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: \( w = z^2 \), \( w = e^z \), \( w = (a^2 / z) \). 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, empheorical 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:


GRAPH THEORY AND COMBINATORICS
(Common to CSE & ISE)

Subject Code: 10CS42 I.A. Marks : 25
Hours/Week : 04 Exam Hours: 03
Total Hours : 52 Exam Marks: 100

PART – A

UNIT - I

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

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

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

UNIT - 4  
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  

UNIT - 6  
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  
Generating Functions: Introductory Examples, Definition and Examples – Calculational Techniques, Partitions of Integers, the Exponential Generating Function, the Summation Operator

UNIT - 8  

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   L.A. Marks : 25
Hours/Week : 04    Exam Hours: 03
Total Hours : 52    Exam Marks: 100

PART – A

UNIT – 1  7 Hours
INTRODUCTION: Notion of Algorithm, Review of Asymptotic Notations, Mathematical Analysis of Non-Recursive and Recursive Algorithms

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:

Reference Books:

UNIX AND SHELL PROGRAMMING
(Common to CSE & ISE)

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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
(Common to CSE & ISE)

Subject Code: 10CS45  L.A. Marks : 25  
Hours/Week : 04  Exam Hours: 03  
Total Hours : 52  Exam Marks: 100  

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)

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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

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 $\{1, 6\}$ 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)

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<td>Total Hours : 42</td>
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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 $n\text{C}_r$ 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.