FACULTY OF SCIENCE

SYLLABI

FOR

MASTER OF COMPUTER APPLICATIONS (MCA)
(SEMESTER SYSTEM)

EXAMINATIONS 2015-2016

i.e.
1st Semester, November/December, 2015
2nd Semester, May/June, 2016
3rd Semester, November/December, 2015
4th Semester, May/June, 2016
5th Semester, November/December, 2015
6th Semester, May/June, 2016

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APPLICABILITY OF REGULATIONS FOR THE TIME BEING IN FORCE

Notwithstanding the integrated nature of a course spread over more than one academic year, the regulations in force at the time a student joins a course shall hold good only for the examinations held during or at the end of the academic year. Nothing in these regulations shall be deemed to debar the University from amending the regulations subsequently and the amended regulations, if any, shall apply to all the students whether old or new.
# Outlines of Tests, Syllabi and Courses of Reading for Master of Computer Applications (MCA) (Three Year Degree Programme) for Exam. 2015-2016.

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<td><strong>FIRST YEAR</strong></td>
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<td><strong>FIRST SEMESTER</strong></td>
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<tr>
<td>CS-55</td>
<td>Computer Fundamentals and C Programming</td>
<td>4+4</td>
<td>80</td>
<td>20</td>
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<tr>
<td>CS-60</td>
<td>Computer Organization and Assembly Language</td>
<td>4+0</td>
<td>80</td>
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<td>CS-61</td>
<td>Data Base Management Systems</td>
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<tr>
<td>CS-62</td>
<td>Mathematical Structures for Computer Science</td>
<td>4+0</td>
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<tr>
<td></td>
<td>(Elective I)</td>
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<tr>
<td>CS-56</td>
<td>Linux Operating System (Elective II)</td>
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<tr>
<td>CS-63</td>
<td>Data and File Structures (Using C)</td>
<td>4+4</td>
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<tr>
<td>CS-64</td>
<td>Object Oriented Programming (Through C++ and Java)</td>
<td>4+4</td>
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<td>CS-48</td>
<td>Data Communication and Networks</td>
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<td>CS-40</td>
<td>Computer Oriented Numerical and Statistical Methods</td>
<td>4+0</td>
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<td>CS-07</td>
<td>Accounting and Financial Management</td>
<td>4+0</td>
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<td><strong>SECOND YEAR</strong></td>
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<td><strong>THIRD SEMESTER</strong></td>
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<tr>
<td>CS-65</td>
<td>Software Engineering</td>
<td>4+0</td>
<td>80</td>
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<td>CS-66</td>
<td>Operating Systems</td>
<td>4+0</td>
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<td>CS-67</td>
<td>Analysis and Design of Algorithms</td>
<td>4+0</td>
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<tr>
<td>CS-68</td>
<td>.NET Framework and C# (Elective V)</td>
<td>4+4</td>
<td>80</td>
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<tr>
<td>CS-69</td>
<td>Relational Data Base Management Systems (Elective VI)</td>
<td>4+4</td>
<td>80</td>
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<td><strong>FOURTH SEMESTER</strong></td>
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<td>CS-70</td>
<td>Data Mining and Data Warehousing</td>
<td>4+0</td>
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<td>CS-12</td>
<td>Interactive Computer Graphics</td>
<td>4+4</td>
<td>80</td>
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<td>CS-37</td>
<td>Theory of Computations</td>
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<td>CS-71</td>
<td>Artificial Intelligence (Using LISP) (Elective VII)</td>
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<td>Advanced Java and Network Programming</td>
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<td>(Elective VIII)</td>
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<td><strong>THIRD YEAR</strong></td>
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<td><strong>FIFTH SEMESTER</strong></td>
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<td>CS-17</td>
<td>Computer Based Optimization Techniques</td>
<td>4+0</td>
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<td>CS-57</td>
<td>Software Project Management</td>
<td>4+0</td>
<td>80</td>
<td>20</td>
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<td>CS-58</td>
<td>Mobile Communication and Android Application Development (Elective IX)</td>
<td>4+4</td>
<td>80</td>
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<tr>
<td>CS-59</td>
<td>Soft Computing Techniques using Neural Networks</td>
<td>4+4</td>
<td>80</td>
<td>20</td>
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<td></td>
<td>(Elective X)</td>
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<tr>
<td>CS-19</td>
<td>Seminar</td>
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<td></td>
<td>Each student will be required to give seminar on selected topics. The seminar will carry 100 marks.</td>
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<tr>
<td><strong>SIXTH SEMESTER</strong></td>
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<tr>
<td>CS-18</td>
<td><strong>PROJECT WORK</strong></td>
<td></td>
<td>320</td>
<td>80</td>
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<td>The Project period will be of 20 to 24 weeks duration. The Project will involve development of application/system software in industries, commercial or scientific environment. It will carry 400 marks.</td>
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SYLLABUS FOR MASTER OF COMPUTER APPLICATIONS (M.C.A.)

PRACTICAL EXAMINATIONS (EXAM 2015-2016)

The Practical examination will be conducted for each of the following:

FIRST YEAR (1st and 2nd Semesters) 

<table>
<thead>
<tr>
<th>SEMESTER</th>
<th>Prac. Exam. Marks</th>
<th>Int. Ass. Marks</th>
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<tr>
<td>PR-11</td>
<td>80</td>
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<td>PR-12</td>
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<tr>
<td>PR-03</td>
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<tr>
<td>PR-04</td>
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</table>

Each student is required to undergo a two months Summer Training at the end of Second Semester. The Internal Assessment Marks for each practical will be based on Minor Project.

SECOND YEAR (3rd and 4th Semesters) 

<table>
<thead>
<tr>
<th>SEMESTER</th>
<th>Prac. Exam. Marks</th>
<th>Int. Ass. Marks</th>
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<tbody>
<tr>
<td>PR-05</td>
<td>80</td>
<td>20</td>
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<tr>
<td>PR-06</td>
<td>80</td>
<td>20</td>
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<tr>
<td>PR-07</td>
<td>80</td>
<td>20</td>
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<tr>
<td>PR-08</td>
<td>80</td>
<td>20</td>
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</table>

Each student is required to undergo a two months Summer Training at the end of Fourth Semester. The Internal Assessment Marks for each practical will be based on Minor Project and Summer Training.

THIRD YEAR (5th Semester) 

<table>
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<tr>
<th>SEMESTER</th>
<th>Prac. Exam. Marks</th>
<th>Int. Ass. Marks</th>
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<tbody>
<tr>
<td>PR-13</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>PR-14</td>
<td>80</td>
<td>20</td>
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</tbody>
</table>

The Internal Assessment Marks for each practical will be based on Minor Project.
ELECTIVES

CS-01 Mathematical Foundations of Computer Science
CS-02 Computer Programming & Problem Solving (Using C)
CS-03 Data and File Structures (Using C) - OLD
CS-04 Object Oriented Programming (Through C++ and Java) - OLD
CS-05 Computer Organization and Assembly Language - OLD
CS-06 Data Base Management System (DBMS) - OLD
CS-07 Accounting and Financial Management
CS-08 Information Systems and Enterprise Resource Planning
CS-09 Software Engineering - OLD
CS-10 Information System Design and Implementation
CS-11 Operating Systems - OLD
CS-13 Data Mining and Data Warehousing - OLD
CS-14 Analysis and Design of Algorithms - OLD
CS-15 Data Base Management System - OLD
CS-20 Emerging Database Technologies
CS-21 .NET Framework and C# - OLD
CS-22 Introduction to Distributed and Parallel Processing
CS-23 Distributed Computing, Networks and Applications
CS-24 Microprocessor & Applications
CS-25 Advanced Java and Network Programming - OLD
CS-26 Emerging Trends and Technologies
CS-27 Relational Data Base Management Systems - OLD
CS-32 Compiler Design
CS-33 Simulation & Modeling
CS-40 Computer Oriented Numerical and Statistical Methods
CS-41 Image Processing
CS-42 Object Oriented Programming Using C++
CS-43 Unix and Shell Programming
CS-44 Web Application Tools and E-Commerce
CS-45 Visual C++ Programming
CS-46 Linux Administration
CS-47 Visual Basic Programming
CS-48 Data Communications and Networks
CS-49 Fundamentals of Information Technology
CS-50 Multimedia Technologies
CS-51 Mathematical Structures for Computer Science - OLD
CS-52 Software Testing and Quality Control
CS-53 Software Testing and Quality Assurance
CS-54 Multi Agent Systems
CS-56 Linux Operating System
CS-58 Mobile Communication and Android Application Development (Elective IX)
CS-59 Soft Computing Techniques using Neural Networks (Elective X)
CS-62 Mathematical Structures for Computer Science
CS-68 .NET Framework and C#
CS-69 Relational Data Base Management Systems
CS-71 Artificial Intelligence (Using LISP)
CS-72 Advanced Java and Network Programming
CS-73* Mathematical, Numerical and Statistical Techniques
CS-74* Current Trends and Technologies

* New Elective according to UGC Compliance and attached as Page No. (i) – (iv)
SYLLABUS AND COURSE OF READINGS

FIRST SEMESTER

Paper Title: COMPUTER FUNDAMENTALS AND C PROGRAMMING.

Paper Code: CS-55          Max. Marks: 80         Time: 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objective:
The objective of this course is to familiarize students with concepts of fundamentals of information technology along with developing the logic for solving a given problem using the procedure oriented language for construction of code.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Overview of Computer System:

2. Information Technology and Internet Basics:

UNIT-II

3. Problem Solving:
   Problem Identification, Analysis, Flowcharts, Decision tables, Pseudo codes and algorithms, Program coding, Program Testing and execution, Types of programming languages, Translators: Interpreters, Compilers, Assemblers and their comparison.

4. Fundamentals of C language:
   History of C Language, Structure of a C program, Variables, Constants, Keywords, Data types, Operators, Expressions and their evaluation using rules of hierarchy, Input/Output statements, Assignment statements, Control statements: If-else, switch, while, do-while, for, nested loops, break, continue, goto statements.
5. **Functions:**
   Declaration, Definition, Passing arguments, Call by value, Call by reference, Recursion, Use of library functions, Storage classes: Automatic, External and Static variables.

6. **Arrays and Strings:**
   Defining and processing arrays, Passing array to a function, Using multi-dimensional arrays, Solving matrices problem using arrays, Strings: Declaration, Operations on strings.

**UNIT-IV**

7. **Pointers, Structures and Union:**
   Pointer declarations, Passing pointer to function, Operations on pointers, Pointers and arrays, Array of pointers, Structures: Defining and processing, Passing structure to a function, Unions.

8. **Files Handling:**
   File operations: Open, Close, Create, Process, Unformatted data files.

**Suggested Readings:**

2. Indu Chhabra and Gursharan Singh: Insight into Microprocessors (Principles, Implementation and Technology), AP Publishers, New Delhi, India.
9. Gookin, Dan: C Programming, Wiley India Pvt. Ltd.
Paper Title: COMPUTER ORGANIZATION AND ASSEMBLY LANGUAGE

Paper Code: CS-60          Max. Marks: 80          Time : 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:
The objective of the course is to provide students with a solid foundation in computer design. Examine the operation of the major building blocks of a computer system. To introduce students to the design and organization of modern digital computers by showing the relationship between hardware and software and focusing on the concepts that are the basis of the current computers such as microprocessors. Includes machine language, instruction set architecture, control design, memory hierarchy, Input/output and communication. To introduce basic assembly language, describe the instruction format/set of a computer and write simple assembly language programs.

Note: (i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Information Representation:
   Number Systems: Binary, Octal, Decimal, Hexadecimal numbers and their interconversions; Complement’s: (r-1)’s and (r)’s complement; Fixed-point and Floating-point representation of numbers; Error Detection and Correction codes: Parity Check, CRC, and Hamming Code; Binary Logic: Digital logic gates, Boolean algebra, Boolean functions, Truth tables, Simplification of Boolean functions, K-maps for 2, 3 and 4 variables.

2. Basic Building Blocks:
   Combinational logic design: half-adder, fulladder, Encoder, Decoder, Multiplexer.
   Sequential circuits: Concept, flip-flops (D, RS, JK, T, and Master-Slave); Registers: Buffer, Shift and Controlled shift registers; Counters: Binary, Ripple, Ring Counter.

UNIT-II

3. Register Transfer and Micro-operations:
   Register Transfer Language, Bus and Memory Transfer, Logic and Shift micro-operations.

4. Computer Organization:
   Microcomputer Organization; Microprocessor Organization; Instruction codes; Instruction cycle; Instruction formats; Processing Unit Design: one, two and three-bus organization.
UNIT-III

5. Memory Organization:
   Memory Hierarchy, Types of Memory: RAM and ROM Chips, Associative Memory, Cache Memory, Auxiliary Memory, Memory Address Map.

6. Input-Output Organization:

UNIT-IV

Assembly Language Programming:

7. Micro Processor Architecture:
   Microcomputer Architecture, Structure of 8086/8088 CPU, The Bus Interface Unit, Execution Unit (EU); Registers, Addressing modes, Instruction set for 8086/8088; Programmers model of a machine. Example of a typical 16 to 32 bit processor.

