Systems 7 th Edition, Addison Wesley N. Delhi.
5. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts" Sixth Edition. ISBN 978-0-07-352332-3.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Understand the concept of database and techniques for its management.

CO2: Design different data models at conceptual and logical level and translate ER Diagrams to Relational Data Model.

CO3: Normalize the database, write queries using Relational Algebra.

CO4: Describe the file organization schemes for DBMS.

CO5: Describe and use features for Concurrency and Recovery.

CO6: Understand data security standards and methods.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-23 Data Communication & Computer Networks L:4 T:0 P:0

Course Objectives: The key objective is to acquire a foundational understanding of computer network and communication technologies. As part of this course, students will be introduced to network models and standards, network protocols and their use, wired and wireless technologies, network security and detailed description of all layers in ISO/OSI and TCP/IP.

UNIT – I

Introduction: Data Communication, Network Components, Protocol & Standards, Standard Organization, Topologies, Transmission modes, Categories of Networks, Uses, Applications. The OSI Reference Model: Layered architecture, Functions of layers, TCP/IP reference model, Comparison of OSI & TCP/IP models.

Physical layer: Guided and wireless transmission media, Magnetic, twisted pair, coaxial cable, fibre optics, radio, microwave, infrared, Communication satellites.

IEEE standards: 802.3 (Ethernet), 802.4 (TokenBus), 802.5 (Token Ring), 802.11(Wireless LAN), 802.15 (Bluetooth).

UNIT – II

Data Link and Mac Layer: Design issues, Framing techniques, Flow control, Error Control, Error Detecting code and Error Correcting codes, Data link Control and Protocols-- For noiseless Channel – Simplest Protocol, Stop-and-Wait Protocol, For Noisy Channel-- Stop-and-Wait ARQ, Go-Back-N ARQ, and Selective-Repeat ARQ Protocol, HDLC Protocol, and PPP Protocol, Multiple Access-- Random Access-- MA, CSMA, CSMA/CD, CSMA/CA, Controlled Access—Reservation, Polling, Token passing, Channelization--FDMA, TDMA, CDMA.

UNIT – III

Network Layer: Network layer design issues, Addressing, Routing algorithms-shortest path routing, flooding, distance vector routing ,link state routing, hierarchical routing, broadcast routing, multicast routing, routing for mobile hosts, Congestion Control algorithms – congestion prevention policies, congestion control in virtual circuit & datagram sub-networks, definition of quality of service, Internetworking – Tunneling, internet-work routing, fragmentation, Network layer in Internet –IP protocol, IP Address, OSPF, BGP, Internet multicasting, Mobile IP, IPv4, IPv6,Internet radio, VoIP.

Transport Layer: Concept of transport service, elements of transport protocols, TCP and UDP, A simple transport protocol, Remote procedure call, Performance issues in computer networks.

UNIT – IV

Application layer services & protocols: Domain name system, SMTP, File transfer protocol, HTTP, HTTPS, TELNET, World Wide Web.

Network Security: Attacks on Computers & Computer security-- Need for security, approaches, principles, types of attacks, Cryptography concept and techniques, Symmetric Key algorithms-- (DES), Asymmetric key algorithms--RSA, Digital signature , Firewalls. E-mail security, Web security, social issues in network security.

Text Books:

1. B. A. Forouzan, “Data Communication & Networking”, 4 th Edition Tata Mcgraw Hill.

Reference Books:

1. A. S. Tanenbaum, “Computer Networks”, Prentice Hall, 1992, 4th edition.
2. William Stallings, “Data & Computer Communication”, McMillan Publishing Co.
3. Black, “Data Networks”, PHI, 1988.
4. Fred Halsall, “Data Communications, Computer Networks”, Pearson Education.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Independently understand basic computer network technology.

CO2: Understand and explain Data Communications System and its components.

CO3: Different types of network topologies and protocols.

CO4: Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.

CO5: Identify the different types of network devices and their functions within a network.

CO6: Understand and build the skills of subnetting and routing mechanisms.

CO7: Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-24(i) Information Security L:4 T:0 P:0

Course Objectives: To understand how cryptography can be used as an effective tool in providing assurance concerning privacy and integrity of information. To recognize the concept of encryption/decryption. To describe the different types of ciphers along with the identification of the characteristics of a good cipher. To provide skills to design security protocols for solving security problems. To develop skills necessary to help organizations in designing, testing and implementing well-planned information security measures for information systems.

UNIT – I

Introduction: Security Attacks: Motives, vulnerabilities, Defense strategies and techniques, Various Attacks- DoS, DDoS, Session Hijacking and Spoofing, Phishing, Buffer Overflow, Format String Attacks, SQL Injection, Malicious Software, Prevention and Detection, Data Protection, Response, Recovery and Forensics.

Basics of Cryptography: Symmetric Cipher Model, Substitution Techniques, Transportation Techniques, Other Cipher Properties- Confusion, Diffusion, Block and Stream Ciphers.

UNIT – II

Secret Key Cryptography: Data Encryption Standard (DES), Strength of DES, Block Cipher, Design Principles and Modes of Operations, Triple DES.

Public Key Cryptography: Principles of Public Key Cryptosystems, RSA Algorithm, DiffieHellman Key Exchange algorithm.

UNIT – III

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Secure Hash Algorithm, Message Authentication Codes – Message Authentication Requirements and Functions, HMAC, Digital signatures, Digital Signature Schemes, Authentication Protocols, Digital Signature Standards. Authentication Applications-Kerberos, Key Management and Distribution, X.509 Directory Authentication service, Public Key Infrastructure.

Electronic Mail Security: Pretty Good Privacy, S/MIME, Operating System Protection-Memory and Address protection, File Protection Mechanism, User Authentication. Database Security-Security Requirement, Reliability and Integrity, Sensitive data, Multilevel Databases.

UNIT – IV

IP Security: Overview, Architecture, Authentication Header, Encapsulating Security Payload, Combining security Associations, Internet Key Exchange, Web Security: Web Security Considerations, Secure Sockets Layer and Transport Layer Security, Electronic Payment.

Intrusion Detection Systems and Firewalls Intruders: Intrusion Detection, Password Management, Firewalls Need, Characteristics, Types of Firewalls, Placement of Firewalls, Firewall Configuration, Trusted systems.

Text Books:

1. 'Cryptography and Network Security- Principles and Practices' by William Stallings, 8th Edition, Prentice Hall Publication.
2. 'Network security and Cryptography' by Bernard Menezes, 1 st Edition, Cengage Learning Publication.
3. 'Computer Security- Principles and Practice' by William Stallings, 1 st Edition, Pearson Education.

Reference Books:

1. 'Network Security Essentials' by William Stallings, 4th Edition, Pearson Publication.
2. 'Applied Cryptography' by Bruce Schneier, Edition 2001, Wiley & Sons Inc.
3. 'Cryptography and Network', 2nd edition, by Behrouz A Fourouzan, Debdeep Mukhopadhyay, TMH.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Understand a variety of generic security threats and vulnerabilities, and identify & analyze particular security problems for a given application.

CO2: Gain knowledge on the notions of various types cryptography techniques.

CO3: Understand and analyze the various cryptography techniques, their principles and applications.

CO4: Identify and analyze the applications of security techniques and technologies in solving real life security problems.

CO5: Understand, analyze and evaluate the security of information systems.

CO6: Analyze and interpret the mechanisms to provide security for communicating information.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-24(ii) Computer Graphics L:4 T:0 P:0

Course Objectives: The Course is introduced to impart students with conceptual knowledge of the graphics techniques and algorithms. To study the multimedia concepts and various I/O technologies. It will enable the students to develop their creativity.

