NEW SCHEME AND SYLLABUS FOR
TWO YEAR POST GRADUATE DEGREE COURSE
MASTER OF COMPUTER APPLICATIONS (M.C.A.)
[W.E.F. 2020-21ADMITTED BATCH]

DEPARTMENT OF INFORMATION TECHNOLOGY AND
COMPUTER APPLICATIONS
AU COLLEGE OF ENGINEERING (AUTONOMOUS)
ANDHRA UNIVERSITY
VISAKHAPATNAM-530 003

MASTER OF COMPUTER APPLICATIONS (M.C.A)
COURSE STRUCTURE AND SCHEME OF VALUATION W.E.F. 2020-21

I SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MCA 1.1	Data Structures and Algorithms	4	--	70	30	100	4
MCA 1.2	Probability, Statistics & Queuing Theory	4	--	70	30	100	4
MCA 1.3	Computer Organization	4	--	70	30	100	4
MCA 1.4	Object Oriented Programming With JAVA	4	--	70	30	100	4
MCA 1.5	Operating Systems	4	--	70	30	100	4
MCA 1.6	Data Structures & Programming Lab	--	3	50	50	100	2
MCA 1.7	Computer Organization Lab	--	3	50	50	100	2
Total		20	6	450	250	700	24

MCA 1.1	DATA STRUCTURES AND ALGORITHMS	
Instruction: 3 Periods & 1 Tut/week		**Credits:4**
Internal: 30 Marks	**University Exam: 70 Marks**	**Total: 100 Marks**

Course Objectives

1. Assess how the choice of data structures and algorithm design methods impacts the performance of programs.
2. Choose the appropriate data structure and algorithm design method for a specified application.
3. Solve problems using data structures such as linear lists, stacks, queues, hash tables, binary trees, heaps, tournament trees, binary search trees, and graphs and writing programs for these solutions.
4. Solve problems using algorithm design methods such as the greedy method, divide and conquer, dynamic programming, backtracking, and branch and bound and writing programs for these solutions.

Course Outcomes

1. Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithm.
2. Demonstrate different methods for traversing trees.
3. Compare alternative implementations of data structures with respect to performance.
4. Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing.

Syllabus

1. **Introduction to Data Structures and Algorithms**: Review of C Programming, , Abstract Data Types, Meaning and Definition of Data Structures, Efficiency of Algorithms, Asymptotic Notations, Time complexity estimation using O notation, Average, Best case and Worst case complexities, Analysis of recursive algorithms, Arrays Operations, single and Multi-dimensional array Representation in memory
2. **Stacks**: Stack as an Abstract Data Type, Primitive Operations, Implementing Stack Operations using Arrays, Infix, Postfix and Prefix: Definitions, Evaluation and Conversions. **Queues**: Queue as an Abstract Data Type, Operations, Implementation using Arrays, Types of Queues, circular Queue, applications.
3. **Linked List**: singly linked list, Circular Lists: Insertion, Deletion and Concatenation Operations, Doubly Linked Lists, Multiply linked lists, applications, Implementation of Stacks, Queues and priority Queues using Linked Lists, Dynamic Memory Management, applications .
4. **Trees and Binary Trees** - Definitions and Terminology, representation of Trees, Binary Tree Terminology, Representation and Traversal, Threaded Binary Trees and their Traversal, Trees and their Applications; Tree Searching: Insertion and Deletion of a node from a Binary Search Tree, AVL Tree operations, Applications
5. **Searching and Hashing**: Basic Searching, Sequential Searching and its Efficiency, Transpose Sequential search, Binary Search, Interpolation Search, Hash Table structure, Hash Functions, Linear open addressing, chaining, applications
6. **Sorting**: General Background: Efficiency of Sorting, Bubble Sort, Selection Sorting, Insertion sort, Shell Sort and Quick Sort, Heap Sort, Merge Radix Sorts and their Efficiency
7. **Graphs and Their Application**: Definition of Graphs, Representation of Graphs, Transitive closure, Linked Representation of Graphs, Graph Traversal and Spanning Forests, Topological sorting of nodes, Undirected Graphs and their Traversals, Applications of Graphs, Minimal Spanning Trees.

Textbooks

1. Data Structures and Algorithms – Concepts, Techniques and Algorithms by G.A.V.Pai , Tata McGraw Hill Publishing
2. Data Structures Using C by Yaddish Langsam, Moshe J. Augenstein and Aaron M.Tanenbaum, Prentice Hall Of India (Low priced Edition)

Reference Books

1. Data Structures using C by E. Balagurusamy, McGraw Hill Education India Pvt Limited
2. Data Structures, Algorithms and Applications with C++, Sahani Mc-Graw Hill.

MCA 1.2	PROBABILITY, STATISTICS & QUEUING THEORY	
Instruction: 3 Periods & 1 Tut/week		Credits:4
Internal: 30 Marks	University Exam: 70 Marks	Total: 100 Marks

Course objectives

1. to provide foundations of probabilistic and statistical analysis
2. to provide an understanding on concepts of probability, random variables, probability distributions, sampling, estimation, hypothesis testing, regression, correlation, multiple regression, hypothesis testing, sample test, queuing methods
3. to explore applications of probabilistic and statistical tools to solve real world problems.

Course outcomes

After completion of the course the student should be able to:

1. define and explain basic concepts in probability theory and how to translate real-world problems into probability models
2. solve standard problems that include random variables, discrete and continuous probability distributions
3. perform Test of Hypothesis and construct a confidence interval to estimate population parameters
4. compute and interpret the results of Correlation Analysis, Multivariate Regression, Chi-Square test for Independence and Goodness of Fit
5. explain basic concepts in Markov processes, M/M/1 and M/M/C queueing systems.

