III SEMESTER

ENGINEERING MATHEMATICS – III

CODE: 10 MAT 31  IA Marks: 25
Hrs/Week: 04  Exam Hrs: 03
Total Hrs: 52  Exam Marks: 100

PART-A

Unit-I: FOURIER SERIES

Convergence and divergence of infinite series of positive terms, definition and illustrative examples*
Periodic functions, Dirichlet’s conditions, Fourier series of periodic functions of period $2\pi$ and arbitrary period, half range Fourier series. Complex form of Fourier Series. Practical harmonic analysis. [7 hours]

Unit-II: FOURIER TRANSFORMS

Infinite Fourier transform, Fourier Sine and Cosine transforms, properties, Inverse transforms [6 hours]

Unit-III: APPLICATIONS OF PDE

Various possible solutions of one dimensional wave and heat equations, two dimensional Laplace’s equation by the method of separation of variables, Solution of all these equations with specified boundary conditions. D’Alembert’s solution of one dimensional wave equation. [6 hours]

Unit-IV: CURVE FITTING AND OPTIMIZATION

Curve fitting by the method of least squares- Fitting of curves of the form
$$y = ax + b, \quad y = a x^2 + b x + c, \quad y = a e^{bx}, \quad y = ax^b$$

Optimization: Linear programming, mathematical formulation of linear programming problem (LPP), Graphical method and simplex method. [7 hours]

PART-B
Unit-V: NUMERICAL METHODS - 1

Numerical Solution of algebraic and transcendental equations: Regula-falsi method, Newton - Raphson method. Iterative methods of solution of a system of equations: Gauss-seidel and Relaxation methods. Largest eigen value and the corresponding eigen vector by Rayleigh’s power method. [6 hours]

Unit-VI: NUMERICAL METHODS – 2

Finite differences: Forward and backward differences, Newton’s forward and backward interpolation formulae. Divided differences - Newton’s divided difference formula, Lagrange’s interpolation formula and inverse interpolation formula.

Numerical integration: Simpson’s one-third, three-eighth and Weddle’s rules (All formulae/rules without proof) [7 hours]

Unit-VII: NUMERICAL METHODS – 3

Numerical solutions of PDE – finite difference approximation to derivatives, Numerical solution of two dimensional Laplace’s equation, one dimensional heat and wave equations [7 hours]

Unit-VIII: DIFFERENCE EQUATIONS AND Z-TRANSFORMS

Difference equations: Basic definition; Z-transforms – definition, standard Z-transforms, damping rule, shifting rule, initial value and final value theorems. Inverse Z-transform. Application of Z-transforms to solve difference equations. [6 hours]

Note: * In the case of illustrative examples, questions are not to be set.

Text Books:

Reference Book:


ELECTRONIC CIRCUITS
(Common to CSE & ISE)

Subject Code: 10CS32   I.A. Marks : 25
Hours/Week : 04   Exam Hours: 03
Total Hours : 52   Exam Marks: 100

PART - A

UNIT - 1                7 Hours
Transistors, UJTs, and Thyristors: Operating Point, Common-Emitter Configuration, Thermal Runaway, Transistor Switch, Unijunction Transistors, SCR.

UNIT - 2                6 Hours
Field Effect Transistors: Bipolar Junction Transistors versus Field Effect Transistors, Junction Field Effect Transistors, Metal Oxide Field Effect Transistors, Differences between JFETs and MOSFETs, Handling MOSFETs, Biasing MOSFETs, FET Applications, CMOS Devices, Insulated Gate Bipolar Transistors (IGBTs)

UNIT - 3                6 Hours
Optoelectronic Devices: Introduction, Photosensors, Photoconductors, Photodiodes, Phototransistors, Light-Emitting Diodes, Liquid Crystal Displays, Cathode Ray Tube Displays, Emerging Display Technologies, Optocouplers

UNIT - 4                7 Hours
Small Signal Analysis of Amplifiers: Amplifier Bandwidth: General Frequency Considerations, Hybrid h-Parameter Model for an Amplifier, Transistor Hybrid Model, Analysis of a Transistor Amplifier using complete h-Parameter Model, Analysis of a Transistor Amplifier Configurations using Simplified h-Parameter Model (CE configuration only), Small-Signal
Analysis of FET Amplifiers, Cascading Amplifiers, Darlington Amplifier, Low-Frequency Response of Amplifiers (BJT amplifiers only).

**PART - B**

**UNIT - 5**  
**6 Hours**  

**UNIT - 6**  
**7 Hours**  
Sinusoidal Oscillators, Wave-Shaping Circuits: Classification of Oscillators, Conditions for Oscillations: Barkhausen Criterion, Types of Oscillators, Crystal Oscillator, Voltage-Controlled Oscillators, Frequency Stability.  

**UNIT - 7**  
**7 Hours**  
Linear Power Supplies, Switched mode Power Supplies: Linear Power Supplies: Constituents of a Linear Power Supply, Designing Mains Transformer; Linear IC Voltage Regulators, Regulated Power Supply Parameters.  

**UNIT - 8**  
**6 Hours**  

**Text Book:**  
   (4.1, 4.2, 4.7, 4.8, 5.1 to 5.3, 5.5, 5.6, 5.8, 5.9, 5.13, 5.14, 6.1, 6.3, 7.1 to 7.5, 7.10 to 7.14, Listed topics only from 8, 10.1, 11, 12.1, 12.2, 12.3, 12.5, 13.1 to 13.6, 13.9, 13.10, 14.1, 14.2, 14.6, 14.7, 15.1, 15.5 to 15.7, 16.3, 16.4, 17.12 to 17.22)
Reference Books:

LOGIC DESIGN
(Common to CSE & ISE)

Subject Code: 10CS33
I.A. Marks: 25
Hours/Week: 04
Exam Hours: 03
Total Hours: 52
Exam Marks: 100

PART-A

UNIT – 1 7 Hours

UNIT – 2 6 Hours
Combinational Logic Circuits

UNIT – 3 6 Hours
Data-Processing Circuits: Multiplexers, Demultiplexers, 1-of-16 Decoder, Encoders, Exclusive-or Gates, Parity Generators and Checkers, Magnitude Comparator, Programmable Array Logic, Programmable Logic Arrays, HDL Implementation of Data Processing Circuits

UNIT – 4 7 Hours
Clocks, Flip-Flops: Clock Waveforms, TTL Clock, Schmitt Trigger, Clocked D FLIP-FLOP, Edge-triggered D FLIP-FLOP, Edge-triggered JK FLIP-FLOP, FLIP-FLOP Timing, JK Master-slave FLIP-FLOP, Switch Contact Bounce Circuits, Various Representation of FLIP-FLOPs, Analysis of Sequential Circuits, HDL Implementation of FLIP-FLOP

PART-B
UNIT – 5
Registers: Types of Registers, Serial In - Serial Out, Serial In - Parallel Out, Parallel In - Serial Out, Parallel In - Parallel Out, Universal Shift Register, Applications of Shift Registers, Register Implementation in HDL.

UNIT – 6
Counters: Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus, Decade Counters, Presetable Counters, Counter Design as a Synthesis problem, A Digital Clock, Counter Design using HDL.

UNIT – 7

UNIT – 8

Text Book:

Reference Books:
UNIT – 1  6 Hours
Set Theory: Sets and Subsets, Set Operations and the Laws of Set Theory, Counting and Venn Diagrams, A First Word on Probability, Countable and Uncountable Sets

UNIT – 2  7 Hours

UNIT – 3  6 Hours
Fundamentals of Logic contd.: The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems

UNIT – 4  7 Hours

PART – B

UNIT – 5  7 Hours
Relations and Functions: Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions – Stirling Numbers of the Second Kind, Special Functions, The Pigeon-hole Principle, Function Composition and Inverse Functions

UNIT – 6  7 Hours
Relations contd.: Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions

UNIT – 7  6 Hours
Groups: Definitions, Examples, and Elementary Properties, Homomorphisms, Isomorphisms, and Cyclic Groups, Cosets, and Lagrange’s Theorem.
Coding Theory and Rings: Elements of Coding Theory, The Hamming Metric, The Parity Check, and Generator Matrices
UNIT – 8                6 Hours

Group Codes: Decoding with Coset Leaders, Hamming Matrices

Rings and Modular Arithmetic: The Ring Structure – Definition and Examples, Ring Properties and Substructures, The Integers Modulo n

Text Book:
   (Chapter 3.1, 3.2, 3.3, 3.4, Appendix 3, Chapter 2, Chapter 4.1, 4.2, Chapter 5.1 to 5.6, Chapter 7.1 to 7.4, Chapter 16.1, 16.2, 16.3, 16.5 to 16.9, and Chapter 14.1, 14.2, 14.3).

Reference Books:

DATA STRUCTURES WITH C  
(Common to CSE & ISE)

Subject Code: 10CS35 I.A. Marks : 25  
Hours/Week : 04 Exam Hours: 03
Total Hours : 52 Exam Marks: 100

PART – A

UNIT - 1                8 Hours


UNIT - 2                6 Hours

ARRAYS and STRUCTURES: Arrays, Dynamically Allocated Arrays, Structures and Unions, Polynomials, Sparse Matrices, Representation of Multidimensional Arrays
UNIT - 3 6 Hours
STACKS AND QUEUES: Stacks, Stacks Using Dynamic Arrays, Queues, Circular Queues Using Dynamic Arrays, Evaluation of Expressions, Multiple Stacks and Queues.

UNIT - 4 6 Hours
LINKED LISTS: Singly Linked lists and Chains, Representing Chains in C, Linked Stacks and Queues, Polynomials, Additional List operations, Sparse Matrices, Doubly Linked Lists

PART - B

UNIT - 5 6 Hours

UNIT - 6 6 Hours

UNIT - 7 6 Hours

UNIT - 8 8 Hours

Text Book:

Reference Books:

OBJECT ORIENTED PROGRAMMING WITH C++
(Common to CSE & ISE)

Subject Code: 10CS36     I.A. Marks : 25
Hours/Week : 04     Exam Hours: 03
Total Hours : 52     Exam Marks: 100

PART – A

UNIT 1
Introduction: Overview of C++, Sample C++ program, Different data types, operators, expressions, and statements, arrays and strings, pointers & user-defined types
Function Components, argument passing, inline functions, function overloading, recursive functions

UNIT 2
Classes & Objects – I: Class Specification, Class Objects, Scope resolution operator, Access members, Defining member functions, Data hiding, Constructors, Destructors, Parameterized constructors, Static data members, Functions

UNIT 3
Classes & Objects – II: Friend functions, Passing objects as arguments, Returning objects, Arrays of objects, Dynamic objects, Pointers to objects, Copy constructors, Generic functions and classes, Applications
Operator overloading using friend functions such as +, - , pre-increment, post-increment, [ ] etc., overloading <<, >>.

UNIT 4
Inheritance – I: Base Class, Inheritance and protected members, Protected base class inheritance, Inheriting multiple base classes

PART – B

UNIT 5
Inheritance – II: Constructors, Destructors and Inheritance, Passing parameters to base class constructors, Granting access, Virtual base classes
UNIT 6  
Virtual functions, Polymorphism: Virtual function, Calling a Virtual function through a base class reference, Virtual attribute is inherited, Virtual functions are hierarchical, Pure virtual functions, Abstract classes, Using virtual functions, Early and late binding.

UNIT 7  
I/O System Basics, File I/O: C++ stream classes, Formatted I/O, I/O manipulators, fstream and the File classes, File operations

UNIT 8  
Exception Handling, STL: Exception handling fundamentals, Exception handling options
STL: An overview, containers, vectors, lists, maps.

Text Books:

Reference Books:

DATA STRUCTURES WITH C/C++ LABORATORY  
(Common to CSE & ISE)

Subject Code: 10CSL37   I.A. Marks : 25  
Hours/Week : 03   Exam Hours: 03  
Total Hours : 42   Exam Marks: 50  

1. Using circular representation for a polynomial, design, develop, and execute a program in C to accept two polynomials, add them, and then print the resulting polynomial.

2. Design, develop, and execute a program in C to convert a given valid parenthesized infix arithmetic expression to postfix expression and then to print both the expressions. The expression consists of
single character operands and the binary operators + (plus), - (minus), * (multiply) and / (divide).

3. Design, develop, and execute a program in C to evaluate a valid postfix expression using stack. Assume that the postfix expression is read as a single line consisting of non-negative single digit operands and binary arithmetic operators. The arithmetic operators are + (add), - (subtract), * (multiply) and / (divide).

4. Design, develop, and execute a program in C to simulate the working of a queue of integers using an array. Provide the following operations:
   a. Insert
   b. Delete
   c. Display

5. Design, develop, and execute a program in C++ based on the following requirements:
   An EMPLOYEE class is to contain the following data members and member functions:
   Data members: Employee_Number (an integer), Employee_Name (a string of characters), Basic_Salary (an integer), All_Allowances (an integer), IT (an integer), Net_Salary (an integer).
   Member functions: to read the data of an employee, to calculate Net_Salary and to print the values of all the data members.
   (All_Allowances = 123% of Basic; Income Tax (IT) = 30% of the gross salary (= basic_Salary _ All_Allowance); Net_Salary = Basic_Salary + All_Allowances _ IT)

6. Design, develop, and execute a program in C++ to create a class called STRING and implement the following operations. Display the results after every operation by overloading the operator <<.
   i. STRING s1 = "VTU"
   ii. STRING s2 = "BELGAUM"
   iii. STRING s3 = s1 + s2; (Use copy constructor)

7. Design, develop, and execute a program in C++ to create a class called STACK using an array of integers and to implement the following operations by overloading the operators + and -:
   i. s1=s1 + element; where s1 is an object of the class STACK and element is an integer to be pushed on to top of the stack.
   ii. s1=s1- ; where s1 is an object of the class STACK and – operator pops off the top element.
Handle the STACK Empty and STACK Full conditions. Also display the contents of the stack after each operation, by overloading the operator <<.

8. Design, develop, and execute a program in C++ to create a class called LIST (linked list) with member functions to insert an element at the front of the list as well as to delete an element from the front of the list. Demonstrate all the functions after creating a list object.

9. Design, develop, and execute a program in C to read a sparse matrix of integer values and to search the sparse matrix for an element specified by the user. Print the result of the search appropriately. Use the triple <row, column, value> to represent an element in the sparse matrix.

10. Design, develop, and execute a program in C to create a max heap of integers by accepting one element at a time and by inserting it immediately into the heap. Use the array representation for the heap. Display the array at the end of insertion phase.

11. Design, develop, and execute a program in C to implement a doubly linked list where each node consists of integers. The program should support the following operations:
   i. Create a doubly linked list by adding each node at the front.
   ii. Insert a new node to the left of the node whose key value is read as an input.
   iii. Delete the node of a given data if it is found, otherwise display appropriate message.
   iv. Display the contents of the list.
   (Note: Only either (a,b and d) or (a, c and d) may be asked in the examination)

12. Design, develop, and execute a program in C++ to create a class called DATE with methods to accept two valid dates in the form dd/mm/yy and to implement the following operations by overloading the operators + and -. After every operation the results are to be displayed by overloading the operator <<.
   i. no_of_days = d1 – d2; where d1 and d2 are DATE objects, d1 >= d2 and no_of_days is an integer.
   ii. d2 = d1 + no_of_days; where d1 is a DATE object and no_of_days is an integer.

13. Design, develop, and execute a program in C++ to create a class called OCTAL, which has the characteristics of an octal number.
Implement the following operations by writing an appropriate constructor and an overloaded operator +.
   i. OCTAL h = x; where x is an integer
   ii. int y = h + k; where h is an OCTAL object and k is an integer.
Display the OCTAL result by overloading the operator <<. Also display the values of h and y.

14. Design, develop, and execute a program in C++ to create a class called BIN_TREE that represents a Binary Tree, with member functions to perform inorder, preorder and postorder traversals. Create a BIN_TREE object and demonstrate the traversals.

Note: In the examination each student picks one question from a lot of all the 14 questions.

ELECTRONIC CIRCUITS & LOGIC DESIGN LABORATORY
(Common to CSE & ISE)

Subject Code: 10CSL38          I.A. Marks : 25
Hours/Week :  03          Exam Hours: 03
Total Hours :  42           Exam Marks : 50

PART-A

1. a) Design and construct a suitable circuit and demonstrate the working of positive clipper, double-ended clipper and positive clamper using diodes.
   b) Demonstrate the working of the above circuits using a simulation package.

2. a) Design and construct a suitable circuit and determine the frequency response, input impedance, output impedance, and bandwidth of a CE amplifier.
   b) Design and build the CE amplifier circuit using a simulation package and determine the voltage gain for two different values of supply voltage and for two different values of emitter resistance.

3. a) Design and construct a suitable circuit and determine the drain characteristics and transconductance characteristics of an enhancement-mode MOSFET.
   b) Design and build CMOS inverter using a simulation package and verify its truth table.
4. a) Design and construct a Schmitt trigger using Op-Amp for given UTP and LTP values and demonstrate its working.
b) Design and implement a Schmitt trigger using Op-Amp using a simulation package for two sets of UTP and LTP values and demonstrate its working.

5. a) Design and construct a rectangular waveform generator (Op-Amp relaxation oscillator) for given frequency and demonstrate its working.
b) Design and implement a rectangular waveform generator (Op-Amp relaxation oscillator) using a simulation package and demonstrate the change in frequency when all resistor values are doubled.

6. Design and implement an astable multivibrator circuit using 555 timer for a given frequency and duty cycle.

PART – B

7. a) Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC.
b) Design and develop the Verilog / VHDL code for an 8:1 multiplexer. Simulate and verify its working.