UNIT – I

Introduction: Definition Of Computer Graphics And Its Applications, Video Display Devices-Raster-Scan Displays, Random-Scan Displays, Color CRT Monitors, Direct View Storage Tubes, Flat Panel Displays Input Devices: Keyboard, Mouse, Trackball and Space ball, Joysticks, Digitizers, Image Scanners, Touch Panels, Light Pens, Voice Systems.

UNIT – II

Output Primitives: Line Drawing Algorithms (DDA, Bresenhaum's Circle) Generating Algorithm: Midpoint Circle Drawing Algorithm, Ellipse Generating Algorithm, Midpoint Ellipse Generating Algorithm, Character Generation,

2D Transformations: Translation, Rotation, Scaling, Reflection, Shear, Composite Transformation-Translation, Rotations, Scaling.

UNIT – III

Two Dimensional Viewing: Window-To-Viewport Coordinate Transformation, Clipping Operations, Point Clipping, Line Clipping–(Cohen-Sutherland Line Clipping, LiangBarsky Line Clipping, Nicholl-Lee-Nicholl Line Clipping), Polygon Clipping–(SutherlandHodgeman Polygon Clipping, Weiler-Atherton Polygon Clipping), Curve Clipping, Text Clipping.

Three Dimensional Concepts: Three Dimensional Display Methods–Parallel Projection, Perspective Projection, Surface Rendering.

Three Dimensional Transformations: Translation, Rotation, Scaling, Reflection, Shear.

UNIT – IV

Curves and Surfaces: Bezier Curves, B-Spline Curves, Fractal Geometory Methods, Octrees. Visible-Surface Detection Methods: Back Face Detection, Depth Buffer Method, ABuffer Method, Scan Line Method, Depth Sorting Method. *Concept of Shading:* Modeling Light Intensity, Diffuse And Specular Reflection, Refracted Light, Concept Of Shading Methods.

Text Books:

1. D. Hearn and M.P. Baker, Computer Graphics (4th ed.), Prentice–Hall of India, 2010.

Reference Books:

1. J.D. Foley, A van Dam, S.K. Feiner and J.F.Hughes, Computer Graphics: Principals and Practices (3rd ed.), Addison-Wesley, MA, 2013.
2. D.F. Rogers, Procedural Elements in Computer Graphics (4th ed.), McGraw Hill Book Company, 2019.
3. D.F. Rogers and A.J. Admas, Mathematical Elements in Computer Graphics (2nd ed.),McGraw Hill Book Company, 1990.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Get Familiar with the principles of graphical user interfaces.

CO2: Learn the introductory concepts in computer graphics and multimedia processing.

CO3: Explain the core concepts of computer graphics, including viewing, projection, perspective, modelling and transformation in two and three dimensions.

CO4: Apply the concepts of color models, lighting and shading models, textures, ray tracing, hidden surface elimination, anti-aliasing, and rendering.

CO5: Use techniques which will allow them to create user-friendly interfaces for computer applications.

CO6: Learn the fundamentals of animation, parametric curves and surfaces, and spotlighting.

CO7: Apply graphic programming techniques to design and create computer graphics.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-25(i) Theory of Computation L:4 T:0 P:0

Course Objectives: Understanding the inherent capabilities and limitations of computers is a fundamental question in computer science. To answer this question, we will define formal mathematical models of computation, and study their relationships with formal languages. Topics will consist of three central areas of the theory of computation: automata, computability, and complexity. Students will also learn that not all problems are solvable by computers, and some problems do not admit efficient algorithms. Throughout this course, they will strengthen their rigorous mathematical reasoning skills.

UNIT – I

Automata: Introduction to finite automata, structural representations, automata and complexity, Alphabets, strings, languages, problems, Chomsky hierarchy, Deterministic Finite Automata (DFA), Mealy Machine, Moore Machine, Non-deterministic Finite Automata (NFA), Finite Automata With Epsilon Transition. Convernation from NFA to DFA.

UNIT – II

Regular Expression and languages: regular expressions, finite automata and regular expressions, applications, algebraic laws, pumping lemma for regular languages, closure properties, equivalence and minimization of automata.
Context Free Grammars and languages: Introduction to context free grammars, parse trees, applications of CFG, ambiguity in grammars and languages.

UNIT – III

Pushdown Automata: definition of PushDown Automata (PDA), languages of a PDA, equivalence of PDA and CFG, deterministic PDA, non-deterministic PDA, properties of context free languages, normal forms, pumping lemma, closure properties, decision properties.

UNIT – IV

Turing Machine: Problems that computer cannot solve, the turing machine, programming techniques for Turing machines, extensions to the basic turing machine, restricted Turing machines, Turing machines and computers. Basic understanding of the classes P and NP.

Text Books:

1. J. E. Hopcroft, R. Motwani, and J. D. Ullman, Introduction to Automata Theory, languages, and computation (2nd ed.), Addison-Wesley, 2001.

Reference Books:

1. H. R. Lewis, C.H. Papadimitriou, C. Papadimitriou, Elements of the Theory of Computation (2nd ed.), Prentice-Hall, NJ, 1997.
2. J. A. Anderson, Automata Theory with Modern Applications, Cambridge University Press, 2006.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Understand key notions of computation, such as algorithm, computability, decidability, reducibility, and complexity, through problem solving.

CO2: Explain the models of computation, including formal languages, grammars and automata, and their connections.

CO3: State and explain the Church-Turing thesis and its significance.

CO4: Analyse and design finite automata, pushdown automata, Turing machines, formal languages, and grammars.

CO5: Solve computational problems regarding their computability and complexity and prove the basic results of the theory of computation.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-25(ii) Security in Computing L:4 T:0 P:0

Course Objectives: This course aims to provide an advanced understanding of computer security principles and practices, focusing on network security, database security, and secure software development. Students will delve into the intricacies of security mechanisms, threat analysis, and defensive strategies, preparing them for the challenges of securing modern computing systems.

UNIT – I

Computer Security Concepts: Overview of computer security principles, assets, threats, and security functional requirements.
Security Architecture and Scope: Designing and implementing security architectures, scope of computer security, and current trends.
Cryptography: Terminology, substitution ciphers, transpositions, cryptanalysis, and cryptographic protocols.
Program Security: Secure programming practices, non-malicious program errors, viruses, and other malicious code.
Control against Program Threats: Techniques to mitigate program threats and ensure program security.

UNIT – II

Secure Data Storage: Techniques for encrypting data at rest, securing database backups, and maintaining data integrity.
Access Control Mechanisms: Implementing role-based access control (RBAC), granular permissions, and database auditing to enforce least privilege principles. *SQL Injection Prevention:* Strategies for mitigating SQL injection attacks, including input validation, parameterized queries, and stored procedures.

UNIT – III

Advanced Firewall Configuration: Configuring stateful inspection, application-layer filtering, and integrating intrusion detection/prevention systems (IDS/IPS) into network architectures.
Secure Wireless Networks: Implementing Wi-Fi security protocols, securing wireless access points, and detecting wireless intrusions. Internet Security *Protocols and Standards:* Exploring SSL/TLS, IPv4 and IPv6 security, Kerberos, X.509, and Public Key Infrastructure.
Network Forensics: Techniques for investigating network security incidents, analyzing network traffic, and collecting digital evidence.

UNIT – IV

Linux and Windows Security: Understanding security models, file system security, vulnerability management, and system hardening. Physical Security: Identifying physical security threats, implementing prevention and mitigation measures, and developing recovery procedures.
Security Auditing and Risk Management: Establishing security auditing architectures, managing audit trails, conducting risk assessments, and implementing security controls.
Cybercrime and Ethical Issues: Exploring cybercrime, intellectual property protection, privacy concerns, and ethical considerations in cybersecurity.