Syllabus

1. **Probability:** Definitions of probability, Addition theorem, Conditional probability, Multiplication theorem, Bayes' Theorem of Probability and Geometric Probability.
2. **Random variables and their properties**: Discrete Random Variable, Continuous Random Variable, Probability Distribution, Joint Probability Distributions their Properties, Transformation Variables, Mathematical Expectations, Probability Generating Functions.
3. **Probability Distributions**: Discrete Distributions : Binomial, Poisson Negative Binominal Distributions And Their Properties; Continuous Distributions : Uniform, Normal, Exponential Distributions And Their Properties.
4. **Multivariate Analysis** : Correlation, Correlation Coefficient, Rank Correlation, Regression Analysis, Multiple Regression, Attributes, Coefficient Of Association, Chi Square Test For Goodness Of Fit, Test For Independence.
5. **Estimation**: Sample, Populations, Statistic, Parameter, Sampling Distribution, Standard Error, Un-biasedness, Efficiency, Maximum Likelihood Estimator, Notion & Interval Estimation.
6. **Testing of Hypothesis**: Formulation of Null hypothesis, critic al region, level of significance, power of the test;
7. **Sample Tests**: Small Sample Tests : Testing equality of .means, testing equality of variances, test of correlation coefficient, test for Regression Coefficient; Large Sample tests: Tests based on normal distribution

8. **Queuing Theory** : Queue description, characteristics of a queuing model, study state solutions of M/M/1: Model, M/M/1 ; N Model, M/M/C: Model, M/M/C: N Model , Case studies

Text Books

1. Probability & Statistics for Engineers and Scientists,Walpole, Myers, Myers, Ye. Pearson Education.
2. Probability, Statistics and Random Processes T.Veerarajan Tata McGraw – Hill

Reference Book

1. Probability & Statistics with Reliability, Queuing and Computer Applications, Kishor S. Trivedi, Prentice Hall of India ,1999

MCA 1.3	COMPUTER ORGANIZATION	
Instruction: 3 Periods & 1 Tut/week		Credits:4
Internal: 30 Marks	University Exam: 70 Marks	Total: 100 Marks

Course objectives

1. to introduce students to the foundations of computer organization and architecture including register transfer logic and arithmetic operations
2. to explore the different types of addressing modes and memory organization
3. to expose students to the basic architecture and functionality of processing, memory and I/O organization in a computer system.
4. to introduce students to the design and implementation of simple CPU and micro-sequencer.

Course outcomes

After completion of the course the student should be able to:

1. describe the internal organization of a computer, CPU, memory unit, input/outputs and the functional units of a processor
2. manipulate representations of numbers stored in digital computers
3. explain addressing modes, instruction formats and program control statements
4. understand the theory and architecture of central processing unit and micro-sequencer.

Syllabus

1. **Introduction to Computer Organization**, CPU Organization, Memory subsystem Organization, and Interfacing, I/O Subsystem Organization and Interfacing, a relative Simple Computer, An8085 Based Computer
2. **Computer arithmetic & Digital Logic Fundamentals**: Unsigned, Notation, Signed Notation, Binary Code Decimal, Specialized Arithmetic Hardware, Floating Point Numbers, The IEEE 754 Floating Point Standard; Boolean Algebra, Basic functions, Mapping Boolean Functions, Combinatorial Logic, Combinational Circuits, Sequential circuits.
3. **Register Transfer Languages**: Micro Operations and Register Transfer Language, RTL Specification, Digital systems, More Complex Digital Systems, VHDL-VHSIC Hardware Description Language
4. **Instruction Set architecture**: Levels of Programming Languages,< Assembly Language Instructions, Instruction Set Architecture Design, A Relatively Sample Instruction Set Architecture, 8085 Microprocessor Instruction Set Architecture.
5. **CPU Design**: Specifying a CPU, Design & Implementation of a Very Simple CPU, Short comings of the simple CPUs, Internal Architecture of the 8085 microprocessor.
6. **Microprocessor Control Unit Design**: Basic Micro-sequencer Design, Design and Implementation of very simple Micro-sequencer, Reducing the number of Micro Instructions, Micro-prgrammed controls Hardware Control, A(Mostly) Micro-coded CPU, The Pentium Microprocessor.

7. **Memory & I/O Organization**: Hierarchical Memory systems, Cache Memory Systems, Virtual Memory., Memory Management in a Pentium/Windows Personal computer, Input/output Organization, Organization of Asynchronous Data Transfers, Programmed I/O, Interrupts, Directory Memory Acess,I/OProcessors, Serial Communications, Serial Communication Standards.

Text Book

1. Computer Systems Organization & Architecture, John D. Carpinelli, Addison Wesley Longman, Inc ./ Pearson Education , 1993

Reference Books

1. Computer System Architecture, M. Morris Mano, Third Edition, Pearson Education, 2007
2. Computer Architecture and organization: Design Principles and Applications, B. Govindarajalu, TMH Publishing Company Ltd., 2004
3. Fundamentals of Computer organization and Design, Sivarama P. Dandamudi Springer International Edition, 2004

MCA 1.4	OBJECT ORIENTED PROGRAMMING WITH JAVA	
Instruction: 3 Periods & 1 Tut/week		Credits:4
Internal: 30 Marks	University Exam: 70 Marks	Total: 100 Marks

Course Objectives

1. To understand Object Oriented Programming concepts, class hierarchy, characteristics of Java, inheritance and polymorphism and become familiar with the relationship between classes and objects in a Java program.
2. Learn programming based on JAVA 7 and above.
3. To write efficient and effective applications in Java, Java's event handling model, graphical user interface (GUI), swing component set, understand the relationship between the AWT and Swing.
4. Have a better understanding of Java's event model and design, build simple Graphical User Interfaces (GUI)s, Networking, Java Database Connectivity with JDBC™, Servlets, JavaServer Pages (JSP).