8. a) Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table.
b) Design and develop the Verilog / VHDL code for D Flip-Flop with positive-edge triggering. Simulate and verify its working.

9. a) Design and implement a mod-n (n<8) synchronous up counter using J-K Flip-Flop ICs and demonstrate its working.
b) Design and develop the Verilog / VHDL code for mod-8 up counter. Simulate and verify its working.

10. a) Design and implement a ring counter using 4-bit shift register and demonstrate its working.
b) Design and develop the Verilog / VHDL code for switched tail counter. Simulate and verify its working.

11. Design and implement an asynchronous counter using decade counter IC to count up from 0 to n (n<=9) and demonstrate its working.

Notes:

1. In the examination, each student picks one question from the lot of questions, either from Part-A or from Part-B. About half the students in the batch are to get a question from Part-A while the rest are to get the question from Part-B.
2. Any simulation package like MultiSim / Pspice etc may be used.

IV SEMESTER

ENGINEERING MATHEMATICS – IV

CODE: 10 MAT 41    IA Marks: 25
Hrs/Week: 04       Exam Hrs: 03
Total Hrs: 52      Exam Marks:100

PART-A

Unit-I: NUMERICAL METHODS - 1

Numerical solution of ordinary differential equations of first order and first degree; Picard’s method, Taylor’s series method, modified Euler’s method, Runge-kutta method of fourth-order. Milne’s and Adams - Bashforth predictor and corrector methods (No derivations of formulae).

[6 hours]

Unit-II: NUMERICAL METHODS – 2


[6 hours]

Unit-III: Complex variables – 1

Function of a complex variable, Analytic functions-Cauchy-Riemann equations in cartesian and polar forms. Properties of analytic functions.
Application to flow problems- complex potential, velocity potential, equipotential lines, stream functions, stream lines. [7 hours]

Unit-IV: Complex variables – 2

Conformal Transformations: Bilinear Transformations. Discussion of Transformations: \( w = z^2, \ w = e^z, \ w = z + \left( \frac{a^2}{z} \right) \). Complex line integrals- Cauchy’s theorem and Cauchy’s integral formula. [7 hours]

PART-B

Unit-V: SPECIAL FUNCTIONS

Solution of Laplace equation in cylindrical and spherical systems leading Bessel’s and Legendre’s differential equations, Series solution of Bessel’s differential equation leading to Bessel function of first kind. Orthogonal property of Bessel functions. Series solution of Legendre’s differential equation leading to Legendre polynomials, Rodrigue’s formula. [7 hours]

Unit-VI: PROBABILITY THEORY - 1

Probability of an event, emphirical and axiomatic definition, probability associated with set theory, addition law, conditional probability, multiplication law, Baye’s theorem. [6 hours]

Unit-VII: PROBABILITY THEORY- 2

Random variables (discrete and continuous), probability density function, cumulative density function. Probability distributions – Binomial and Poisson distributions; Exponential and normal distributions. [7 hours]

Unit-VIII: SAMPLING THEORY
Sampling, Sampling distributions, standard error, test of hypothesis for means, confidence limits for means, student’s t-distribution. Chi -Square distribution as a test of goodness of fit

[6 hours]

Text Books:


Reference Book:


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**GRAPH THEORY AND COMBINATORICS**

(Common to CSE & ISE)

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<th>I.A. Marks : 25</th>
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<td>Hours/Week : 04</td>
<td>Exam Hours: 03</td>
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<tr>
<td>Total Hours : 52</td>
<td>Exam Marks: 100</td>
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PART – A

UNIT - 1

**Introduction to Graph Theory:** Definitions and Examples, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits

7 Hours
UNIT – 2 6 Hours
Introduction to Graph Theory contd.: Planar Graphs, Hamilton Paths and Cycles, Graph Colouring, and Chromatic Polynomials

UNIT - 3 6 Hours
Trees: Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes

UNIT - 4 7 Hours
Optimization and Matching: Dijkstra’s Shortest Path Algorithm, Minimal Spanning Trees – The algorithms of Kruskal and Prim, Transport Networks – Max-flow, Min-cut Theorem, Matching Theory

PART – B

UNIT - 5 6 Hours

UNIT - 6 6 Hours
The Principle of Inclusion and Exclusion: The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials

UNIT - 7 7 Hours
Generating Functions: Introductory Examples, Definition and Examples – Calculational Techniques, Partitions of Integers, the Exponential Generating Function, the Summation Operator

UNIT - 8 7 Hours

Text Book:
   (Chapter 11, Chapter 12.1 to 12.4, Chapter 13, Chapter 1, Chapter 8.1 to 8.4, Chapter 9 Chapter 10.1 to 10.4).

Reference Books:

DESIGN AND ANALYSIS OF ALGORITHMS
(Common to CSE & ISE)

Subject Code: 10CS43  I.A. Marks : 25
Hours/Week : 04  Exam Hours: 03
Total Hours : 52  Exam Marks: 100

PART – A

UNIT – 1  7 Hours

UNIT - 2  6 Hours

UNIT - 3  7 Hours
THE GREEDY METHOD: The General Method, Knapsack Problem, Job Sequencing with Deadlines, Minimum-Cost Spanning Trees: Prim’s Algorithm, Kruskal’s Algorithm; Single Source Shortest Paths.

UNIT - 4  6 Hours

PART – B

UNIT - 5  7 Hours

UNIT – 6 7 Hours

UNIT - 7 6 Hours
COPING WITH LIMITATIONS OF ALGORITHMIC POWER:
Backtracking: n - Queens problem, Hamiltonian Circuit Problem, Subset – Sun Problem.
Branch-and-Bound: Assignment Problem, Knapsack Problem, Traveling Salesperson Problem.
Approximation Algorithms for NP-Hard Problems – Traveling Salesperson Problem, Knapsack Problem.

UNIT – 8 6 Hours
PRAM ALGORITHMS: Introduction, Computational Model, Parallel Algorithms for Prefix Computation, List Ranking, and Graph Problems,

Text Books:
   (Listed topics only from the Chapters 1, 2, 3, 5, 7, 8, 10, 11).
   (Listed topics only from the Chapters 3, 4, 5, 13)

Reference Books:

UNIX AND SHELL PROGRAMMING
(Common to CSE & ISE)
PART – A

UNIT – 1 6 Hours
The Unix Operating System, The UNIX architecture and Command Usage,
The File System

UNIT - 2 6 Hours
Basic File Attributes, the vi Editor

UNIT – 3 7 Hours
The Shell, The Process, Customizing the environment

UNIT - 4 7 Hours
More file attributes, Simple filters

PART – B

UNIT – 5 6 Hours
Filters using regular expressions,

UNIT – 6 6 Hours
Essential Shell Programming

UNIT - 7 7 Hours
awk – An Advanced Filter

UNIT - 8 7 Hours
perl - The Master Manipulator

Text Book:
   (Chapters 1.2, 2, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 18, 19)

Reference Books:

MICROPROCESSORS
PART A

UNIT – 1  7 Hours

UNIT – 2  7 Hours
Microprocessor Architecture – 2, Addressing Modes: Introduction to Protected Mode Memory Addressing, Memory Paging, Flat Mode Memory Addressing Modes: Data Addressing Modes, Program Memory Addressing Modes, Stack Memory Addressing Modes

UNIT – 3  6 Hours
Programming – 1: Data Movement Instructions: MOV Revisited, PUSH/POP, Load-Effective Address, String Data Transfers, Miscellaneous Data Transfer Instructions, Segment Override Prefix, Assembler Details. Arithmetic and Logic Instructions: Addition, Subtraction and Comparison, Multiplication and Division.

UNIT - 4  6 Hours

PART B

UNIT - 5  6 Hours
Programming – 3: Combining Assembly Language with C/C++: Using Assembly Language with C/C++ for 16-Bit DOS Applications and 32-Bit Applications Modular Programming, Using the Keyboard and Video Display, Data Conversions, Example Programs
UNIT - 6                7 Hours
Hardware Specifications, Memory Interface – 1: Pin-Outs and the Pin Functions, Clock Generator, Bus Buffering and Latching, Bus Timings, Ready and Wait State, Minimum versus Maximum Mode.
Memory Interfacing: Memory Devices

UNIT – 7               6 Hours
Memory Interface – 2, I/O Interface – 1: Memory Interfacing (continued): Address Decoding, 8088 Memory Interface, 8086 Memory Interface.
Basic I/O Interface: Introduction to I/O Interface, I/O Port Address Decoding.

UNIT 8                 7 Hours
I/O Interface – 2, Interrupts, and DMA: I/O Interface (continued): The Programmable Peripheral Interface 82C55, Programmable Interval Timer 8254.
Interrupts: Basic Interrupt Processing, Hardware Interrupts: INTR and INTA/; Direct Memory Access: Basic DMA Operation and Definition.

Text Book:
   (Listed topics only from the Chapters 1 to 13)

Reference Books:

COMPUTER ORGANIZATION
(Common to CSE & ISE)

Subject Code: 10CS46   Hours/Week : 04   Total Hours : 52
L.A. Marks : 25   Exam Hours: 03   Exam Marks: 100

PART – A

UNIT - 1               6 Hours
Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic
Performance Equation, Clock Rate, Performance Measurement, Historical Perspective

**Machine Instructions and Programs**: Numbers, Arithmetic Operations and Characters, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing,

**UNIT - 2** 7 Hours
**Machine Instructions and Programs contd.**: Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions

**UNIT - 3** 6 Hours
**Input/Output Organization**: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses

**UNIT - 4** 7 Hours
**Input/Output Organization contd.**: Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB

**PART – B
UNIT - 5** 7 Hours
**Memory System**: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations, Virtual Memories, Secondary Storage

**UNIT - 6** 7 Hours
**Arithmetic**: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations

**UNIT - 7** 6 Hours
**Basic Processing Unit**: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Microprogrammed Control

**UNIT - 8** 6 Hours
**Multicores, Multiprocessors, and Clusters**: Performance, The Power Wall, The Switch from Uniprocessors to Multiprocessors, Amdahl’s Law, Shared Memory Multiprocessors, Clusters and other Message Passing Multiprocessors, Hardware Multithreading, SISD, SIMD, SPMD, and Vector.

**Text Books:**
(Listed topics only from Chapters 1, 2, 4, 5, 6, 7)
(Listed topics only)

Reference Books:

DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY  
(Common to CSE & ISE)

Subject Code: 10CSL47     I.A. Marks : 25  
Hours/Week : 03          Exam Hours: 03  
Total Hours : 42         Exam Marks: 50

Design, develop and implement the specified algorithms for the following problems using C/C++ Language in LINUX / Windows environment.

1. Sort a given set of elements using the Quicksort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.

2. Using OpenMP, implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.

3. a. Obtain the Topological ordering of vertices in a given digraph.  
b. Compute the transitive closure of a given directed graph using Warshall’s algorithm.
4. Implement 0/1 Knapsack problem using Dynamic Programming.

5. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.

6. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.

7. a. Print all the nodes reachable from a given starting node in a digraph using BFS method.
   b. Check whether a given graph is connected or not using DFS method.

8. Find a subset of a given set $S = \{s_1, s_2, \ldots, s_n\}$ of $n$ positive integers whose sum is equal to a given positive integer $d$. For example, if $S=\{1, 2, 5, 6, 8\}$ and $d = 9$ there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$. A suitable message is to be displayed if the given problem instance doesn't have a solution.

9. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.


11. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. Parallelize this algorithm, implement it using OpenMP and determine the speed-up achieved.

12. Implement N Queen's problem using Back Tracking.

Note: In the examination each student picks one question from the lot of all 12 questions.

MICROPROCESSORS LABORATORY
(Common to CSE & ISE)

Subject Code : 10CSL48       I.A. Marks : 25
Hours/Week : 03            Exam Hours: 03
Total Hours : 42           Exam Marks: 50
Notes:

- Develop and execute the following programs using 8086 Assembly Language. Any suitable assembler like MASM, TASM etc may be used.
- Program should have suitable comments.
- The board layout and the circuit diagram of the interface are to be provided to the student during the examination.

1. a) Search a key element in a list of ‘n’ 16-bit numbers using the Binary search algorithm.
   b) Read the status of eight input bits from the Logic Controller Interface and display ‘FF’ if it is the parity of the input read is even; otherwise display 00.

2. a) Write two ALP modules stored in two different files; one module is to read a character from the keyboard and the other one is to display a character. Use the above two modules to read a string of characters from the keyboard terminated by the carriage return and print the string on the display in the next line.
   b) Implement a BCD Up-Down Counter on the Logic Controller Interface.

3. a) Sort a given set of ‘n’ numbers in ascending order using the Bubble Sort algorithm.
   b) Read the status of two 8-bit inputs (X & Y) from the Logic Controller Interface and display X*Y.

4. a) Read an alphanumeric character and display its equivalent ASCII code at the center of the screen.
   b) Display messages FIRE and HELP alternately with flickering effects on a 7-segment display interface for a suitable period of time. Ensure a flashing rate that makes it easy to read both the messages (Examiner does not specify these delay values nor is it necessary for the student to compute these values).

5. a) Reverse a given string and check whether it is a palindrome or not.
   b) Assume any suitable message of 12 characters length and display it in the rolling fashion on a 7-segment display interface for a
suitable period of time. Ensure a flashing rate that makes it easy to read both the messages. (Examiner does not specify these delay values nor is it necessary for the student to compute these values).

6. a) Read two strings, store them in locations STR1 and STR2. Check whether they are equal or not and display appropriate messages.
Also display the length of the stored strings.
b) Convert a 16-bit binary value (assumed to be an unsigned integer) to BCD and display it from left to right and right to left for specified number of times on a 7-segment display interface.

7. a) Read your name from the keyboard and display it at a specified location on the screen after the message “What is your name?” You must clear the entire screen before display.
b) Scan a 8 x 3 keypad for key closure and to store the code of the key pressed in a memory location or display on screen. Also display row and column numbers of the key pressed.

8. a) Compute \( nC_r \) using recursive procedure. Assume that ‘n’ and ‘r’ are non-negative integers.
b) Drive a Stepper Motor interface to rotate the motor in specified direction (clockwise or counter-clockwise) by N steps (Direction and N are specified by the examiner). Introduce suitable delay between successive steps. (Any arbitrary value for the delay may be assumed by the student).

9. a) Read the current time from the system and display it in the standard format on the screen.
b) Generate the Sine Wave using DAC interface (The output of the DAC is to be displayed on the CRO).

10. a) Write a program to simulate a Decimal Up-counter to display 00-99.
b) Generate a Half Rectified Sine wave form using the DAC interface. (The output of the DAC is to be displayed on the CRO).

11. a) Read a pair of input co-ordinates in BCD and move the cursor to the specified location on the screen.
b) Generate a Fully Rectified Sine waveform using the DAC interface. (The output of the DAC is to be displayed on the CRO).

12. a) Write a program to create a file (input file) and to delete an existing file.
b) Drive an elevator interface in the following way:
   i. Initially the elevator should be in the ground floor, with all requests in OFF state.
   ii. When a request is made from a floor, the elevator should move to that floor, wait there for a couple of seconds (approximately), and then come down to ground floor and stop. If some requests occur during going up or coming down they should be ignored.

Note: In the examination each student picks one question from the lot of all 12 questions.
V SEMESTER
SOFTWARE ENGINEERING

Subject Code: 10IS51  I.A. Marks : 25
Hours/Week : 04  Exam Hours: 03
Total Hours : 52  Exam Marks: 100

PART – A

UNIT – 1  6 Hours
Overview: Introduction: FAQ's about software engineering, Professional and ethical responsibility.
Socio-Technical systems: Emergent system properties; Systems engineering; Organizations, people and computer systems; Legacy systems.

UNIT – 2  6 Hours

UNIT – 3  7 Hours
Requirements: Software Requirements: Functional and Non-functional requirements; User requirements; System requirements; Interface specification; The software requirements document.
Requirements Engineering Processes: Feasibility studies; Requirements elicitation and analysis; Requirements validation; Requirements management.

UNIT – 4  7 Hours
System models, Project Management: System Models: Context models; Behavioral models; Data models; Object models; Structured methods.
Project Management: Management activities; Project planning; Project scheduling; Risk management

PART - B

UNIT – 5  7 Hours
Software Design: Architectural Design: Architectural design decisions; System organization; Modular decomposition styles; Control styles.
Object-Oriented design: Objects and Object Classes; An Object-Oriented design process; Design evolution.

UNIT – 6  
Development: Rapid Software Development: Agile methods; Extreme programming; Rapid application development.  
Software Evolution: Program evolution dynamics; Software maintenance; Evolution processes; Legacy system evolution.

UNIT – 7  
Verification and Validation: Verification and Validation: Planning; Software inspections; Automated static analysis; Verification and formal methods.  
Software testing: System testing; Component testing; Test case design; Test automation.

UNIT – 8  
Management: Managing People: Selecting staff; Motivating people; Managing people; The People Capability Maturity Model.  
Software Cost Estimation: Productivity; Estimation techniques; Algorithmic cost modeling, Project duration and staffing.

Text Books:
   (Chapters:- 1, 2, 3, 4, 5, 6, 7, 8, 11, 14, 17, 21, 22, 23, 25, 26)

Reference Books:

SYSTEM SOFTWARE

<table>
<thead>
<tr>
<th>Subject Code: 10CS52</th>
<th>I.A. Marks : 25</th>
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<tr>
<td>Hours/Week : 04</td>
<td>Exam Hours: 03</td>
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<tr>
<td>Total Hours : 52</td>
<td>Exam Marks: 100</td>
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PART – A

UNIT – 1  
UNIT – 2
Assemblers -1: Basic Assembler Function - A Simple SIC Assembler, Assembler Algorithm and Data Structures, Machine Dependent Assembler Features - Instruction Formats & Addressing Modes, Program Relocation.