8. Introduction to Assembly Language:

Suggested Readings:

6. B. Brey: The Intel Microprocessors, Pearson Education.
12. Rafiquzzaman, Microprocessors & Microcomputers Based System Design, UBS.
13. Gupta, Vikas: Comdix Computer Hardware and Networking Course Kit, Wiley India Pvt. Ltd.
Paper Title: DATABASE MANAGEMENT SYSTEMS

Paper Code: CS-61
Max. Marks: 80
Time : 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objective:

The objective of this course is to teach the students concepts related to database, database design techniques, transaction management, crash recovery, backup and security of databases.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Basic Concepts:
   
   Database, DBMS: Need, Characteristics, Database Users, 3-tier Architecture, Advantages over 2-tier, Components, Advantages, Disadvantages, Views of data-schemas and instances, Data independence, Conventional data models & systems.

2. Data Models:
   

UNIT-II

3. Storage and File Organization:
   
   Overview of physical storage media, RAID, Storage access; File organization, Operations on Files, Serial Files, Sequential Files, Indexed-Sequential Files, Direct Files.

4. The Relational Model:
   
   Relational Database: Attributes, Domains, Tuples, Relations and their schemes, Relation representation, Keys, Relationship, Relational operations, Integrity constraints.

UNIT-III

5. Relational Algebra and Relational Calculus:

   Relational Algebra: Operations - Union, Intersection, Difference, Cartesian product, Projection, Selection, Division and relational algebra queries; Relational Calculus: Tuple oriented and domain oriented relational calculus and its operations.
6. **Transaction and Concurrency control:**

   Concept of Transaction, ACID properties, Serializibility, States of transaction, Concurrency control: Locking techniques, Time stamp based protocols, Granularity of data items, Deadlock.

**UNIT-IV**

7. **Crash Recovery and Backup:**

   Failure classifications, storage structure, Recovery & atomicity, Log base recovery, Recovery with concurrent transactions, Failure with loss of non-volatile storage, Database backup & recovery from catastrophic failure, Remote Backup System.

8. **Security and privacy:**

   Database security issues, Discretionary access control based on grant & revoking privilege, Mandatory access control and role based access control for multilevel security, Encryption & public key infrastructures.

**Suggested Readings:**

1. Introduction to Database Systems : C.J. Date
2. Database Management Systems : Bipin Desai
3. Database System Concepts : Korth
4. Principles of Database Management : James Martin
5. Computer Database Organization : James Martin
7. Object-Oriented Modeling and Design : Rumbaugh and Blaha
8. Object-Oriented Analysis and Design : Grady Booch
Paper Title: MATHEMATICAL STRUCTURES FOR COMPUTER SCIENCE


Objective:
To provide basic knowledge about mathematical structures required for various computer science courses.

Note :
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Mathematical Logic:
   Introduction, Conjunction, Disjunction & negation, Propositions and truth table, Tautologies and contradictions, Equivalence of formulas, Duality law, Normal forms: Disjunctive Normal form, Conjunctive Normal form, Predicate Calculus: Predicates, the statement function, variables and quantifiers, predicate formulas, Methods of proof (Inference Theory).

2. Functions:
   Composite functions & their range, Domain, Functions for computer science like characteristic function, Hashing function, Growth of a function.

UNIT-II

3. Ordered Sets, Lattices, Boolean Algebra :

4. Introduction to Finite State Machine:
   Introduction to Finite State Machine, Simplification of machine, Machine and regular languages.

UNIT-III

5. Graphs:
   Incidence and Degree, Handshaking Lemma, Isomorphism, Connectedness, Walk, Path and Circuits, Shortest Path Algorithm between two Vertices, Eulerian graph, Fleury’s Algorithm, Directed graphs, Kuratowski’s graphs, Detection of planarity.
6. **Trees:**

   Properties of Trees, Rooted and Binary Trees, Directed Tree, Spanning Tree, Cutest & Cut Vertices, Max-flow–Min-cut theorem.

   **UNIT-IV**

7. **Recurrence Relations:**

   Recursion, Recurrence Relation, Linear homogenous recurrence relations with constant coefficients, Non-homogeneous recurrence relation, Generating Functions.

8. **Coding Theory :**

   Coding of binary Information & Error detection, Decoding & Error Correction.

**Suggested Readings:**

5. Deo, N.: Graph Theory with Applications to Engineering and Computer Science, PHI.
Paper Title: LINUX OPERATING SYSTEM

Paper Code: CS-56

Max. Marks: 80

Time : 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objective:

The objective of the course is to make students aware of the functioning of a multi-user operating system. This course will serve as a foundation for the higher level course in Linux. The students are expected to learn the commands while doing practical and emphasis should be given to those switches/options and flags, which are most frequently used in real life.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Theoretical Concepts of LINUX Operating System:

   Basic Features of Operating System, File Structure, CPU Scheduling, Memory management: Swapping, Demand Paging; File system: ext2 and ext3 architecture, Blocks and Fragments, Inodes Directory Structure.

2. Getting Started with LINUX:

   User Names and Groups; Logging in; Changing your password; Format of LINUX commands.

UNIT-II

3. Characters with special meaning; LINUX Documentation; Files and Directories:


4. Text Manipulation:

   Inspecting Files; File Statistics; Searching for Patterns, Comparing Files; Operating on Files; Printing Files; Rearranging Files; Sorting Files; Splitting Files; Translating characters.
UNIT-III

5. **Shell Programming:**

   Programming in the Borne and the C-shell: Wild cards, simple shell programs, shell variables, shell programming constructs, interactive shell scripts, Advanced features.

6. **System Administration:**

   Definition, Booting the system, Maintaining user accounts, File system and special files, Backups and restoration, Role and functions of a system manager.

UNIT-IV

7. **System Calls :**

   C as System Programming Language, I/O system calls – umask(); create(); open(); read(); write(); lseek(); dup(); link(); access(); chmod(); chown(); Process management system calls; fork(); getpid(); getppid(); exit(); wait(); sleep(); Signal system calls – kill(); signal().

**Suggested Readings :**

7. Graham, Steven: Linux Administration, Tata McGraw.
8. Jones, Tim: GNU/Linux Application Programming, Wiley India Pvt. Ltd.
SECOND SEMESTER

Paper Title: DATA AND FILE STRUCTURES (USING C)

Paper Code: CS-63

Course Duration: 60 Lectures of one hour each.

Objectives:

The emphasis of this course is on the organization of information, the implementation of common data structures such as lists, stacks, queues, trees, and graphs.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Introduction to Data Structures:
   Concepts and definition of data types, Linear and non-linear data structures.

2. Arrays:
   Representation of one and multidimensional arrays in memory, ADT, Operations: traversing, insertion, deletion, reversing, searching, sorting, merging two arrays; Matrix operations: addition, multiplication; Sparse matrices: ADT, representation; Applications of array: Polynomial evaluation and addition of two polynomials.

UNIT-II

3. Linked List:
   Introduction, sequential vs linked representation, Operations: traversal, creation, insertion, deletion, reversing; Application of linked lists: Polynomial addition; Introduction to the operations of circular linked lists and doubly linked lists; Fundamental concepts of dynamic memory allocation and garbage collection.

4. Stacks and Queues:
   Sequential and linked representations, ADT, Stack Operations: Traversal, pop, push; Applications of stack: polish notation, infix to postfix, evaluating postfix expression; Queues: Sequential and linked representation, Queue operations: Traversal, insertion, deletion; Dequeue, Circular queues.

UNIT-III

5. Trees:
   Terminology, ADT, Types: Binary tree, Complete binary tree, Threaded Binary tree, Binary search tree, B-trees; Binary tree: properties, sequential and linked representation, Traversal techniques: inorder, preorder, postorder; BST operations: Traversal, Searching, Insertion, Deletion.
6. **Sets and Graphs:**

Sets: Representation, union and find algorithms; Graphs: ADT, types, sequential and linked representation; Operations: Insertion, deletion, traversal: DFS, BFS; Minimum cost spanning trees: Kruskal’s and Prim’s algorithm.

**UNIT-IV**

7. **Searching and Sorting:**

Definition of recursion and its applications, Towers of Hanoi; Sorting Techniques: Bubble sort, Selection sort, Merge sort, Heap sort, Quick sort; Implementation of linear and binary searches techniques in C.

8. **File Structures:**

Sequential file organization, variable length records and text files; Indexing structures: B-trees, ISAM, Hashing techniques for direct files.

**Suggested Readings:**

8. Deshpanday: C and Data Structures, Wiley India Pvt. Ltd.
11. Leendert: Algorithms and Data Structure in C++, Wiley India Pvt. Ltd.
Paper Title: OBJECT ORIENTED PROGRAMMING (THROUGH C++ AND JAVA)

Paper Code: CS-64 Max. Marks: 80 Time : 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:

This course will expose you to the features in C++ and Java as well as help you design software using the object oriented paradigm of programming using C++ and Java.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Introduction to Object Oriented Programming, Characteristics of OOPs, Dynamic binding, Message Passing, Tokens, Expressions, Data Types, Variables, Operators, Control Statements, Arrays, String Handling.

UNIT-II


UNIT-III

3. Java – Introduction, JVM, Byte code, Data Types, Variables, Arrays, Operators, Control Statements, Classes, Objects, Overloading methods, Member access and inheritance, Method overriding, Using super and final, Defining a package, Understanding CLASSPATH, Importing Packages, Interface and its implementation.

UNIT-IV

Suggested Readings:

9. Schildt, Herbert: The Complete Reference Java 2, TMH.
Paper Title: DATA COMMUNICATION AND NETWORKS

Course Duration: 60 Lectures of one hour each.

Objectives:
As part of this course, students will be introduced to computer networks and data communication paradigms, about network models and standards, network protocols and their use, wireless technologies.

Note:  
(i) The Question paper will consist of four units.  
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.  
(iii) The students are required to attempt one question from each unit and the compulsory question.  
(iv) All questions carry equal marks.

UNIT-I

1. Introduction:
   Data Transmission concepts, transmission impairments, switching, modulation, multiplexing.  
   **Network Hardware:** LAN, MAN, WAN, Wireless networks, Internet-works.  
   **Network Software:** Layer, Protocols, interfaces and services.  
   **Reference Models:** OSI, TCP/IP and their comparison.  

2. Physical Layer:
   **Transmission Media:**  
   Magnetic, twisted pair, coaxial cable, fiber optics, wireless transmission (Radio, Microwave, Infrared, Light wave).

UNIT-II

3. Introduction to ATM, ISDN, Cellular radio and communication satellites.

4. Data Link Layer:
   Framing, Error control, Sliding window protocols (one bit, Go back n, selective repeat).  
   Examples of DLL Protocols – HDLC, PPP.  
   **Medium Access Sub layer:**  
   **Bridges** - Transparent, source routing, remote.
UNIT-III

5. Network Layer:
   Design issues, routing algorithms (shortest path, flooding, flow based, distance vector, hierarchical, broadcast, multicast, for mobile hosts). Congestion control algorithms (Leaky bucket, Token bucket, Choke Packet, Load shedding), Internetworking, IP Protocol, ARP, RARP.

6. Network Trouble Shooting:
   Using Ping, Traceroute, IP config, Netstat, nslookup etc.

UNIT-IV

7. Transport Layer:
   Addressing, establishing and releasing connection, flow control, buffering, Internet Transport Protocol (TCP and UDP).

8. Application Layer:
   Domain name system, E-mail, File transfer protocol, HTTP, HTTPS, World Wide Web.

Suggested Readings:

Paper Title: COMPUTER ORIENTED NUMERICAL AND STATISTICAL METHODS

Paper Code: CS-40  Max. Marks: 80  Time: 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:

The course aims at discussing various significant and fundamental concepts to inculcate in the students an adequate understanding of the application of Numerical Algorithms and Statistical Methods.

Note:  
(i) The Question paper will consist of four units.  
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.  
(iii) The students are required to attempt one question from each unit and the compulsory question.  
(iv) All questions carry equal marks.  
(v) The students can use only Non-programmable & Non-storage type calculator.

Prerequisite: Mathematical Foundation of Computer Science, Probability and Statistics.

UNIT-I

Numeric Computation:  
Computer Arithmetic: Floating point numbers - Operations, Normalization and their consequences.

Iterative Methods: Zeros of a single transcendental equation and zeros of polynomial using Bisection, False position, Newton-Raphson, convergence of solution.

Simultaneous Linear Equations, Solution of simultaneous Linear equation, Gauss elimination method and pivoting, ILL - conditioned equations and refinement of solutions, Gauss Siedel iterative methods.

UNIT-II


Interpolation and Approximation: Polynomial interpolation - Newton Lagranges, Difference tables, Approximation of function by Taylor series and Chebyshev polynomials.

UNIT-III

Statistical Computation:  
Frequency Charts: Different Frequency charts.

Regression Analysis: Least square fit, Polynomial and curve fittings, Linear regression and Nonlinear regression Algorithms; Introduction to Multiple regression.
UNIT-IV

Time Series and forecasting, moving averages, smoothening of curves, Forecasting models and methods.

Tests of significance: Chi square test and F-test.

SPSS and Mat Lab: Introduction and features of SPSS and Mat Lab.

Suggested Readings:

Paper Title: ACCOUNTING AND FINANCIAL MANAGEMENT

Paper Code: CS-07  Max. Marks: 80  Time: 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:
To provide an overview of theoretical and practical concepts of Accounting.

Note:  
(i) The Question paper will consist of four units.  
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.  
(iii) The students are required to attempt one question from each unit and the compulsory question.  
(iv) All questions carry equal marks.

UNIT-I

1. Accounting: Principles, concepts and conventions, double entry system of accounting, introduction of 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, Introduction to manufacturing account, final accounts of partnership firms, limited company.