Course outcomes

1. The course aims to make the students learn programming in Java. Java language elements and characteristics, including data types, operators, and control structures are discussed in order to make the students develop Java applications.
2. The course also intended for students who would like to learn how to develop internet based applications, graphical user interface (GUI), and graphics in both AWT and SWING.
3. Advanced Java topics discussed helps students writing programs for Java database connectivity with JDBC; Manipulating databases with JDBC; Programming for Internet, JavaServer pages.

Syllabus

1. Introduction to Computers, Programming, and Java; Elementary Programming; Selections; Mathematical Functions, Characters, and Strings; Loops;
2. Methods; Single-Dimensional Arrays; Multidimensional Arrays; Objects and Classes; Object-Oriented Thinking;
3. Inheritances and Polymorphism; Exception Handling and Text I/O; Abstract Classes and Interfaces.
4. JavaFX Basics; Event-Driven Programming and Animations;
5. JavaFX UI Controls and Multimedia; Multithreading and Parallel Programming;
6. Networking; Java Database Programming ;
7. Servlets; JavaServer Pages.

Text Book

1. Introduction to Java Programming Comprehensive version, Y. Daniel Liang, Tenth Edition, Pearson Education, Inc.

Reference Books

1. Object Oriented Programming Through Java, P. Radha Krishna, CRC Press.
2. Java And Object Oriented Programming Paradigm, Debasish Jana, PHI Learning Pvt. Ltd.

MCA 1.5	OPERATING SYSTEMS	
Instruction: 3 Periods & 1 Tut/week		Credits:4
Internal: 30 Marks	University Exam: 70 Marks	Total: 100 Marks

Course objectives

1. to provide overview of types of operating systems, operating system calls and services
2. to introduce the notion of a process and various stages of processes, including scheduling, creation, and termination
3. to explore inter-process communication using shared memory and message passing and to introduce the critical-section problem
4. to introduce CPU scheduling and various CPU-scheduling algorithms
5. to develop a description of deadlocks and different methods for preventing or avoiding deadlocks
6. to explore various techniques of allocating memory to processes, how paging works, the concepts of virtual memory, demand paging and page-replacement algorithms
7. to describe the details of implementing local file systems and directory structures and to introduce the characteristics of mass-storage devices, disk scheduling.

Course outcomes

After completion of the course the student should be able to:

1. describe the basic concepts of operating systems, including structure and components
2. explain how memory, I/O devices, files, processes and threads are managed, and evaluate the performance of various scheduling algorithms
3. explain the concepts covered in concurrency control, including mutual exclusion and synchronization, deadlock and starvation
4. understand key concepts on physical and virtual memory, scheduling, I/O and file systems and mass storage structures.

Syllabus

1. **Introduction to Operating Systems**: Over view of Operating Systems, Types Of Operating Systems, Operating System Structures, Operating-System Services, System Calls, Virtual Machines, Operating System Design and Implementation.
2. **Process Management**: Process Concepts, Operations On Processes, Cooperating Processes, Threads, Inter Process Communication, Process Scheduling, Scheduling Algorithms, Multiple - Processor Scheduling. Thread Scheduling.
3. **Process Synchronization**: The Critical Section Problem, Semaphores, And Classical Problems Of Synchronization, Critical Regions, Monitors, Synchronization examples
4. **Deadlocks**: principles of Deadlocks,-System Model, Deadlocks Characterization, Methods For Handling Deadlocks, Deadlock- Prevention, Avoidance, Detection,& Recovery from Deadlocks
5. **Memory Management**: Logical Versus Physical Address, Swapping, contiguous memory allocation, paging, structure of the page table , segmentation, , Virtual Memory, Demand Paging, Page Replacement Algorithms, Thrashing

6. **File System Implementation**: Concept of a file, Access Methods, Directory Structure, Protection, File System Structure, Allocation Methods, Free Space Management, Directory Management, Device Drivers
7. **Mass-storage structure**: overview of Mass-storage structure, Disk structure, disk attachment, disk scheduling, swap-space management.

Text Book

1. Operating Systems, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Wiley John Publ., Seventh Edition.

Reference Books

1. Operating Systems, William Stallings 5th Edition - PHI
2. Operating Systems: A Design-Oriented Approach', Charles Crowley, 'Tata Hill Co.,1998 edition.
3. Modern Operating Systems, Andrew S.Tanenbaum, , 2nd edition, 1995, PHI.
4. Operating Systems - A concept based approach, Dhamdhere, 2nd Edition, TMH, 2006.
5. Understanding the Linux Kernel, Daniel P Bovet and Marco Cesati, 3rd Edition,' Reilly, 2005.

MCA 1.6	DATA STRUCTURES AND PROGRAMMING LAB	
Instruction: 3 Periods/week		Credits:2
Internal: 50 Marks	University Exam: 50 Marks	Total: 100 Marks

Course Objectives

1. To implement stacks and queues using arrays and linked lists.
2. To develop programs for searching and sorting algorithms.
3. To write programs using concepts of various trees.
4. To implement programs using graphs.

Course Outcomes

1. Student will be able to write programs to implement stacks and queues.
2. Ability to implement various searching and sorting techniques.
3. Ability to implement programs using trees and graphs.