UNIT – 3

UNIT – 4

PART – B

UNIT – 5
Editors and Debugging Systems: Text Editors - Overview of Editing Process, User Interface, Editor Structure, Interactive Debugging Systems - Debugging Functions and Capabilities, Relationship With Other Parts Of The System, User-Interface Criteria

UNIT – 6

UNIT – 7
LEX and YACC, LEX and Hand-Written Lexers, Using LEX - Regular Expression, Examples of Regular Expressions, A Word Counting Program, Parsing a Command Line.

UNIT – 8  6 Hours

Text Books:
1. Leland.L.Beck: System Software, 3rd Edition, Pearson Education, 1997. (Chapters 1.1 to 1.3, 2 (except 2.5.2 and 2.5.3), 3 (except 3.5.2 and 3.5.3), 4 (except 4.4.3))

Reference Books:

OPERATING SYSTEMS

Subject Code: 10CS53  I.A. Marks : 25
Hours/Week : 04  Exam Hours: 03
Total Hours : 52  Exam Marks: 100

PART – A

UNIT – 1  6 Hours
Introduction to Operating Systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and security; Distributed system; Special-purpose systems; Computing environments. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating System design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot.
UNIT – 2
Process Management: Process concept; Process scheduling; Operations on processes; Inter-process communication. Multi-Threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling criteria; Scheduling algorithms; Multiple-Processor scheduling; Thread scheduling.

UNIT – 3
Process Synchronization: Synchronization: The Critical section problem; Peterson’s solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.

UNIT – 4
Deadlocks: Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

PART – B
UNIT – 5
Memory Management: Memory Management Strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation. Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.

UNIT – 6
File System, Implementation of File System: File System: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection. Implementing File System: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management

UNIT – 7
Secondary Storage Structures, Protection: Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability-Based systems.

UNIT – 8
Case Study: The Linux Operating System: Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory management; File systems, Input and output; Inter-process communication.
Text Books:
1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 8th edition, Wiley India, 2009. (Listed topics only from Chapters 1 to 12, 17, 21)

Reference Books:

DATABASE MANAGEMENT SYSTEMS

Subject Code: 10CS54  L.A. Marks : 25
Hours/Week : 04  Exam Hours: 03
Total Hours : 52  Exam Marks: 100

PART - A

UNIT – 1  6 Hours
Introduction: Introduction; An example; Characteristics of Database approach; Actors on the screen; Workers behind the scene; Advantages of using DBMS approach; A brief history of database applications; when not to use a DBMS.
Data models, schemas and instances; Three-schema architecture and data independence; Database languages and interfaces; The database system environment; Centralized and client-server architectures; Classification of Database Management systems.

UNIT – 2  6 Hours
Entity-Relationship Model: Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design; ER Diagrams, Naming Conventions and Design Issues; Relationship types of degree higher than two.

UNIT – 3  8 Hours
Relational Model and Relational Algebra: Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update
Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra; Relational Database Design Using ER- to-Relational Mapping.

UNIT – 4  6 Hours
SQL – 1: SQL Data Definition and Data Types; Specifying basic constraints in SQL; Schema change statements in SQL; Basic queries in SQL; More complex SQL Queries.

PART - B

UNIT – 5  6 Hours
SQL – 2: Insert, Delete and Update statements in SQL; Specifying constraints as Assertion and Trigger; Views (Virtual Tables) in SQL; Additional features of SQL; Database programming issues and techniques; Embedded SQL, Dynamic SQL; Database stored procedures and SQL / PSM.

UNIT – 6  6 Hours
Database Design – 1: Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form

UNIT – 7  6 Hours
Database Design -2: Properties of Relational Decompositions; Algorithms for Relational Database Schema Design; Multivalued Dependencies and Fourth Normal Form; Join Dependencies and Fifth Normal Form; Inclusion Dependencies; Other Dependencies and Normal Forms

UNIT – 8  8 Hours
Transaction Management: The ACID Properties; Transactions and Schedules; Concurrent Execution of Transactions; Lock- Based Concurrency Control; Performance of locking; Transaction support in SQL; Introduction to crash recovery; 2PL, Serializability and Recoverability; Lock Management; Introduction to ARIES; The log; Other recovery-related structures; The write-ahead log protocol; Checkpointing; Recovering from a System Crash; Media Recovery; Other approaches and interaction with concurrency control.

Text Books:
(Chapters 1, 2, 3 except 3.8, 5, 6.1 to 6.5, 7.1, 8, 9.1, 9.2 except SQLJ, 9.4, 10)

Reference Books:

COMPUTER NETWORKS - I

Subject Code: 10CS55                         I.A. Marks : 25
Hours/Week : 04                                      Exam Hours: 03
Total Hours : 52                                      Exam Marks: 100

PART – A

UNIT - 1                                          7 Hours
Introduction: Data Communications, Networks, The Internet, Protocols & Standards, Layered Tasks,
The OSI model, Layers in OSI model, TCP/IP Protocol suite, Addressing

UNIT- 2                                          7 Hours
Physical Layer-1: Analog & Digital Signals, Transmission Impairment, Data Rate limits, Performance, Digital-digital conversion (Only Line coding: Polar, Bipolar and Manchester coding), Analog-to-digital conversion (only PCM), Transmission Modes, Digital-to-analog conversion

UNIT- 3                                          6 Hours
Physical Layer-2 and Switching: Multiplexing, Spread Spectrum, Introduction to switching, Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks

UNIT- 4                                          6 Hours
Data Link Layer-1: Error Detection & Correction: Introduction, Block coding, Linear block codes, Cyclic codes, Checksum.

PART - B
UNIT- 5                           6 Hours
Data Link Layer-2: Framing, Flow and Error Control, Protocols, Noiseless Channels, Noisy channels, HDLC, PPP (Framing, Transition phases only)

UNIT- 6                          7 Hours
Multiple Access & Ethernet: Random access, Controlled Access, Channelization, Ethernet: IEEE standards, Standard Ethernet, Changes in the standard, Fast Ethernet, Gigabit Ethernet

UNIT - 7                         6 Hours
Wireless LANs and Cellular Networks: Introduction, IEEE 802.11, Bluetooth, Connecting devices, Cellular Telephony

UNIT - 8:                        7 Hours

Text Books:

Reference Books:
UNIT – 1                 7 Hours
Introduction to Finite Automata: Introduction to Finite Automata; The central concepts of Automata theory; Deterministic finite automata; Nondeterministic finite automata

UNIT – 2                 7 Hours
Finite Automata, Regular Expressions: An application of finite automata; Finite automata with Epsilon-transitions; Regular expressions; Finite Automata and Regular Expressions; Applications of Regular Expressions

UNIT – 3               6 Hours
Regular Languages, Properties of Regular Languages: Regular languages; Proving languages not to be regular languages; Closure properties of regular languages; Decision properties of regular languages; Equivalence and minimization of automata

UNIT – 4               6 Hours
Context-Free Grammars And Languages: Context –free grammars; Parse trees; Applications; Ambiguity in grammars and Languages

PART – B

UNIT – 5               7 Hours
Pushdown Automata: Definition of the Pushdown automata; the languages of a PDA; Equivalence of PDA’s and CFG’s; Deterministic Pushdown Automata

UNIT – 6               6 Hours
Properties of Context-Free Languages: Normal forms for CFGs; The pumping lemma for CFGs; Closure properties of CFLs

UNIT – 7               7 Hours
Introduction To Turing Machine: Problems that Computers cannot solve; The turning machine; Programming techniques for Turning Machines;
Extensions to the basic Turning Machines; Turing Machine and Computers.

UNIT – 8                   6 Hours
Undecidability: A Language that is not recursively enumerable; An Undecidable problem that is RE; Post’s Correspondence problem; Other undecidable problems.

Text Books:
   (Chapters: 1.1, 1.5, 2.2 to 2.5, 3.1 to 3.3, 4, 5, 6, 7, 8.1 to 8.4, 8.6, 9.1, 9.2, 9.4.1, 9.5)

Reference Books:

DATABASE APPLICATIONS LABORATORY

Subject Code: 10CSL57     I.A. Marks : 25
Hours/Week : 03           Exam Hours: 03
Total Hours : 42          Exam Marks: 50

1. Consider the following relations:
   Student (snum: integer, sname: string, major: string, level: string, age: integer)
   Class (name: string, meets at: string, room: string, d: integer)
   Enrolled (snum: integer, cname: string)
   Faculty (fid: integer, fname: string, deptid: integer)

   The meaning of these relations is straightforward; for example, Enrolled has one record per student-class pair such that the student is enrolled in the class. Level is a two character code with 4 different values (example: Junior: JR etc)

   Write the following queries in SQL. No duplicates should be printed in any of the answers.
i. Find the names of all Juniors (level = JR) who are enrolled in a class taught by Prof. Harshith.

ii. Find the names of all classes that either meet in room R128 or have five or more Students enrolled.

iii. Find the names of all students who are enrolled in two classes that meet at the same time.

iv. Find the names of faculty members who teach in every room in which some class is taught.

v. Find the names of faculty members for whom the combined enrollment of the courses that they teach is less than five.

2. The following relations keep track of airline flight information:
   Flights (no: integer, from: string, to: string, distance: integer, 
   Departs: time, arrives: time, price: real)
   Aircraft (aid: integer, aname: string, cruisingrange: integer)
   Certified (eid: integer, aid: integer)
   Employees (eid: integer, ename: string, salary: integer)

   Note that the Employees relation describes pilots and other kinds of employees as well; Every pilot is certified for some aircraft, and only pilots are certified to fly.

   Write each of the following queries in SQL.
   i. Find the names of aircraft such that all pilots certified to operate them have salaries more than Rs.80,000.
   ii. For each pilot who is certified for more than three aircrafts, find the eid and the maximum cruisingrange of the aircraft for which she or he is certified.
   iii. Find the names of pilots whose salary is less than the price of the cheapest route from Bengaluru to Frankfurt.
   iv. For all aircraft with cruisingrange over 1000 Kms, find the name of the aircraft and the average salary of all pilots certified for this aircraft.
   v. Find the names of pilots certified for some Boeing aircraft.
   vi. Find the aids of all aircraft that can be used on routes from Bengaluru to New Delhi.

3. Consider the following database of student enrollment in courses & books adopted for each course.
   STUDENT (regno: string, name: string, major: string, bdate:date)
   COURSE (course #: int, cname:string, dept:string)
   ENROLL ( regno:string, course#:int, sem:int, marks:int)
4. The following tables are maintained by a book dealer.

i. Create the above tables by properly specifying the primary keys and the foreign keys.

ii. Enter at least five tuples for each relation.

iii. Give the details of the authors who have 2 or more books in the catalog and the price of the books is greater than the average price of the books in the catalog and the year of publication is after 2000.

iv. Find the author of the book which has maximum sales.

v. Demonstrate how you increase the price of books published by a specific publisher by 10%.

vi. Generate suitable reports.

vii. Create suitable front end for querying and displaying the results.

5. Consider the following database for a banking enterprise

i. Create the above tables by properly specifying the primary keys and the foreign keys.

ii. Enter at least five tuples for each relation.

iii. Demonstrate how you add a new text book to the database and make this book be adopted by some department.

iv. Produce a list of text books (include Course #, Book-ISBN, Book-title) in the alphabetical order for courses offered by the ‘CS’ department that use more than two books.

v. List any department that has all its adopted books published by a specific publisher.

vi. Generate suitable reports.

vii. Create suitable front end for querying and displaying the results.
i. Create the above tables by properly specifying the primary keys and the foreign keys
ii. Enter at least five tuples for each relation
iii. Find all the customers who have at least two accounts at the *Main* branch.
iv. Find all the customers who have an account at *all* the branches located in a specific city.
v. Demonstrate how you delete all account tuples at every branch located in a specific city.
vi. Generate suitable reports.
vii. Create suitable front end for querying and displaying the results.

**Instructions:**
1. The exercises are to be solved in an RDBMS environment like Oracle or DB2.
2. Suitable tuples have to be entered so that queries are executed correctly.
3. Front end may be created using either VB or VAJ or any other similar tool.
4. The student need not create the front end in the examination. The results of the queries may be displayed directly.
5. Relevant queries other than the ones listed along with the exercises may also be asked in the examination.
6. Questions must be asked based on lots.
b) Program to count the numbers of comment lines in a given C program. Also eliminate them and copy the resulting program into separate file.

2. a) Program to recognize a valid arithmetic expression and to recognize the identifiers and operators present. Print them separately.
   b) Program to recognize whether a given sentence is simple or compound.

3. Program to recognize and count the number of identifiers in a given input file.

Design, develop, and execute the following programs using YACC:

4. a) Program to recognize a valid arithmetic expression that uses operators +, -, * and /.
   b) Program to recognize a valid variable, which starts with a letter, followed by any number of letters or digits.

5. a) Program to evaluate an arithmetic expression involving operators +, -, * and /.
   b) Program to recognize strings ‘aaab’, ‘abbb’, ‘ab’ and ‘a’ using the grammar \((a^n b^n, n \geq 0)\).

6. Program to recognize the grammar \((a^n b^n, n \geq 10)\).

PART B

UNIX Programming:
Design, develop, and execute the following programs:

7. a) Non-recursive shell script that accepts any number of arguments and prints them in the Reverse order. (For example, if the script is named rargs, then executing rargs A B C should produce C B A on the standard output).
   b) C program that creates a child process to read commands from the standard input and execute them (a minimal implementation of a shell-like program). You can assume that no arguments will be passed to the commands to be executed.

8. a) Shell script that accepts two file names as arguments, checks if the permissions for these files are identical and if the permissions
are identical, outputs the common permissions, otherwise outputs each file name followed by its permissions.

b) C program to create a file with 16 bytes of arbitrary data from the beginning and another 16 bytes of arbitrary data from an offset of 48. Display the file contents to demonstrate how the hole in file is handled.

9. a) Shell script that accepts file names specified as arguments and creates a shell script that contains this file as well as the code to recreate these files. Thus if the script generated by your script is executed, it would recreate the original files(This is same as the “bundle” script described by Brain W. Kernighan and Rob Pike in “The Unix Programming Environment”, Prentice – Hall India).

b) C program to do the following: Using fork() create a child process. The child process prints its own process-id and id of its parent and then exits. The parent process waits for its child to finish (by executing the wait( )) and prints its own process-id and the id of its child process and then exits.

Operating Systems:

10. Design, develop and execute a program in C / C++ to simulate the working of Shortest Remaining Time and Round-Robin Scheduling Algorithms. Experiment with different quantum sizes for the Round-Robin algorithm. In all cases, determine the average turn-around time. The input can be read from keyboard or from a file.

11. Using OpenMP, Design, develop and run a multi-threaded program to generate and print Fibonacci Series. One thread has to generate the numbers up to the specified limit and another thread has to print them. Ensure proper synchronization.

12. Design, develop and run a program to implement the Banker’s Algorithm. Demonstrate its working with different data values.

Instructions:
In the examination, a combination of one LEX and one YACC problem has to be asked from Part A for a total of 30 marks and one programming exercise from Part B has to be asked for a total of 20 marks.
PART - A

UNIT – 1          6 Hours
UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics.

UNIT – 2                     6 Hours

UNIT – 3                 7 Hours
UNIX File APIs: General File APIs, File and Record Locking, Directory File APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs, General File Class, regfile Class for Regular Files, dirfile Class for Directory Files, FIFO File Class, Device File Class, Symbolic Link File Class, File Listing Program.

UNIT – 4                 7 Hours
Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes.

**PART - B**

**UNIT – 5**  
7 Hours  

**UNIT – 6**  
7 Hours  

**UNIT – 7**  
6 Hours  
*Interprocess Communication – 1*: Overview of IPC Methods, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores.

**UNIT – 8**  
6 Hours  

**Text Books:**
   (Chapters 1, 5, 6, 7, 8, 9, 10)  
   (Chapters 7, 8, 9, 13, 14, 15)

**Reference Books:**
PART – A

UNIT – 1  8 Hours
Introduction, Lexical analysis: Language processors; The structure of a Compiler; The evolution of programming languages; The science of building a Compiler; Applications of compiler technology; Programming language basics. Lexical analysis: The Role of Lexical Analyzer; Input Buffering; Specifications of Tokens; Recognition of Tokens.

UNIT – 2  6 Hours
Syntax Analysis – 1: Introduction; Context-free Grammars; Writing a Grammar. Top-down Parsing; Bottom-up Parsing.

UNIT – 3  6 Hours
Syntax Analysis – 2: Top-down Parsing; Bottom-up Parsing.

UNIT – 4  6 Hours
Syntax Analysis – 3: Introduction to LR Parsing; Simple LR; More powerful LR parsers (excluding Efficient construction and compaction of parsing tables); Using ambiguous grammars; Parser Generators.

PART – B

UNIT – 5  7 Hours
Syntax-Directed Translation: Syntax-directed definitions; Evaluation orders for SDDs; Applications of syntax-directed translation; Syntax-directed translation schemes.

UNIT – 6  6 Hours
Intermediate Code Generation: Variants of syntax trees; Three-address code; Translation of expressions; Control flow; Back patching; Switch-statements; Procedure calls.
UNIT – 7  
Run-Time Environments: Storage Organization; Stack allocation of space; Access to non-local data on the stack; Heap management; Introduction to garbage collection.