UNIT-II

3. Financial Management:
   Meaning and role.

4. Ratio Analysis:
   Meaning, advantages, limitations, types of ratios and their usefulness.

5. Fund Flow Statement:
   Meaning of the terms – fund flow and fund working capital cycle, preparation and interpretation of the fund flow statement.

UNIT-III

6. Costing:
   Nature, importance and basic principles.

7. Marginal Costing:
   Nature, scope and importance, Break-even analysis, its uses and limitations, construction of breakeven chart, practical applications of marginal costing.

8. Standard Costing:
   Nature and scope, Computational and analysis of variances with reference to material cost, labour cost and overhead cost, interpretation of the variances.
UNIT-IV

9. Budget and Budgetary Control:

10. 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 (The concepts may be explained using available accounting package).

Suggested Readings:

THIRD SEMESTER

Paper Title: SOFTWARE ENGINEERING

Paper Code: CS-65              Max. Marks: 80              Time : 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:

The course aims to give students a theoretical foundation in Software Engineering and help them learn its principles and methods including emerging practices and support tools. It also familiarizes students with concepts of software testing and quality assurance and its various techniques.

Note :  
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT I

1. Introduction:

Software Engineering goals, SDLC, Software Process Models: Waterfall, Prototyping, Spiral; S/w Inspection, Preview and Inspection Procedures, Communication skill for Software Engineer, Human factors in Software Engineering, Software requirements: Definition, Software requirements specifications (SRS), Components of SRS.

2. Software Project Planning:


UNIT II

3. Software Design:


4. Quality Assurance:

UNIT III

5. Software Testing and Techniques:


6. Software Testing Strategies:


UNIT IV

7. Software Maintenance:

Characteristics, Types of software maintenance, Reverse Engineering, Software maintenance process models.

8. System Configuration Management (SCM):


Suggested Readings:

SYLLABUS FOR MASTER OF COMPUTER APPLICATIONS (M.C.A.)

Paper Title: OPERATING SYSTEMS


Course Duration: 60 Lectures of one hour each.

Objectives:

To understand the various concepts of Operating System like process management, synchronization, deadlocks, storage and memory management.

Note:

(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT I

1. Introduction to Operating System:

   Introduction to operating system, its need and services; Operating system classification: Single user, Multi user, Simple batch processing, Multiprogramming, Multitasking, Parallel systems, Distributed systems, Real time systems.

2. Process Management:


UNIT II

3. Synchronization:

   Critical section problem, Peterson’s solution, Synchronization hardware, Semaphores: Mutual exclusion, Binary semaphores, Bounded concurrency, Producer-consumers, Reader-writers problem; Deadlocks & starvation, Problems of synchronization: Bounded buffer, Dining philosophers; Monitors.

4. Deadlocks:

   System model, Deadlock characterization: Necessary conditions, Resource allocation graph, Method for handling deadlock; Deadlock prevention: Mutual exclusion, Hold and wait, No preemption, Circular wait, Deadlock avoidance: Safe state, Resource allocation graph algorithm, Banker’s algorithm; Deadlock detection, Recovery from deadlock.
UNIT III

5. Memory Management-I:
   Static and dynamic memory allocation, Memory allocation to process: Stacks, Heap, Memory allocation model; Reuse of memory: Performing fresh allocations using a free list, memory fragmentation, Merging free areas; Contiguous memory allocation: Fragmentation, Swapping.

6. Memory Management-II:

UNIT IV

7. Storage Management I:
   File Concept: Attributes, Operations, Types, Structure; Access methods: Sequential and direct access, Index; Directory structure: Single level, Two Level, Tree Structured, acyclic Graph directories; File System mounting, File sharing, Protection: Types of access, access Control.

8. Storage Management II:
   File system structure, File system implementation, Directory implementation, Allocation methods, Free space management, Disk scheduling: FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK; Disk management, Swap space management, RAID.

Suggested Readings:

5. Richie: Operating System, BPB.
Paper Title: ANALYSIS AND DESIGN OF ALGORITHMS

Paper Code: CS-67  Max. Marks: 80  Time: 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objective:

The objective of the module is to create skills in students to design and analyze algorithms.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT I

1. Algorithms and Analysis:
   Introduction, Algorithms specification, Recursive algorithms, space and time complexity, Asymptotic Notation (O, _, and Θ, o) practical complexities, Best, average and worst case performance of algorithms, examples, Introduction to recurrence relations.

2. Divide and Conquer:
   General method, Binary search, Merge sort, Quick sort, Selection problem, Strassen's matrix multiplication and analysis of these problems.

UNIT II

3. Greedy Method:
   General Method, Knapsack problem, Job sequencing with deadlines, Minimum spanning Trees, Single source shortcut paths and analysis of these problems.

4. Dynamic Programming:
   General method, Optimal binary search trees, 0/1 Knapsack, the travelling salesperson problem.

UNIT III

5. Back Tracking:
   General method, 8 queen's problem, Graph coloring, Hamiltonian cycles, Analysis of these problems.

6. Branch-And-Bound:
   Method, 0/1 Knapsack and Travelling Salesperson problems, Efficiency considerations.
UNIT IV

7. **Lower-Bound Theory:**
   Introduction to Algebraic problems, Introduction to lower bounds, Comparison Trees, Techniques for Algebraic problems, Some Lower Bounds on Parallel Computation.

8. **NP-hard and NP-complete problems:**
   Basic concepts, Statement of Cook’s Theorem, Examples of NP-hard graph and NP-scheduling problems, some simplified NP-hard problems.

**Suggested Readings:**

Paper Title: .NET FRAMEWORK AND C#

Paper Code: CS-68                 Max. Marks: 80              Time : 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:

This course aims at making a student’s capable of developing console, windows and web applications using C# on .NET platform.

Note :  
(i) The Question paper will consist of four units.  
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.  
(iii) The students are required to attempt one question from each unit and the compulsory question.  
(iv) All questions carry equal marks.

UNIT I

1. Introduction to .NET environment:

   The .NET strategy, the origins of the .NET technology, the .NET framework, the common language runtime, framework base classes, user and programs interface, visual studio .NET, .NET languages, benefits of the .NET approach.

2. Introduction to C#:

   Introducing C#, Overview of C#, Literals, Variables, Data Types, Operators, Expressions, Branching, Looping, Methods, Arrays, Strings, Structures, Enumerations, difference between C++ and C#, difference between Java and C#.

UNIT II

3. Object oriented aspects of C#:

   Classes, Objects, Inheritance, Polymorphism, Interfaces, Operator Overloading, Delegates, Events, Errors and Exceptions.

4. I/O and object serialization:

UNIT III

5. Writing windows forms applications and deploying windows forms applications:

Writing windows forms applications: Understanding windows forms, Window form controls, Menus, MDI forms, Using inheritance in windows forms, Using common dialog controls, Deploying windows forms applications: Introduction to deployment, Click Once deployment, Creating an installation package for project.

6. Writing asp.net applications and deploying asp.net applications:

Introduction to ASP.NET, Using validation controls, Managing state in ASP.NET web applications, Deploying ASP.NET Applications with windows installer.

UNIT IV

7. Accessing data with ado.net:

ADO.NET: Architecture, Components, Database, Data Reader, Data Adapter, Dataset, Viewing data using Data Grid View Control, Creating applications.

Suggested Readings:

Paper Title: RELATIONAL DATA BASE MANAGEMENT SYSTEMS

Paper Code: CS-69 Max. Marks: 80 Time: 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objective:

The course aims at providing the students through insight on few DBMS principles and practices. Students will learn and implement the operations for making and using databases with help of SQL and PL/SQL.

Note: (i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT I

1. Relational Design:

Relation scheme, Codd’s Rules for RDBMS, Anomalies in a database, Functional Dependency: Dependencies and logical implications, Closure set, Testing if FD is in closure, Covers, Non redundant and minimum cover, Canonical cover, Functional dependencies and keys.

2. Normalization:

Normal forms- 1NF, 2NF, 3NF, BCNF, Difference between 3NF and BCNF, Multivalued dependencies and joined dependencies, 4NF, 5NF, Difference between 4NF and 5NF.

UNIT II

3. SQL:

Introduction to SQL, Oracle server and oracle database, Oracle products, Oracle data types, Starting SQL *Plus, Querying database tables, Conditional retrieval of rows, Working with null values, Matching a pattern from a table, Ordering the result of a query, Aggregate Functions, Grouping the result of a query, ROLLUP operation: Getting sub totals, CUBE operation: Getting cross tabs, Command summary of SQL *Plus editor, Querying multiple tables: Equi Joins, Cartesian Joins, Outer Joins, Self Joins; SET Operators: Union, Intersect, Minus; Functions: Arithmetic functions, Character functions, Date functions, Group functions.

4. Data Manipulation and Control-I:

Data Definition Language (DDL), Creating Tables, Creating a Table with data from another table, Inserting Values into a Table, Updating Column(s) of a Table, Deleting Row(s) from a Table, Dropping a Column; VIEW: Manipulating the Base table, Rules of DML Statements on Join Views, Dropping a VIEW, Inline Views, Materialized Views.
UNIT III

5. Data Manipulation and Control-II:

Database security and privileges, GRANT command, REVOKE command, Application privileges management, Enhancing performance, Sequences, Maintaining database objects, COMMIT and ROLLBACK.

6. PL/SQL-I:


UNIT IV

7. PL/SQL-II:

Cursor management in PL/SQL, Cursor manipulation, Implicit cursor attributes, Exception handling in PL/SQL; Predefined exceptions, User defined exceptions.

8. Advanced PL/SQL:

Subprograms in PL/SQL, advantages of subprograms, procedure, functions, actual versus formal parameters, argument modes, stored packages, advantages of packages, dropping a procedure, dropping a function, dropping a package, using stored function in SQL statements, database trigger, Types of triggers, Dropping triggers.

Suggested Readings:

3. Ivan Bayross: PL/SQL The Programming Language of ORACLE, (BPB Publication)
FOURTH SEMESTER

Paper Title: DATA MINING AND DATA WAREHOUSING

Paper Code: CS-70  Max. Marks: 80  Time: 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:

This course will introduce concepts and techniques of data mining and data warehousing, including concepts, principles, architecture, design, implementation, application of data warehousing and data mining. Some systems for data warehousing and/or data mining will also be introduced. To study the methodology of engineering legacy databases for data warehousing and data mining to derive business rules for decision support systems.

Note: (i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT I

1. Introduction:

Data Warehousing: Definition, usage and trends, Characteristics of a Data Warehouse, DBMS vs data warehouse

2. Developing Data Warehouse:

Building a Data warehouse, Data warehousing components, Architecture for a warehouse, Three-tier Data warehouse architecture, Steps and Crucial decisions for the design and construction of Data Warehouses, Design performance and technological considerations, Metadata.

UNIT II

3. Developing Data Mart based Data warehouse:

Types of data marts, Loading a data mart, Metadata for a data mart, Data model for a data mart, Maintenance of a data mart, Software components for a data mart, External data, Reference data, Performance issues, Security in data mart, Nature of data in data Mart: External data, Reference data.

4. OLTP and OLAP Systems:

OLTP vs OLAP, types of OLAP, Relational vs Multidimensional OLAP, Data modeling, Schemas for multidimensional view: Star schema, Snowflake schema, implementing data warehouse; Categories of OLAP tools.

UNIT III

5. Data Mining:

Introduction to data mining definition, KDD versus data mining, data mining process, Application areas for data mining, Data preprocessing: Data cleaning, Data integration and transformation, Data reduction; Tools for data mining.
6. Data Mining Techniques:

UNIT IV

7. Classification and Prediction:
   Definition, issues regarding classification and prediction, classification by decision tree induction, Bayesian Classification, Prediction: Linear and Non-Linear Regression

8. Clustering:
   Definition, Types of data in cluster analysis, Clustering paradigms, Partitioning Algorithms: K-means and K-method, CLARANS; Hierarchical methods: BIRCH, CURE.

Suggested Readings:

5. Jiawei Han, Micheline Kamber, 2000: Data Mining: Concepts and Techniques, Morgan Koffman Elsvier.
Paper Title: INTERACTIVE COMPUTER GRAPHICS

Paper Code: CS-12               Max. Marks: 80               Time : 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:

The aim is to introduce the students to key concepts of Computer Graphics like display devices, co-ordinate system, transformations, line and circle drawing, pointing, positioning, projections, etc.

Note:  
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT I

1. Display Devices:

Line and point plotting systems, Raster, vector, pixel and point plotters, Continual Refresh and storage displays, Digital frame buffer, Plasma panel displays, Display processors, Character generators, Colour-display techniques: shadow mask and penetration CRT, Colour look-up tables, hard-copy colour printers.

UNIT II

2. Display Description:

Screen co-ordinates, user co-ordinates, use of homogeneous coordinates, Display code generation, Graphical functions, the view algorithm, Two-dimensional transformation, Line-drawing, Circle drawing algorithms.

UNIT III

3. Interactive Graphics:

Pointing and positioning devices (cursor, light pen, digitizing tablet, the mouse, track balls), Interactive graphical techniques, Positioning, (Elastic or Rubber Band lines, Linking, zooming, panning, clipping, windowing, scissoring), Mouse Programming.

4. 3-D Graphics:

Wire-frame, perspective display, perspective depth, Projective transformations, Hidden line and surface elimination (Black face removal algorithm).
UNIT IV

5. **Turbo-C Graphic Language:**

Primitives (constants, actions, operators, variables), Plotting and geometric transformations, Display subroutines, Concept of Animation, Saving, Loading and Printing graphics images from/to disk, Animated algorithms for Sorting, Towers of Hanoi.