List of Programs

1. Write a program for sorting a list using Bubble sort and then apply binary search.
2. Write a program to implement the operations on stacks.
3. Write a program to implement the operations on circular queues.
4. Write a program for evaluating a given postfix expression using stack.
5. Write a program for converting a given infix expression to postfix form using stack.
6. Write a program for implementing the operations of a priority queue using dynamic allocation.
7. Write a program for the representation of polynomials using circular linked list and for the addition of two such polynomials
8. Write a program for quick sort
9. Write a program for Merge sort.
10. Write a program for Heap sort
11. Write a program to create a binary search tree and for implementing the in order, preorder, post order traversal using recursion
12. a)Write a program for finding the transitive closure of a digraph

    b)Write a program for finding the shortest path from a given source to any vertex in a digraph using Dijkstra's algorithm.

MCA 1.7	COMPUTER ORGANIZATION LAB	
Instruction: 3 Periods/week		Credits:2
Internal: 50 Marks	University Exam: 50 Marks	Total: 100 Marks

Course objectives

1. to design and analyze the operational behavior of IC gates, multiplexers, decoders, flip-flops, counters, shift registers, binary adders and subtractors and ALU
2. to implement assembly language programming using various trainers
3. to make students familiar with Pentium class PC architecture

Course outcomes

After completion of the course the student should be able to:

1. analyze the operational behavior of various digital logic units such as multiplexers, decoders, flip-flops, counters, shift registers, binary adders and subtractors and ALU
2. write assembly language code using various trainers
3. understand Pentium class PC architecture.

I - Cycle: Digital Logic Design Experiments

1. TTL Characteristics and TTL IC Gates
2. Multiplexers & Decoders
3. Flip-Flops
4. Counters
5. Shift Registers
6. Binary Adders & Subtractors
7. A L U

II - CYCLE: 8085 Assembly Language Programming

1. 8085 Assembly Language Programming according to theory course microprocessors-I using the following trainers:

   Keyboard Monitor of 8085µP Trainer

   Serial Monitor of 8085µP Trainer with Terminal

   8085 Line Assembler of 8085µP Trainer with PC as Terminal

   8085 Cross Assembler using In-Circuit Emulator (ICE) with 8085µP Trainer and PC as Terminal

   Graded Problems are to be used according to the syllabus of COMPUTER ORGANIZATION
2. PENTIUM CLASS PC ARCHITECTURE FAMILIARIZATION HARDWARE & SOFTWARE PARTS DEMONSTRATION

II Semester

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MCA 2.1	Web Technologies	4	--	70	30	100	4
MCA 2.2	Data Base Management Systems	4	--	70	30	100	4
MCA 2.3	Artificial Intelligence	4	--	70	30	100	4
MCA 2.4	Business Analytics	4	--	70	30	100	4
MCA 2.5	Elective-I	4	--	70	30	100	4
MCA 2.6	Web Technologies Lab	--	3	50	50	100	2
MCA 2.7	Data Base Management Systems Lab	--	3	50	50	100	2
Total		20	6	450	250	700	24

Elective I

Computer Graphics/Embedded Systems/Formal Languages and Automata Theory/Management Accountancy

MCA 2.1	WEB TECHNOLOGIES	
Instruction: 3 Periods & 1 Tut/week		Credits:4
Internal: 30 Marks	University Exam: 70 Marks	Total: 100 Marks

Course objectives

1. to familiarize students with the formats and languages used in modern web-pages including HTML, CSS, XML, Javascript, DOM
2. to establish database connectivity using JDBC and implement embedded SQL
3. to introduce students to the concepts of servlet, JSP, client request handling and response and MVC architecture.

Course outcomes

After completion of the course the student should be able to:

1. understand and be able to analyse any real time web application
2. acquire working knowledge to develop web applications using both client side and server side scripting and retrieving data from databases
3. appreciate the importance of MVC architecture pattern in development of web applications.

Syllabus

1. Introduction to HTML , Core Elements , Links and Addressing, Images , Text , Colors and Background, Lists, Tables and Layouts , Frames, Forms , Cascading Style Sheets.
2. Introduction to Java Scripts, Elements of Objects in Java Script, Dynamic HTML with Java Script
3. Document type definition, XML Syntax, XML Schemas, Document Object model, Presenting XML, Using XML Processors
4. JDBC OBJECTS- JDBC Driver Types, JDBC Packages, Database Connection, Statement Objects, Result Set.
5. JDBC and Embedded SQL - Tables, Inserting Data into Tables , Selecting Data from a Table, Meta Data ,Updating Table , Deleting data from Table , Joining Table , Calculating Data, Grouping and Ordering Data , Sub quires ,View.
6. Introduction to Servlet, Servlet Life Cycles, Servlet Basics, Tomcat Web Server, Configuring Apache Tomcat, Handling Client Request and Response, Handling Cookies, Session Tracking
7. Introduction to JSP, Benefits of JSP, Basic Syntax, Invoking Java code with JSP Scripting Elements, JSP Page Directive, Including Files in JSP Pages,
8. Introduction to Java Beans, Using JAVA Bean Components in JSP Documents, MVC Architecture.

Text Books

1. Web Programming, building internet applications, 2nd Ed., Chris Bates, Wiley Dreamtech
2. The complete Reference HTML and DHTML, Thomas A. Powey
3. The complete Reference J2ME, James Keogh
4. Core Servlets and Java Server Pages, Marty Hall Larry Brown, Second Edition

Reference Books

1. Internet , World Wide Web , How to program, Dietel , Nieto, PHI/PEA
2. Web Technologies, Godbole, Kahate, 2nd Ed., TMH

MCA 2.2	DATA BASE MANAGEMENT SYSTEMS	
Instruction: 3 Periods & 1 Tut/week		Credits:4
Internal: 30 Marks	University Exam: 70 Marks	Total: 100 Marks

Course objectives

1. to introduce students to the database concepts of relational model, relational algebra, SQL and various database design architectures
2. to understand conceptual database design, ER diagrams, functional dependencies and standard database design practices such as normalization
3. to familiarize students with database application design tools including embedded SQL, JDBC, cursors and stored procedures
4. to understand transaction management, concurrency control and recovery systems.