UNIT – 8  
Code Generation: Issues in the design of Code Generator; The Target Language; Addresses in the target code; Basic blocks and Flow graphs; Optimization of basic blocks; A Simple Code Generator

Text Books:
1. Alfred V Aho, Monica S.Lam, Ravi Sethi, Jeffrey D Ullman: Compilers- Principles, Techniques and Tools, 2nd Edition, Pearson Education, 2007. (Chapters 1, 3.1 to 3.4, 4 excluding 4.7.5 and 4.7.6, 5.1 to 5.4, 6.1, 6.2, 6.4, 6.6, 6.7 to 6.9, 7.1 to 7.5, 8.1 to 8.6.)

Reference Books:

COMPUTER NETWORKS - II

Subject Code: 10CS64  
I.A. Marks : 25

Hours/Week : 04  
Exam Hours: 03

Total Hours : 52  
Exam Marks: 100

PART - A

UNIT - 1  

UNIT – 2  
Packet Switching Networks – 2: Shortest path routing (continued), Traffic management at the Packet level, Traffic management at Flow level, Traffic management at flow aggregate level.
UNIT – 3 6 Hours
TCP/IP-1: TCP/IP architecture, The Internet Protocol, IPv6, UDP.

UNIT – 4 8 Hours
TCP/IP-2: TCP, Internet Routing Protocols, Multicast Routing, DHCP, NAT and Mobile IP.

PART – B
UNIT - 5 7 Hours

UNIT – 6 6 Hours

UNIT - 7 7 Hours
Multimedia Networking: Overview of data compression, Digital voice and compression, JPEG, MPEG, Limits of compression with loss, Compression methods without loss, Overview of IP Telephony, VoIP signaling protocols, Real-Time Media Transport Protocols, Stream control Transmission Protocol (SCTP)

UNIT – 8 6 Hours
Text Books:
   (7 - excluding 7.6, 8)
2. Computer & Communication Networks, Nadir F Mir, Pearson Education, India
   (9, 10 excluding 10.7, 12.1 to 12.3, 16, 17.1 to 17.6, 18.1 to 18.3, 18.5, 19, 20)

Reference Books:

COMPUTER GRAPHICS AND VISUALIZATION

Subject Code: 10CS65                  I.A. Marks : 25
Hours/Week : 04                       Exam Hours: 03
Total Hours : 52                      Exam Marks: 100

PART - A

UNIT – 1                                7 Hours
Introduction: Applications of computer graphics; A graphics system; Images: Physical and synthetic; Imaging Systems; The synthetic camera model; The programmer’s interface; Graphics architectures; Programmable Pipelines; Performance Characteristics
Graphics Programming: The Sierpinski gasket; Programming Two Dimensional Applications.

UNIT – 2                                6 Hours
The OpenGL: The OpenGL API; Primitives and attributes; Color; Viewing; Control functions; The Gasket program; Polygons and recursion; The three-dimensional gasket; Plotting Implicit Functions
UNIT – 3  
**Input and Interaction:** Interaction; Input devices; Clients and Servers; Display Lists; Display Lists and Modeling; Programming Event Driven Input; Menus; Picking; A simple CAD program; Building Interactive Models; Animating Interactive Programs; Design of Interactive Programs; Logic Operations

UNIT – 4  
**Geometric Objects and Transformations-I:** Scalars, Points, and Vectors; Three-dimensional Primitives; Coordinate Systems and Frames; Modeling a Colored Cube; Affine Transformations; Rotation, Translation and Scaling;

UNIT – 5  
**Geometric Objects and Transformations-II:** Geometric Objects and Transformations; Transformation in Homogeneous Coordinates; Concatenation of Transformations; OpenGL Transformation Matrices; Interfaces to three-dimensional applications; Quaternion’s.

UNIT – 6  
**Viewing:** Classical and computer viewing; Viewing with a Computer; Positioning of the camera; Simple projections; Projections in OpenGL; Hidden-surface removal; Interactive Mesh Displays; Parallel-projection matrices; Perspective-projection matrices; Projections and Shadows.

UNIT – 7  
**Lighting and Shading:** Light and Matter; Light Sources; The Phong Lighting model; Computation of vectors; Polygonal Shading; Approximation of a sphere by recursive subdivisions; Light sources in OpenGL; Specification of materials in OpenGL; Shading of the sphere model; Global Illumination.

UNIT – 8  
**Implementation:** Basic Implementation Strategies; Four major tasks; Clipping; Line-segment clipping; Polygon clipping; Clipping of other primitives; Clipping in three dimensions; Rasterization; Bresenham’s algorithm; Polygon Rasterization; Hidden-surface removal; Antialiasing; Display considerations.

**Text Books:**

**Reference Books:**

OPERATIONS RESEARCH

Subject Code: 10CS661      I.A. Marks : 25
Hours/Week : 04           Exam Hours: 03
Total Hours : 52          Exam Marks: 100

PART - A

UNIT – 1                   6 Hours
Introduction, Linear Programming – 1: Introduction: The origin, nature and impact of OR; Defining the problem and gathering data; Formulating a mathematical model; Deriving solutions from the model; Testing the model; Preparing to apply the model; Implementation. Introduction to Linear Programming: Prototype example; The linear programming (LP) model.

UNIT – 2                  7 Hours
LP – 2, Simplex Method – 1: Assumptions of LP; Additional examples. The essence of the simplex method; Setting up the simplex method; Algebra of the simplex method; the simplex method in tabular form; Tie breaking in the simplex method.

UNIT – 3                6 Hours
Simplex Method – 2: Adapting to other model forms; Post optimality analysis; Computer implementation. Foundation of the simplex method.

UNIT – 4                 7 Hours
Simplex Method – 2, Duality Theory: The revised simplex method, a fundamental insight. The essence of duality theory; Economic interpretation of duality, Primal dual relationship; Adapting to other primal forms.

PART - B

UNIT – 5               7 Hours
Duality Theory and Sensitivity Analysis, Other Algorithms for LP: The role of duality in sensitive analysis; The essence of sensitivity analysis;
Applying sensitivity analysis. The dual simplex method; Parametric linear programming; The upper bound technique.

UNIT – 6 7 Hours
Transportation and Assignment Problems: The transportation problem; A streamlined simplex method for the transportation problem; The assignment problem; A special algorithm for the assignment problem.

UNIT – 7 6 Hours
Game Theory, Decision Analysis: Game Theory: The formulation of two persons, zero sum games; Solving simple games– a prototype example; Games with mixed strategies; Graphical solution procedure; Solving by linear programming, Extensions.
Decision Analysis: A prototype example; Decision making without experimentation; Decision making with experimentation; Decision trees.

UNIT – 8 6 Hours

Text Books:
   (Chapters: 1, 2, 3.1 to 3.4, 4.1 to 4.8, 5, 6.1 to 6.7, 7.1 to 7.3, 8, 13, 14, 15.1 to 15.4)

Reference Books:

SIGNALS AND SYSTEMS

Subject Code: 10CS662 I.A. Marks : 25
Hours/Week : 04 Exam Hours: 03
Total Hours : 52 Exam Marks: 100

PART - A 7 Hours
Introduction: Definitions of a signal and a system; Classification of signals; Basic operations on signals; Elementary signals.
UNIT – 2
Systems, Time-domain representations – 1: Systems viewed as interconnections of operations; Properties of systems; Convolution; Impulse response representation; Properties of impulse response representation.

UNIT – 3
Time domain representation – 2: Differential and difference equation representations; Block diagram representations.

UNIT – 4
Fourier Representation – 1: Fourier representation: Introduction; Fourier representations for four signal classes; Orthogonality of complex sinusoidal signals.

PART – B

UNIT – 5
Fourier Representation -2: DTFS representations; Continuous-time Fourier-series representations; DTFT and FT representations; Properties of Fourier representations.

UNIT – 6
Application of Fourier representations – 1: Frequency response of LTI systems; Solution of differential and difference equations using system function.

UNIT – 7
Applications of Fourier Representations – 2, Z-Transforms – 1: Fourier transform representations for periodic signals; Sampling of continuous time signals and signal reconstruction. Introduction to Z-transform; Properties of ROC; Properties of Z-transforms; Inversion of Z-transforms

UNIT –Z – 8
Transforms – 2: Transforms analysis of LTI systems; Transfer function; Stability and causality; Unilateral Z-transforms and its application to solve difference equations

Text Books:
   (Chapters: 1.1 to 1.8, 2.2 to 2.5, 3.1 to 3.6, 4.2 to 4.3, 4.7, 7.1 to 7.6, 7.8)

Reference Books:
DATA COMPRESSION

Subject Code: 10CS663
Hours/Week : 04
Total Hours : 52
I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT – 1                  7 Hours
Introduction, Lossless Compression -1: Compression techniques; Modeling and coding.
Mathematical preliminaries for lossless compression: Overview; Basic concepts of Information Theory; Models; Coding; Algorithmic information theory; Minimum description length principle.
Huffman coding: Overview; The Huffman coding algorithm, Minimum variance Huffman codes; Application of Huffman coding for text compression.

UNIT – 2                  6 Hours
Lossless Compression – 2: Dictionary Techniques: Overview; Introduction; Static dictionary; Adaptive dictionary; Applications: UNIX compress, GIF, PNG, V.42.
Lossless image compression: Overview; Introduction; Basics; CALIC; JPEG-LS; Multiresolution approaches; Facsimile encoding: Run-length coding, T.4 and T.6.

UNIT – 3                  6 Hours
Basics of Lossy Coding: Some mathematical concepts: Overview; Introduction; Distortion criteria; Models.
Scalar quantization: Overview; Introduction; The quantization problem; Uniform quantizer; Adaptive quantization.

UNIT – 4                  7 Hours
Vector Quantization, Differential Encoding: Vector quantization: Overview; Introduction; Advantages of vector quantization over scalar quantization; The LBG algorithm.
Differential Encoding: Overview; Introduction; The basic algorithm; Prediction in DPCM; Adaptive DPCM; Delta modulation; Speech coding; Image coding.
PART - B

UNIT – 5 7 Hours
Some Mathematical Concepts, Transform coding: Some mathematical concepts: Linear systems; Sampling; Discrete Fourier transform; Z-transform.
Transform coding: Overview; introduction; The transform; Transforms of interest; Quantization and coding for transform coefficients; Application to image compression – JPEG; Application to audio compression – MDCT.

UNIT – 6 6 Hours
Subband Coding, Audio Coding: Subband Coding: Overview; introduction; Filters; The basic subband coding algorithm; Bit allocation; Application to speech coding – G.722; Application to audio coding – MPEG audio; Application to image compression.
Audio Coding: Overview; Introduction; MPEG audio coding; MPEG advanced audio coding; Dolby AC3; Other standards.

UNIT – 7 6 Hours
Wavelet-Based Compression: Overview; Introduction; Wavelets; Multiresolution and the scaling function; Implementation using Filters; Image compression; Embedded zerotree coder; Set partitioning in hierarchical trees; JPEG 2000.

UNIT – 8 7 Hours
Video Compression: Overview; Introduction; Motion compensation; Video signal representation; H.261; Model-based coding; Asymmetric applications; MPEG-1 and MPEG-2; H.263; H.264, MPEG-4 and advanced video coding; Packet video.

Text Books:
1. Khalid Sayood: Introduction to Data Compression, 3rd Edition, Elsevier, 2006. (Chapters 1, 2 excluding 2.2.1 and 2.4.3, 3.1, 3.2, 3.2.1, 3.8.2, 5, 7.1 to 7.5, 7.6, 7.6.1, 7.6.2, 8.1 to 8.3, 8.6, 9.1 to 9.5, 10.1 to 10.4, 11, 12.6 to 12.9, 13, 14.1 to 14.4, 14.9 to 14.12, 15, 16, 18.1 to 18.13)

Reference Books:
PART A

UNIT 1
Introduction: Machine perception, an example; Pattern Recognition System; The Design Cycle; Learning and Adaptation.

UNIT 2
Bayesian Decision Theory: Introduction, Bayesian Decision Theory; Continuous Features, Minimum error rate, classification, classifiers, discriminant functions, and decision surfaces; The normal density; Discriminant functions for the normal density.

UNIT 3
Maximum-likelihood and Bayesian Parameter Estimation: Introduction; Maximum-likelihood estimation; Bayesian Estimation; Bayesian parameter estimation: Gaussian Case, general theory; Hidden Markov Models.

UNIT 4
Non-parametric Techniques: Introduction; Density Estimation; Parzen windows; \( k_n \) – Nearest-Neighbor Estimation; The Nearest-Neighbor Rule; Metrics and Nearest-Neighbor Classification.

PART B

UNIT 5
Linear Discriminant Functions: Introduction; Linear Discriminant Functions and Decision Surfaces; Generalized Linear Discriminant Functions; The Two-Category Linearly Separable case; Minimizing the Perception Criterion Functions; Relaxation Procedures; Non-separable Behavior; Minimum Squared-Error procedures; The Ho-Kashyap procedures.

UNIT 6
Stochastic Methods: Introduction; Stochastic Search; Boltzmann Learning; Boltzmann Networks and Graphical Models; Evolutionary Methods.

UNIT 7
Non-Metric Methods: Introduction; Decision Trees; CART; Other Tree Methods; Recognition with Strings; Grammatical Methods.
UNIT – 8 7 Hours
Unsupervised Learning and Clustering: Introduction; Mixture Densities and Identifiability; Maximum-Likelihood Estimates; Application to Normal Mixtures; Unsupervised Bayesian Learning; Data Description and Clustering; Criterion Functions for Clustering.

Text Books:

Reference Books:

STOCHASTIC MODELS AND APPLICATIONS

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PART – A

UNIT – 1 6 Hours
Introduction – 1: Axioms of probability; Conditional probability and independence; Random variables; Expected value and variance; Moment-Generating Functions and Laplace Transforms; conditional expectation; Exponential random variables.

UNIT – 2 6 Hours
Introduction – 2: Limit theorems; Examples: A random graph; The Quicksort and Find algorithms; A self-organizing list model; Random permutations.

UNIT – 3 7 Hours
Probability Bounds, Approximations, and Computations: Tail probability inequalities; The second moment and conditional expectation inequality; probability bounds via the Importance sampling identity; Poisson random variables and the Poisson paradigm; Compound Poisson random variables.

UNIT – 4 7 Hours
Markov Chains: Introduction; Chapman-Kolmogorov Equations; Classification of states; Limiting and stationary probabilities; some
applications; Time-Reversible Markov Chains; Markov Chain Monte Carlo methods.

PART – B

UNIT – 5
6 Hours
The Probabilistic Method: Introduction; Using probability to prove existence; Obtaining bounds from expectations; The maximum weighted independent set problem: A bound and a random algorithm; The set covering problem; Antichains; The Lovasz Local lemma; A random algorithm for finding the minimal cut in a graph.

UNIT – 6
6 Hours
Martingales: Martingales: Definitions and examples; The martingale stopping theorem; The Hoeffding-Azuma inequality; Sub-martingales.

UNIT – 7
7 Hours
Poisson Processes, Queuing Theory – 1: The non-stationary Poisson process; The stationary Poisson process; Some Poisson process computations; Classifying the events of a non-stationary Poisson process; Conditional distribution of the arrival times

UNIT – 8
7 Hours
Queuing Theory – 2: Birth-and-Death exponential queuing systems; The backwards approach in exponential queues; A closed queuing network; An open queuing network; The M/G/1 queue; Priority queues.

Text Books:

Reference Books:
PROGRAMMING LANGUAGES

Subject Code: 10CS666
I.A. Marks : 25
Hours/Week : 04
Exam Hours: 03
Total Hours : 52
Exam Marks: 100

PART - A

UNIT – 1                   7 Hours
Introduction; Names, Scopes, and Bindings: The art of language design; Programming language spectrum; Why study programming languages? Compilation and interpretation; Programming environments. Names, scope, and bindings: The notion of binding time; Object lifetime and storage management; Scope rules; Implementing scope; The meaning of names within a scope; The binding of referencing environments; Macro expansion.

UNIT – 2                   7 Hours
Control Flow: Expression evaluation; Structured and unstructured flow; Sequencing; Selection; Iteration; Recursion; Non-determinacy

UNIT – 3                 6 Hours
Data Types: Type systems; Type checking; Records and variants; Arrays; Strings; Sets; Pointers and recursive types; Lists; Files and Input/Output; Equality testing and assignment.

UNIT – 4                  6 Hours
Subroutines and Control Abstraction: Review of stack layout; Calling sequences; Parameter passing; Generic subroutines and modules; Exception handling; Coroutines; Events.

PART – B

UNIT – 5                   6 Hours
Data Abstraction and Object Orientation: Object oriented programming; Encapsulation and Inheritance; Initialization and finalization; Dynamic method binding; Multiple inheritance; Object oriented programming revisited.
UNIT – 6                  7 Hours
Functional Languages, and Logic Languages: Functional Languages: Origins; Concepts; A review/overview of scheme; Evaluation order revisited; Higher-order functions; Functional programming in perspective. Logic Languages: Concepts; Prolog: Logic programming in perspective.

UNIT – 7                   6 Hours
Concurrency: Background and motivation; Concurrency programming fundamentals; Implementing synchronization; Language-level mechanisms; Message passing.

UNIT – 8                   7 Hours
Run-Time Program Management: Virtual machines; Late binding of machine code; Inspection/introspection.