6. **Open GL:**

Primitives of the language and interface with C/C++.

7. **Programming Projects:**

Two Dimensional Transformations, 3-dimensional Transformations, Interactive Graphical Techniques, GUI, Turbo C (Graphics Routines) is to be used as the standard teaching tool.

**Suggested Readings:**

Paper Title : THEORY OF COMPUTATIONS

Paper Code: CS-37           Max. Marks: 80           Time : 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:

The goal of this course is to provide students with an understanding of basic concepts of Theory of Computation.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT I

1. Recursive Languages:

Recursive definition, Alphabets, Language, Regular expression, definitions of Finite state machine, Transition graphs, Deterministic & non-deterministic finite state machines, Regular grammar, Left-linear and right linear, Thomson’s construction to convert regular Expression to NDFA & subset algorithm to convert NDFA to DFA. Minimization of DFA, Finite state machine with output (Moore machine and Meally Machine), conversion of Moore machine to Meally machine & vice-versa.

UNIT II

2. Properties of Regular Languages:

Conversion of DFA to regular expression, Pumping lemma, Properties and limitations of finite state machine, Decision properties of regular languages, ApplicationS of finite automata.

3. Context Free Grammar:

Context free grammar, Writing context free grammar for problems, Derivation tree and ambiguity, Application of context free grammars, Chomsky and Greibach Normal form, Conversion of CFG to CNF and GNF Properties of context free grammar, CYK algorithm.

UNIT III

4. PDA:

Push down stack machine, Design of deterministic and non-deterministic push-down stack, Parser design.

5. Turing Machine:

UNIT IV

6. **Incommutability:**

   Halting problem, Turing enumerability, Turing acceptability and Turing decidabilities, Unsolvable problems about Turing machines.

7. **Computation Complexity:**

   P, NP and NP Complete Problems.

**Suggested Readings:**

Paper Title: ARTIFICIAL INTELLIGENCE (USING LISP)

Paper Code: CS-71          Max. Marks: 80          Time: 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:

The objective of this course is to familiarize students with concepts of AI, its tools & technologies.

Note: (i) The Question paper will consist of four units.
      (ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
      (iii) The students are required to attempt one question from each unit and the compulsory question.
      (iv) All questions carry equal marks.

Prerequisite: System Software, Operating System, Data and File Structure.

UNIT I

1. Introduction to Artificial Intelligence (AI) and Problem Space:

   Introduction AI technique, Turing test, History and developments in AI, applications of AI, State space representation, production systems, systematic control strategies: Breadth first search and Depth first search, problem characteristics, product system characteristics, issues in the design of search programs.

2. Heuristic Search Technologies:

   Introduction to heuristic search, Generate and test, Hill Climbing, Best First search, A*, Problem reduction, AO*, constraint satisfaction and Means-ends-analysis techniques.

UNIT II

3. Knowledge representation:

   Information and knowledge, Knowledge acquisition and manipulation, Issues in knowledge representation, Knowledge representation methods-Propositional logic and first order predicate logic, Resolution principle, Horn's clauses, Features of language PROLOG, Semantic networks, Partitioned semantic nets, Frames, Scripts and conceptual dependencies.

4. Game playing:

   Mini Max search procedure, reducing alternatives using Alpha-Beta pruning method examples.

UNIT III

5. Expert systems:

   Introduction, examples, characteristics architecture, People involved and their role in building an expert system, case studies of expert systems, MYCIN and DENDRAL; features of knowledge acquisition systems: MOLE and SALT.
6. **Natural Language understanding and processing:**

   Introduction, Complexity of the problem, Chomsky hierarchy of grammars, Techniques for Syntactic processing, Semantic Analysis, Discourse and pragmatic processing

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**UNIT IV**

7. **Tools and Technologies for AI:**

   Introduction to AI language LISP: Symbolic expression, creating, appending and modifying lists, defining functions, Predicates, Conditionals, Recursion, Iteration, Printing and reading, Lambda expressions and higher order function, List storage.

**Laboratory work:**

1. Programming in LISP & PROLOG.
2. Hands on experience with expert system shell.

**Suggested Readings:**

Paper Title: ADVANCED JAVA AND NETWORK PROGRAMMING

Paper Code: CS-72, Max. Marks: 80, Time: 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:

To create enterprise application development skills among students using Advanced Java.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT I

1. Review of Java Basic Features, Applets, AWT Controls, Event Handling, Multithreading, I/O files.
2. Swing: Features, components, Swing vs AWT, swing containers, controls, using Dialogs, Sliders, Progress bars, tables, Creating user interface using swing.

UNIT II

3. Java Database Connectivity: Connectivity model, Java.SQL package, JDBC Exception classes, Database connectivity, Data manipulation and navigation, creating database applications.
4. Java RMI: Distributed object technologies, RMI architecture, creating RMI applications.

UNIT III

5. Java Servlets: Servlets vs CGI, Servlet lifecycle, creating and running servlets.

UNIT IV

7. Java Beans: Component architecture, Components, Advantages of Beans, Bean Developer kit (BDK), JAR files, introspection, developing Beans, Using Bound properties, The Java Beans API, Introduction to EJB (Enterprise Java Beans), Types of EJB, Uses of EJB.

Suggested Readings:

1. Schildt, Herbert: The Complete Reference Java 2, TMH.
2. Ivan Bayross: Web Enabled Commercial Application Development using Java 2.0, BPB.
SYLLABUS FOR MASTER OF COMPUTER APPLICATIONS (M.C.A.)

FIFTH SEMESTER

Paper Title: COMPUTER BASED OPTIMIZATION TECHNIQUES

Paper Code: CS-17               Max. Marks: 80               Time : 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:

To introduce linear programming, dynamic programming and related Optimization Theories to solve real life / simulated problems.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.
(v) The student can use only Non-programmable & Non-storage type Calculator.

UNIT I


UNIT II

2. Special types of linear programming problems - Transportation and assignment problems.
3. Integer programming: Introduction, Branch and bound techniques, Binary linear programming.

UNIT III

5. Dynamic Programming, Deterministic and probabilistic dynamic programming.

UNIT IV

6. Queuing models: Application and characteristics of queuing models, Structure of basic queuing system.
7. PERT and CPM: Phases of project management, PERT and CPM computations.
8. Simulation: Definition types of simulation models, Phases of simulation, Applications of simulation, Inventory and queuing problems, Advantages and disadvantages.

Suggested Readings:

Paper Title: SOFTWARE PROJECT MANAGEMENT

Paper Code: CS-57    Max. Marks: 80    Time : 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:

To familiarize the students with Project management, Project Planning and Scheduling, Advanced DSS, ERP and Software metrics.

Note: (i) The Question paper will consist of four units. (ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi. (iii) The students are required to attempt one question from each unit and the compulsory question. (iv) All questions carry equal marks. (v) The student can use only Non-programmable & Non-storage type Calculator.

UNIT I

1. Project Management:
   Introduction to project and project management, problems with software projects, Project management knowledge area and framework, Stages of project: feasibility study: cost-benefit analysis, Planning, project execution, project and product life cycle; Project stakeholders: All parties of project, role of project manager; Exploration of open source software tools for project management.

2. Checkpoints and Processes of Project:

UNIT II

3. Project Planning:
   Integration management: Introduction, Project plan development, Plan execution; Scope management: Introduction, methods for selecting projects, project charter, scope statement, work breakdown structure; Stepwise project planning: Overview, Main steps in project planning.

4. Project Scheduling:
   Time Management: Importance of project schedules, Schedules and activities, Sequencing and scheduling activity; Project network diagrams: Network planning models, Duration estimating and schedule development, Critical path analysis, Program evaluation and review Techniques.

UNIT III

5. Technical Metrics for Software:
   Software process and project metrics: Size-oriented metrics, Function-oriented metrics, Extended function point metrics, A Framework for technical software metrics, Metrics for requirement specification quality, Metrics for analysis, Metrics for design, Metrics for source code, Metrics for testing, Metrics for maintenance.
6. **Technical Metrics for Object-Oriented Systems:**

UNIT IV

7. **Introduction to ERP:**
   Overview, Benefits, Technologies related to ERP, ERP packages, Business process re-engineering, Implementation life cycle of ERP, Training: Team training, End user training; Post implementation (maintenance mode), Implementation in large-scale organization, Applications of ERP in functional areas: Marketing, Personnel, Financial & Production.

8. **DSS:**
   Decision structure, Decision support trends, DSS components, Using DSS: What-if analysis, sensitivity analysis, Goal seeking analysis, Optimization analysis, Executive information systems, Enterprise portals and decision support, knowledge management systems.

**Suggested Readings:**

Paper Title: MOBILE COMMUNICATION AND ANDROID APPLICATION DEVELOPMENT

Paper Code: CS-58
Max. Marks: 80
Time: 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:
The course will familiarize the students with basic concepts about mobile communication, its architecture, protocols, mobile databases and operating systems. It will also enable them to develop mobile applications using Android.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.
(v) The student can use only Non-programmable & Non-storage type Calculator.

UNIT I

1. Mobile communication:

UNIT II

2. Mobile database:
   Database hoarding techniques, Data Caching, Client Server computing: 2tier and 3tier client server architecture; Transactional models, Query processing, Data Recovery process; Data Dissemination; Communication Asymmetry, Classification of Data delivery mechanism: Push based, pull based, Hybrid; Selective tuning and indexing technique, Mobile Application Languages, Mobile Operating system: PalmOS, Symbian, Android.

UNIT III

3. Android Application Development:

UNIT IV

4. Android Application Development:
   Managing Application Resources: Working with Simple Resource values, Drawable Resources, Layouts, Files; Configuring the Android Manifest file and basic application Settings, registering activities, Designating the launch activity, Managing Application permissions, Designing an application framework.

Suggested Readings:
6. Shane Conder, Lauren Darcey: Sams Teach Yourself Android™ Application Development in 24 Hours.
Paper Title: SOFT COMPUTING TECHNIQUES USING NEURAL NETWORKS

Paper Code: CS-59  Max. Marks: 80  Time: 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:
To get the knowledge and exposure for Advanced AI Techniques to solve the problem lying in fuzzy environment.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.
(v) The student can use only Non-programmable & Non-storage type Calculator.

UNIT I

Fundamentals:

1. Introduction to Soft Computing:
   Basic soft computing techniques: Neural networks, Fuzzy logic, Genetic algorithms; Hybrid systems, Applications to soft computing.

2. Basics of Neural Networks:

UNIT II

Neural Network Learning Models:

3. Supervised Learning Networks:
   Introduction to supervised learning, Architecture and training algorithms for perception network and back propagation networks.

4. Unsupervised Learning Networks:
   Introduction to unsupervised learning, Architecture and training algorithms for Kohonen self-organizing maps and adaptive resonance theory networks (ART1, ART2).

5. Hopfield Networks:
   Introduction, Architecture and training algorithm for discrete Hopfield nets.

UNIT III

Fuzzy Logic:

6. Fuzzy Logic:
   Introduction and Application to Fuzzy logic, Classical sets, Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership functions: Features & Methods of membership value assignment, Defuzzification methods.
7. **Fuzzy Logic Control Systems:**
   Architecture and Operation of Fuzzy Logic Control (FLC) systems, FLC System Models, Applications of FLC Systems.

UNIT IV

**Genetic Algorithms:**

8. Introduction to genetic algorithms; Biological background, Genetic algorithms versus traditional algorithms. Basic terminologies in genetic algorithm: Genes, fitness and populations.


**Suggested Readings:**

5. Rao and Rao: C++ Neural Networks & Fuzzy Logic, BPB.
CS-19 Seminar

Max. Marks: 100

Each student will be required to give seminar on selected topic and submit the report.

SEMINARS TOPICS

1. Artificial Neural Networks.
2. Tele Immersion - The future of Internet telecommunication.
5. Natural Language Processing.
7. Honey pots & Honey net.
8. Ubiquitous Computing.
10. MANET.
14. Cloud Computing
15. J2EE
17. Digital Watermarking.
19. Information Security (Security, Cryptography, Digital Signatures etc.).
22. Robotic Surgery.
23. Any other topic related to recent developments.
SIXTH SEMESTER

CS-18 GUIDELINES FOR SUBMISSION OF PROJECT REPORT

Max. Marks: 320

The report should consist of the following:

- Cover page including Project title, Name of the student, Name of the Department and Names of the Project Guides (both External and Internal).
- Acknowledgements.
- Certificate from company and department duly signed by external guide, chairman and internal guide.
- Contents with page numbers.
- Introduction (includes background and application or importance of the project).
- Objectives.
- System Analysis.

System Feasibility Study:

- Software requirement specifications.
- Design with system flowcharts and input/output design.
- Implementation and Testing
  - Hardware and software used.
  - Listing of well commented programs with result/output or detailed algorithms with input and output.

Further Scope of the Project:

- Bibliography.
- Appendices (any other information related to project).

Each student should observe the following norms while submitting the synopsis/thesis for the Project:

(a) Use both sides of the paper instead of only single side.
(b) Use one and half interline spacing in the text (instead of double space).
(c) Stop using a blank sheet before the page, carrying figure or table.
(d) Try to insert figure/table in the text page itself (instead of using a fresh page for it, each time).