Text Books:

1. Charles. P. Pfleeger & Shari Lawrence Pfleeger, Security in Computing, Pearson Education.

Reference Books:

1. William Stalling, Lawrie Brown, Computer Security Principles and Practice, Pearson Education.
2. Atul Kahate, Cryptography and Network Security, Tata McGraw-Hill Education.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Analyze and implement advanced cryptographic protocols for securing data transmission and storage.

CO2: Perform threat modeling and risk assessments to identify and prioritize security vulnerabilities.

CO3: Apply secure coding practices and integrate security into the software development lifecycle to develop resilient and secure software systems.

CO4: Design and implement robust network security architectures to defend against sophisticated cyber threats.

CO5: Evaluate and implement effective security measures for databases and web applications, including mitigation of common security vulnerabilities and integration of security controls into development frameworks.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-31 OOPs with Java L:4 T:0 P:0

Course Objectives: The course aims is to equip the students with JAVA programming language concepts with object-oriented programming principles. In this course student will be able to learn the basic syntax and semantics of the Java language and programming environment; build robust applications using Java's object-oriented features; implement the interface and inheritance; understand exceptional handling and multi-threading concepts along with Applets, AWT and Event Handling.

UNIT – I

Introduction to Java Programming, Overview of JVM, JDK, and JRE, Java Elements: Data Types, Literal and Variables, Operators: Arithmetic, Bit-wise, Relational, Boolean Logical, Assignment, Operator Precedence, Control Statements–Selection (if, switch), Iteration Statements (while, do-while, for) Jump Statements (break, continue, return), Arrays (One-dimensional, Multi-Dimensional).

UNIT – II

Overview of OOP concepts, Understanding classes and objects, Encapsulation: Access modifiers (public, private, protected, default), Constructors and destructors, Types of Constructors, method overloading.

Inheritance: Overview, Single, multiple, multilevel, hierarchical inheritance, Hybrid Inheritance, Method overriding and dynamic method dispatch, Abstract classes and interfaces, Polymorphism: Compile-time and run-time polymorphism, Understanding the "super" keyword Using "final" keyword for classes, methods, and variables.

UNIT – III

Introduction to exception handling, Exception Types, Uncaught Exceptions, Handling exceptions using try-catch blocks, Dealing With Exceptions (try, throw, throws, finally), In-built and User Defined Exceptions.

File I/O basics: Reading from and writing to files Using BufferedReader, BufferedWriter, FileReader, and FileWriter classes, Exception handling in file operations.

UNIT – IV

Threading: Thread Basics, Thread life cycle phases, creating and running thread, multithreading, Thread Priorities, Synchronization, inter-thread communication using wait(), notify(), and notifyAll() methods, Thread runnable interface.

Swing GUI Development: Swing Introduction, characteristics, MVC structure in swing, Creating GUI components: JFrame, JPanel, JButton, JLabel, Layout management: BorderLayout, FlowLayout, GridLayout, BoxLayout, Event handling: ActionListener, MouseEvent, KeyListener, Creating custom GUI components, Using JDialog and JOptionPane for dialog boxes and messages, Advanced Swing components: JTable, JTree, JList, etc.

Text Books:

1. Patrick Naughten & Herbert Schildt, "The Complete Reference Java", Seventh Edition, Tata McGraw Hill.

Reference Books:

1. Gilbert, Stephan D. and William B. Hccarthy, “Object Oriented Programming in Java”, 1997, The Waite Group Press.
2. Mary Compoine and Kathy Walrath, “The Java Tutorial”, Addision Wesley, 1996.
3. Horstmann, Cay S. and Gary Cornell, “Core Java 1.1: Fundamentals”, Addison – Wesley, 1997.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Learn the basic features of Java.
CO2: Develop program using different concepts of OOPs.
CO3: Develop programming using Java I/O and Applet Programming.
CO4: Design and Implement Graphics programming using AWT and Layouts.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-32 Web Technologies L:4 T:0 P:0

Course Objectives: The course is designed to provide a Basic understanding of Web Technologies. This Course enables students to create Static and Dynamic Web Pages using HTML5, CSS, and JAVASCRIPT. Extra emphasis is placed on building Mobile Responsive Websites using various frameworks like BOOTSTRAP.

UNIT – I

Web Terminologies: Internet, WWW, Web Browser, Web Server, understanding how Web Browser Communicates with Web Server, Client-Server Architecture, Uniform Resource Locator (URL), Hyper Text Transfer Protocol Secure (HTTPS), Evolution of Web Technologies.

HTML5 Introduction: Structure of HTML5 Program, Heading Styles, Text Styles, Other Text Effects; List Definition, Creating Ordered and Unordered Lists, Adding Images, Creating Tables, Multimedia, Graphics; Form: Tags, Elements, Input Types, Text Area, Checkboxes, Submit Button, Frames, Audio Tag, Video Tag, i-frame, Form Validation, Designing Static Web Pages with HTML5.

UNIT – II

CSS Introduction: Understanding the Role of CSS in Web Development, Syntax and Structure, CSS Box Model and Layouts, Implementing Margins, Borders, and Padding, Creating Layouts with CSS Floats and Flexbox, Styling Text, and fonts, Applying CSS Styles to Text Elements, Customizing Fonts and Fonts Properties. *Advanced CSS Techniques:* CSS Colours and Backgrounds, Creating Gradient Backgrounds with CSS, CSS Transforms, Transitions, and Animations, *Responsive Web Design:* Responsive Design and Layout Techniques, Building Responsive Layouts with CSS Media Queries, Implementing CSS Grid Layout for Complex Structures.

UNIT – III

JavaScript Introduction: Variables, Obtaining User Input, Operators, Control Structure, Looping Constructs, Break and Continue Statements, User Defined Functions, Recursion and Iterations, Array Declaration and Memory Allocation, Passing Array as an Argument to Function, Basic Form Validation in JavaScript. *JavaScript Objects:* Definition, String, Boolean, Window, Document, Cookies, Document Object Model (DOM), Event Handling using JavaScript.

UNIT – IV

Bootstrap Introduction: Overview of Frontend Frameworks, Advantages and Features of Bootstrap, Bootstrap Grid System, Creating Responsive Layouts with Containers, Rows, and Columns, Customizing Grid Layouts for Various Screen Sizes, Bootstrap Components, Typography and Utilities, Implementing Buttons, Creating Forms.

Bootstrap Extensions: Using Bootstrap Modals for Popup Dialogs, Tabs, Pills, and Accordion Components, Bootstrap Card of Content Display, Advanced Bootstrap Techniques, Customizing Bootstrap with SASS, Integrating Bootstrap with JavaScript frameworks, Optimizing Bootstrap for Performance, Building Responsive and Mobile-First Websites with Bootstrap.

Text Books:

1. Kogent Learning, Web Technologies: HTML, JavaScript, PHP, JAVA, JSP, XML, AJAX – Black Book, Wiley India Pvt. Ltd.
2. Bootstrap by Jake Spurlock Publisher(s): O'Reilly Media, Inc. ISBN: 9781449344597.

Reference Books:

1. Bootstrap 4 Cookbook by Ajdin Imsirovic Publisher: Packt Publishing.
2. Beginning HTML5 and CSS3: The Web Evolved by Christopher Murphy , Divya Manian, Oliver Studholme Publisher: Apress.
3.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Understand about Basic Terminologies of Web Development, Data Validation Using JavaScript.

CO2: Design Web Pages using HTML5, CSS.

CO3: Design a Mobile Responsive Website Using Bootstrap.

CO4: Apply JavaScript methods in building various Interactive UI Projects.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-33 Artificial Intelligence L:4 T:0 P:0

Course Objectives: The objective of the course is to provide the knowledge of artificial intelligence and expert systems. To enable the understanding of the concepts, methods, and techniques of Natural Language processing, genetic algorithms, and neural networks. To prepare students to be in a position to develop a system based on artificial intelligence.