Course outcomes

After completion of the course the student should be able to:

1. apply formal database ideas of ER diagrams, functional dependencies and normalization in development of real world database applications
2. be familiar with modern database application design tools and interfaces
3. understand the notion of concurrency, its importance in transactions and various recovery techniques.

Syllabus

1. **Database Systems**: Introduction to the Database Systems, Concepts of Relational Models and Relational Algebra. SQL: Introduction to SQL Queries, Integrity Constraints, Joins, Views, Intermediate and Advanced SQL features and Triggers.
2. **Database Design**: Overview of the Design process, E-R Models, Functional dependencies and other kinds of dependencies, Normal forms, Normalization and Schema Refinement.
3. **Database Application Design and Development**: User Interfaces and Tools, Embedded SQL, Dynamic SQL, Cursors and Stored procedures, JDBC, Security and Authorization in SQL, Internet Applications.
4. **Query Evaluation**: Overview, Query processing, Query optimization, Performance Tuning.
5. **Database System Architectures**: Centralized and Client-Server Architecture, Server system Architecture, Parallel and Distributed database, Object based databases and XML. Advanced data types in databases. Cloud based data storage systems.
6. **Transaction Management**: Overview of Transaction Management, Transactions, Concurrency control, Recovery systems, Advanced Transaction Processing.
7. **Case Studies**: Postgre SQL, Oracle, IBM DB2 Universal Database, Microsoft SQL Server.

Text Book

1. Database System Concepts, Avi Silberschatz , Henry F. Korth , S. Sudarshan McGraw- Hill, Sixth Edition, ISBN 0-07-352332-1.

Reference Book

1. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke,McGraw-Hill.

MCA 2.3	ARTIFICIAL INTELLIGENCE	
Instruction: 3 Periods & 1 Tut/week		Credits:4
Internal: 30 Marks	University Exam: 70 Marks	Total: 100 Marks

Course objectives

1. to introduce students to the key concepts in AI, standard AI problems and techniques
2. to formulate AI problems as state space search and understand the standard search techniques including BFS, DFS, heuristic search techniques, hill climbing, Best-First Search, A* Algorithm, AO*Algorithm, Constraint Satisfaction, Means-Ends Analysis
3. to understand how knowledge is represented in computers, the various structured representations and symbolic logic
4. explore the key ideas in Expert Systems and Natural Language Processing.

Course outcomes

After completion of the course the student should be able to:

1. understand AI problem characteristics and state space approach for solving AI problem. The student will have learned several optimal search strategies and the use of heuristics
2. understand relational, inferential, inheritable and procedural knowledge and the corresponding knowledge representation approaches
3. acquire AI problem solving approaches to natural language processing, planning and expert systems.

Syllabus

1. **Introduction to Artificial Intelligence**: Artificial Intelligence, AI Problems, AI Techniques, The Level of the Model, Criteria For Success. Defining the Problem as a State Space Search, Problem Characteristics , Production Systems, , Production System Characteristics
2. **Search**: Issues in The Design of Search Programs, Un-Informed Search, BFS, DFS; Heuristic Search Techniques: Generate-And- Test, Hill Climbing, Best-First Search, A* Algorithm, Problem Reduction, AO*Algorithm, Constraint Satisfaction, Means-Ends Analysis.
3. **Knowledge Representation**: Procedural Vs Declarative Knowledge, Representations and Mappings, Approaches to Knowledge Representation, Issues in Knowledge Representation, Logic Programming Forward Vs Backward Reasoning,
4. **Symbolic Logic**: Propositional Logic, First Order Predicate Logic: Representing Instance and is- a Relationships, Computable Functions and Predicates, Syntax & Semantics of FOPL, Normal Forms, Unification &Resolution, Representation Using Rules, Natural Deduction.
5. **Structured Representations of Knowledge**: Semantic Nets, Partitioned Semantic Nets, Frames, Conceptual Dependency, Conceptual Graphs, Scripts, Matching Techniques, Partial Matching, Fuzzy Matching Algorithms and RETE Matching Algorithms.
6. **Reasoning under Uncertainty**: Introduction to Non-Monotonic Reasoning, Truth Maintenance Systems, Statistical Reasoning: Bayes Theorem, Certainty Factors and Rule-Based Systems, Bayesian Probabilistic Inference, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic & Fuzzy Systems.

7. **Experts Systems**: Overview of an Expert System, Structure of an Expert Systems, Different Types of Expert Systems- Rule Based, Model Based, Case Based and Hybrid Expert Systems, Knowledge Acquisition and Validation Techniques, Black Board Architecture, Knowledge Building System Tools, Expert System Shells
8. **Natural Language Processing**: Role of Knowledge in Language Understanding, Approaches Natural Language Understanding, Steps in The Natural Language Processing, Syntactic Processing and Augmented Transition Nets, Semantic Analysis, NLP Understanding Systems; Planning, Components of a Planning System, Goal Stack Planning, Hierarchical Planning, Reactive Systems.

Text Book

1. Artificial Intelligence, Elaine Rich, McGraw-Hill Publications

Reference Books

1. Introduction To Artificial Intelligence & Expert Systems, Patterson, PHI
2. Artificial Intelligence, George F Luger, Pearson Education Publications
3. Artificial Intelligence, Robert Schalkoff, Mcgraw-Hill Publications

MCA 2.4	BUSINESS ANALYTICS	
Instruction: 3 Periods & 1 Tut/week		Credits:4
Internal: 30 Marks	University Exam: 70 Marks	Total: 100 Marks

Course objectives

1. to introduce students to problem solving with Business Analytics and the use of spreadsheets for descriptive analytics, data queries and visualization
2. to introduce students to statistical sampling, sampling distributions, confidence intervals and statistical inference
3. to familiarize students with various types of regression including simple linear regression and multiple linear regression
4. to introduce students to key concepts in statistical forecasting models for time series data
5. to familiarize students with predictive decision modeling, model analysis and developing spreadsheet applications including building linear optimization models on spreadsheets.