Text Books:
1. Michael L. Scott: Programming Language Pragmatics, 3rd Edition, Elsevier, 2009. (Chapters 1.1 to 1.5, 3.1 to 3.7, 6 excluding the sections on CD, 7 excluding the ML type system, 8, 9, 10 excluding the sections on CD, 11 excluding the sections on CD, 12, 15. Note: Text Boxes titled Design & Implementation are excluded)

Reference Books:

COMPUTER GRAPHICS AND VISUALIZATION LABORATORY

Subject Code: 10CSL67       I.A. Marks : 25
Hours/Week : 03             Exam Hours: 03
Total Hours : 42            Exam Marks: 50

PART - A

Design, develop, and implement the following programs in C / C++

1. Program to recursively subdivide a tetrahedron to from 3D Sierpinski gasket. The number of recursive steps is to be specified by the user.
2. Program to implement Liang-Barsky line clipping algorithm.
3. Program to draw a color cube and spin it using OpenGL transformation matrices.
4. Program to create a house like figure and rotate it about a given fixed point using OpenGL functions.
5. Program to implement the Cohen-Sutherland line-clipping algorithm. Make provision to specify the input line, window for clipping and view port for displaying the clipped image.
6. Program to create a cylinder and a parallelepiped by extruding a circle and quadrilateral respectively. Allow the user to specify the circle and the quadrilateral.
7. Program, using OpenGL functions, to draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the surfaces of the solid object used in the scene.
8. Program to draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing. Use OpenGL functions.
9. Program to fill any given polygon using scan-line area filling algorithm. (Use appropriate data structures.)
10. Program to display a set of values \( \{f_{ij}\} \) as a rectangular mesh.

**PART - B**

Develop a suitable Graphics package to implement the skills learnt in the theory and the exercises indicated in Part A. Use the OpenGL.

**Note:**
1. Any question from Part A may be asked in the examination.
2. A report of about 10 – 12 pages on the package developed in Part B, duly certified by the department must be submitted during examination.

**Instructions:**
In the examination, one exercise from Part A is to be asked for a total of 30 marks. The package developed under Part B has to be evaluated for a total of 20 marks.
List of Experiments for USP: Design, develop, and execute the following programs

1. Write a C/C++ POSIX compliant program to check the following limits:
   (i) No. of clock ticks   (ii) Max. no. of child processes
   (iii) Max. path length   (iv) Max. no. of characters in a file name
   (v) Max. no. of open files/process

2. Write a C/C++ POSIX compliant program that prints the POSIX defined configuration options supported on any given system using feature test macros.

3. Consider the last 100 bytes as a region. Write a C/C++ program to check whether the region is locked or not. If the region is locked, print pid of the process which has locked. If the region is not locked, lock the region with an exclusive lock, read the last 50 bytes and unlock the region.

4. Write a C/C++ program which demonstrates interprocess communication between a reader process and a writer process. Use mkfifo, open, read, write and close APIs in your program.

5. a) Write a C/C++ program that outputs the contents of its Environment list
    b) Write a C / C++ program to emulate the unix ln command

6. Write a C/C++ program to illustrate the race condition.

7. Write a C/C++ program that creates a zombie and then calls system to execute the ps command to verify that the process is zombie.

8. Write a C/C++ program to avoid zombie process by forking twice.

9. Write a C/C++ program to implement the system function.
10. Write a C/C++ program to set up a real-time clock interval timer using the alarm API.

List of Experiments for Compiler Design: Design, develop, and execute the following programs.

11. Write a C program to implement the syntax-directed definition of “if E then S1” and “if E then S1 else S2”. (Refer Fig. 8.23 in the textbook prescribed for 06CS62 Compiler Design, Alfred V. Aho, Ravi Sethi, and Jeffrey D. Ullman: Compilers—Principles, Techniques and Tools, 2nd Edition, Pearson Education, 2007).

12. Write a yacc program that accepts a regular expression as input and produce its parse tree as output.

Note: In the examination each student picks one question from the lot of all 12 questions.

VII SEMESTER
OBJECT-ORIENTED MODELING AND DESIGN

Subject Code: 10CS71  LA. Marks : 25
Hours/Week : 04  Exam Hours: 03
Total Hours : 52  Exam Marks: 100

PART – A

UNIT – 1  7 Hours
Introduction, Modeling Concepts, class Modeling: What is Object Orientation? What is OO development? OO themes; Evidence for usefulness of OO development; OO modeling history
Modeling as Design Technique: Modeling; abstraction; The three models.
Class Modeling: Object and class concepts; Link and associations concepts; Generalization and inheritance; A sample class model; Navigation of class models; Practical tips.

UNIT – 2  6 Hours
Advanced Class Modeling, State Modeling: Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages; Practical tips.
State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Practical tips.

UNIT – 3                6 Hours
**Advanced State Modeling, Interaction Modeling:** Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models; Practical tips.
Interaction Modeling: Use case models; Sequence models; Activity models.
Use case relationships; Procedural sequence models; Special constructs for activity models.

UNIT – 4                     7 Hours
**Process Overview, System Conception, Domain Analysis:** Process Overview: Development stages; Development life cycle.
System Conception: Devising a system concept; Elaborating a concept; Preparing a problem statement.
Domain Analysis: Overview of analysis; Domain class model; Domain state model; Domain interaction model; Iterating the analysis.

PART – B

UNIT – 5                7 Hours
**Application Analysis, System Design:** Application Analysis: Application interaction model; Application class model; Application state model; Adding operations.
Overview of system design; Estimating performance; Making a reuse plan; Breaking a system into sub-systems; Identifying concurrency; Allocation of sub-systems; Management of data storage; Handling global resources; Choosing a software control strategy; Handling boundary conditions; Setting the trade-off priorities; Common architectural styles; Architecture of the ATM system as the example.

UNIT – 6                        7 Hours
**Class Design, Implementation Modeling, Legacy Systems:** Class Design: Overview of class design; Bridging the gap; Realizing use cases; Designing algorithms; Recursing downwards, Refactoring; Design optimization; Realification of behavior; Adjustment of inheritance; Organizing a class design; ATM example.
Implementation Modeling: Overview of implementation; Fine-tuning classes; Fine-tuning generalizations; Realizing associations; Testing.
Legacy Systems: Reverse engineering; Building the class models; Building the interaction model; Building the state model; Reverse engineering tips; Wrapping; Maintenance.

UNIT – 7                6 Hours

68
Design Patterns – 1: What is a pattern and what makes a pattern? Pattern categories; Relationships between patterns; Pattern description
Communication Patterns: Forwarder-Receiver; Client-Dispatcher-Server; Publisher-Subscriber.

UNIT – 8               6 Hours
Design Patterns – 2, Idioms: Management Patterns: Command processor; View handler.
Idioms: Introduction; what can idioms provide? Idioms and style; Where to find idioms; Counted Pointer example

Text Books:
   (Chapters 1 to 17, 23)
   (Chapters 1, 3.5, 3.6, 4)

Reference Books:
EMBEDDED COMPUTING SYSTEMS

Sub Code: 10CS72  IA Marks :25
Hrs/Week: 04        Exam Hours :03
Total Hrs: 52              Exam Marks :100

PART- A

UNIT – 1                6 Hours
Design Example: Model Train Controller.

UNIT – 2                7 Hours
Instruction Sets, CPUs: Preliminaries, ARM Processor, Programming Input and Output, Supervisor mode, Exceptions, Traps, Coprocessors, Memory Systems Mechanisms, CPU Performance, CPU Power Consumption. Design Example: Data Compressor.

UNIT – 3                6 Hours
Bus-Based Computer Systems: CPU Bus, Memory Devices, I/O devices, Component Interfacing, Designing with Microprocessor, Development and Debugging, System-Level Performance Analysis
Design Example: Alarm Clock.

UNIT – 4                7 Hours
Program Design and Analysis: Components for embedded programs, Models of programs, Assembly, Linking and Loading, Basic Compilation Techniques, Program optimization, Program-Level performance analysis, Software performance optimization, Program-Level energy and power analysis, Analysis and optimization of program size, Program validation and testing. Design Example: Software modem.

PART- B

UNIT – 5                6 Hours
Real Time Operating System (RTOS) Based Design – 1: Basics of OS, Kernel, types of OSs, tasks, processes, Threads, Multitasking and Multiprocessing, Context switching, Scheduling Policies, Task Communication, Task Synchronization.

UNIT – 6                6 Hours
RTOS-Based Design - 2: Inter process Communication mechanisms, Evaluating OS performance, Choice of RTOS, Power Optimization. Design Example: Telephone Answering machine

UNIT – 7 7 Hours

UNIT – 8 7 Hours

Text Books:
   (Chapters 10, 13)

Reference Books:

PROGRAMMING THE WEB

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UNIT – 1 6 Hours
XHTML: Basic syntax, Standard structure, Basic text markup, Images, Hypertext Links.
UNIT – 2                   7 Hours
XHTML – 2, CSS: XHTML (continued): Lists, Tables, Forms, Frames
CSS: Introduction, Levels of style sheets, Style specification formats,
Selector forms, Property value forms, Font properties, List properties, Color,
Alignment of text, The box model, Background images, The <span> and
<div> tags, Conflict resolution.

UNIT – 3               6 Hours
Javascript: Overview of Javascript, Object orientation and Javascript,
Syntactic characteristics, Primitives, operations, and expressions, Screen
output and keyboard input, Control statements, Object creation and
modification, Arrays, Functions, Constructors, Pattern matching using
regular expressions, Errors in scripts, Examples.

UNIT – 4                                  7 Hours
Javascript and HTML Documents, Dynamic Documents with Javascript:
The Javascript execution environment, The Document Object Model, Element
access in Javascript, Events and event handling, Handling events from the
Body elements, Button elements, Text box and Password elements, The DOM
2 event model, The navigator object, DOM tree traversal and modification.
Introduction to dynamic documents, Positioning elements, Moving elements,
Element visibility, Changing colors and fonts, Dynamic content, Stacking
elements, Locating the mouse cursor, Reacting to a mouse click, Slow
movement of elements, Dragging and dropping elements.

PART - B

UNIT – 5                6 Hours
XML: Introduction, Syntax, Document structure, Document type definitions,
Namespaces, XML schemas, Displaying raw XML documents, Displaying
XML documents with CSS, XSLT style sheets, XML processors, Web
services.

UNIT – 6                              7 Hours
Perl, CGI Programming: Origins and uses of Perl, Scalars and their
operations, Assignment statements and simple input and output, Control
statements, Fundamentals of arrays, Hashes, References, Functions, Pattern
matching, File input and output; Examples.
The Common Gateway Interface; CGI linkage; Query string format; CGI.pm
module; A survey example; Cookies.
Database access with Perl and MySQL.

UNIT – 7                                    6 Hours
PHP: Origins and uses of PHP, Overview of PHP, General syntactic
characteristics, Primitives, operations and expressions, Output, Control
statements, Arrays, Functions, Pattern matching, Form handling, Files, Cookies, Session tracking, Database access with PHP and MySQL.

UNIT – 8  
Ruby, Rails: Origins and uses of Ruby, Scalar types and their operations, Simple input and output, Control statements, Arrays, Hashes, Methods, Classes, Code blocks and iterators, Pattern matching. Overview of Rails, Document requests, Processing forms, Rails applications with Databases, Layouts.

Text Books:  

Reference Books:  

ADVANCED COMPUTER ARCHITECTURES

Subject Code: 10CS74  
I.A. Marks : 25
Hours/Week : 04  
Exam Hours: 03
Total Hours : 52  
Exam Marks: 100

PART - A

UNIT – 1  
Fundamentals Of Computer Design: Introduction; Classes of computers; Defining computer architecture; Trends in Technology, power in Integrated Circuits and cost; Dependability; Measuring, reporting and summarizing Performance; Quantitative Principles of computer design.

UNIT – 2  
Pipelining: Introduction; Pipeline hazards; Implementation of pipeline; What makes pipelining hard to implement?

UNIT – 3  
Instruction –Level Parallelism – 1: ILP: Concepts and challenges; Basic Compiler Techniques for exposing ILP; Reducing Branch costs with
UNIT – 4 7 Hours
Instruction –Level Parallelism – 2: Exploiting ILP using multiple issue and static scheduling; Exploiting ILP using dynamic scheduling, multiple issue and speculation; Advanced Techniques for instruction delivery and Speculation; The Intel Pentium 4 as example.

PART - B

UNIT – 5 7 Hours
Multiprocessors and Thread –Level Parallelism: Introduction; Symmetric shared-memory architectures; Performance of symmetric shared–memory multiprocessors; Distributed shared memory and directory-based coherence; Basics of synchronization; Models of Memory Consistency

UNIT – 6 6 Hours
Review of Memory Hierarchy: Introduction; Cache performance; Cache Optimizations, Virtual memory

UNIT – 7 6 Hours
Memory Hierarchy design: Introduction; Advanced optimizations of Cache performance; Memory technology and optimizations; Protection: Virtual memory and virtual machines.

UNIT – 8 7 Hours
Hardware and Software for VLIW and EPIC: Introduction: Exploiting Instruction-Level Parallelism Statically; Detecting and Enhancing Loop-Level Parallelism; Scheduling and Structuring Code for Parallelism; Hardware Support for Exposing Parallelism: Predicated Instructions; Hardware Support for Compiler Speculation; The Intel IA-64 Architecture and Itanium Processor; Conclusions.

Text Books:

Reference Books:

### ADVANCED DBMS

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**PART - A**

**UNIT – 1**  
Overview of Storage and Indexing, Disks and Files: Data on external storage; File organizations and indexing; Index data structures; Comparison of file organizations; Indexes and performance tuning  
Memory hierarchy; RAID; Disk space management; Buffer manager; Files of records; Page formats and record formats

**UNIT – 2**  
Tree Structured Indexing: Intuition for tree indexes; Indexed sequential access method; B+ trees, Search, Insert, Delete, Duplicates, B+ trees in practice

**UNIT – 3**  
Hash-Based Indexing: Static hashing; Extendible hashing, Linear hashing, comparisons

**UNIT – 4**  
Overview of Query Evaluation, External Sorting: The system catalog; Introduction to operator evaluation; Algorithms for relational operations; Introduction to query optimization; Alternative plans: A motivating example; what a typical optimizer does.  
When does a DBMS sort data? A simple two-way merge sort; External merge sort

**PART - B**

**UNIT – 5**  
Evaluating Relational Operators: The Selection operation; General selection conditions; The Projection operation; The Join operation; The Set operations; Aggregate operations; The impact of buffering
UNIT – 6

A Typical Relational Query Optimizer: Translating SQL queries into Relational Algebra; Estimating the cost of a plan; Relational algebra equivalences; Enumeration of alternative plans; Nested sub-queries; other approaches to query optimization.

UNIT – 7

Physical Database Design and Tuning: Introduction; Guidelines for index selection, examples; Clustering and indexing; Indexes that enable index-only plans; Tools to assist in index selection; Overview of database tuning; Choices in tuning the conceptual schema; Choices in tuning queries and views; Impact of concurrency; DBMS benchmarking.

UNIT – 8

More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management

Text Books:

Reference Books:

DIGITAL SIGNAL PROCESSING

Subject Code: 10CS752  I.A. Marks : 25
Hours/Week : 04  Exam Hours: 03
Total Hours : 52  Exam Marks: 100

PART - A

UNIT – 1

The Discrete Fourier Transform: Its Properties and Applications:
UNIT – 2  
7 Hours  
Efficient Computation of the DFT: Fast Fourier Transform Algorithms:  
Efficient Computation of the DFT, FFT Algorithms: Direct Computation of the DFT,  
Applications of FFT Algorithms: Efficient computation of the DFT of Two Real Sequences, Efficient computation of the DFT of a 2N-Point Real Sequence, Use of the FFT Algorithm in Linear filtering and Correlation.  
Quantization Effects in the Computation of the DFT: Quantization Errors in the Direct Computation of the DFT, Quantization Errors in FFT Algorithms.

UNIT – 3  
6 Hours  
Structures for FIR Systems: Direct-Form Structures, Cascade-Form Structures, Frequency-Sampling Structures, Lattice Structure.  

UNIT – 4  
6 Hours  
Representation of Numbers: Fixed-Point Representation of Numbers, Binary Floating-Point Representation of Numbers, Errors Resulting from Rounding and Truncation.

PART – B

UNIT – 5  
6 Hours  
Implementation of Discrete-Time Systems – 3: Quantization of Filter Coefficients: Analysis of Sensitivity to Quantization of Filter Coefficients, Quantization of Coefficients in FIR Filters

UNIT – 6
Design of Digital Filters – 1: 7 Hours
General Considerations: Causality and its Implications, Characteristics of Practical Frequency-Selective Filters.
Design of FIR Filters: Symmetric And Antisymmetric FIR Filters, Design of Linear-Phase FIR Filters Using Windows, Design of Linear-Phase FIR Filters by the Frequency-Sampling Method, Design of Optimum Equiripple Linear-Phase FIR Filters, Design of FIR Differentiators, Design of Hilbert Transformers, Comparison of Design Methods for Linear-Phase FIR filters.

UNIT – 7
Design of Digital Filters – 2: 6 Hours

UNIT – 8
Design of Digital Filters – 3: 7 Hours

Text Books:

Reference Books:
UNIT – 1
Introduction to Java: Java and Java applications; Java Development Kit (JDK); Java is interpreted, Byte Code, JVM; Object-oriented programming; Simple Java programs.
Data types and other tokens: Boolean variables, int, long, char, operators, arrays, white spaces, literals, assigning values; Creating and destroying objects; Access specifiers.
Operators and Expressions: Arithmetic Operators, Bitwise operators, Relational operators, The Assignment Operator, The ? Operator; Operator Precedence; Logical expression; Type casting; Strings
Control Statements: Selection statements, iteration statements, Jump Statements.

UNIT – 2
Classes, Inheritance, Exceptions, Applets: Classes: Classes in Java; Declaring a class; Class name; Super classes; Constructors; Creating instances of class; Inner classes.
Inheritance: Simple, multiple, and multilevel inheritance; Overriding, overloading.
Exception handling: Exception handling in Java.
The Applet Class: Two types of Applets; Applet basics; Applet Architecture; An Applet skeleton; Simple Applet display methods; Requesting repainting; Using the Status Window; The HTML APPLET tag; Passing parameters to Applets; getDocumentbase() and getCodebase(); ApletContext and showDocument(); The AudioClip Interface; The AppletStub Interface; Output to the Console.