UNIT – I

Overview of A.I.: Definition of AI, The Importance of AI, previous works in the history of AI, AI and related fields, Problem spaces and Search.

Knowledge: General concepts-Definition and Importance of Knowledge, Knowledge-Based Systems, Representation of Knowledge, Knowledge Organization, Knowledge Manipulation, Acquisition of Knowledge.

UNIT – II

Natural Language Processing: Overview of Linguistics, Grammar and Language, Parsing Techniques, Semantic Analysis and Pragmatics.

Multi Agent Systems: Agents and Objects, Agents and Expert Systems, Generic Structure of Multiagent Systems, Semantic Web, Agent Communication, Knowledge Sharing using Ontologies, Agent Development Tools.

UNIT – III

Genetic Algorithms (GA): Encoding Strategies, Genetic Operators, Fitness Functions and GA Cycle, Problem Solving using GA.

Artificial Neural Networks (ANN): Supervised, Unsupervised and Reinforcement Learning, Single Perceptron, Multi-Layer Perceptron, SelfOrganizing Maps, Hopfield Network.

UNIT – IV

Pattern Recognition: Introduction, Recognition and Classification Process, Learning Classification Pattern, Recognizing and Understanding Speech.

Expert Systems: Definition, Rule Based System Architecture, NonProduction System Architecture, Basic Components of Expert system.

Text Books:

1. Dan W. Patterson, “Introduction to Artificial Intelligence and Expert Systems.” Prentice-Hall, India.
2. P. H. Winston, “Artificial Intelligence”, Addison Wesley.

Reference Books:

1. A. Rich and K. Knight, “Artificial Intelligence”, Tate McGraw Hill.
2. E. Charnaik and D. Mcdermott, “Introduction To Artificial Intelligence”, Addison-Wesley Publishing Company.
3. N. J. Nilsson, “Artificial Intelligence: A New Synthesis”, Morgan Kauffman.
4. T. Dean, J. Allen and Y. Aloimonos, “Artificial Intelligence: Theory and Practice”, Benjamin/Cummings.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Analyze different approaches for artificial intelligence.

CO2: Identify and select optimal solutions for different situations and projects.

CO3: Implement the knowledge through practicing AI systems.

CO4: Conduct independent research in artificial intelligence and expert systems and apply that knowledge in their future research and practice.

CO5: Evaluate the work of peers constructively by following proven methods of peer-review, and by using the principles of research ethics.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-34(i) Data Mining using R L:4 T:0 P:0

Course Objectives: The objective of this course is to provide the in-depth coverage of data mining and integration aspects along with its implementation in R programming language.

UNIT – I

Data Warehouse: A Brief History, Characteristics, Architecture for a Data Warehouse.
Data Mining: Introduction, Motivation, Importance, Knowledge Discovery Process, Data Mining Functionalities, Interesting Patterns, Classification of Data Mining Systems, Major issues.
Data Pre-processing: Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization, Outliers

UNIT – II

Data Mining Techniques: Clustering-Requirement for Cluster Analysis, Clustering Methods-Partitioning Methods, Hierarchical Methods, Decision Tree-Decision Tree Induction, Attribute Selection Measures, Tree Pruning. Association Rule Mining-Market Basket Analysis, Frequent Itemset Mining using Apriori Algorithm, Improving the Efficiency of Apriori. Concept of Nearest Neighborhood and Neural Networks.

UNIT – III

Data Integration: Architecture of Data Integration, Describing Data Sources: Overview and Desiderate, Schema Mapping Language, Access Pattern Limitations, String Matching: Similarity Measures, Scaling Up String Matching, Schema Matching and Mapping: Problem Definition, Challenges, Matching and Mapping Systems, Data Matching: Rule- Based Matching, Learning- Based Matching, Matching by Clustering.

UNIT – IV

R Programming: Advantages of R over other Programming Languages, Working with Directories and Data Types in R, Control Statements, Loops, Data Manipulation and integration in R.
Exploring Data in R: Data Frames, R Functions for Data in Data Frame, Loading Data Frames, Decision Tree packages in R, Issues in Decision Tree Learning, Hierarchical and K-means Clustering functions in R, Mining Algorithm interfaces in R.

Text Books:

1. J. Hanes, M. Kamber, Data Mining Concepts and Techniques, Elsevier India.
2. A. Doan, A. Halevy, Z. Ives, Principles of Data Integration, Morgan Kaufmann Publishers.
3. S. Acharya, Data Analytics Using R, McGraw Hill Education (India) Private Limited.

Reference Books:

1. G.S. Linoff, M.J.A. Berry, Data Mining Techniques, Wiley India Pvt. Ltd.
2. Berson, S.J. Smith, Data Warehousing, Data Mining & OLAP, Tata McGraw-Hill.
3. J.Horbulyk, Data Integration Best Practices.
4. Jared P. Lander, R For Everyone, Pearson India Education Services Pvt. Ltd.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Understand the fundamental concepts of data warehousing and data mining;

CO2: Acquire skills to implement data mining techniques.

CO3: Learn schema matching, mapping and integration strategies.

CO4: Implement data mining techniques in R to meet the market job requirements.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-34(ii) Cloud Computing L:4 T:0 P:0

Course Objectives: To study the fundamental concepts of cloud computing, enabling technologies, cloud service models and security concerns.

UNIT – I

Cloud Computing: Definition, roots of cloud computing, characteristics, cloud architecture, deployment models, service models.

Virtualization: Benefits & drawbacks of virtualization, server virtualization, virtualization of - operating system, platform, CPU, network, application, memory and I/O devices etc.

UNIT – II

Cloud Computing Service Platforms: compute services, storage services, database services, application services, queuing services, e-mail services, notification services, media services, content delivery services, analytics services, deployment & management services, identity & access management services and their case studies.

UNIT – III

Cloud Technology: Introduction to Cloud Technologies, Study of Hypervisors Compare SOAP and REST Web-services, AJAX and mashups-Web services: SOAP and REST, SOAP versus REST, AJAX: asynchronous 'rich' interfaces, Mashups: user interface services, *Virtualization Technology:* Virtual machine technology, virtualization applications in enterprises, Pitfalls of virtualization Multitenant software: Multi-entity support, Multi-schema approach, Multitenance using cloud data stores, Data access control for enterprise applications, Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo.

UNIT – IV

Cloud Security Fundamentals: issues, threats, data security and information security, Vulnerability assessment tool for cloud, Privacy and Security in cloud.

Cloud Computing Security Architecture: Architectural Considerations General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro-architectures; Identity Management and Access control-Identity management, Access control, Autonomic Security Cloud computing security challenges: Virtualization security management, virtual threats, VM Security Recommendations, VM-Specific Security techniques, Secure Execution Environments and Communications in cloud.

Text Books:

1. Arshdeep Bahga, Vijay Madisetti, Cloud Computing – A Hands-on Approach, University Press.
2. Rajkumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing – Principles and Paradigms, Wiley India Pvt. Ltd.
3. S. Acharya, Data Analytics Using R, McGraw Hill Education (India) Private Limited.
4. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper (Wiley India Edition).
5. Enterprise Cloud Computing by Gautam Shroff, Cambridge.
6. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India.