Course outcomes

After completion of the course the student should be able to:

1. describe data and models used for Business Analytics and apply various descriptive analytic techniques to analyze data
2. estimating population parameters, interval estimates, construct confidence intervals and perform hypothesis testing
3. estimate and interpret the parameters of simple linear regression and multiple linear regression
4. apply forecasting models for various time series data including stationary time series, time series with linear trend and time series with seasonality
5. implement models on spreadsheets, develop user-friendly applications and build linear poptimization models on spreadsheets.

Syllabus

1. **Foundations of Business Analytics**: Evolution of Business Analytics, Scope, data and models for Business Analytics, problem solving with Business Analytics, Analytics on spreadsheets, Excel functions for Database queries, Add-ons for Business Analytics. **Descriptive Analytics**: Data visualization, creating charts in MS Excel, Data Queries, Tables, sorting and filtering, Data summarization with statistics, Data exploration using Pivot tables
2. **Statistical Sampling:** methods, estimating population parameters, sampling error, sampling distributions, interval estimates, confidence intervals, using confidence intervals for decision making, prediction intervals

   Statistical Inference: Hypothesis testing, one-sample Hypothesis testing, two-tailed test of Hypothesis for mean, two-sample Hypothesis testing, Analysis of variance, chi-square test for independence
3. **Trendliness and Regression:** Modelling Relationships and trends in data, Simple linear regression, least squares regression, regression on analysis of variance, testing hypothesis for regression coefficients, Confidence intervals for regression coefficients, Residual analysis and regression

assumptions, Multiple linear regression, building regression models, regression with categorical independent variables with two or more levels, regression with nonlinear terms, advanced techniques for regression modelling

4. **Forecasting Techniques:** Qualitative and judgemental forecasting, statistical forecasting models, forecasting models for stationery time series, forecasting models for time series with linear trend, forecasting models for time series with seasonality, selecting appropriate time-series-based forecasting models, regression forecasting with casual variables, practice of forecasting
5. **Spreadsheet modeling and Analysis:** Strategies for predictive decision modelling, Implementing models on spreadsheet, spreadsheet applications in Business analytics, Model assumptions, complexity and realism, developing user-friendly applications, analyzing uncertainty and model assumptions, model analysis using analytics solver platform
6. **Linear Optimization & Applications:** Building Linear Optimization Models on spreadsheets, solving Linear Optimization models, Graphical interpretation of linear optimization, Using optimization models of prediction and insight, Types of constraints in optimization models, process selection models, Blending Models, Portfolio Investment models

Text Book

1. "Business Analytics: Methods, Models, and Decisions" James R. Evans, Pearson Publications, Second edition

Reference Book

1. "Business Analytics: The Science of Data-Driven Decision Making", U.Dinesh Kumar, Wiley Publications

MCA 2.5	Elective - I COMPUTER GRAPHICS	
Instruction: 3 Periods & 1 Tut/week		Credits:4
Internal: 30 Marks	University Exam: 70 Marks	Total: 100 Marks

Course Objectives

1. Provides a comprehensive introduction to computer graphics with a foundation in Graphics Applications.
2. A thorough introduction to computer graphics techniques.
3. To give the basics of Geometric Transformations and projections.
4. To introduce three dimensional concepts and object representations with color models and basics of computer animation.

Course Outcomes

1. The students will understand graphics principles and graphics hardware.
2. The students can demonstrate geometrical transformations.
3. The students can create interactive graphics applications and demonstrate computer graphics animation.

Syllabus

1. **Introduction:** Computer Graphics and their applications: Computer Aided Design, Computer Art, Entertainment, Education and Training, Graphical User Interfaces; Overview of Graphics systems: Video Display Devices, Raster Scan Systems, Random Scan Systems, Graphics Monitors And Workstations, Input Devices, Hard Copy Devices, Interactive Input Methods, Windows and Icons, Virtual Reality Environments, Graphics Software
2. **Output primitives:** Points and Lines, **,** Line and Curve Attributes, Color and Gray scale levels, Antialiasing, Loading the Frame buffer, Line function, Line Drawing Algorithms, Circle Generating Algorithms, Ellipse Generating Algorithms, Pixel Addressing, Area Fill Attributes, Filled Area Primitives, Filled Area Functions, Cell Array, Character Generation, Character Attributes, Bundled Attributes, Curve Functions, Parallel Curve Algorithms.
3. **Two Dimensional Transformations:** Basic 2D Transformations, Matrix Representations, Homogeneous Coordinates, Composite Transformations, Other Transformations, Transformations between Coordinate Systems, AffineTransformations.
4. **Three Dimensional Transformations & Projections:** Translation, Rotation, Scaling, Other Transformations, Composite Transformations, 3D Transformation Functions, Modeling and Coordinate Transformations, Need for projections, Parallel & Perspective projections, General Projection Transformations.
5. **Viewing Pipeline and Clipping operations :** Viewing Pipeline ,Viewing Coordinates & Reference frames, Window-to-Viewport Coordinate Transformation, Two Dimensional Viewing Functions, , Three Dimensional Viewing, View Volumes, Clipping and its Operations, Types of clipping operations- Point Clipping, Line Clipping, Polygon Clipping,, Curve Clipping,, Text and Exterior Clipping.
6. **Three Dimensional Concepts and Object representations:** 3D display methods, 3D Graphics, Polygon Surfaces, Curved Lines and Surfaces, Quadratic Surfaces, Super Quadrics, Blobby Objects, SplineRepresentations, Cubic Spline methods, Bézier Curves and Surfaces, B-Spline Curves and Surfaces.