UNIT – 3
Multi Threaded Programming, Event Handling: Multi Threaded Programming: What are threads? How to make the classes threadable; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, read-write problem, producer-consumer problems.
Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes.
UNIT – 4 7 Hours
Swings: Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; Jlabel and ImageIcon; JTextField; The Swing Buttons; JTabbedPane; JScrollPane; JList; JComboBox; JTable.

PART – B

UNIT – 5 6 Hours
Java 2 Enterprise Edition Overview, Database Access: Overview of J2EE and J2SE
The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions.

UNIT – 6 7 Hours
Servlets: Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The javax.servlet Package; Reading Servlet Parameter; The javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking.

UNIT – 7 6 Hours
JSP, RMI: Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects.
Java Remote Method Invocation: Remote Method Invocation concept; Server side, Client side.

UNIT – 8 7 Hours
Enterprise Java Beans: Enterprise java Beans; Deployment Descriptors; Session Java Bean, Entity Java Bean; Message-Driven Bean; The JAR File.

Text Books:
   (Chapters 1, 2, 3, 4, 5, 6, 8, 10, 11, 21, 22, 29, 30, 31)
   (Chapters 5, 6, 11, 12, 15)

Reference Books:
PART – A

UNIT – 1 7 Hours
Introduction, Media and Data Streams, Audio Technology: Multimedia Elements; Multimedia Applications; Multimedia Systems Architecture; Evolving Technologies for Multimedia Systems; Defining Objects for Multimedia Systems; Multimedia Data Interface Standards; The need for Data Compression; Multimedia Databases.
Sound: Frequency, Amplitude, Sound Perception and Psychoacoustics; Audio Representation on Computers; Three Dimensional Sound Projection; Music and MIDI Standards; Speech Signals; Speech Output; Speech Input; Speech Transmission.

UNIT – 2 7 Hours
Graphics and Images, Video Technology, Computer-Based Animation: Capturing Graphics and Images Computer Assisted Graphics and Image Processing; Reconstructing Images; Graphics and Image Output Options. Basics; Television Systems; Digitalization of Video Signals; Digital Television; Basic Concepts; Specification of Animations; Methods of Controlling Animation; Display of Animation; Transmission of Animation; Virtual Reality Modeling Language.

UNIT – 3 7 Hours
Data Compression – 1: Storage Space; Coding Requirements; Source, Entropy, and Hybrid Coding; Basic Compression Techniques; JPEG: Image Preparation, Lossy Sequential DCT-based Mode, Expanded Lossy DCT-based Mode, Lossless Mode, Hierarchical Mode
Data Compression – 2: H.261 (Px64) and H.263: Image Preparation, Coding Algorithms, Data Stream, H.263+ and H.263L; MPEG: Video Encoding, Audio Coding, Data Stream, MPEG-2, MPEG-4, MPEG-7; Fractal Compression.

PART - B

Optical Storage Media: History of Optical Storage; Basic Technology; Video Discs and Other WORMs; Compact Disc Digital Audio; Compact Disc Read Only Memory; CD-ROM Extended Architecture; Further CD-ROM-Based Developments; Compact Disc Recordable; Compact Disc Magneto-Optical; Compact Disc Read/Write; Digital Versatile Disc.

Content Analysis : Simple Vs. Complex Features; Analysis of Individual Images; Analysis of Image Sequences; Audio Analysis; Applications.

Data and File Format Standards: Rich-Text Format; TIFF File Format; Resource Interchange File Format (RIFF); MIDI File Format; JPEG DIB File Format for Still and Motion Images; AVI Indeo File Format; MPEG Standards; TWAIN

Multimedia Application Design : Multimedia Application Classes; Types of Multimedia Systems; Virtual Reality Design; Components of Multimedia Systems; Organizing Multimedia Databases; Application Workflow Design Issues; Distributed Application Design Issues.

Text Books:
1. Ralf Steinmetz, Klara Narstedt: Multimedia Fundamentals: Vol 1-Media Coding and Content Processing, 2nd Edition, PHI, Indian Reprint 2008. (Chapters 2, 3, 4, 5, 6, 7, 8, 9)

Reference Books:
DATA WAREHOUSING AND DATA MINING

Subject Code: 10CS755                     I.A. Marks : 25
Hours/Week : 04                     Exam Hours: 03
Total Hours : 52                     Exam Marks: 100

PART – A

UNIT – 1                                                                                  6 Hours
Data Warehousing:
Introduction, Operational Data Stores (ODS), Extraction Transformation Loading (ETL), Data Warehouses. Design Issues, Guidelines for Data Warehouse Implementation, Data Warehouse Metadata

UNIT – 2                                                                                  6 Hours
Online Analytical Processing (OLAP): Introduction, Characteristics of OLAP systems, Multidimensional view and Data cube, Data Cube Implementations, Data Cube operations, Implementation of OLAP and overview on OLAP Softwares.

UNIT – 3                                                                                  6 Hours
Data Mining: Introduction, Challenges, Data Mining Tasks, Types of Data, Data Preprocessing, Measures of Similarity and Dissimilarity, Data Mining Applications

UNIT – 4                                                                                  8 Hours
Association Analysis: Basic Concepts and Algorithms: Frequent Itemset Generation, Rule Generation, Compact Representation of Frequent Itemsets, Alternative methods for generating Frequent Itemsets, FP Growth Algorithm, Evaluation of Association Patterns

PART - B

UNIT – 5                                                                                  6 Hours
Classification -1 : Basics, General approach to solve classification problem, Decision Trees, Rule Based Classifiers, Nearest Neighbor Classifiers.

UNIT – 6                                                                                  6 Hours
UNIT – 7                                                                                   8 Hours
Clustering Techniques: Overview, Features of cluster analysis, Types of 
Data and Computing Distance, Types of Cluster Analysis Methods, 
Partitional Methods, Hierarchical Methods, Density Based Methods, Quality 
and Validity of Cluster Analysis

UNIT – 8                    6 Hours
Web Mining: Introduction, Web content mining, Text Mining, Unstructured 
Text, Text clustering, Mining Spatial and Temporal Databases.

Text Books:
  1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to 
  2. G. K. Gupta: Introduction to Data Mining with Case Studies, 3rd 

Reference Books:
  2. Jiawei Han and Micheline Kamber: Data Mining - Concepts and 
  3. Alex Berson and Stephen J. Smith: Data Warehousing, Data Mining, 

NEURAL NETWORKS
Subject Code: 10CS756 I.A. Marks : 25
Hours/Week : 04 Exam Hours: 03
Total Hours : 52 Exam Marks: 100
PART – A
UNIT – 1                 7 Hours
Introduction
What is a Neural Network?, Human Brain, Models of Neuron, Neural 
Networks viewed as directed graphs, Feedback, Network Architectures, 
Knowledge representation, Artificial Intelligence and Neural Networks.

UNIT – 2                 6 Hours
Learning Processes – 1
Introduction, Error-correction learning, Memory-based learning, Hebbian 
learning, Competitive learning, Boltzamann learning, Credit Assignment 
problem, Learning with a Teacher, Learning without a Teacher, Learning 
tasks, Memory, Adaptation.

UNIT – 3                 7 Hours

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UNIT – 4

PART - B

UNIT – 5

UNIT – 6

UNIT – 7
UNIT – 8                7 Hours
Optimization Methods – 2:
Iterated gradient descent, Simulated Annealing, Random Search, Evolutionary computation- Evolutionary algorithms, Initialization, Termination criterion, Reproduction, Operators, Replacement, Schema theorem

Text Books:

Reference Books:

C# PROGRAMMING AND .NET

Subject Code: 10CS761                I.A. Marks : 25
Hours/Week : 04                  Exam Hours: 03
Total Hours : 52                  Exam Marks: 100

PART – A

UNIT – 1                 6 Hours
Interfaces and Collections: Defining Interfaces Using C# Invoking Interface Members at the object Level, Exercising the Shapes Hierarchy, Understanding Explicit Interface Implementation, Interfaces As Polymorphic Agents, Building Interface Hierarchies, Implementing, Implementation, Interfaces Using VS .NET, understanding the IConvertible Interface, Building a Custom Enumerator (IEnumerable and Enumerator), Building Cloneable objects ( ICloneable), Building Comparable Objects ( IComparable ), Exploring the system. Collections Namespace, Building a Custom Container (Retrofitting the Cars Type).

UNIT – 2                 8 Hours
Callback Interfaces, Delegates, and Events, Advanced Techniques: Understanding Callback Interfaces, Understanding the .NET Delegate Type, Members of System. Multicast Delegate, The Simplest Possible Delegate Example, , Building More a Elaborate Delegate Example, Understanding Asynchronous Delegates, Understanding (and Using)Events.
The Advances Keywords of C#, A Catalog of C# Keywords Building a Custom Indexer, A Variation of the Cars Indexer Internal Representation of Type Indexer. Using C# Indexer from VB .NET. Overloading operators, The Internal Representation of Overloading Operators, interacting with Overload Operator from Overloaded- Operator- Challenged Languages. Creating Custom Conversion Routines, Defining Implicit Conversion Routines, The Internal Representations of Customs Conversion Routines

UNIT – 3 6 Hours
Understanding .NET Assemblies: Problems with Classic COM Binaries, An Overview of .NET Assembly, Building a Simple File Test Assembly, A C#. Client Application, A Visual Basic .NET Client Application, Cross Language Inheritance, Exploring the CarLibrary’s Manifest, Exploring the CarLibrary’s Types, Building the Multifile Assembly, Using Assembly, Understanding Private Assemblies, Probing for Private Assemblies (The Basics), Private A Assemblies XML Configurations Files, Probing for Private Assemblies (The Details), Understanding Shared Assembly, Understanding Shared Names, Building a Shared Assembly, Understanding Delay Signing, Installing/Removing Shared Assembly, Using a Shared Assembly

UNIT – 4 6 Hours
Object-Oriented Programming with C#: Forms Defining of the C# Class, Definition the “Default Public Interface” of a Type, Recapping the Pillars of OOP, The First Pillars: C#'s Encapsulation Services, Pseudo-Encapsulation: Creating Read-Only Fields, The Second Pillar: C#'s Inheritance Supports, keeping Family Secrets: The “Protected” Keyword, Nested Type Definitions, The Third Pillar: C#'s Polymorphic Support, Casting Between .

PART – B

UNIT – 5 6 Hours
Exceptions and Object Lifetime: Ode to Errors, Bugs, and Exceptions, The Role of .NET Exception Handling, the System. Exception Base Class, Throwing a Generic Exception, Catching Exception, CLR System – Level Exception(System. System Exception), Custom Application-Level Exception(System. System Exception), Handling Multiple Exception, The Family Block, the Last Chance Exception Dynamically Identifying Application – and System Level Exception Debugging System Exception Using VS. NET, Understanding Object Lifetime, the CIT of “new”. The Basics of Garbage Collection,, Finalization a Type, The Finalization Process, Building an Ad Hoc Destruction Method, Garbage Collection Optimizations, The System. GC Type.

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UNIT – 6  
**Interfaces and Collections:** Defining Interfaces Using C# Invoking Interface Members at the object Level, Exercising the Shapes Hierarchy, Understanding Explicit Interface Implementation, Interfaces As Polymorphic Agents, Building Interface Hierarchies, Implementing, Implementation, Interfaces Using VS .NET, understanding the IConvertible Interface, Building a Custom Enumerator (IEnumerable and Enumerator), Building Cloneable objects (ICloneable), Building Comparable Objects (IComparable), Exploring the system. Collections Namespace, Building a Custom Container (Retrofitting the Cars Type).

UNIT – 7  
**Callback Interfaces, Delegates, and Events, Advanced Techniques:** Understanding Callback Interfaces, Understanding the .NET Delegate Type, Members of System. Multicast Delegate, The Simplest Possible Delegate Example, Building More a Elaborate Delegate Example, Understanding Asynchronous Delegates, Understanding (and Using)Events. The Advances Keywords of C#, A Catalog of C# Keywords Building a Custom Indexer, A Variation of the Cars Indexer Internal Representation of Type Indexer. Using C# Indexer from VB .NET. Overloading operators, The Internal Representation of Overloading Operators, interacting with Overload Operator from Overloaded- Operator- Challenged Languages, Creating Custom Conversion Routines, Defining Implicit Conversion Routines, The Internal Representations of Customs Conversion Routines

UNIT – 8  
**Understanding .NET Assemblies:** Problems with Classic COM Binaries, An Overview of .NET Assembly, Building a Simple File Test Assembly, A C#. Client Application, A Visual Basic .NET Client Application, Cross Language Inheritance, Exploring the CarLibrary’s, Manifest, Exploring the CarLibrary’s Types, Building the Multifile Assembly, Using Assembly, Understanding Private Assemblies, Probing for Private Assemblies (The Basics), Private A Assemblies XML Configurations Files, Probing for Private Assemblies (The Details), Understanding Shared Assembly, Understanding Shared Names, Building a Shared Assembly, Understanding Delay Signing, Installing/Removing Shared Assembly, Using a Shared Assembly

**Text Books:**

Reference Books:

DIGITAL IMAGE PROCESSING

Subject Code: 10CS762  I.A. Marks : 25
Hours/Week : 04  Exam Hours: 03
Total Hours : 52  Exam Marks: 100

PART – A

UNIT – 1  6 Hours
Digitized Image and its properties: Basic concepts, Image digitization, Digital image properties

UNIT – 2  7 Hours
Image Preprocessing: Image pre-processing: Brightness and geometric transformations, local preprocessing.

UNIT – 3  7 Hours
Segmentation – 1: Thresholding, Edge-based segmentation.

UNIT – 4  7 Hours
Segmentation – 2: Region based segmentation, Matching.

PART – B

UNIT – 5  7 Hours

UNIT – 6  6 Hours
UNIT – 7 7 Hours
Shape representation: Region identification, Contour-based shape representation and description, Region based shape representation and description, Shape classes.

UNIT – 8 6 Hours
Morphology: Basic morphological concepts, Morphology principles, Binary dilation and erosion, Gray-scale dilation and erosion, Morphological segmentation and watersheds

Text Books:

Reference Books:

GAME THEORY

Subject Code: 10CS763 I.A. Marks : 25
Hours/Week : 04 Exam Hours: 03
Total Hours : 52 Exam Marks: 100

PART - A

UNIT – 1 8 Hours
Introduction, Strategic Games: What is game theory? The theory of rational choice; Interacting decision makers.
Strategic games; Examples: The prisoner’s dilemma, Bach or Stravinsky, Matching pennies; Nash equilibrium; Examples of Nash equilibrium; Best-response functions; Dominated actions; Equilibrium in a single population: symmetric games and symmetric equilibria.
UNIT – 2
Mixed Strategy Equilibrium: Introduction; Strategic games in which players may randomize; Mixed strategy Nash equilibrium; Dominated actions; Pure equilibria when randomization is allowed; Illustration: Expert Diagnosis; Equilibrium in a single population; Illustration: Reporting a crime; The formation of players’ beliefs; Extensions; Representing preferences by expected payoffs.

UNIT – 3
Extensive Games: Extensive games with perfect information; Strategies and outcomes; Nash equilibrium; Subgame perfect equilibrium; Finding subgame perfect equilibria of finite horizon games; Backward induction. Illustrations: The ultimatum game, Stackelberg’s model of duopoly, Buying votes.

UNIT – 4
Extensive games: Extensions and Discussions: Extensions: Allowing for simultaneous moves, Illustrations: Entry into a monopolized industry, Electoral competition with strategic voters, Committee decision making, Exit from a declining industry; Allowing for exogenous uncertainty, Discussion: subgame perfect equilibrium and backward induction.

PART – B

UNIT – 5
Bayesian Games, Extensive Games with Imperfect Information: Motivational examples; General definitions; Two examples concerning information; Illustrations: Cournot’s duopoly game with imperfect information, Providing a public good, Auctions; Auctions with an arbitrary distribution of valuations.

UNIT – 6
Strictly Competitive Games, Evolutionary Equilibrium: Strictly competitive games and maximization; Maximization and Nash equilibrium; Strictly competitive games; Maximization and Nash equilibrium in strictly competitive games.

UNIT – 7
Evolutionary Equilibrium: Monomorphic pure strategy equilibrium; Mixed strategies and polymorphic equilibrium; Asymmetric contests; Variations on themes: Sibling behavior, Nesting behavior of wasps, The evolution of sex ratio.
Iterated Games: Repeated games: The main idea; Preferences; Repeated games; Finitely and infinitely repeated Prisoner’s dilemma; Strategies in an infinitely repeated Prisoner’s dilemma; Some Nash equilibria of an infinitely repeated Prisoner’s dilemma, Nash equilibrium payoffs of an infinitely repeated Prisoner’s dilemma.

UNIT – 8
Coalesional Games and Bargaining: Coalitional games. The Core. Illustrations: Ownership and distribution of wealth, Exchanging homogeneous items, Exchanging heterogeneous items, Voting, Matching. Bargaining as an extensive game; Illustration of trade in a market; Nash’s axiomatic model of bargaining

Text Books:
   (Listed topics only from Chapters 1 to 11, 13, 14, 16)

Reference Books:

ARTIFICIAL INTELLIGENCE

Subject Code: 10CS764 I.A. Marks : 25
Hours/Week : 04 Exam Hours: 03
Total Hours : 52 Exam Marks: 100

PART – A

UNIT – 1
Introduction: What is AI? Intelligent Agents: Agents and environment; Rationality; the nature of environment; the structure of agents. Problem-solving: Problem-solving agents; Example problems; Searching for solution; Uninformed search strategies.