Reference Books:

1. Kai Hwang, Geoffrey C.Fox, and Jack J. Dongarra, Distributed and Cloud Computing, Elsevier India Private Limited.
2. Saurabh Kumar, Cloud Computing, Wiley India Pvt. Ltd.
3. Shailendra Singh, Cloud Computing, Oxford
4. Coulouris, Dollimore and Kindber, Distributed System: Concept and Design, Addison Wesley.
5. Michael Miller, Cloud Computing, Dorling Kindersley India
6. Anthony T. Velte, Toby J. Velte and Robert Elsenpeter, Cloud computing: A practical Approach, McGraw Hill.
7. Google Apps by Scott Granneman,Pearson
8. Cloud Security & Privacy by Tim Malhar, S.Kumaraswammy, S.Latif (SPD,O'REILLY).
9. Cloud Computing: A Practical Approach, Antohy T Velte, et.al McGraw Hill.
10. Cloud Computing Bible by Barrie Sosinsky, Wiley India.
11. Stefano Ferretti et.al., QoS–aware Clouds", 2010 IEEE 3rd International Conference on Cloud Computing.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Understand core issues of cloud computing and enabling technologies.
CO2: Design services based on cloud computing platforms;
CO3: Evaluate the cloud technologies.
CO4: Analyse the cloud securities.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-35(i) Cyber Security L:4 T:0 P:0

Course Objectives: This course equips you with a comprehensive understanding of cyber security concepts, threats, and defensive strategies. Gain foundational knowledge of cyber security principles and terminology. Explore various cyber threats, actors, and their motivations. Understand cybercrime classifications, laws, and forensic investigation techniques. Identify social engineering tactics and methods to protect against identity theft. Grasp essential network security tools and configure basic network defences.

UNIT – I

Introduction to Cyber Security: Definition, Importance, Scope, Evolving Threat Landscape, Key Concepts: Cyberspace, Attacks, Vulnerabilities, Risks.
Cyber Threats and Actors: Cyber Warfare, Crime, Terrorism, Espionage, Information Theft, Motivations.
Cyber Security Governance: Challenges, Constraints, Comprehensive Policy Need, International Cooperation.

UNIT – II

Origins and Classification of Cybercrime: Common Types, Impact on Individuals and Organizations.
Cybercrime Investigation and Law Enforcement: The Indian IT Act 2000 (and Amendments).
Tools and Methods used in Cybercrime: Proxy Servers, Password Cracking, Malware (DoS, DDoS, SQL Injection).
Digital Evidence and Forensics: Need, Collection, Digital Forensics Life Cycle.

UNIT – III

Phishing and Social Engineering: Techniques, Methods, Red Flags, Advanced Techniques (Spy Phishing), Social Engineering Attack Vectors: Pretexting, Tailgating, Quid Pro Quo, Baiting, Countering Social Engineering: User Awareness Training, Secure Communication Practices.
Identity Theft and Protection: Personal Identifiable Information (PII), Risks, Types, Impact, Techniques, Prevention, Data Breaches and Identity Theft: Common Scenarios, Data Breach Response, identity Theft Protection Methods: Strong Passwords, Multi-Factor Authentication, Credit Monitoring.

UNIT – IV

Network Security Fundamentals: Firewalls (Stateless vs. Stateful), Network Address Translation (NAT), Port Forwarding, Virtual Private Networks (VPNs), Intrusion Detection/Prevention Systems (IDS/IPS), Introduction to Blockchain Technology.
Security Tools and Practices: Firewall Configuration (Linux/Windows), Secure Network Design, Access Controls, Incident Response, Disaster Recovery.

Text Books:

1. Mike Shema, Anti-Hacker Tool Kit (Indian Edition), McGraw Hill.
2. Nina Godbole and Sunit Belpure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley.

Reference Books:

1. Marjie T. Britz, Computer Forensics and Cyber Crime: An Introduction, Pearson Education.
2. Chwan-Hwa (John) Wu, J. David Irwin, Introduction to Computer Networks and Cyber security, CRC Press.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Apply Cybersecurity Concepts: Apply foundational knowledge of cybersecurity principles and terminologies to analyze and address security challenges in various contexts.

CO2: Identify Cyber Threats: Recognize and differentiate between different types of cyber threats, including cyber warfare, crime, terrorism, espionage, and information theft, along with understanding the motivations behind these threats.

CO3: Analyze Cybercrime Incidents: Utilize investigative techniques and legal frameworks to analyze cybercrime incidents, collect digital evidence, and contribute to legal proceedings.

CO4: Mitigate Cybersecurity Risks: Implement security measures and best practices to mitigate cybersecurity risks, including social engineering attacks, identity theft, and network vulnerabilities.

CO5: Implement Network Security Solutions: Configure and deploy network security tools and solutions, such as firewalls, intrusion detection/prevention systems, and encryption protocols, to protect network infrastructure and data.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-35(ii) Digital Marketing L:4 T:0 P:0

Course Objectives: This course aims to train students in formulating effective digital marketing strategies and implementing them across various channels such as SEO, SEM, social media, and email marketing. Students will also learn advanced topics like influencer marketing, online reputation management, and analytics, ensuring they can create impactful campaigns while upholding ethical and legal standards.

UNIT – I

Introduction to Digital Marketing: Definition and scope of digital marketing, Evolution and significance of digital marketing, Digital marketing vs. traditional marketing.
Digital Marketing Strategy: Understanding the marketing funnel, Setting SMART objectives, Target audience identification and segmentation, Competitive analysis, Developing a digital marketing plan.

UNIT – II

Website Planning and Development: Principles of website design and usability, Basics of HTML, CSS, and JavaScript, Content management systems (CMS) like WordPress, Website analytics and tracking.
Search Engine Optimization (SEO): On-page and off-page SEO, Keyword research and analysis, Technical SEO fundamentals, SEO tools and analytics.
Search Engine Marketing (SEM): Introduction to Pay-Per-Click (PPC) advertising, Google Ads and Bing Ads platforms, Campaign setup, management, and optimization, Budgeting and bidding strategies.

UNIT – III

Social Media Marketing (SMM): Overview of major social media platforms, Creating engaging content for social media, Social media advertising, Social media analytics and measurement.
Content Marketing: Content creation and curation, Blogging and article writing, Content distribution strategies, Content marketing metrics.
Email Marketing: Building an email list, Email campaign planning and execution, Email automation and personalization, Email marketing analytics.

UNIT – IV

Influencer Marketing: Understanding influencer marketing, Identifying and engaging with influencers, Influencer marketing platforms, Measuring influencer marketing ROI.
Online Reputation Management (ORM): Importance of online reputation, Strategies for managing online reputation, Monitoring tools and techniques, Responding to online feedback and reviews.
Analytics and Performance Measurement: Key performance indicators (KPIs) in digital marketing, Web analytics with Google Analytics, Conversion tracking and attribution modelling, Reporting and dashboarding.
Ethical and Legal Considerations: Privacy and data protection laws, Intellectual property rights, Ethical dilemmas in digital marketing, Best practices for responsible marketing.

Text Books:

1. Chaffey, D., & Ellis-Chadwick, F.: Digital marketing: Strategy, implementation and practice, Pearson.

Reference Books:

1. Kaushik, A.: Web analytics 2.0: The art of online accountability and science of customer centricity, Sybex.
2. Barker, M., Barker, D. I., & Bormann, N. F.: Social media marketing: A strategic approach, Sage Publications.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Explain the digital marketing concepts, including its definition, scope, and evolution, compared to traditional marketing.

CO2: Develop skills in formulating effective digital marketing strategies, identifying target audiences and conducting competitive analyses.

CO3: Acquire proficiency in utilizing various digital marketing channels and tools, such as website development, SEO, SEM, social media marketing, content marketing and email marketing.

CO4: Implement advanced digital marketing tactics, including influencer marketing, online reputation management, and performance measurement using key performance indicators (KPIs) and web analytics tools.