Students must consult/inform the internal guides regarding the progress of their work at least once in 20 days. It is the duty of the student to be in touch with his/her internal guide. The student must prepare 5 copies of the report including one copy for self. The remaining four are to be submitted before 31st May every year as per the following:


One softcopy of the work is to be submitted to the concerned head of the dept./institution along with the report. The student must present his/her work in 15 minutes mainly focusing on his/her contribution with the help of slides followed by demonstration of the practical work done. The Project Viva will be completed before 15th June every year. Exact dates will be informed before 31st May every year.

Project Viva will be conducted by an external examiner, internal examiner and the internal guide.
OLD PAPERS (ELECTIVES)

Paper Title : MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Paper Code: CS-01 Max. Marks: 80 Time : 3 Hrs.
Course Duration: 60 Lectures of one hour each.

Objectives:

To provide basic mathematical foundation required for various computer science courses.

Note :  
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Sets, Relations and Functions:
   Definition of Sets and Subsets; Venn Diagrams, Intersection, Union and Complements; DeMorgan’s Law; Set Properties, Cardinality, Relations-Equivalence relations etc., Classes of Sets; Mappings-One-one, Onto etc.

2. Calculus: Functions; Limits and Continuity; Differentiation and Integration.

UNIT-II


4. Logic: Logic Operators like AND, OR etc., Truth Tables; Theory of Inference and Deduction; Mathematical Induction; Predicate Calculus; Predicates and Quantifiers.

UNIT-III

5. Linear Equations & Matrices:
   Various types of matrices, Row/Column Operations, Solution of Linear Equations, Determinants, Properties of Determinants, Cramer’s Rule, Gaussian Elimination; Decomposition, Inverse of a Matrix, Calculation of Inverse by Elementary Row Operations.

6. Vector Spaces, Inner Products and Norms:
   Linear Independence; Linear Dependence; Bases, Subspaces and Dimensionality.

UNIT-IV

7. Length of an Inner Product, Angle, Direction Cosines; Orthogonalizations. Definitions and Theorems on each topic.

8. Graph, Directed Graph, Machines:
   Basic Concepts, Paths & Connectivity, Labelled Graphs, Tree Graph, Rooted Trees, Directed Graphs, Finite State Machines.

Suggested Readings:

Paper Title: COMPUTER PROGRAMMING AND PROBLEM SOLVING (USING C)

Paper Code: CS-02  Max. Marks: 80  Time: 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:

To develop the Logic for given problem and to gain experience of procedure oriented language, its syntax and construction of code.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Problem Solving:
   Problem Identification, Analysis, Flowcharts, Decision Tables, Pseudocodes and algorithms, Program Coding, Program Testing and Execution, Types of Programming Languages.

UNIT-II

2. Computer Programming Language (C Language):
   Concept of variables and constants, Structure of a C program, various operators, Expressions and their evaluation using rules of hierarchy, Assignment statements.

UNIT-III

3. Control Structures:
   Sequencing, alternation, iteration, Arrays, Manipulating vectors and matrices, Pointers, Strings and string functions, structures.

4. User defined functions, Data management, Input/Output and files, Documentation, debugging, C preprocessor, Macros.

UNIT-IV

5. A brief introduction to C++ Object Oriented Programming techniques, Difference between C & C++.

6. Examples illustrating structured program development methodology and use of a block structured algorithmic language to solve specific problems.

Suggested Readings:

9. Gookin, Dan: C Programming, Wiley India Pvt. Ltd.
Paper Title: DATA AND FILE STRUCTURES (USING C) - OLD

Paper Code: CS-03
Max. Marks: 80
Time: 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:

After completing this course, the learner will be able to use various concepts of Algorithm development, use various Data Structures, apply various Sorting and Searching Techniques, apply Data Structures and other techniques to real life problems.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Introduction to Data Structures:
Concepts and definition of Data types, Data objects, Data structures (linear and non-linear).

Lists:
Linear lists, arrays and operations including traversing, insertion, deletion, reverting searching, Sorting and merging two arrays, Representation of one and multidimensional arrays in memory, Matrix operations, algorithms, Sparse matrices and their representation in memory, Application of array: Polynomial Evaluation and addition of two polynomial, Algorithms to implement array operations and applications.

UNIT-II

2. Linked list:
Introduction, Sequential representation versus linked representation, operations using linked lists: Creation, Insertion, Deletion, Traversal, Inverse, Concatenation, Application of linked lists: Polynomial addition; algorithms to implement operations and applications, Circular linked lists, doubly linked lists and operations, dynamic memory allocation and garbage collection.

3. Stacks:
Sequential and linked representations, Operations, Applications of stack: Conversion from infix to postfix form, Evaluation of postfix expression, Algorithm to implement operation and applications.

4. Queues:
Sequential and linked representation operations, Circular queues.

UNIT-III

5. Trees:
Introduction to terminology of trees, Binary tree, full binary tree, complete binary tree, Sequential and linked representation of binary trees in memory, conversion of tree into a binary tree, Tree traversal: inorder, pre-order and post-order, Application of binary trees: binary search trees, Algorithms to implement tree operations, creation of heap, and heap sort.

6. Sets and Graphs:
Set representation, Union and find algorithms, Graphs and their representation in memory.
UNIT-IV

7. **Searching and Sorting:**

   Recursion and recursive algorithms, Bubble sort, Insertion sort, Selection sort, Merger sort, Linear and binary Searching techniques, Algorithms to implement the above methods and complexity of the algorithms.

8. **File structures:**

   Concepts of fields, records and files, Sequential file organisation, variable length records and text files, Indexing structures like B-trees, ISAM, Hashing techniques for direct files, Inverted lists, Multilists.

**Suggested Readings:**

8. Deshpanday: C and Data Structures, Wiley India Pvt. Ltd.
11. Leendert: Algorithms and Data Structure in C++, Wiley India Pvt. Ltd.
SYLLABUS FOR MASTER OF COMPUTER APPLICATIONS (M.C.A.)

Paper Title: OBJECT ORIENTED PROGRAMMING (THROUGH C++ AND JAVA) - OLD

Paper Code: CS-04
Max. Marks: 80
Time: 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:
This course will expose you to the features in C++ and Java as well as help you design software using the object oriented paradigm of programming using C++ and Java.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Introduction to Object Oriented Programming – Objects, Classes, Data abstraction, Data Encapsulation, Inheritance (Single, Multiple, Hierarchical, Multilevel, Hybrid) Polymorphism, Dynamic binding, Message Passing, Tokens, Expressions, Data Types, Variables, Operators, Control Statements, Arrays, Constructors & Destructors, new and delete operators, string handling.

UNIT-II

2. Classes, Objects, Functions & Methods, Virtual functions, Friend functions, pass by value vs Pass by Reference, Operator overloading, File Handling, Exception Handling, Class and Functions, Templates.

UNIT-III

3. Java – Introduction, JVM, byte-code, Data Types, Variables and Arrays, Operators, Control Statements, Classes, Overloading Methods, Member Access and Inheritance, Method Overriding, Using super and final, Defining a Package, Understanding CLASSPATH, Importing Packages, Defining an Interface, Implementing Interfaces, Applying Interfaces, Variables in Interfaces.

UNIT-IV


Suggested Readings:

9. Schildt, Herbert: The Complete Reference Java 2, TMH.
Paper Title: COMPUTER ORGANIZATION AND ASSEMBLY LANGUAGE - OLD

Paper Code: CS-05
Max. Marks: 80
Time: 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:

The objective of the course is to provide students with a solid foundation in computer design. Examine the operation of the major building blocks of a computer system. To introduce students to the design and organization of modern digital computers by showing the relationship between hardware and software and focusing on the concepts that are the basis of the current computers such as microprocessors. Includes machine language, instruction set architecture, and control design, memory hierarchy, and input/output and communication. To introduce basic assembly language. Describe the instruction format/set of a computer. Write simple assembly program.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Representation of Information:
   Number Systems, Integer and floating point representation, Character codes, (ASCII, EBCDIC), Error detection and correction codes, Boolean Algebra.

UNIT-II

2. Basic Building Blocks:
   K-maps for 2, 3 & 4 variables, Flip-flops: RS Latches, D, JK and Master-slave, Registers, Buffer, Shift and Controlled shift registers, Counters: Ripple, Synchronous and Ring Counters, Half Adders and Full Adders.

UNIT-III

3. Organization of Control Unit, Memory:
   Types and Organization, Peripheral Devices: I/O devices (Video Terminals and Printers) and Controllers, Storage Devices (Tape and disks)

UNIT-IV

4. Assembly Language Programming:
   Programmers model of a machine, Example of a typical 16 to 32 bit processor (8088 microprocessor) — Registers, Addressing modes, Instruction set, Use of an Assembly Language for specific programmes for typical problems: Simple string and numeric manipulations, searching and sorting of a list and use of I/O instructions.
Suggested Readings:

9. Rafiquzzaman, Microprocessors & Microcomputers Based System Design, UBS.
10. Gupta, Vikas: Comdix Computer Hardware and Networking Course Kit, Wiley India Pvt. Ltd.
Paper Title: DATABASE MANAGEMENT SYSTEMS (DBMS) - OLD

Course Duration: 60 Lectures of one hour each.

Objectives:

The concepts related to database, database design techniques, transaction management, SQL, PL/SQL and database operations are introduced in this subject. This creates strong foundation for database creation.

Note:

(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Data Base Concepts:

Data base vs file oriented approach, Data Independence, Data Base Models, General Architecture of a Data Base Management Software, Components of a DBMS, Advantages and Disadvantages of DBMS.

UNIT-II

2. Data Base Design:

Entities, Attributes, E-R Diagrams, EE-R Diagrams, Functional dependencies, Normalization, Multivalued dependencies, Decomposition, Relational algebra and calculus, The relational calculus query processor and optimizer, Storage organization for relations.

UNIT-III

3. Data Base Protection:

Concurrency, recovery, Integrity, Protection, essentials of security, Authorization, types of database security.

UNIT-IV

4. System Development using RDBMS:

Brief introduction to RDBMS, Oracle data types, Querying database tables, conditional retrieval of rows, working with Null values, matching a pattern from the table, querying multiple tables: equi joins, Cartesian joins, Outer joins, Self join, Set operator: Union, Intersect, Minus, Nested queries, views. Introduction to PL/SQL, the PL/SQL block structure, PL/SQL data types, variables and constants, assignment and expressions, Writing PL/SQL code, cursor management in PL/SQL, Concept of stored packages, Database triggers, types of triggers, Dropping triggers, storage of triggers. Program Design & Development for Inventory, Personnel and Financial Management using Oracle.

Suggested Readings:

Paper Title: INFORMATION SYSTEMS AND ENTERPRISE RESOURCE PLANNING

Objectives:

The key objective of an ERP system is to integrate information and processes from all functional divisions of an organization. The course provides students a fundamental understanding of Management Information System Concepts and their role in contemporary business. At the end of this course, students should be able to participate in information systems development as an informed person.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Information systems, The sub-systems of Information systems, EDP & MIS, management levels, EDP/MIS/DSS/ESS MIS: Overview, Definition and characteristics, components, Framework, Anthony’s Hierarchy of Management Activity, Information requirements and levels of management, Simon’s model of decision making, structured Vs unstructured decisions, Formal Vs Informal systems.

UNIT-II


UNIT-III


UNIT-IV


Suggested Readings:

2. Rajaraman, V.: Analysis and Design of Information Systems, PHI.
Paper Title : SOFTWARE ENGINEERING - OLD

Paper Code: CS-09    Max. Marks: 80    Time : 3 Hrs.
Course Duration: 60 Lectures of one hour each.

Objectives:

The course aims to give students a theoretical foundation in Software Engineering and help them learn its principles and methods including emerging practices and support tools.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

Prerequisite: Computer Organization & Assembly Language Programming, Problem Solving and C Programming.

UNIT-I

1. Introduction:


2. Software Specifications:

Software requirements, Definition, Software requirements specifications (SRS), Components of SRS.

UNIT-II

3. Software Project Planning & Scheduling:

Objectives, Decomposition techniques, Problem based estimation, Cost estimation models, COCOMO model, Risk in estimation.

4. System Analysis:

Principles of Structured Analysis, DFD, E-R-diagram, Data Dictionary.

UNIT-III

5. Software Metrics:


6. Software Design:

Objectives, Principles, Concepts, Design Process, Design Methodologies, Structured design, Modular design, Object oriented design, User-interface design, Features of a Modern GUI, Windows, icons, error messages etc.
UNIT-IV

7. **System Administration and Training:**

8. **Hardware and Software Selection:**
   Hardware acquisition, Benchmarking, Vendor selection, Software selection, Performance and acceptance criteria, Site preparation.

**Suggested Readings:**

Paper Title: INFORMATION SYSTEM DESIGN AND IMPLEMENTATION

Paper Code: CS-10  Max. Marks: 80  Time: 3 Hrs.
Course Duration: 60 Lectures of one hour each.

Objectives:

Coursework is designed with the objective of teaching Methodologies of designing Information System and also their implementation.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

2. Concepts of balanced MIS Effectiveness and Efficiency criteria.

UNIT-II


UNIT-III

4. Advanced MIS-Concept, need and problems in achieving advanced MIS, Decision Support System.
5. Rationale of Computer Application.

UNIT-IV

6. A study of major financial, production, Manpower and marketing MIS.

Suggested Readings:

Paper Title: OPERATING SYSTEMS - OLD

Paper Code: CS-11 Max. Marks: 80 Time: 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:
To understand the concepts and components of system programming and to learn the fundamentals of Operating System including dealing with deadlocks and file management.