7. **Color Models and Basics of Computer Animation:** Intuitive color concepts, Basics of RGB Color model, YIQ Color Model, CMY & HSV Color models. Design of animation Sequences, Raster Animations, Key Frame systems: Morphing, A Simple program on Animation.

Text Book

1. Computer Graphics, Donald Hearn & M. Pauline Baker, Pearson Education, NewDelhi.

Reference Books

1. Procedural Elements for Computer Graphics, David F.Rogers, Tata Mc Graw Hill Book Company, NewDelhi, 2003.
2. Computer Graphics: Principles & PracticeinC, J.D.Foley, S.KFeiner, AVanDam F.H John Pearson Education, 2004.
3. Computer Graphics using Open GL, Franscis S Hill Jr, Pearson Education, 2004.
4. Computer Vision and Image Processing: A Practical Approach using CVIP tools, S.E. Umbaugh, Prentice Hall, 1998.

MCA 2.5	Elective-I EMBEDDED SYSTEMS	
Instruction: 3 Periods & 1 Tut/week		Credits:4
Internal: 30 Marks	University Exam: 70 Marks	Total: 100 Marks

Course objectives

1. to make students familiar with embedded system architecture, Microprocessor Architecture, Round–Robin Architecture and typical hardware of an embedded system
2. to understand the concept of shared data and semaphores, message queues and RTOS design
3. to understand how to get the embedded software into target system and testing on host machine.

Course outcomes

After completion of the course the student should be able to:

1. describe embedded system architecture and its typical hardware
2. understand tasks and task states, shared data and semaphores, message queues
3. test embedded software on host machines using instruction set simulators

Syllabus

1. **Examples of Embedded Systems** – Typical Hardware – Memory – Microprocessors – Busses – Direct Memory Access – Introduction to 8051 Microcontroller – Architecture-Instruction set – Programming
2. **Microprocessor Architecture** – Interrupt Basics – The Shared-Data problem – Interrupt Latency.
3. **Round–Robin Architecture** - Round–Robin with Interrupts Architecture - Function-Queue-Scheduling Architecture – Real-Time Operating Systems Architecture – Selection of Architecture.
4. **Tasks and Task States** – Tasks and Data – Semaphores and Shared Data – Semaphore Problems – Semaphore variants.
5. **Message Queues** – Mailboxes – Pipes – Timer Functions – Events – Memory Management – Interrupt Routines in RTOS Environment.
6. **RTOS design** – Principles – Encapsulation Semaphores and Queues – Hard Real- Time Scheduling Considerations – Saving Memory Space – Saving Power.
7. **Host and Target Machines** – Linker/Locator for Embedded Software- Getting Embedded Software into the Target System.
8. **Testing on your Host Machine** – Instruction Set Simulators – Laboratory Tools used for Debugging.

Text Book

1. The 8051 Microcontroller Architecture, Programming & Applications, Kenneth J. Ayala, Penram International.
2. An Embedded Software Primer, David E. Simon, Pearson Education , 2005.

Reference Book

1. Embedded Systems: Architecture , Programming and Design, Raj Kamal, Tata McGraw-Hill Education, 2008

MCA 2.5	Elective - I FORMAL LANGUAGES & AUTOMATA THEORY	
Instruction: 3 Periods & 1 Tut/week		Credits:4
Internal: 30 Marks	University Exam: 70 Marks	Total: 100 Marks

Course objectives

1. to introduce students to the concepts in automata theory and theory of computation to design grammars and recognizers for different formal languages
2. to employ finite state machines to solve problems in computing
3. to introduce context free grammars and Turing Machines and their properties as the basis for the formal expressivity of computer languages
4. to understand the concepts of tractability and decidability, the concepts of NP-completeness and NP-hard problems.

Course outcomes

After completion of the course the student should be able to:

1. think analytically for problem-solving situations in related areas of theory in computer science
2. describe the language accepted by an automata or generated by a regular expression or a context-free grammar
3. understand the functioning of Finite-State Machines, Deterministic Finite-State Automata, Nondeterministic Finite-State Automata and Pushdown Automata and Turing Machines.

Syllabus

1. **Finite Automata and Regular Expressions**: Basic Concepts of Finite State Systems, Deterministic and Non-Deterministic Finite Automata, Finite Automata with ϵ-moves, Regular Expressions, Mealy and Moore Machines, Two-Way Finite Automate, Applications of FSM.
2. **Regular sets & Regular Grammars**: Basic Definitions of Formal Languages and Grammars, Regular Sets and Regular Grammars, Closure Properties of Regular Sets, Pumping Lemma for Regular Sets, Decision Algorithm for Regular Sets, Myhill-Nerode Theorem, Minimization of Finite Automata.
3. **Context Free Grammars and Languages**: Context Free Grammars and Languages, Derivation Trees, Simplification of Context Free Grammars, Normal Forms, Pumping Lemma for CFL, Closure properties of CFL's, Decision Algorithm for CFL.
4. **Push down Automata**: Informal Description, Definitions, Push-Down Automata and Context free Languages, Parsing and Push-Down Automata.
5. **Turing Machines**: The Definition of Turing Machine, Design and Techniques for Construction of Turing Machines, Combining Turing Machines.
6. **Universal Turing Machines and Undecidability** : Universal Turing Machines. The Halting Problem, Variants of Turing Machines, Restricted Turing Machines , Decidable & Undecidable Problems - Post Correspondence Problem.
7. **Chomsky Hierarchy of Languages:** Regular Grammars, Unrestricted Grammars, Context Sensitive languages, Relationship between Classes of Languages.