UNIT – 2
Informed Search, Exploration, Constraint Satisfaction, Adversial Search: Informed search strategies; Heuristic functions; On-line search agents and unknown environment. Constraint satisfaction problems; Backtracking search
for CSPs. Adversial search: Games; Optimal decisions in games; Alpha-Beta pruning.

UNIT – 3  
Logical Agents: Knowledge-based agents; The wumpus world as an example world; Logic; propositional logic Reasoning patterns in propositional logic; Effective propositional inference; Agents based on propositional logic.

UNIT – 4  
First-Order Logic, Inference in First-Order Logic – 1: Representation revisited; Syntax and semantics of first-order logic; Using first-order logic; Knowledge engineering in first-order logic. Propositional versus first-order inference; Unification and lifting

PART – B

UNIT – 5  
Inference in First-Order Logic – 2: Forward chaining; Backward chaining; Resolution.

UNIT – 6  
Knowledge Representation: Ontological engineering; Categories and objects; Actions, situations, and events; Mental events and mental objects; The Internet shopping world; Reasoning systems for categories; Reasoning with default information; Truth maintenance systems.

UNIT – 7  
Planning, Uncertainty, Probabilistic Reasoning: Planning: The problem; Planning with state-space approach; Planning graphs; Planning with propositional logic. Uncertainty: Acting under certainty; Inference using full joint distributions; Independence; Bayes’ rule and its use. Probabilistic Reasoning: Representing knowledge in an uncertain domain; The semantics of Bayesian networks; Efficient representation of conditional distributions; Exact inference in Bayesian networks.

UNIT – 8  
Learning, AI: Present and Future: Learning: Forms of Learning; Inductive learning; Learning decision trees; Ensemble learning; Computational learning theory. AI: Present and Future: Agent components; Agent architectures; Are we going in the right direction? What if AI does succeed?

Text Books:
   (Chapters 1.1, 2, 3.1 to 3.4, 4.1, 4.2, 4.5, 5.1, 5.2, 6.1, 6.2, 6.3, 7, 8, 9, 10, 11.1, 11.2, 11.4, 11.5, 13.1, 13.4, 13.5, 13.6, 14.1, 14.2, 14.3, 14.4, 18, 27)

Reference Books:

STORAGE AREA NETWORKS

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<th>I.A. Marks : 25</th>
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<td>Exam Hours: 03</td>
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<td>Total Hours : 52</td>
<td>Exam Marks: 100</td>
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PART –A

UNIT - 1

Introduction to Information Storage and Management, Storage System Environment: Information Storage, Evolution of Storage Technology and Architecture, Data Center Infrastructure, Key Challenges in Managing Information, Information Lifecycle

Components of Storage System Environment, Disk Drive Components, Disk Drive Performance, Fundamental Laws Governing Disk Performance, Logical Components of the Host, Application Requirements and Disk Performance.

UNIT - 2

Data Protection, Intelligent Storage system: Implementation of RAID, RAID Array Components, RAID Levels, RAID Comparison, RAID Impact on Disk Performance, Hot Spares

Components of an Intelligent Storage System, Intelligent Storage Array

UNIT - 3

Direct-Attached Storage, SCSI, and Storage Area Networks: Types of DAS, DAS Benefits and Limitations, Disk Drive Interfaces, Introduction to Parallel SCSI, Overview of Fibre Channel, The SAN and Its Evolution, Components of SAN, FC Connectivity, Fibre Channel Ports, Fibre Channel Architecture, Zoning, Fibre Channel Login Types, FC Topologies.

UNIT - 4

NAS, IP SAN: General – Purpose Service vs. NAS Devices, Benefits of NAS, NAS File I/O, Components of NAS, NAS Implementations, NAS
File-Sharing Protocols, NAS I/O Operations, Factors Affecting NAS Performance and Availability, iSCSI, FCIP.

PART - B

UNIT - 5  6 Hours
Content-Addressed Storage, Storage Virtualization: Fixed Content and Archives, Types of Archive, Features and Benefits of CAS, CAS Architecture, Object Storage and Retrieval in CAS, CAS Examples Forms of Virtualization, SNIA Storage Virtualization Taxonomy, Storage Virtualizations Configurations, Storage Virtualization Challenges, Types of Storage Virtualization

UNIT - 6  6 Hours
Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Process, Backup and restore Operations, Backup Topologies, Backup in NAS Environments, Backup Technologies.

UNIT - 7  7 Hours
Local Replication, Remote Replication: Source and Target, Uses of Local Replicas, Data Consistency, Local Replication Technologies, Restore and Restart Considerations, Creating Multiple Replicas, Management Interface, Modes of Remote Replication, Remote Replication Technologies, Network Infrastructure.

UNIT - 8  7 Hours
Monitoring the Storage Infrastructure, Storage Management Activities, Storage Infrastructure Management Challenges, Developing an Ideal Solution.

Text Books:

Reference Books:

FUZZY LOGIC

Subject Code: 10CS766 I.A. Marks : 25
Hours/Week : 04 Exam Hours: 03
Total Hours : 52 Exam Marks: 100

PART – A

UNIT – 1 7 Hours
Classical Sets - Operations on Classical Sets, Properties of Classical (Crisp) Sets, Mapping of Classical Sets to Functions
Fuzzy Sets - Fuzzy Set operations, Properties of Fuzzy Sets. Sets as Points in Hypercubes

UNIT – 2 6 Hours
Tolerance and Equivalence Relations

UNIT – 3 6 Hours

UNIT – 4 7 Hours
Fuzzy-to-Crisp Conversions, Fuzzy Arithmetic: Lambda-Cuts for Fuzzy Sets, Lambda-Cuts for Fuzzy Relations, Defuzzification Methods
Extension Principle - Crisp Functions, Mapping and Relations, Functions of fuzzy Sets – Extension Principle, Fuzzy Transform (Mapping), Practical Considerations, Fuzzy Numbers
Interval Analysis in Arithmetic, Approximate Methods of Extension - Vertex method, DSW Algorithm, Restricted DSW Algorithm, Comparisons, Fuzzy Vectors

PART - B

UNIT – 5                 6 Hours

UNIT – 6                 6 Hours
Fuzzy Rule- Based Systems: Natural Language, Linguistic Hedges, Rule-Based Systems - Canonical Rule Forms, Decomposition of Compound Rules, Likelihood and Truth Qualification, Aggregation of Fuzzy Rules, Graphical Techniques of Inference

UNIT – 7                 7 Hours

UNIT – 8                 7 Hours
Fuzzy Classification: Classification by Equivalence Relations - Crisp Relations, Fuzzy Relations. Cluster Analysis, Cluster Validity, c-Means Clustering - Hard c-Means (HCM), Fuzzy c-Means (FCM). Classification Metric, Hardening the Fuzzy c-Partition, Similarity Relations from Clustering

Text Books:
   (Chapter 1 (pp 1-14), Chapter 2 (pp 17-34), Chapter 3 ( pp 46-70), Chapter 4 (pp 87-122), Chapter 5 (pp 130-146), Chapter 6 (pp 151-178), Chapter 7 ( pp 183-210), Chapter 8 (pp 232-254), Chapter 9 (pp 313-352), Chapter 10 ( pp 371 – 400))

Reference Books:
Networks Laboratory

Subject Code: 10CSL77   L.A. Marks : 25
Hours/Week : 03   Exam Hours: 03
Total Hours : 42   Exam Marks: 50

Note: Student is required to solve one problem from PART-A and one problem from PART-B. The questions are allotted based on lots. Both questions carry equal marks.

PART A – Simulation Exercises

The following experiments shall be conducted using either NS228/OPNET or any other suitable simulator.

1. Simulate a three nodes point – to – point network with duplex links between them. Set the queue size and vary the bandwidth and find the number of packets dropped.
2. Simulate a four node point-to-point network with the links connected as follows:
   n0 – n2, n1 – n2 and n2 – n3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP / UDP.
3. Simulate the transmission of ping messages over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
4. Simulate an Ethernet LAN using n nodes (6-10), change error rate and data rate and compare throughput.
5. Simulate an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
6. Simulate simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets.

PART-B

Implement the following in C/C++:

7. Write a program for error detecting code using CRC-CCITT (16- bits).
8. Write a program for distance vector algorithm to find suitable path for transmission.
9. Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.
10. Implement the above program using as message queues or FIFOs as IPC channels.
11. Write a program for simple RSA algorithm to encrypt and decrypt the data.
12. Write a program for congestion control using leaky bucket algorithm.

Note:
In the examination, a combination of one problem has to be asked from Part A for a total of 25 marks and one problem from Part B has to be asked for a total of 25 marks. The choice must be based on random selection from the entire lots.

Web Programming Laboratory

Subject Code: 10CSL78  I.A. Marks : 25
Hours/Week : 03  Exam Hours: 03
Total Hours : 42  Exam Marks: 50

1. Develop and demonstrate a XHTML file that includes Javascript script for the following problems:
   a) Input: A number n obtained using prompt
      Output: The first n Fibonacci numbers
   b) Input: A number n obtained using prompt
      Output: A table of numbers from 1 to n and their squares using alert

2. a) Develop and demonstrate, using Javascript script, a XHTML document that collects the USN (the valid format is: A digit from 1 to 4 followed by two upper-case characters followed by two digits followed by two upper-case characters followed by three digits; no embedded spaces allowed) of the user. Event handler must be included for the form element that collects this information to validate the input. Messages in the alert windows must be produced when errors are detected.
   b) Modify the above program to get the current semester also (restricted to be a number from 1 to 8)

3. a) Develop and demonstrate, using Javascript script, a XHTML document that contains three short paragraphs of text, stacked on top of each other, with only enough of each showing so that the mouse cursor can be placed over some part of them. When the cursor is placed over the exposed part of any paragraph, it should rise to the top to become completely visible.
   b) Modify the above document so that when a paragraph is moved from the top stacking position, it returns to its original position rather than to the bottom.

4. a) Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include
USN, Name, Name of the College, Branch, Year of Joining, and e-mail id.
Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.

b) Create an XSLT style sheet for one student element of the above document and use it to create a display of that element.

5. a) Write a Perl program to display various Server Information like Server Name, Server Software, Server protocol, CGI Revision etc.
   b) Write a Perl program to accept UNIX command from a HTML form and to display the output of the command executed.

6. a) Write a Perl program to accept the User Name and display a greeting message randomly chosen from a list of 4 greeting messages.
   b) Write a Perl program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.

7. Write a Perl program to display a digital clock which displays the current time of the server.

8. Write a Perl program to insert name and age information entered by the user into a table created using MySQL and to display the current contents of this table.

9. Write a PHP program to store current date-time in a COOKIE and display the ‘Last visited on’ date-time on the web page upon reopening of the same page.

10. Write a PHP program to store page views count in SESSION, to increment the count on each refresh, and to show the count on web page.

11. Create a XHTML form with Name, Address Line 1, Address Line 2, and E-mail text fields. On submitting, store the values in MySQL table. Retrieve and display the data based on Name.

12. Build a Rails application to accept book information viz. Accession number, title, authors, edition and publisher from a web page and store the information in a database and to search for a book with the title specified by the user and to display the search results with proper headings.

Note: In the examination each student picks one question from the lot of all 12 questions.
PART – A

UNIT – 1  6 Hours
Introduction: The Architecture Business Cycle: Where do architectures come from? Software processes and the architecture business cycle; What makes a “good” architecture? What software architecture is and what it is not; Other points of view; Architectural patterns, reference models and reference architectures; Importance of software architecture; Architectural structures and views.

UNIT – 2  7 Hours
Architectural Styles and Case Studies: Architectural styles; Pipes and filters; Data abstraction and object-oriented organization; Event-based, implicit invocation; Layered systems; Repositories; Interpreters; Process control; Other familiar architectures; Heterogeneous architectures. Case Studies: Keyword in Context; Instrumentation software; Mobile robotics; Cruise control; Three vignettes in mixed style.

UNIT – 3  6 Hours
Quality: Functionality and architecture; Architecture and quality attributes; System quality attributes; Quality attribute scenarios in practice; Other system quality attributes; Business qualities; Architecture qualities. Achieving Quality: Introducing tactics; Availability tactics; Modifiability tactics; Performance tactics; Security tactics; Testability tactics; Usability tactics; Relationship of tactics to architectural patterns; Architectural patterns and styles.

UNIT – 4  7 Hours
Architectural Patterns – 1: Introduction; From mud to structure: Layers, Pipes and Filters, Blackboard.
PART – B

UNIT – 5

UNIT – 6
Architectural Patterns – 3: Adaptable Systems: Microkernel; Reflection.

UNIT – 7
Some Design Patterns: Structural decomposition: Whole – Part; Organization of work: Master – Slave; Access Control: Proxy.

UNIT – 8
Designing and Documenting Software Architecture: Architecture in the life cycle; Designing the architecture; Forming the team structure; Creating a skeletal system. Uses of architectural documentation; Views; Choosing the relevant views; Documenting a view; Documentation across views.

Text Books:
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal: Pattern-Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2007. (Chapters 2, 3.1 to 3.4)
3. Mary Shaw and David Garlan: Software Architecture- Perspectives on an Emerging Discipline, PHI, 2007. (Chapters 1.1, 2, 3)

Reference Books:
1. E. Gamma, R. Helm, R. Johnson, J. Vlissides: Design Patterns-Elements of Reusable Object-Oriented Software, Pearson Education, 1995.

Web Reference: http://www.hillside.net/patterns/
PART – A

UNIT – 1                  8 Hours
Introduction: When simulation is the appropriate tool and when it is not appropriate; Advantages and disadvantages of Simulation; Areas of application; Systems and system environment; Components of a system; Discrete and continuous systems; Model of a system; Types of Models; Discrete-Event System Simulation; Steps in a Simulation Study. The basics of Spreadsheet simulation, Simulation example: Simulation of queuing systems in a spreadsheet.

UNIT – 2                6 Hours

UNIT – 3                6 Hours
Statistical Models in Simulation: Review of terminology and concepts; Useful statistical models; Discrete distributions; Continuous distributions; Poisson process; Empirical distributions.

UNIT – 4                6 Hours
Queuing Models: Characteristics of queuing systems; Queuing notation; Long-run measures of performance of queuing systems; Steady-state behavior of M/G/1 queue; Networks of queues; Rough-cut modeling: An illustration..

PART – B

UNIT – 5                8 Hours
Random-Number Generation, Random-Variate Generation: Properties of random numbers; Generation of pseudo-random numbers; Techniques for generating random numbers; Tests for Random Numbers Random-Variate Generation: Inverse transform technique; Acceptance-Rejection technique; Special properties.
UNIT – 6 6 Hours  
**Input Modeling:** Data Collection; Identifying the distribution with data; Parameter estimation; Goodness of Fit Tests; Fitting a non-stationary Poisson process; Selecting input models without data; Multivariate and Time-Series input models.

UNIT – 7 6 Hours  
**Estimation of Absolute Performance:** Types of simulations with respect to output analysis; Stochastic nature of output data; Absolute measures of performance and their estimation; Output analysis for terminating simulations; Output analysis for steady-state simulations.

UNIT – 8 6 Hours  
**Verification, Calibration, and Validation; Optimization:** Model building, verification and validation; Verification of simulation models; Calibration and validation of models, Optimization via Simulation

**Text Books:**
   (Listed topics only from Chapters 1 to 12)

**Reference Books:**

**WIRELESS NETWORKS AND MOBILE COMPUTING**

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<td>Total Hrs: 52</td>
<td>Exam Marks : 100</td>
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**PART-A**

UNIT – 1 6 Hours  
UNIT – 2  7 Hours
Wireless Networks – 1: GSM and SMS: Global Systems for Mobile Communication (GSM) and Short Service Messages (SMS): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Introduction to SMS, SMS Architecture, SM MT, SM MO, SMS as Information bearer, applications

UNIT – 3  6 Hours

UNIT – 4  7 Hours

PART - B
UNIT – 5  6 Hours
Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6

UNIT – 6  7 Hours

UNIT – 7  6 Hours
Building, Mobile Internet Applications: Thin client: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML.

UNIT – 8  7 Hours
J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life-cycle, Creating new application, MIDlet
event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP.

Text Books:


Reference Books:


WEB 2.0 AND RICH INTERNET APPLICATIONS

Sub Code: 10CS832  IA Marks : 25
Hrs/ Week: 04  Exam Hours : 03
Total Hours: 52  Exam Marks : 100

PART - A

UNIT – 1  6 Hours
Introduction, Ajax – 1: Web 2.0 and Rich Internet Applications, Overview of Ajax, Examples of usage of Ajax: Updating web page text, Chatting in real time, Dragging and dropping, Downloading images. Creating Ajax Applications: An example, Analysis of example ajax.html, Creating the JavaScript, Creating and opening the XMLHttpRequest object, Data download, Displaying the fetched data, Connecting to the server, Adding Server-side programming, Sending data to the server using GET and POST, Using Ajax together with XML.

UNIT – 2  7 Hours
UNIT – 3
Ajax – 3: Drawing user’s attention to downloaded text, Styling text, colors and background using CSS, Setting element location in the web pages, Setting the stacking order of web page elements, Further examples of using Ajax. Displaying all the data in an HTML form, Working with PHP server variables, Getting the data in to array format, Wrapping applications in to a single PHP page, Validating input from the user, Validating integers and text, DOM, Appending new elements to a web page using the DOM and Ajax, Replacing elements using the DOM, Handling timeouts in Ajax, Downloading images with Ajax, Example programs.