Prerequisite: Computer Organization & Assembly Language Programming, Problem Solving and C Programming.

Note: (i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Introduction to Operating System:
   OS, Types of OS, functions/operations of OS, History of OS, User services/jobs.

2. Memory Management-I:
   Address Protection, Segmentation, Virtual memory, paging, page replacement algorithms.

UNIT-II

3. Memory Management-II:
   Cache memory, hierarchy of memory types, Associative memory.

4. Support for Concurrent Process:
   Mutual exclusion, shared data, critical sections, Busy form of waiting, Lock and unlock primitives, synchronization.

UNIT-III

5. Scheduling:
   Process states, Virtual processors, Interrupt mechanism, Scheduling algorithms, Preemptive Scheduling & Non-Preemptive scheduling.

UNIT-IV

6. System Deadlock:
   Prevention, detection and avoidance.

7. Multiprogramming System:
   Queue management, File and directory systems, Disk scheduling: FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK.

Suggested Readings:
4. Richie: Operating System, BPB.
Paper Title: DATA MINING AND DATA WAREHOUSING - OLD

Paper Code: CS-13  Max. Marks: 80  Time: 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:

This course will introduce concepts and techniques of data mining and data warehousing, including concept, principle, architecture, design, implementation, application of data warehousing and data mining. Some systems for data warehousing and/or data mining will also be introduced. To study the methodology of engineering legacy databases for data warehousing and data mining to derive business rules for decision support systems.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Introduction:
   Data Warehousing, Characteristics of a Data Warehouse, Data marts and Data mining.

2. Developing Data Warehouse:
   Building a Data Warehouse, Data Warehouse architectural strategies, Design considerations, Data content, metadata, distribution of data, Tools for Data Warehousing, performance considerations, Crucial decisions in Designing a Data Warehouse, various technological considerations.

UNIT-II

3. Developing Data Mart based Data Warehouse:
   Types of Data Marts, Loading a Data Mart, Metadata for a data Mart, Data Model for a Data Mart, Maintenance of a Data Mart, Nature of Data in Data Mart, Software components for a Data Mart, Tables in Data Mart, External Data, Reference Data, Performance issues, Monitoring requirements for a Data Mart, Security in Data Mart.

UNIT-III

4. OLTP and OLAP Systems:
   Data Modeling, Star Schema for multidimensional view, Multi fact star schema, categories of OLAP tools, Managed Query Environment.

UNIT-IV

5. Data Mining:
   Introduction, From Data Warehouse to Data Mining, Steps of Data Mining Process, Types of Data Mining Tasks, Data Mining Algorithms Viz. Classification, Association Rules and Clustering, Database Segmentation, Predictive Modeling, Link Analysis, Tools for Data Mining.

Suggested Readings:
6. Jiawei Han, Micheline Kamber, 2000: Data Mining: Concepts and Techniques, Morgan Koffman Elsvier.
Paper Title: ANALYSIS AND DESIGN OF ALGORITHMS - OLD

Paper Code: CS-14  Max. Marks: 80  Time: 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objective:
The objective of the module is to create skills in students to design and analyses the algorithms.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

Prerequisite: Computer Programming and Problem Solving, Data and File Structure.

UNIT-I

1. Algorithms and Analysis:
   Introduction, Algorithms specification, Recursive algorithms, space and time complexity, Asymptotic Notation (O, _, and Θ, o) practical complexities, Best, average and worst case performance of algorithms, examples, Introduction to recurrence relations.

2. Divide and Conquer:
   General method, Binary Search, Merge sort, Quick sort, Selection sort, Strassen's matrix multiplication and analysis of these problems.

UNIT-II

3. Greedy Method:
   General Method, Knapsack problem, Job sequencing with deadlines, Minimum spanning Trees, Single Source Shortcut paths and analysis of these problems.

4. Dynamic Programming:
   General method, Optimal Binary Search Trees, 0/1 Knapsack, the travelling salesperson problem.

UNIT-III

5. Back Tracking:
   General method, 8 queen's problem, Graph colouring, Hamiltonian cycles, Analysis of these problems.

6. Branch-And-Bound:
   Method, 0/1 Knapsack and Travelling Salesperson problem, Efficiency considerations.

UNIT-IV

7. Lower-Bound Theory:
   Techniques for Algebraic problems, Some Lower Bounds on Parallel Computation.

8. NP-hard and NP-complete problems:
   Basic concepts, Statement of Cook's Theorem, Examples of NP-hard graph and NP-scheduling problems, some simplified NP-hard problems.

Suggested Readings:

Objective:
The course aims at providing the students through insight on DBMS principle and practices. Starting from the rudimentary concepts, students will move on to the complex topics related to DBMS. After completion of the course, students will be able to design, implement and use database system. At the end of the course, the students will be able to create small client server application, write SQL Queries, Draw ER Diagram and design databases, and describe and use the features of Recovery, Concurrency and Security in DBMS.

Note: (i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I
1. Data independence, data models, Network model, DBTG proposal; Data definition and manipulation languages; Hierarchical and relational models.

UNIT-II
2. Storage organization for relations, Relational algebra and calculus; Query language, SQL: Introduction, basic structure, data types, select command and option, union, insert, delete, update, aggregate function, grouping result, views, null, nested queries. The relational calculus query processor and optimizer.

UNIT-III
3. Functional dependencies: Normal forms, multivalued dependencies: decomposition, Integrity; Protection.

UNIT-IV

Suggested Readings:
8. Martin, James: Principles of Data Base Management, PHI.
Paper Title: EMERGING DATABASE TECHNOLOGIES

Paper Code: CS-20 
Max. Marks: 80
Time : 3 Hrs.
Course Duration: 60 Lectures of one hour each.

Objectives:
The Objective of this course is to introduce the students with the Emerging database technologies and their applications.

Note:  
(i) The Question paper will consist of four units.  
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.  
(iii) The students are required to attempt one question from each unit and the compulsory question.  
(iv) All questions carry equal marks.

UNIT-I

1. Object Oriented Databases:
   Concepts of Object oriented databases, Object Identity, structure and type constructors, encapsulation, Hierarchies and Inheritance, Object Definition Language, Object Query Language, ODBMS conceptual design, Object relationship features of Oracle/SQL server, overview of SQL3, Database design and tuning in relational model.

UNIT-II

2. Enhanced Data Models, Distributed Database and Client Server Architecture:
   Active Database concepts, Temporal database concepts, Spatial and multimedia databases, Distributed database concepts, Data Fragmentation, Replication and Allocation techniques, Query processing recovery and concurrency control in distributed databases. Types of Distributed databases, Client server and Distributed database relationship.

UNIT-III

3. Deductive Databases:
   Prolog/Datalog Notation, Rules, Inference Mechanism, Datalog programs and evaluation, Deductive database systems, Deductive object oriented databases, Applications of Deductive databases.

UNIT-IV

4. Data Warehousing & Data Mining:

Books Recommended:
4. Berson, Alex, Smith, Stephen J. 1997: Data Archousing Data Mining and OLA, McGraw
Paper Title: .NET FRAMEWORK AND C# - OLD

Paper Code: CS-21   Max. Marks: 80   Time: 3 Hrs.
Course Duration: 60 Lectures of one hour each.

Objectives:
At the completion of this course, the student will be able to:

- Create and populate Windows Forms and use user controls, menus in a Windows Forms application
- Add code to form and control event procedures in a Windows Forms application
- Create Multiple Document Interface (MDI) applications and Validate user input.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. INTRODUCTION TO .NET ENVIRONMENT:
The .NET strategy, the origins of the .NET technology, the .NET framework, the common language runtime, framework base classes, user and programs interface, Visual Studio .NET, .NET languages, benefits of the .NET approach.

2. INTRODUCTION TO C#:
Introducing C#, Overview of C#, Literals, Variables, Data Types, Operators, Expressions, Branching, Looping, Methods, Arrays, Strings, Structures, Enumerations, difference between C++ and C#, difference between Java and C#.

UNIT-II

3. OBJECT ORIENTED ASPECTS OF C#:
Classes, Objects, Inheritance, Polymorphism, Interfaces, Operator Overloading, Delegates, Events, Errors and Exceptions.

4. I/O, OBJECT SERIALIZATION AND REMOTING:

UNIT-III

5. WRITING WINDOWS FORMS APPLICATIONS AND DEPLOYING WINDOWS FORMS APPLICATIONS:
6. **WRITING ASP .NET APPLICATIONS AND DEPLOYING ASP.NET APPLICATIONS:**

**UNIT-IV**

7. **ACCESSING DATA WITH ADO .NET:**
   Looking Inside ADO.NET, Database, Using Objects, Using Data Adapters and Datasets, Using Binding to a Data Grid Control, Creating Applications.

**Suggested Readings:**

Paper Title: INTRODUCTION TO DISTRIBUTED AND PARALLEL PROCESSING

Objectives:
- To develop proficiency in parallel methodologies
- To study and understand the technologies enabling parallel computing
- To study different parallel programming models

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Introduction: Need for Computational speed; Applications of parallel computers in various fields including Mathematics, Physics, Chemistry and Computer Science, Configuration of some existing Mainframe and Super Computers for parallel processing; issues in parallel processing.

2. Parallel Processing Architectures: Parallelism in Sequential Machines, Abstract model of parallel computer, multiprocessor architecture, programmability issues.

UNIT-II


4. Shared Memory Programming: General Model, Process Model under UNIX.

UNIT-III

5. Thread Based Implementation: Thread Management, Thread Implementation.


UNIT-IV

8. Quadrature Problem, Matrix Multiplication, Parallel Sorting Algorithms and Solving Linear System.


Laboratory Exercise:
Using FORTRAN—90 or ‘C’ Write Parallel programs for sorting, matrix multiplication, merging operations, Graph algorithms, solving linear systems.

Minor Project Work:
Design and simulate parallel environment using MPI and PVM.

Suggested Readings:
1. Sasikumar, M., Shikhara, Dinesh and Ravi Prakash, P.: Introduction to Parallel Processing, PHI.
3. Crichlow, Joel M.: An Introduction to Distributed and Parallel Computing, PHI.
4. Rajaraman, V.: Elements of Parallel Computing, PHI.
Paper Title: DISTRIBUTED COMPUTING, NETWORKS AND APPLICATIONS

Paper Code: CS-23  Max. Marks: 80  Time: 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:
The objective of this course is to introduce students to the fundamentals and techniques of distributed computing and provide them with the basic skills of how to write distributed programs. Topics to be covered include: distributed computing, distributed programming, distributed systems, concurrency, distributed computing paradigms, inter-process communications, group communications, operating system support, distributed objects, application programming interfaces (RMI, RPC), client server model, the socket API, security issues and Internet applications. Students are expected to develop distributed applications using latest technologies.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

Prerequisite: Data and File Structures, Operating System.

UNIT-I

1. Distributed Processing Potential:
   Forms of Distributed Processing Strategies, Hexagon diagrams.

UNIT-II

2. Communications:
   Concepts of data transmission, Signal encoding, Modulation methods, Synchronization, Multiplexing and concentration, Coding method, Cryptography.

UNIT-III

3. Networks:
   Communication system architecture OSI reference model, Topology types, Selections, Design, Local Area Networks (LAN), Switching techniques,

UNIT-IV

4. CSMA/CD, Token bus, Token ring techniques. Link Level Control (LLC) protocols, Medium Access Control (MCA) protocols, Wide Area Networks (WAN), Physical layer description (X.21), Data link layer protocols, HDLC, Analysis of protocols and performance, Concepts in network layer, Routing methods.

Suggested Readings:
Paper Title: MICROPROCESSOR AND APPLICATIONS

Paper Code: CS-24                       Max. Marks: 80                       Time : 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:

The purpose of this course is to teach students the fundamentals of microprocessor and to introduce students to features and technology of microprocessor systems. The students studying the subject are supposed to learn the architecture of a typical microprocessor and also get general information about microprocessor based control systems.

Note:

(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

Prerequisite: Computer Organization and Assembly Language Programming.

UNIT-I

1. Microcomputer structure (Processor, Memory and I/O); Bit slices and 8/16/32-bit microprocessors, Microprocessor architecture (registers, index and stack pointers, addressing modes); I/O interface adapters (parallel and serial) interface devices, system clock, clock phase and bit rates.

UNIT-II

2. Memory read-write and read only, memory mapping of I/O; Interrupts, types, handling of interrupts, polling and vectored interrupts.

UNIT-III

3. Direct memory access methodologies.
4. Software development and debugging aids.

UNIT-IV

5. Microprocessor based real-time control and instrumentation systems.

Suggested Readings:

Paper Title: ADVANCED JAVA AND NETWORK PROGRAMMING - OLD

Paper Code: CS-25
Max. Marks: 80
Time: 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:
To create Enterprise application development skills among students using Advanced Java.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Review of Java Basic Features, Applets, AWT Controls, Event Handling, Multithreading, I/O files.
2. Swing: Features, components, swing vs AWT, swing containers, controls, using Dialogs, sliders, progress bars, tables, creating user interface using swing.

UNIT-II

3. Java Database Connectivity: Connectivity model, Java. SQL package, JDBC Exception classes, Database connectivity, Data manipulation and navigation, creating database applications.
4. Java RMI: Distributed object technologies, RMI architecture, creating RMI applications.