CO5: Understand and adhere to ethical and legal standards in digital marketing.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-41 Linux and Shell Programming L:4 T:0 P:0

Course Objectives: The objectives of this course are to provide the in-depth coverage of various concepts of Linux. Linux administration is an essential course for the students.

UNIT – I

Introduction: History of Linux - Linux Components/Architecture - Features of Linux – Linux Environment and Linux Structure - Posix and Single Linux specification - The login prompt - Linux commands – Basic commands - echo, printf, ls, who, date,passwd, cal - Combining commands - Internal and external commands – type, man , more and other commands - the user terminal, displaying its characteristics and setting characteristics - The root login - super user: su command - /etc/passwd and /etc/shadow files - Commands to add, modify and delete users.

UNIT – II

File System: File basics - File types and Categories – File Organization – Directories - home directory and the HOME variable - Reaching required files- the PATH variable - Relative and absolute pathnames.

Directory commands – pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent parent directories - File related commands – cat, mv, rm, cp, wc - File inodes and the inode structure. File links – hard and soft links – Head and tail commands - Cut and paste commands - The sort command - Special files /dev/null and /dev/tty - File attributes and permissions - The umask and default file permissions - ls command - Changing file permissions: the relative and absolute permissions changing methods. Recursively changing file permissions, Directory permissions.

UNIT – III

Process Management: The Structure of Processes: Process States and Transitions - Layout of system memory - Context of a process. Process Control: Process Creation – Signals – Process Termination – Invoking other programs – PID & PPID – Shell on a Shell.

Vi Editor: Introduction to Text Processing, Command & edit Mode, Invoking vi, deleting & inserting Line, Deleting & Replacing Character, Searching for Strings, Yanking, Running Shell Command Macros, Set Window, Set Auto Indent, Set No. Communicating with Other Users: who, mail, wall, send, mesg.

UNIT – IV

Shell programming: Introduction – Need for Scripts – Creating and Calling the Script – The Shebang – Different ways of running a script - Using variables in Script – Reading Input – Integer Variables – Arithmetic Expressions – Read-only variables – Exporting variables – Arrays - Control Statements: If, Then, Else, While and Until, Classic For, Break and Continue, Case – Handling Script Parameters: Shift, Getopts – Shell Functions – Handling Conditional expression patterns and Regular expressions in scripts.

Text Books:

1. Sumitabha Das., UNIX Concepts and Applications. 4th Edition. Tata McGraw Hill, July 2017.
2. Behrouz A. Forouzan, Richard F. Gilberg : UNIX and Shell Programming- Cengage Learning – India Edition. 2009.

Reference Books:

1. M.G. Venkatesh Murthy: UNIX & Shell Programming, Pearson Education.
2. Richard Blum, Christine Bresnahan: Linux Command Line and Shell Scripting Bible, 2nd Edition, Wiley, 2014.
3. Beginning Linux Programming, 4th Edition, N. Matthew, R. Stones, Wrox, Wiley India Edition.
4. Unix for programmers and users, 3rd Edition, Graham Glass, King Ables, Pearson.
5. System Programming with C and Unix, A. Hoover, Pearson.
6. Unix System Programming, Communication, Concurrency and Threads, K. A. Robbins and S. Robbins, Pearson Education.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Learn the concepts and commands of Linux.
CO2: Understand the file management and process manipulation in Linux.
CO3: Apply system administration and communication mechanisms in Linux.
CO4: Implementation of C environment under Linux.
CO5: Design shell programs in Linux.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-42 Advanced Web Technologies L:4 T:0 P:0

Course Objectives: The course aims to equip students with advanced skills in web development using modern technologies. Through practical modules, students will learn about frameworks like AngularJS for dynamic web pages, NodeJS for server-side scripting, and MongoDB for database management. By the end, students will be proficient in building interactive web applications and integrating various components seamlessly.

UNIT – I

Introduction: Introduction to Web Technologies, Evolution of Web Technologies and Frameworks, Advantages of Using Frameworks for Building Dynamic and Interactive Web Pages, NoSQL Overview.

Advanced Client-Side Programming: Fundamentals of jQuery, Working with AJAX and jQuery, JavaScript Client Side Framework, Client Server Architecture.

UNIT – II

AngularJS: Introduction to AngularJS, Features of AngularJS, MVC (Model View Controller) Architecture, Angular CLI/Angular Project Setup, Data Binding, Expressions, Modules, Controllers, Directives, Scopes, Dependency.

Angular User Interfaces: Angular Forms, DOM, Using Angular with Angular UI and Angular Bootstrap, Angular AJAX.

UNIT – III

NodeJS: Introduction to NodeJS, Features of NodeJS, setting up NodeJS, NPM (Node Package Manager), Creating NodeJS Hello World Application, REPL Terminal, Callback, Callback as Arrow Function, Creating Web Server, Sending Requests, Handling HTTP Requests.

Event-Driven Programming: Events Event Loop Event Emitter, Creating Buffers, Debugger, Global Objects, NodeJS Streams, Handling HTTP Requests, File Systems, Utility Modules.

UNIT – IV

MongoDB: Introduction to MongoDB, NoSQL Database Overview, Advantages, Installing and Setting up MongoDB.

Data Modeling: Collections and Documents, CRUD Operations, Querying Data with MongoDB, Data Aggregation, Using Mongoose ORM with NodeJS for MongoDB Integration, Real-Time Data Synchronizations between MongoDB, AngularJS and NodeJS using WebSocket.

Text Books:

1. Shyam Seshadri & Brad Green, AngularJS: Up and Running, O'Relly.
2.Brad Dayley, Node.js, MongoDB, and AngularJS Web Development (Developer's Library), Addison Wesley.

Reference Books:

1. Poornima G. Naik & Girish R. Naik, MEAN Stack Web Development Explained to Novice Learners-Vol I (covers Node.js, Express.js, and MongoDB), Shashwat Publication.
2. Simon Holmes, Getting MEAN with Mongo, Express, Angular, and Node, Manning Publications.
3. Black Book, HTML5, Dreamtech Press.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Develop dynamic and interactive web pages using advanced client-side programming techniques such as jQuery and AngularJS.

CO2: Implement server-side scripting and handle HTTP requests effectively using NodeJS, along with understanding event-driven programming concepts.

CO3: Design and manage databases using MongoDB, perform CRUD operations, and integrate MongoDB with NodeJS applications using Mongoose ORM.

CO4: Create real-time data synchronization between MongoDB, AngularJS, and NodeJS applications using WebSocket technology, enabling seamless communication and updates across platforms.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-43(i) Soft Computing L:4 T:0 P:0

Course Objectives: The course aims to provide students with a deep understanding of soft computing methodologies such as neural networks, fuzzy logic, and genetic algorithms, alongside traditional optimization methods. By exploring the principles, structures, and applications of these techniques, students will develop the skills to tackle complex computational problems, optimize solutions, and model uncertainty effectively using tools like MATLAB, WEKA, and FisPro.

UNIT – I

Introduction: Introduction to soft computing, difference between hard computing and soft computing, features of hard computing and soft computing, examples of hard computing and soft computing, need for soft computing, applications of soft computing, hybrid computing, examples of hybrid computing.

Optimization and Some Traditional Methods: Introduction to Optimization, Classification of Optimization Problems, Traditional Methods of Optimization- Exhaustive Search Method, Random Walk Method, Steepest Descent Method, Drawbacks of Traditional Optimization Methods.

UNIT – II

Artificial Neural Network: Neurons and neural network, Neural network types, structure of neural network, basic model of neural network, single layer perceptron, multi-layer perceptron, radial basis function network, self-organizing map (SOM), recurrent neural network, training of neural network, supervised and unsupervised learning of neural network, applications of neural network.