UNIT – 4

PART B

UNIT – 5
Flex – 2: MXML: Understanding MXML Syntax and Structure, Making MXML Interactive Working with UI Components: Understanding UI Components, Buttons, Value Selectors, Text Components, List-Based Controls, Pop-Up Controls, Navigators, Control Bars Customizing Application Appearance: Using Styles, Skinning components, Customizing the preloader, Themes, Runtime CSS

UNIT – 6

UNIT – 7
Flex – 4: Managing State: Creating States, Applying States, Defining States, Adding and Removing Components, Setting Properties, Setting Styles,

UNIT – 8


Text Books:
   (Listed topics from Chapters 3, 4, 6, 7, 11, 12)
   (Listed topics from Chapters 1 to 8, 12 to 15)

Reference Books:

VLSI DESIGN AND ALGORITHMS

Sub Code: 10CS833
IA Marks : 25
Hrs/Week: 04
Exam Hours : 03
Total Hrs: 52
Exam Marks : 100

PART - A

UNIT 1


UNIT 2

Fabrication and Devices: Fabrication Processes, Transistors, Wires and vias, SCOMOS Design Rules, Layout design and tools.

UNIT 3  
Logic Gates – 1: Combinatorial logic functions, Static Complementary gates, Switch Logic.

UNIT 4  
Logic Gates – 2: Alternative gate Circuits, Low Power gates, Delay through resistive interconnect; Delay through inductive interconnect, Design for yield, Gates as IP.

PART - B

UNIT 5  
Combinational Logic Networks: Standard cell-based layout, Combinatorial network delay, Logic and interconnect design, Power Optimization, Switch logic networks, Combinational logic testing.

UNIT 6  
Sequential Machines: Latches and Flip-flops, Sequential systems and clocking disciplines, Clock generators, Sequential systems design, Power optimization, Design validation, Sequential testing.

UNIT 7  
Architecture Design: Register Transfer design, High Level Synthesis, Architecture for Low Power, Architecture testing.

UNIT 8  

Text Books:
   (Listed topics only from Chapters 1 to 5, and 8)
   (Listed topics only from Chapters 7, 8, and 9)
UNIT 1

UNIT 2
Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model.

UNIT 3

UNIT 4
PART - B

UNIT 5  6 Hours
SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMON1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications; ATM Remote Monitoring, A Case Study of Internet Traffic Using RMON.

UNIT 6  6 Hours

UNIT 7  6 Hours

UNIT 8  8 Hours

Text Books:

Reference Books:

INFORMATION AND NETWORK SECURITY

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<td>Total Hours : 52</td>
<td>Exam Marks: 100</td>
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PART – A

UNIT 1 Planning for Security: Introduction; Information Security Policy, Standards, and Practices; The Information Security Blue Print; Contingency plan and a model for contingency plan

UNIT 2 Security Technology-1: Introduction; Physical design; Firewalls; Protecting Remote Connections

UNIT 3 Security Technology – 2: Introduction; Intrusion Detection Systems (IDS); Honey Pots, Honey Nets, and Padded cell systems; Scanning and Analysis Tools

UNIT 4 Cryptography: Introduction; A short History of Cryptography; Principles of Cryptography; Cryptography Tools; Attacks on Cryptosystems.

PART - B
UNIT 5  

UNIT 6  
Electronic Mail Security: Pretty Good Privacy (PGP); S/MIME

UNIT 7  
IP Security: IP Security Overview; IP Security Architecture; Authentication Header; Encapsulating Security Payload; Combining Security Associations; Key Management.

UNIT 8  
Web Security: Web security requirements; Secure Socket layer (SSL) and Transport layer Security (TLS); Secure Electronic Transaction (SET)

Text Books:
1. Michael E. Whitman and Herbert J. Mattord: Principles of Information Security, 2nd Edition, Cengage Learning, 2005. (Chapters 5, 6, 7, 8; Exclude the topics not mentioned in the syllabus)

Reference Book:

MICROCONTROLLER-BASED SYSTEMS

Subject Code: 10CS836  I.A. Marks : 25
Hours/Week : 04  Exam Hours: 03
Total Hours : 52  Exam Marks: 100

PART – A

UNIT 1  
Introduction, 8051 Assembly Language Programming – 1: Microcontrollers and embedded processors; Overview of the 8051 family 8051 Assembly Language Programming (ALP) -1: Inside the 8051; Introduction to 8051 ALP; Assembling and running an 8051 program; The
PC and ROM space in 8051; Data types, directives, flag bits, PSW register, register banks, and the stack.

UNIT 2 6 Hours
ALP – 2: Jump and loop instructions; Call instructions; Time delay for various 8051 family members; I/O programming; I/O bit manipulation programming. Immediate and register addressing modes; Accessing memory using various addressing modes.

UNIT 3 7 Hours
ALP – 3 - Programming in C: Bit addresses for I/O and RAM; Extra 128 bytes of on-chip RAM in 8052. Arithmetic instructions; Signed numbers and arithmetic operations; Logic and compare instructions; rotate instruction and serialization; BCD, ASCII, and other application programs. Programming in C: Data types and time delays; I/O programming; Logic operations; Data conversion programs; Accessing code ROM space; Data serialization.

UNIT 4 6 Hours
Pin Description, Timer Programming: Pin description of 8051; Intel Hex file; Programming the 8051 timers; Counter programming; Programming Timers 0 and 1 in C.

PART – B

UNIT 5 6 Hours
Serial Port Programming, Interrupt Programming: Basics of serial communications; 8051 connections to RS232; Serial port programming in assembly and in C 8051 interrupts; Programming timer interrupts; Programming external hardware interrupts; Programming the serial communications interrupt; Interrupt priority in 8051 / 8052; Interrupt programming in C.

UNIT 6 7 Hours
Interfacing LCD, Keyboard, ADC, DAC and Sensors: LCE interfacing; Keyboard interfacing; Parallel and serial ADC; DAC interfacing; Sensor interfacing and signal conditioning

UNIT 7 7 Hours
Interfacing to External Memory, Interfacing with 8255: Memory address decoding; Interfacing 8031 / 8051 with external ROM; 8051 data memory space; Accessing external data memory in C. Interfacing with 8255; Programming 8255 in C.

UNIT 8 6 Hours
ADHOC NETWORKS

Sub Code: 10CS841  IA Marks : 25
Hrs/Week: 04  Exam Hours : 03
Total Hrs: 52  Exam Marks : 100

PART – A

UNIT 1  6 Hours

UNIT 2  7 Hours

UNIT 3  6 Hours
MAC – 2: Contention-based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas, Other MAC protocols.

UNIT 4  7 Hours
UNIT 5

Routing – 2: Hybrid routing protocol, Routing protocols with effective flooding mechanisms, Hierarchical routing protocols, Power aware routing protocols

UNIT 6

Transport Layer: Transport layer protocols for Ad hoc wireless Networks: Introduction, Issues in designing a transport layer protocol for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks, Classification of transport layer solutions, TCP over Ad hoc wireless Networks, Other transport layer protocols for Ad hoc wireless Networks.

UNIT 7


UNIT 8


Text Books:

Reference Books:
SOFTWARE TESTING

Subject Code: 10CS842       I.A. Marks: 25
Hours/Week:  4        Exam Marks: 100
Total Hours:   52       Exam Hours: 3

PART – A

UNIT 1                6 Hours

UNIT 2                7 Hours
Boundary Value Testing, Equivalence Class Testing, Decision Table-Based Testing: Boundary value analysis, Robustness testing, Worst-case testing, Special value testing, Examples, Random testing, Equivalence classes, Equivalence test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations. Decision tables, Test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations.

UNIT 3                  7 Hours
Path Testing, Data Flow Testing: DD paths, Test coverage metrics, Basis path testing, guidelines and observations. Definition-Use testing, Slice-based testing, Guidelines and observations.

UNIT 4                 6 Hours
Levels of Testing, Integration Testing: Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing. A closer look at the SATM system, Decomposition-based, call graph-based, Path-based integrations.

PART – B

UNIT 5                  7 Hours
System Testing, Interaction Testing: Threads, Basic concepts for requirements specification, Finding threads, Structural strategies and functional strategies for thread testing, SATM test threads, System testing guidelines, ASF (Atomic System Functions) testing example. Context of
interaction, A taxonomy of interactions, Interaction, composition, and determinism, Client/Server Testing.

UNIT 6 7 Hours

UNIT 7 6 Hours
Fault-Based Testing, Test Execution: Overview, Assumptions in fault-based testing, Mutation analysis, Fault-based adequacy criteria, Variations on mutation analysis. Test Execution: Overview, from test case specifications to test cases, Scaffolding, Generic versus specific scaffolding, Test oracles, Self-checks as oracles, Capture and replay.

UNIT 8 6 Hours
Planning and Monitoring the Process, Documenting Analysis and Test: Quality and process, Test and analysis strategies and plans, Risk planning, Monitoring the process, Improving the process, The quality team, Organizing documents, Test strategy document, Analysis and test plan, Test design specifications documents, Test and analysis reports.

TEXT BOOKS:
1. Paul C. Jorgensen: Software Testing, A Craftsman’s Approach, 3rd Edition, Auerbach Publications, 2008. (Listed topics only from Chapters 1, 2, 5, 6, 7, 9, 10, 12, 13, 14, 15)
2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009. (Listed topics only from Chapters 2, 3, 4, 16, 17, 20, 24)

REFERENCE BOOKS:
PART – A

UNIT 1  6 Hours
Introduction: The RISC design philosophy; The ARN design philosophy; Embedded system hardware and software. ARM processor fundamentals: Registers; Current Program Status Register; Pipeline; Exceptions, interrupts and the Vector Table; Core extensions; Architecture revisions; ARM processor families.

UNIT 2  7 Hours
ARM Instruction Set and Thumb Instruction Set: ARM instruction set: Data processing instructions; Branch instructions; Load-store instructions; Software interrupt instruction; Program Status Register functions; Loading constants; ARMv5E extensions; Conditional execution. Thumb instruction set: Thumb register usage; ARM –Thumb interworking; Other branch instructions; Data processing instructions; Single-Register Load-Store instructions; Multiple-Register Load-Store instructions; Stack instructions; Software interrupt instruction.

UNIT 3  6 Hours
Writing and Optimizing ARM Assembly Code: Writing assembly code; Profiling and cycle counting; Instruction scheduling; Register allocation; Conditional execution; Looping constructs; Bit manipulation; Efficient switches; Handling unaligned data.

UNIT 4  7 Hours
Optimized Primitives: Double-precision integer multiplication; Integer normalization and count leading zeros; Division; Square roots; Transcendental functions; Endian reversal and bit operations; Saturated and rounded arithmetic; Random number generation.

PART - B

UNIT 5  7 Hours
Exception and Interrupt Handling: Exception handling; Interrupts and interrupt handling schemes.
UNIT 6  
**Caches :** The memory hierarchy and the cache memory; Cache architecture; Cache policy; Coprocessor 15 and cache; Flusing and cleaning cache memory; Cache lockdown; Caches and software performance.

UNIT 7  
**Memory – 1:** Memory Protection Units: Protected regions; Initializing the MPU, cache and write buffer; Demonstration of an MPU system. Memory Management Units: Moving from MPU to an MMU; How virtual memory works; Details of the ARM MMU.

UNIT 8  
**Memory – 2:** Page tables; The translation lookaside buffer; Domains and memory access permission; The caches and write buffer; Coprocessor 15 and MMU configuration; The fast context switch extension.

**Text Books:**

**Reference Books:**

**SERVICES ORIENTED ARCHITECTURE**

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**PART – A**

UNIT 1  
**Introduction o SOA, Evolution of SOA:** Fundamental SOA; Common Characteristics of contemporary SOA; Common tangible benefits of SOA; An SOA timeline (from XML to Web services to SOA); The continuing evolution of SOA (Standards organizations and Contributing vendors); The roots of SOA (comparing SOA to Past architectures).
UNIT 2 6 Hours
Web Services and Primitive SOA: The Web services framework; Services (as Web services); Service descriptions (with WSDL); Messaging (with SOAP).

UNIT 3 6 Hours
Web Services and Contemporary SOA – 1: Message exchange patterns; Service activity; Coordination; Atomic Transactions; Business activities; Orchestration; Choreography

UNIT 4 7 Hours
Web Services and Contemporary SOA – 2: Addressing; Reliable messaging; Correlation; Policies; Metadata exchange; Security; Notification and eventing

PART – B
UNIT 5 7 Hours
Principles of Service – Orientation: Services-orientation and the enterprise; Anatomy of a service-oriented architecture; Common Principles of Service-orientation; How service orientation principles inter-relate; Service-orientation and object-orientation; Native Web service support for service-orientation principles.

UNIT 6 6 Hours
Service Layers: Service-orientation and contemporary SOA; Service layer abstraction; Application service layer, Business service layer, Orchestration service layer; Agnostic services; Service layer configuration scenarios

UNIT 7 7 Hours
Business Process Design: WS-BPEL language basics; WS-Coordination overview; Service-oriented business process design; WS-addressing language basics; WS-Reliable Messaging language basics

UNIT 8 6 Hours
SOA Platforms: SOA platform basics; SOA support in J2EE; SOA support in .NET; Integration considerations

Text Books:

Reference Books:
UNIT - 1  
Introduction: Overview of Cloud Computing, Applications, Intranets and the Cloud, When can cloud Computing be used? Benefits and limitations, Security concerns, Regulatory issues

UNIT - 2  
Business Case for Cloud, Examples of Cloud Services: Cloud computing services, Help to the business, Deleting the data center. Examples: Google, Microsoft, IBM, Salesforce.com and its uses, Cloud at Thomson Reuters.

UNIT - 3  

UNIT - 4  
Other issues: Overview of SaaS (Software as a Service), Driving forces, Company offerings: Google, Microsoft, IBM. Software plus Service: Overview, Mobile device integration Local Clouds, Thin Clients, Migrating to the Cloud: Virtualization, Server solutions, Thin clients, Cloud services for individuals, mid-markets, and enterprises, Migration.

PART - B

UNIT - 5
The Grid and the Database: Issues in Database Integration with the Grid, The Requirements of a Grid enabled database, Storage Request Broker (SRB), How to integrate the Database with the Grid? The Architecture of OGSA-DAI for Offering Grid Database Services

UNIT - 6 6 Hours

UNIT - 7 7 Hours

UNIT - 8 6 Hours
Text Books:

Reference Books:
2. Internet Resources

MULTI-CORE ARCHITECTURE AND PROGRAMMING

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PART - A

UNIT 1 7 Hours
Introduction
The power and potential of parallelism, Examining sequential and parallel programs, Parallelism using multiple instruction streams, The Goals: Scalability and performance portability, Balancing machine specifics with portability, A look at six parallel computers: Chip multiprocessors, Symmetric multiprocessor architectures, Heterogeneous chip designs, Clusters, Supercomputers, Observations from the six parallel computers.

UNIT 2 6 Hours
Reasoning about Performance
Motivation and basic concepts, Sources of performance loss, Parallel structure, Performance trade-offs, Measuring performance, Scalable performance.

UNIT 3 6 Hours
Examples of Multi-Core Architectures
Introduction to Intel Architecture, How an Intel Architecture System works, Basic Components of the Intel Core 2 Duo Processor: The CPU, Memory Controller, I/O Controller; Intel Core i7: Architecture, The Intel Core i7 Processor, Intel QuickPath Interconnect, The SCH; Intel Atom Architecture.
Introduction to Texas Instruments’ Multi-Core Multilayer SoC architecture for communications, infrastructure equipment

UNIT 4 7 Hours
Parallel Algorithm Design

PART – B

UNIT 5 7 Hours
Parallel Programming – 1 (Using OpenMP)
Designing for threads: Task decomposition, Data decomposition, Data flow decomposition, Implications of different decompositions; Challenges in decomposition, Parallel programming patterns, A motivating problem: Error diffusion.
Threading and Parallel Programming Constructs: Synchronization, Critical sections, Deadlocks, Synchronization primitives: Semaphores, Locks, Condition variables; Messages, Flow Control-Based concepts: Fence, Barrier; Implementation-Dependent threading issues.

UNIT 6 6 Hours
Parallel Programming – 2 (Using OpenMP)

UNIT 7 7 Hours
Solutions to Common Parallel Programming Problems
Too many threads, Data races, deadlocks, and live locks, Heavily contended locks, Non-blocking algorithms, Thread-safe functions and libraries, Memory issues, Cache-related issues, Avoiding pipeline stalls, Data organization for high performance.

UNIT 8 6 Hours
Threading in the Processor
Single-Core Processors: Processor architecture fundamentals, Comparing Superscalar and EPIC architectures.
Multi-Core Processors: Hardware-based threading, Hyper-threading technology, Multi-Core processors, Multiple processor interactions, Power consumption, Beyond multi-core architecture.

NOTE: In order to acquire a sound understanding of the subject, it is desirable for the students to work in the laboratory using OpenMP. The
hands-on experience would reinforce the concepts learnt in theory. Problems similar to the ones solved in the Algorithms Laboratory can be solved and issues like speed-up achieved can be analyzed in depth. Several free tools are available from companies like INTEL to facilitate such a study.

Text Books:
   (Listed topics only from Chapters 1, 2, 3)
   (Listed topics only from Chapters 3, 17)
   (Listed topics only from Chapters 3, 4, 7, 9, 10)
4. Web resources for Example Architectures of INTEL and Texas Instruments:  
   http://download.intel.com/design/intarch/papers/321087.pdf ;  
   http://focus.ti.com/lit/wp/spry133/spry133.pdf

Reference Books:
2. Reinders : Intel Threading Building Blocks, O’reilly – 2005