UNIT-III

5. Java Servlets: Servlets vs CGI, Serve let lifecycle, creating and running serve lets.

UNIT-IV


Suggested Readings:

2. Ivan Bayross: Web Enabled Commercial Application Development using Java 2.0, BPB.
3. Schildt, Herbert: The Complete Reference Java 2, TMH.
Paper Title: RELATIONAL DATABASE MANAGEMENT SYSTEMS - OLD


Course Duration: 60 Lectures of one hour each.

Objectives:

The course aims at providing the students through insight on DBMS principles and practices. Knowledge of DBMS, both in terms of use and implementation, design and to make students familiar with concept of ER and EER Diagram Experience with SQL and PL/SQL and Increased proficiency with the FoxPro

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Database Concepts:
   Database vs file oriented approach, Database Models, General Architecture of a Data Base Management Software, Components of a DBMS, Advantages and Disadvantages of DBMS.

2. Database Design:
   Entities, Attributes, E-R Diagrams, EE-R Diagrams, Conceptual Design of a Relational database model. Designing databases for commercial applications like inventory control, financial management, personnel management etc.

UNIT-II

3. Software Development using FOXPRO:
   Introduction to FOXPRO, basic data types, expressions, constructs, commands used in files: SET TALK ON/OFF, RETURN, SKIP, COUNT etc. Basic screen manipulation commands, commands used for data entry and editing. Program Design and development for Library and Hospital Management System using FOXPRO.

UNIT-III

4. Software Development using ORACLE:
   Brief introduction to Oracle, Oracle data types, Quering database tables, Conditional retrieval of rows, working with Null values, matching a pattern from the table, quering multiple tables: Equi joins, Cartesian joins, Outer joins, Self join, Set operator: Union, Intersect, Minus, Nested queries.

UNIT-IV


Suggested Readings:
5. Taxali, R.K.: FoxPro 2.5 Made Simple, BPB Publication
Paper Title: COMPILER DESIGN

Paper Code: CS-32   Max. Marks: 80   Time : 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:

To Introduce the major concept areas of language translation and compiler design.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Regular Expressions and Finite Automata:
   The structure of a compiler, Phases of a Compiler, Compiler construction tools, Finite automata, Regular expressions, Conversion from regular expression to finite automata.

UNIT-II

2. Parsing and Syntax Analysis:
   Syntax Analysis, Context Free Grammars, Top-down and Bottom-up Parsing techniques, Parsing Table Construction, LR, SLR & LALR Parsers.

UNIT-III

3. Syntax Directed Translation:

UNIT-IV

4. Storage Management and Code Optimization:

Suggested Readings:

5. Grune, Dick: Modern Compiler Design, Wiley.
6. Gaddis, David: Starting out with Modern Compiler Design, Wiley India Pvt. Ltd.
Paper Title: SIMULATION AND MODELLING

Paper Code: CS-33  Max. Marks: 80  Time: 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:

The Objective of this course is to teach students methods of Modeling the systems using discrete event simulation.

Note:  
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

Prerequisite: Probability and Statistics

UNIT-I

1. Introduction:
Definitions and scope of Modelling and Simulation; Variables, Problem formulation and constraints; Different steps in simulation; Other approaches – physical modelling and model laws, Electrical analogy methods; Utility of other approaches; Verification and Validation procedures.

2. Analog Simulation:
Analog, Digital and Hybrid computers - a comparison; Basic principles – summer, divider, integrator, subtractor and multiplier; Time scaling; Circuit diagrams for typical examples.

UNIT-II

3. System Modelling:
Types of systems – Continuous and discrete types; Static and dynamic systems; Principles of mathematical modelling of physical processes. Market management model; Distributed lag and cobweb models; Autopilot; Exponential models and logistic curves; Simple system dynamics diagrams. Host–parasite system.

4. Probability Concepts:
Stochastic and random variables, Probability distributions – Rectangular, Poisson, exponential, Erlang, hyper-exponential and normal distributions with examples; Generation of uniformly distributed random numbers and related chi–square and poker tests.

UNIT-III

5. Probabilistic Modelling:
Generation of non-uniformly distributed random numbers - inverse transformation and rejection methods; Generation of normal variates; Congestion in systems– Poisson arrivals and service times.

6. Queuing Systems:
Queuing disciplines and measures; Computer solution of queuing problems; Utilization factor and grade of service.
UNIT-IV

7. **Simulation Examples:**

Discrete events, representation of time; Simulation of time sharing in a computer system; Simulation of a telephone system.

8. **Simulation Languages:**

Comparison with HLL; Study and use of GPSS, basic symbols and language; Examples of simulation of single-server and two-server queuing systems; Use of data structures and A.I. techniques in modelling and simulation.

**Suggested Readings:**

Paper Title: IMAGE PROCESSING

Paper Code: CS-41   Max. Marks: 80               Time : 3 Hrs.
Course Duration: 60 Lectures of one hour each.

Objectives:
Image processing is an advanced course offered as elective to students interested in learning the theory, techniques and applications of the subject. It also aims to stimulate interest in current research areas in image processing and in developing tools for use in research as well as in multimedia applications.

Note : 
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Introduction to Image Processing:

2. Digital Image Fundamentals:
   Uniform and Non-uniform Sampling and Quantization, Basic Relationships between pixels—Neighbours of a pixel, Connectivity, Distance Measures, Imaging Geometry—Perspective transformations, Camera Model, Stereo Imaging.

UNIT-II

3. Image Transforms:

4. Image Enhancement:

UNIT-III

5. Image Restoration:

6. Image Compression:
   Fundamentals, Image Compression models, Low Compression, Image Compressions standards.

UNIT-IV

7. Image Segmentation:
   Detection of Discontinuities, Edge Linking and Boundary Detection, Hough Transform, Thresholding, Region Oriented Segmentation.

8. Representation, Description, recognition and Interpretation Fundamentals.

Suggested Readings:
Paper Title: OBJECT ORIENTED PROGRAMMING USING C++

Paper Code: CS-42  Max. Marks: 80  Time : 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:
This course will expose you to the advanced features in C++ as well as help you design software using the object oriented paradigm of programming.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Introduction to Object Oriented Programming – Objects, Classes, Data Abstraction, Data Encapsulation, Inheritance (Single, Multiple, Hierarchical, Multilevel, Hybrid) Polymorphism, Dynamic binding, Message Passing.

UNIT-II

2. Tokens, Expressions, Data Types, Variables, Operators, Control Statements, Arrays, Constructors & Destructors, new and delete operators, String handling.

UNIT-III


UNIT-IV

4. File Handling, Exception Handling, Class and Functions Templates.

Suggested Readings:

4. Schioldt, Herbert : Schioldt’s Advanced Win 95 Prog. in C & C++, MH.
SYLLABUS FOR MASTER OF COMPUTER APPLICATIONS (M.C.A.)

Paper Title: UNIX AND SHELL PROGRAMMING

Paper Code: CS-43  Max. Marks: 80  Time : 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:
The objective of the course is to make students aware of the functioning of a multi-user operating system. This course will serve as a foundation course for the higher level course in Unix. The students are expected to learn the commands while doing practical and emphasis should be given to those switches/options and flags, which are most frequently used in real life.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I
1. Theoretical Concepts of UNIX Operating System:
   Basic Features of Operating System; File Structure; CPU Scheduling; Memory Management : Swapping, Demand Paging; File System : Blocks and Fragments, Inodes Directory Structure; User to User Communication.

2. Getting Started with UNIX:
   User Names and Groups; Logging in; Format of UNIX commands; Changing your Password.

UNIT-II

UNIT-III
4. Text Manipulation:
   Inspecting Files, File Statistics, Searching for Patterns Comparing Files, Operating on Files, Printing Files, Rearranging Files, Sorting Files, Splitting Files, Translating characters, AWK utility.

5. Shell Programming:
   Programming in the Borne and the C-shell, Wild cards.

UNIT-IV

7. System Administration:
   Definition of System Administration: Booting the System, Maintaining user Accounts, File Systems and Special Files, Backups and Restoration, Role and functions of a system manager.

Suggested Readings:
4. Love: Beginning Unix.
5. Eric Faster–Johnson: Beginning Shell Scripting (Covers Linux, Unix Windows & Mac), Wiley India Pvt. Ltd.
8. Dass, Sumitabha: Your Unix the Ultimate Guide
Paper Title: WEB APPLICATION TOOLS AND E-COMMERCE

Objectives:
To create familiarity with various Web Technologies which can be used at Client side / Sever side and encourage web applications development using them.

Note: (i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I
1. DHTML:

2. ASP:
   Introduction, Basics of VB scripts (Data types, Variables, Operators, Control structures, built-in-functions etc.).

UNIT-II
3. JAVA:
   The Genesis of Java: Why Java is important to the Internet, An Overview, Object-Oriented Programming, Data Types, Variables and Arrays, Operators, Control Statements.
   Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, Overloading Methods, Using Objects as Parameters, Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding Static, Nested and Inner Classes, Exploring the String Class, Using Command-Line Arguments; Inheritance: Inheritance Basics, Member Access and Inheritance, Using super to call Super-class Constructors, Creating a Multilevel Hierarchy, Method Overriding; Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, Using final to prevent Overriding, Using final to prevent Inheritance.

UNIT-III
4. Packages and Interface:
UNIT-IV


6. **Introduction to E-commerce:**

   Basics, Payment system, security and legal issues.

**Suggested Readings:**

2. Lemay, L.: Teach yourself Java 2 in 21 days, Tech.
5. DHTML unleashed Techmedia.
6. Teach yourself DHTML in a week, Techmedia.
7. Teach yourself ASP in 21 days, Techmedia.
Paper Title: VISUAL C++ PROGRAMMING

Paper Code: CS-45   Max. Marks: 80   Time : 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:
An Advanced course focusing on ANSI C++; the Standard Template Library and Graphical Programming using the Microsoft Foundation Classes.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Introduction to Developer Studio, its working and debugging support:

2. Visual C++ Programming:
   Visual C++’s Program Structure, Variables, data-types, basic I/O, selection statements, Repetition statements, arrays, pointers, Dynamic memory allocation, functions, recursion, Visual C++ library of functions, inheritance, Polymorphism, Virtual functions, Storing data in disk files, using disk files.

3. Win 32 Architecture and the Windows GUI:
   The Win 32 API, Architecture of a Win 32 program, Elements of Windows GUI.

UNIT-II

4. Windows Programming with MFC:
   MFC fundamentals: The structure and usage of the MFC, The application framework, MFC support for multithreading, MFC class categories, The document/view architecture, Handling window messages, Managing handlers with Class Wizard, Errors and error handling, MFC diagnostic functions and macros, Exceptions and exception handling.

UNIT-III

MFC and user interface programming: MFC classes and user interface elements. Commands and menus, Toolbars, Dialog bars and status bars, Creating dialog boxes, Standard windows controls and MFC classes, Dialog Data Exchange (DDX) and Dialog Data Validation (DDV), Using list boxes, Building an ActiveX control framework, MFC support for Context-sensitive help. Viewing and Storing Data: Form views, Control views, Splitter windows, Handling multiple views.

UNIT-IV

5. Database Creation Programming in Windows:
   Data access with MFC: Introduction to data access, MFC database classes, Record sets and transactions.
   Developing Database Applications: Creating an ODBC application, Structure of a database application, Connecting the recordset to controls, Creating a joined recordset.
   Querying the Database: Customizing a query, Querydefs and parameterized, queries, Seek and Find functions.
6. **Application Deployment:**

   The Registry and application setup, Linking, MFC and DLLs.

**Suggested Readings:**

Paper Title: VISUAL BASIC PROGRAMMING


Course Duration: 60 Lectures of one hour each.

Objectives:
This course is an introduction to computer programming using Microsoft Visual Basic. Topic include designing a Visual Basic user interface, creating a windows application, variables and arithmetic operations, applications using decision structures, loop structures, string manipulation, arrays, function procedures and exception handling, incorporating databases with ADO.NET, creating classes and introduction to object programming.

Note:  (i) The Question paper will consist of four units.
      (ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
      (iii) The students are required to attempt one question from each unit and the compulsory question.
      (iv) All questions carry equal marks.

UNIT-I


2. Event-Driven Programming: Working with Visual Basic Source Files, Using the MSG-Box Function when an Event is Fired, Adding Code to a Form Click Event, Properties and Methods in Visual Basic: Properties, Methods, Event Firing Order: Form Startup Events, Form User Response Events, Form Shutdown Events; The MSG-Box Function and Query Unload, Adding Code to Form and control events, Basic concepts to Object-Oriented Programming, Encapsulating VB Dialog; Understanding Class Modules: Properties, Methods, Using Class Properties and Methods; Creating, Firing and Handling Custom Events.

UNIT-II

3. Visual Basic Language Overview: VB code lines and comments, Identifiers, Constants and Variables, Using Option Explicit, Numbers, Operators, Control loops and conditional statements, Modules, Subroutines and Functions, Passing Arguments, Programmer--Defined Structures, Arrays, Speaking the Language of Objects : Using Active X controls, Using ActiveX components, Quickly Finding Information in the Documentation, Calling External Procedures, Calling the Windows API.

4. Visual Basic Windows User Interface Control: Creating a Property Sheet, Using the Tab Strip control; Creating a Wizard.