UNIT – III

Fuzzy Logic: Concept of fuzzy logic and fuzzy sets, classical sets, fuzzy relations and rule base, fuzzy arithmetic, fuzzy reasoning and clustering, defuzzification, neuro-fuzzy systems, applications of fuzzy systems.

Genetic algorithm: Concept of genetic algorithm (GA), binary GA, real GA, GA operators, selection, crossover and mutation, optimizations through GA – single objective and multi objective, applications of GA.

UNIT – IV

Soft Computing Tools: Different tools for soft computing applications – MATLAB, WEKA, FisPro, kappalab, GUAJE Fuzzy.

Uncertainty Quantification: Soft computing for uncertainty modeling and quantification.

Text Books:

1. D. K. Pratihar: Soft Computing Fundamentals and Applications, Alpha Science International.

Reference Books:

1. N. P. Padhy, S P Simon: Soft Computing with MATLAB programming, Oxford University Press, India.
2. S. Kaushik, S. Tiwari: Soft Computing Fundamentals, Techniques and Applications, McGraw Hill India.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Identify the needs of soft computing.

CO2: Differentiate the use of soft computing over other computing techniques.

CO3: Implement the techniques in soft computing for solving problems.

CO4: Inspect methodologies for soft computing for suitable applications.

CO5: Work on various tools for soft computing applications to solve real life problems.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-43(ii) Software Quality & Testing L:4 T:0 P:0

Course Objectives: The course aims to provide students with a deep understanding of Software quality and testing concepts. By exploring software quality metrics, models and evidence class & structural testing.

UNIT – I

Software and Quality Concept: Objectives, overview, Software perspective, Software Quality Control, Software Quality Assurance, Software Quality models, Software Quality measurement and metrics.

Assuring Software Quality Assurance (SQA): Objectives, goals, responsibilities, life cycle, SQA planning, SQA monitoring and controlling, testing, setting standards and procedures, SQA techniques: Management Review Process, Walkthrough, Software inspection process, configuration audits & document verification, Developing and controlling relevant metrics, SQA activities- revision, process evaluation, software standards.

UNIT – II

Software Quality Metrics: Objectives, Software metrics, Software Quality metrics framework, Software Quality metrics features, Development of software quality metrics- SATC's approach, Kitchenham's approach, Abreu's approach, Victor's approach, Selection of software quality metrics- Size related metrics, complexity metrics, Halstead metrics, quality metrics.

Software Quality Models: Objectives, Hierarchical model- factor- criteria metrics model, McCall's model, Boehm model, ISO 9126 model, Dromey's Quality model, Non-hierarchical model-Bayesian belief networks, star model, capability maturity models.

UNIT – III

Software Testing: Introduction, Definition (testing, fault, error, failure, bug, mistake), test oracle, test case, Process, Limitations of Testing, benefits & goals of testing.

Functional Testing: Boundary Value Analysis- Introduction & Definition, Generalizing, limitations, Robustness testing, Worst case testing, Test cases.

Equivalence Class Testing: Introduction & Definition, Weak normal, strong normal, Weak robust, Strong robust, Test cases. Decision Table Based Testing- Introduction & Definition, technique, test cases. Non-functional testing: Acceptance Testing: types, criteria, process.

UNIT – IV

Structural Testing (White Box Testing): Path testing - Introduction & definition, pitfalls & tools for structural testing. DD-path, Test coverage metrics, statement coverage, decision coverage, condition coverage, path coverage McCabe's basis path method, its observations and complexity. Control flow testing, Data Flow Testing: Definition, data flow graphs, data flow model, Data flow testing strategies. Levels of Testing: Traditional view of testing levels, Integration Testing (Decomposition based integration), Unit Testing, System Testing. Metrics and Complexity: Metrics definition, objectives, Linguistic Metrics: definition, LOC, Statement counts, related metrics, Halstead's metrics, token count. Structural Metrics - Definition, Cyclomatic complexity (its calculation & uses), Hybrid Metrics.

Text Books:

1. Boris Beizer, "Software Testing Techniques", dreamtech press.
2. Anirban Basu "Software Quality Assurance Testing & Metrics", PHI Learning.
3. Paul C. Jorgensen, "Software Testing: A Craftsman's approach", CRC Press.

Reference Books:

1. Alan C. Gillies, “Software Quality: Theory & Management”, Cengage Learning.
2. Jeff Tian, “Software Quality Engineering”, Wiley Publication.
3. Nina S Godbole, “Software Quality Assurance: Principles & Practice”, Narosa Publishing House.
4. Aditya P. Mathur, “Fundamentals of Software Testing”, Pearson Education.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Understand the basics Software Quality Assurance (SQA) and use the SQA techniques efficiently.

CO2: Understand the importance of Software Quality metrics and acquire the knowledge about McCall’s, Boehm, ISO 9126 and Dromey’s Quality model.

CO3: Acquire the knowledge about Software testing and skill to perform functional, equivalence, and acceptance testing.

CO4: Calculate Cyclomatic Complexity and perform Unit & System testing.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-43(iii) Machine Learning L:4 T:0 P:0

Course Objectives: The objective of this course is to enable student to perform experiments in Machine Learning using real-world data.

UNIT – I

Introduction: Machine Learning- Introduction, Supervised Learning- Classification, Regression, Unsupervised Learning- Discovering Clusters, Discovering latent factors, Discovering graph Structure, Matrix Completion, Basic Concepts in Machine Learning – Parametric vs Non-parametric models, A simple non-parametric classifier: K – nearest Neighbours, the curse of dimensionality, Parametric models for classification and regression, Linear regression, Logistic regression, Overfitting, Model selection, No free lunch theorem.

Machine Learning Applications: Learning Associations, Classification, Regression, Unsupervised Learning, Reinforcement Learning.

Generative models for discrete data: The Dirichlet-multinomial model – Likelihood, Prior, Posterior, Posterior predictive; Naive Bayes Classifiers - Model fitting, Using the model for prediction, the log-sum-exp trick, Feature selection using mutual information, Classifying documents using bag of words.

UNIT – II

Clustering: Introduction, Mixture Densities, k-Means Clustering, Expectation-Maximization Algorithm, Mixtures of Latent Variable Models, Supervised Learning after Clustering, Spectral Clustering, Hierarchical Clustering, Choosing the Number of Clusters.

UNIT – III

Decision Trees: Introduction, Univariate Trees – Classification Trees, Regression Trees, Pruning, Rule Extraction from Trees, Learning Rules from Data, Multivariate Trees.

UNIT – IV

Design and Analysis of Machine Learning Experiments: Introduction, Factors, Response, and Strategy of Experimentation, Randomization, Replication, and Blocking, Guidelines for Machine Learning Experiments, Cross-Validation and Resampling Methods – k-Fold Cross-Validation, 5*2 Cross-Validation, Bootstrapping, Measuring Classifier Performance, Interval Estimation, Hypothesis Testing, Assessing a Classification Algorithm's Performance - Binomial Test, Approximate Normal Test, t Test, Comparison over Multiple Datasets – Comparing Two algorithms, Multiple Algorithms.

Text Books:

1. Alpaydin, Ethem. Introduction to Machine Learning. United Kingdom, MIT Press, 2014.
2. Murphy, Kevin P. Machine Learning: A Probabilistic Perspective. United States, MIT Press, 2012.

Reference Books:

1. James, Gareth, et al. An Introduction to Statistical Learning: With Applications in R. Germany, Springer New York, 2013.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Learn different methods of machine learning.

CO2: Understand different machine learning models.

CO3: Analyze the techniques for classification of data.

CO4: Implementation of algorithms to predict results of experiments.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-44(i) Digital Image Processing L:4 T:0 P:0

Course Objectives: This course provides a comprehensive understanding of digital image processing, covering acquisition, spatial and frequency domain processing, color image processing, compression, segmentation, and object recognition. Students gain hands-on experience through projects, developing skills to apply image processing techniques effectively in real-world scenarios while emphasizing critical thinking and communication skills.