Text Book

1. Introduction to Automata Theory, Languages and Computations – J.E. Hopcroft, & J.D. Ullman , Pearson Education Asia.

Reference Books

1. Introduction to languages and theory of computation – John C. Martin (MGH)
2. Theory of Computation, KLP Mishra and N. Chandra Sekhar, IV th Edition, PHI
3. Introduction to Theory of Computation – Michael Sipser (Thomson Nrools/Cole)

MCA 2.5	Elective - I MANAGEMENT ACCOUNTANCY	
Instruction: 3 Periods & 1 Tut/week		Credits:4
Internal: 30 Marks	University Exam: 70 Marks	Total: 100 Marks

Course objectives

1. to introduce students to fundamental concepts in accounting, double entry book keeping and the basic books of accounts
2. to analyze financial statements by using ratio analysis and Fund Flow Statement
3. to explore the basic principles of budgetary control, marginal costing and break-even analysis
4. to familiarize students with computerized accounting systems

Course outcomes

After completion of the course the student should be able to:

1. prepare Trading, Profit And Loss Account And Balance Sheet of sole proprietary concerns
2. calculate key financial indicators using ratio analysis and prepare Fund Flow Statement
3. understand the key concepts in marginal costing and construct Break Even Chart.

Syllabus

1. **Principles Of Accounting** : Nature And Scope Of Accounting, Double Entry System Of Accounting, Introduction To Basic Books Of Accounts Of Sole Proprietary Concern, Closing Of Books Of Accounts And Preparation Of Trial Balance.
2. **Final Accounts** : Trading, Profit And Loss Accounts And Balance Sheet Of Sole Proprietary Concern With Normal Closing Entries. (With numerical problems)
3. **Ratio Analysis**: Meaning, Advantages, Limitations, Types of Ratio and Their Usefulness. (Theory only) Fund Flow Statement: Meaning Of The Term Fund, Flow Of Fund, Working Capital Cycle, Preparation and Inter-preparation Of Statement.
4. **Costing**: Nature, Importance And Basic Principles. Budget and Budgetary Control: Nature And Scope, Importance Method Of Finalization And Master Budget, Functional Budgets.
5. **Marginal Costing** : Nature, Scope, Importance, Construction Of Break Even Chart, Limitations And Uses Of Break Even Chart, Practical Applications Of Marginal Costing.(with numerical problems)
6. **Introduction To Computerized Accounting System**: Coding Logic And Codes Required, Master Files, Transaction Files, Introduction To Documents Used For Data Collection, Processing Of Different Files And Outputs Obtained.

Text Books

1. Introduction to Accountancy. T.S.Grewal.
2. Management Accountancy, S .P.Jain.

Reference Book

1. Introduction To Accounting, G.Agarwal

MCA 2.6	WEB TECHNOLOGIES LAB	
Instruction: 3 Periods/week		**Credits:2**
Internal: 50 Marks	**University Exam: 50 Marks**	**Total: 100 Marks**

Course objectives

1. to introduce students to design of web pages learn and practice client and server side programming
2. to understand database connectivity and implement web enabling of databases
3. to apply multimedia effects on web pages.

Course outcomes

After completion of the course the student should be able to:

1. design web pages using modern web constructs and client and server side programming.
2. enable database connectivity to websites
3. apply multimedia effects on web pages design using Flash.

List of programs

1. Design of the Web pages using various features of HTML and DHTML
2. Client server programming using Servlets, ASP and JSP on the server side and java script on the client side
3. Web enabling of databases
4. Multimedia effects on web pages design using Flash.
5. Case Study: Design & Development of Websites with Database Connectivity and Multimedia Effects

Reference Books

1. Internet and Web Technologies by Raj Kamal, Tata McGraw-Hill
2. Programming the World Wide Web by Robert W. Sebesta, Pearson Education.

MCA 2.7	DATABASE MANAGEMENT SYSTEMS LAB	
Instruction: 3 Periods/week		**Credits:2**
Internal: 50 Marks	**University Exam: 50 Marks**	**Total: 100 Marks**

Course Objectives

1. To introduce to a commercial DBMS such as ORACLE.
2. To learn and practice SQL commands for schema creation, data manipulation.
3. To learn conceptual and physical database design based on a case study.
4. To apply database design stages by studying a case study.

Course Outcomes

1. The student is exposed to a commercial RDBMS environment such as ORACLE.
2. The student will learn SQL commands for data definition and manipulation.
3. The student understands conceptual through physical data base design.
4. The student takes up a case study and applies the design steps.

Features of a commercial RDBMS package such as ORACLE/DB2, MS Access, MYSQL & Structured Query Language (SQL) used with the RDBMS.

I Laboratory Exercises should include

1. Defining Schemas for Applications,
2. Creation of Database,
3. Writing SQL Queries,
4. Retrieve Information from Database,
5. Creating Views
6. Creating Triggers
7. Normalization up to Third Normal Form
8. Use of Host Languages,
9. Interface with Embedded SQL,
10. Use of Forms
11. Report Writing

II Some sample applications are given below

1. Accounting Package for Shops,
2. Database Manager for Magazine Agency or Newspaper Agency,
3. Ticket Booking for Performances,
4. Preparing Greeting Cards & Birthday Cards

5. Personal Accounts - Insurance, Loans, Mortgage Payments, Etc.,
6. Doctor's Diary & Billing System
7. Personal Bank Account
8. Class Marks Management
9. Hostel Accounting
10. Video Tape Library,
11. History of Cricket Scores,
12. Cable TV Transmission Program Manager,
13. Personal Library.
14. Sailors Database
15. Suppliers and Parts Database