5. Secrets of Good Practice using Visual Basic: Good Programming Practice, Architectural Design of Applications, Naming clarity and conventions, Custom from Properties and Methods: Adding acustom method, Adding a custom property, Firing custom events, Implementing a Stack as an Array, Interrupting a Do Loop, Managing List Boxes, Tracking multiple list boxes, Avoiding list box deletion errors, Copying selected list box items to the Clipboard, String Manipulation : Capitalizing words in a string, Parsing Visual Basic code and Checking line lengths, Rounding Numbers, Enumerating Fonts.
UNIT-III


UNIT-IV


9. Application development using VB with MS-ACCESS.

**Suggested Readings :**

2. Greg Perry: Visual Basic 6 in 21 days, TMH.
5. Evangelos, Petroutsor: Mastering VB 6.0, BPB.
7. Cornel, Gary: Visual Basic from the Ground up, TMH.
Paper Title: FUNDAMENTALS OF INFORMATION TECHNOLOGY

Objectives:
The objective of this course is to familiarize students with concepts of Fundamentals of IT and its applications.

Note: (i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

Overview of Computer System:

UNIT-II

Operating System:
Role of an OS, Types of OS, Features of OS & functions of OS. Booting procedure.

Command-Line OS:
Fundamentals of DOS, Disk organization, Internal commands, External commands, Batch files, using screen editor, spooling, communicating with other devices, parallel Vs serial communication.

Graphical OS:

UNIT-III

Personal Productivity Software:

Word processing:
Editing features, formatting features, saving, printing, table handling, page settings, spell-checking, macros, mail-merge, equation editors.

Spreadsheet:
Workbook, worksheets, data types, operators, cell formats, freeze panes, editing features, formatting features, creating formulas, using formulas, cell references, replication, sorting, filtering, functions, Charts & Graphs, PivotTable and PivotChart, Macros, What-If Analysis.

Presentation Graphics Software:
Templates, views, formatting slide, slides with graphs, animation, using special features, presenting slide shows.

Web-designing:
Uses, interface, adding text, images, creating links, tables, forms, publishing.
UNIT-IV

Information Technology Basics:

Information, Technology, Information Technology, Role, Information technology and Internet, Applications.

Disk management tools:

PC tools, Norton Utilities, Virus, worms, threats, virus detection, prevention and cure utilities, Firewalls, Proxy servers.

Internet:

Internet & its applications, working of search engines, use of e-mail, types, Topologies, major features of internet (www, e-mail, telnet, ftp, IRC, news), structure and types of internet connections, Addressing schemes.

Suggested Readings:

3. Habraken, Joe: Office 2000, PHI.
4. Stultz: Learn MS-Office 2000 BPB.
7. Finkelstein: How to Do Every Thing with Microsoft Office PowerPoint 2003, WileyIndia Pvt. Ltd.
8. Walkenbach: Microsoft Excel 2003 Programming with VBA Bible, WileyIndia Pvt. Ltd.
Paper Title: MULTIMEDIA TECHNOLOGIES

Paper Code: CS-50               Max. Marks: 80               Time : 3 Hrs.
Course Duration: 60 Lectures of one hour each.

Objectives:
The Objective of this course is to introduce the students with the various technologies related to multimedia.

Note: (i) The Question paper will consist of four units.
   (ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
   (iii) The students are required to attempt one question from each unit and the compulsory question.
   (iv) All questions carry equal marks.

UNIT-I

1. **Introduction to Multimedia Systems:**
   Architecture and Subsystems of Multimedia Computer Systems, multimedia applications, multimedia building blocks (text, hypertext, image, audio, video, animation, multimedia networks).

2. **Multimedia Hardware:**
   Input devices–Keyboard, mouse, touch screen, graphic tablets, scanner, microphone, digital camera.
   Output devices–Monitor, projector, sound system, video system. Memory & Storage Devices–RAM, magnetic media, CD, DVD.

UNIT-II

3. **Multimedia Files:**
   Image and sound file formats, compression standards and compression techniques.

4. **Photoshop:**
   Photoshop workspace, Image editing tools. Specifying and adjusting colours, using gradient tools, selection and move tools, Transforming, Path drawing and editing tools, using channels, layers, filters and actions.

UNIT-III

5. **Flash:**
   Exploring interface, using selection and pen tools, working with drawing and painting tools, applying color, viewing and manipulating timeline, timeline/stage relationship, animating (frame-by-frame, tweening), guiding layers, masking, importing and editing sound & video clips in flash, working with 3D graphics, using Action Script.

UNIT-IV

6. **Director:**

7. **Virtual Reality:** Basics, Hardware and Software requirements, applications.

Suggested Readings:
2. Jeffcoate, Judith: Multimedia in Practice, Technology & Practice, PHI.
4. Reinhardt & Lentz: Flash 5 Bible, Wiley India Pvt. Ltd.
5. Nyquist & Martin: Director-5 and Lingo Bible, Wiley India Pvt. Ltd.
6. Mcclelland, Deke: Photoshop (Version -9), C 52, Bible, Wiley India Pvt. Ltd.
Paper Title: MATHEMATICAL STRUCTURES FOR COMPUTER SCIENCE - OLD

Paper Code: CS-51          Max. Marks: 80          Time : 3 Hrs.
Course Duration: 60 Lectures of one hour each.

Objectives:
To provide basic mathematical structures required for various computer science courses.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I
1. Mathematical Logic:

2. Relation and Functions:
   Binary relations, Composition of relations, Equivalence relations, function : Injection, Surjection & Bijection, Function Composition & Inverse function.

UNIT-II
3. Set Theory:

4. Linear Equation:
   Linear Equation in one, two and n-unknowns, Solution of a Triangular System, Gaussian Elimination, Determinants and System of Linear Equation.

UNIT-III
5. Graphs:
   Incidence and Degree, Handshaking Lemma, Isomorphism, Connectedness, Walk, Path and Circuits. Shortest Path Algorithm between two Vertices, Eulerian graph, Fleury’s Algorithm. Directed graphs.

6. Trees:
   Properties of Trees, Rooted and Binary Trees; Directed Tree, Spanning Tree, Cutest & Cut Vertices, Max-flow–Min-cut theorem.

UNIT-IV
7. Planner Graphs:
   Combinatorial and geometric duals; Kuratowski’s graphs; Detection of planarity.

8. Matrix Representations of Graphs:
   Incidence; Adjacency matrices and their properties.

Suggested Readings:
4. Deo, N.: Graph Theory with Applications to Engineering and Computer Science. PHI.
SYLLABUS FOR MASTER OF COMPUTER APPLICATIONS (M.C.A.)

Paper Title: SOFTWARE TESTING AND QUALITY CONTROL
Paper Code: CS-52       Max. Marks: 80                  Time : 3 Hrs.
Course Duration: 60 Lectures of one hour each.

Objectives:
The objective of this course is to familiarize students with concepts of Software testing and quality control and its various techniques.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I
1. An Overview of Testing Process:

2. Software Testing Techniques:

UNIT-II
3. White-Box Testing and its Techniques:
   Domain and Boundary Testing, Logic Based Testing, Data Flow Testing.

4. Software Testing Strategies:

UNIT-III
5. Metrics for Software:

6. Quality Assurance:
   Overview of Software Quality, Software Quality Attributes, Factors Affecting Software Quality, Building Software Quality Assurance Plan, Components of SQAP.

UNIT-IV
7. Quality Management & Quality Models:

8. Software Reliability:
   Factors Affecting Software Reliability, Software Reliability VS Hardware Reliability, Software Reliability Metrics.

Suggested Readings:
Paper Title: SOFTWARE TESTING AND QUALITY ASSURANCE

Objective:
The objective of this course is to familiarize students with concepts of Software testing and quality assurance and its various techniques.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I
1. An Overview of Testing Process:

2. Software Testing Techniques:

UNIT-II
3. Software Testing Strategies:

4. Metrics for Software:

UNIT-III
5. Quality Assurance:
   Overview of Software Quality, Software Quality Attributes, Factors Affecting Software Quality, Building Software Quality Assurance Plan, Components of SQAP.

6. Quality Management & Quality Models:

UNIT-IV
7. Software Reliability:
   Factors Affecting Software Reliability, Software Reliability Vs Hardware Reliability, Software Reliability Metrics.

8. System Configuration Management (SCM):

Suggested Readings:
Paper Title: MULTI AGENT SYSTEMS

Paper Code: CS-54  Max. Marks: 80  Time: 3 Hrs.

Course Duration: 60 Lectures of one hour each.

Objectives:
Identify and discuss the characteristics of agent-based systems; and Program actual agents in one multiagent environment. To have a rich understanding of multiagent systems and their limitations, skills to design automation solutions using multiagent system techniques.

Note: (i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

UNIT-I

1. Introduction:
Limitation of Artificial Intelligence (AI), Introduction and Advantages of Distributed AI, Agents, Multiagent systems (MAS), applications.

2. Intelligent Agents:
Examples, architecture for Intelligent agents: abstract, logic based, reactive, belief – desire intention architecture and layered architecture, agent oriented programming.

UNIT-II

3. Agent Communication:
Communication levels, Message types, KQML (Knowledge Query and Manipulation Language), KIF (Knowledge Interchange Format), Ontologies, agent interaction protocol, Co-ordination & co-operation protocols, Contract nets, and black board systems.

UNIT-III

4. Distributed Model for Decision Support:

UNIT-IV

5. Tools and Techniques for Agent Development:
Java Agent Development Environment (JADE), Java agents, Java agent framework. Introduction to Neural Networks, Fuzzy Logic and Genetic algorithms and agent development using these techniques.

Suggested Readings:
Paper Title: MATHEMATICAL, NUMERICAL AND STATISTICAL TECHNIQUES

Objectives:

To provide basic knowledge about mathematical structures required for various computer science courses and various significant and fundamental concepts to inculcate in the students an adequate understanding of the application of Numerical Algorithms and Statistical Methods.

Note:
(i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

Prerequisite: Mathematical Foundation of Computer Science, Probability and Statistics.

UNIT I

1. Mathematical Logic:

2. Graphs and Trees:
   Graph: Definition of a graph, Isomorphism, walks, paths, circuits; Types of graphs: Connected, Regular, Bipartite, Hamiltonian, Eulerian and Kuratowski’s graphs; Tree: Definition of a Tree, Properties of Trees; Cut-set & Cut vertices: Introduction to cut-sets, properties of a cut-set, Max-flow-Min-cut theorem.

UNIT II

3. Error and Solution of Non-Linear Equations:

4. Solution of System of Linear Equations:
   Solution of Simultaneous Linear Equations: Gauss Elimination Method and Pivoting, ILL-Conditioned Equations and Refinement of solution; Gauss Siedel iterative method - Algorithms and Examples.

UNIT III

5. Numerical Differentiation and Integration:
   Numerical Differentiation: Differentiating a function tabulated at equal intervals and unequal intervals, Higher order derivatives.
   Solution of Differential Equations: Euler’s Method, Runge-Kutta Second order and Fourth order methods; Predictor corrector methods: Modified Euler’s Method.
6. **Interpolation and Approximation:**
   Approximation of a function by Taylor Series and Chebyshev Polynomials.

**UNIT IV**

7. **Regression Analysis:**

8. **Time Series:**

9. **SPSS and MatLab:**
   Introduction and Features of SPSS and MatLab.

**Suggested Readings:**

2. Deo, Narsingh : Graph Theory with Applications to Engineering and Computer Science, PHI.
5. Gupta, S.P.: Statistical Methods, Sultan Chand and Sons.
PAPER TITLE: CURRENT TRENDS AND TECHNOLOGIES

Objectives:
To familiarize students with emerging technologies such as Multimedia, Parallel and distributed computing, E-technologies, ethics in computing.

Note: (i) The Question paper will consist of four units.
(ii) Examiner will set total of nine questions comprising two questions from each unit and one compulsory question of short answer type covering whole syllabi.
(iii) The students are required to attempt one question from each unit and the compulsory question.
(iv) All questions carry equal marks.

Unit I

Introduction to Multimedia Systems:
Introduction, Use of multimedia system, Hardware and software requirements for multimedia computer systems, multimedia applications.

Multimedia building blocks:
Text: fonts and faces, using text in multimedia, designing with text, choosing text fonts, hypertext, hypermedia; Image: bitmaps, vector drawing, 3-D drawing and rendering, color palettes, image file formats; Audio: digital audio, making MIDI audio, audio file formats. MIDI vs digital audio; Video: working of video, digital video standards and formats, storyboarding; Animation: Animation techniques and formats.

Multimedia authoring: Introduction, stages of authoring, methodologies: Frame Based, Time based, Icon Based.

Unit II

Semantic Web Technologies

E-Content Development
Integrating Multimedia in Education & Educational software applications, Instructional Design System & Communication Modes in Education: Formulation of Instructional Strategies, Task Analysis, Designing of Instructional strategies using curriculum specific Educational software.

E-Technologies
Unit III

Multiagent Technology:

Introduction to distributed artificial intelligence, Types of agents, applications of multiagent system, issues in multiagent system development, agent communication protocols: KQML and FIPA; Tools for multiagent system development: Downloading and exploring features of Java agent development environment (JADE) and understanding multiagent programs using JADE.

Parallel and distributed computing:

Fundamentals and Need for parallel and distributed computing, Parallel processing architectures, examples and requirements of complex or high end applications, issues in parallel and distributed computing: shared memory vs distributed memory programming.

Unit IV

Ethics in Computing:

Introduction, Need of ethics, issues related to computer ethics, ethical standards, Netiquette; Plagiarism: Introduction, types of plagiarism, risks involved in plagiarism, avoiding plagiarism, plagiarism detection software: their features and use.

Introduction to the following:


References:

3. Sasikumar M., Shikhara Dinesh, Prakash P. Ravi, 2004 : Introduction to Parallel Processing, PHI.