UNIT – I

Introduction to Digital Image Processing: Overview and Fundamentals, Origins and Evolution of Digital Image Processing, Fields and Applications of Digital Image Processing, Image Acquisition, and Representation, Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Mathematical Tools and Spatial Domain Processing, Basic Relationships between Pixels, Introduction to Mathematical Tools, Intensity Transformations and Spatial Filtering, Histogram Processing.

UNIT – II

Frequency Domain Processing and Image Restoration: Fourier Transform and Frequency Domain Filtering, Preliminary Concepts of Fourier Transform, Sampling and Discrete Fourier Transform, Filtering in the Frequency Domain: Smoothing and Sharpening, Image Restoration Techniques, Image Degradation Models, Noise Models and Reduction Techniques, *Image Restoration:* Spatial and Frequency Domain Filtering, Image Reconstruction and Color Image Processing, Image Reconstruction from Projections, Color Fundamentals and Models, Color Image Processing Techniques.

UNIT – III

Image Compression and Segmentation, Basics of Image Compression, Coding Redundancy and Compression Models, Basic Compression Methods: Huffman, Arithmetic, etc. Advanced Compression Techniques and Morphological Image Processing, Wavelets and Multiresolution Processing, Digital Image Watermarking, Morphological Image Processing: Erosion, Dilation, etc.

UNIT – IV

Image Segmentation and Object Recognition, Segmentation Techniques, Point, Line, and Edge Detection, Thresholding, and Region-Based Segmentation, Segmentation Using Morphological Watersheds, Representation and Description, Boundary Representation and Descriptors, Regional Descriptors and Texture Analysis, Use of Principal Components for Description, Object Recognition, Recognition Based on Decision-Theoretic Methods, structural Methods: Shape Matching, String Matching, etc.

Text Books:

1. Rafael C. Gonzales, Richard E. Woods, Digital Image Processing, Pearson Education.

Reference Books:

1. Anil Jain K., Fundamentals of Digital Image Processing, PHI Learning.
2. Willliam K Pratt, Digital Image Processing, John Willey.
3. Malay K. Pakhira, Digital Image Processing and Pattern Recognition.

Course Outcomes:

By the end of the Course, Student will be able to:

CO1: Understanding Fundamentals: Gain comprehensive knowledge of digital image processing principles and concepts.

CO2: Application of Techniques: Apply various image processing methods to solve real-world problems.

CO3: Critical Thinking: Evaluate and select appropriate techniques for image analysis and optimization.

CO4: Effective Communication: Communicate technical findings through presentations and reports.

CO5: Hands-on Experience: Develop practical skills through projects and collaborative activities.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-44(ii) Internet of Things L:4 T:0 P:0

Course Objectives: The course aims to provide students with a comprehensive understanding of IoT fundamentals, technologies, and applications. Students will explore IoT architecture, web connectivity principles, sensor technology, and design methodologies. They will also learn about security solutions and analyze real-world case studies to apply theoretical knowledge to practical IoT challenges.

UNIT – I

Introduction: Definition, Characteristics of IOT, IOT Conceptual framework, IOT Architectural view, Physical design of IOT, Logical design of IOT, Application of IOT. Machine-to-machine (M2M), SDN (software-defined networking), and NFV (network function virtualization) for IOT, data storage in IOT, IOT Cloud Based Services.

UNIT – II

Design Principles for Web Connectivity: Web Communication Protocols for connected devices, Message Communication Protocols for connected devices, SOAP, REST, HTTP Restful, and Web Sockets. Internet Connectivity Principles: Internet Connectivity, Internet-based communication, IP addressing in IOT, and Media Access control.

UNIT – III

Sensor Technology: Participatory Sensing, Industrial IOT and Automotive IOT, Actuator, Sensor data Communication Protocols, Radio Frequency Identification Technology, Wireless Sensor Network Technology.

UNIT – IV

IOT Design methodology: Prototyping and Designing the Software for IoT Applications, IOT Privacy, security and vulnerabilities solutions, IOT Case studies: smart city streetlights control & monitoring.

Text Books:

1. Raj Kamal, Internet of Things - Architecture and Design Principles, McGraw Hills.

Reference Books:

1. Dimitrios Serpnos, Marilyn Wolf, Internet of Things (IoT) Systems, Architecture, Algorithms, Methodologies, Springer.
2. Vijay Madisetti and Arshdeep Bahga, Internet of Things (A Hands-onApproach), VPT.
3. Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, Apress Publications.

Course Outcomes:

By the end of the Course, Student will be able to:
CO1: Deep Understanding of IoT Fundamentals: Architecture, connectivity, and sensor technologies.
CO2: Proficiency in IoT System Design: Addressing security vulnerabilities and applying solutions.
CO3: Practical Application Skills: Analyzing real-world IoT challenges.
CO4: Effective Collaboration: Communicating findings and proposing solutions.
CO5: Career Readiness: Preparedness for roles in IoT-related industries.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-25-44(iii) Evolutionary Algorithms L:4 T:0 P:0

Course Objectives: The course aims to provide students with a comprehensive understanding of knowledge, evolutionary computing, unsupervised learning and advanced genetic algorithms techniques.

UNIT – I

Knowledge: Introduction and Importance of Knowledge, Knowledge based systems, Knowledge Representation, First Order Predicate Logic (FOPL), Syntax and Semantics of FOPL, Knowledge Organization and Manipulation.

UNIT – II

Un–supervised Learning: Kohonen Self Organization Feature maps and Adaptive Resonance Theory. Introduction to Fuzzy Logic and Fuzzy Sets, Fuzzy Relations, Fuzzyfication, Defuzzyfication. Introduction to Hybrid Soft Computing. Applications of Advanced Computing in Pattern Recognition, Signal Processing & Image Retrieval.

UNIT – III

Introduction to Evolutionary Computing & Genetic Algorithms: Introduction to Genetic Algorithms, Goals of Optimization, Working of Genetic Algorithms, A Simple Genetic Algorithm's Computer Implementation highlighting Reproduction by Selection, Crossover, Mutation.

UNIT – IV

Advanced GA Techniques: Mapping Objective Function to Fitness Form, Fitness scaling, discretization, Different types of Selection and Crossover techniques. A case study of Travelling Salesman Problem using GA Techniques. Introduction to other Evolutionary Techniques: PSO, Simulated Annealing and Ant Colony Optimization.

Text Books:

1. David E. Goldberg, Genetic Algorithms in Search Optimization and Machine Learning, Pearson Education.
2. S. N. Sivanandam, S. N. Deepa, Principles of Soft Computing, Wiley Publications.

Reference Books:

1. How to Solve It: Modern Heuristics, by Zbigniew Michalewicz, David B.Fogel, second Edition Springer Verlag-2004, ISBN- 3-540-22494-7.
2. Gallant Stephen I, Neural Network Learning & Extent Systems, MIT Press, 1993.
3. Alek sander & Morton, Neural Computing, Chapman & Hall, 1991.
4. Kosko, Neural Networks & Fuzzy Systems, PHI, 1991.
5. Dan W. Patterson, 'Introduction to Artificial Intelligence and Expert Systems', Prentice Hall India Private Limited, 2006.

Course Outcomes:

By the end of the Course, Student will be able to:
CO1: Understand the basic concepts of evolutionary algorithms.
CO2: Apply fuzzy logic theory to imprecisely defined problems.
CO3: Evaluation of advanced genetic algorithms for optimized solutions.
CO4: Design high-quality solutions using Genetic Algorithms for optimization and search problems.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.