P.B. SIDDHARTHA COLLEGE OF ARTS & SCIENCE

Siddhartha Nagar, Vijayawada – 520 010
Reaccredited at 'A+' level by NAAC
Autonomous&ISO 9001:2015 Certified

Title of the Course : COMPUTATIONAL MATHEMATICS
Semester : III

Course Code	22OE3MA2	Course Delivery Method	Blended Mode
Credits	3	CIA Marks	30
No. of Lecture Hours / Week	3	Semester End Exam Marks	70
Total Number of Lecture Hours	45	Total Marks	100
Year of Introduction : 2020-21	Year of offering : 2023-24	Year of Revision: 2023-24	Percentage of Revision :5%

COURSE OUTCOME	Upon successful completion of this course, students will be able to:
CO1	Understand properties of sets, functions, matrices and their operations.
CO2	Perform combinatorial analysis to solve computing problems and analyze algorithms.
CO3	Demonstrate the abstract mathematical structures used to represent discrete objects and relationships between objects.
CO4	Model problems in Computer Science using graphs and trees.
CO5	Apply the Boolean principles to solve problems in various domains.

UNIT I

Basic Structures:Sets, Functions, Sequences and Sums: Sets, Set Operations, Functions, Recursive Functions, Sequences and Summations.

The Fundamentals: Algorithms, The Integers and Matrices: Algorithms, The Growth of Functions, Complexity of Algorithms, The Integers and Divisions, Primes and Greatest Common Divisors, Integers and Algorithms, Applications of Number Theory, Matrices.

UNIT II

Induction and Recursion: Mathematical Induction, Strong Induction and Well-Ordering, Recursive Definitions and Structural Induction, Recursive Algorithms.

Counting: The Basics of Counting, The Pigeon Hole Principle, Permutations and Combinations, Binomial Coefficients, Generalized Permutations and Combinations, Generating Permutations and Combinations.

UNIT III

Advanced Counting Techniques: Recurrence Relations, Solving Linear Recurrence Relations, Divide and Conquer Algorithms and Recurrence Relations, Generating Functions, Inclusion, Exclusion, Applications of Inclusion & Exclusion.

Relations: Relations and their Properties, N-ary Relations and their Applications, Representing Relations, Closures of Relations, Equivalence Relations, Partial Orderings.

UNIT IV

Graphs: Graphs and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism's, Connectivity, Euler and Hamilton Paths, Shortest Path Problems, Planar Graphs, Graph Coloring.

UNIT V

Trees: Introduction to Trees, Applications of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees.

Boolean Algebra: Boolean Functions, Representing Boolean Functions, Logic Gates, Minimization of Circuits.

Prescribed Text Book			
	Author	Title	Publisher
1	Kenneth H Rosen, KamalaKrithivasan	Discrete Mathematics and its Applications with Combinatorics&Graph Theory	7th Edition, Tata McGraw-Hill (2011), Special Indian Edition.

Reference Books			
	Author	Title	Publisher
1	Ralph P. Grimaldi, B.V. Ramana	Discrete and Combinational Mathematics	5th Edition, Pearson Education (2008).
2	Swapan Kumar Sarkar	A Text Book of Discrete Mathematics	S.Chand (2008)
3	D.S.Malik and M.K.Sen	Discrete Mathematical Structures	Thomson (2006)

P B SIDDHARTHA COLLEGE OF ARTS AND SCIENCE::VIJAYAWADA
(An Autonomous college in the jurisdiction of Krishna University)
II SEMESTER

OPEN ELECTIVE
COMPUTATIONAL MATHEMATICS- 22OE--

Time: 3 Hours **Max. Marks: 70**

Answer ALL questions. **(5×4 = 20M)**

1 a)Write the power set of the sets {1,2,3} and $\{\phi\}$ (CO1, L1)

(OR)

b) What is the Cartesian product of the sets A = { 1,2,3} and B ={a,b} (CO1, L1)

2 a) State and prove 'Well Ordering Principle' (CO2, L2)

(OR)

b) State and prove 'Pigeon Hole Principle'. (CO2, L2)

3 a) Explain the Principle of Inclusion and Exclusion? (CO3, L2)

(OR)

b) Define Equivalence Relation and partly ordered relation and give examples. (CO3, L2)

4 a) Write Adjacency Matrix for the following Graph (CO4, L4)

(OR)

b) Define Chromatic Number and give an example. (CO4, L4)

5 a) Define Spanning Trees, minimal spanning tree and give examples. (CO5, L3)

(OR)

b) Minimize the Boolean Expression F = x y z + x $\bar{y}$ z using Boolean Laws.(CO5, L3)

SECTION B

Answer All Questions. **(5×10 = 50 M)**

6 a)Let f(x) = x+1 and g(x) = x^2 be functions from N to N.
Findf+g, fog, gof, f^{-1} and g^{-1}
b) Determine whether the function f(x) = 3x+4 is a bijection from R to R. Justify your Answer. (CO1, L2)

(OR)

c) Find the gcd of 414 and 662 using Euclidean Algorithm.

d) Find the Boolean product of the matrices A and B

where A = $\begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 0 \end{bmatrix}$ and B = $\begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix}$ (CO1, L2)

7 a) Expand $(2x+3y)^4$ using Binomial theorem and find the coefficient of $x^{12}\ y^{13}$ in the expansion of $(x+y)^{25}$ (CO2, L3)

(OR)

b) Find the values of following

(i) C(12, 6) (ii) C(30, 6) (iii) P(10, 9) (iv) P(15, 5) (CO2, L3)

8 a) Solve the recurrence relation $a_n - 3a_{n-1} - 4_{n-2} = 3^n,\ \ a_0 = 1, a_1 = 2$. (CO3, L4)

(OR)

b) State the Properties of Relations and explain clearly with examples. (CO3, L4)

9a) Define Isomorphism between two Graphs. Explain the methods to check whether the Graphs are Isomorphic or not with an example. (CO4, L3)

(OR)

b) Explain the Dijkstra's Algorithm to find the Shortest Path with an example. (CO4, L3)

10 a) Explain how to produce Minimum Spanning tree using Prim's Algorithm with an example. (CO5, L4)

(OR)

b) Use Karnaugh Maps to minimize these Sum-of Products expansions. (CO5, L4)

1. $x\,y\,\bar{z} + x\,\bar{y}\,\bar{z} + \bar{x}\,\bar{y}\,\bar{z}$
2. $x\,\bar{y}\,z \mid x\,\bar{y}\,\bar{z} \mid \bar{x}\,y\,z \mid \bar{x}\,\bar{y}\,z \mid \bar{x}\,\bar{y}\,\bar{z}$
3. $x\,y\,\bar{z} \mid x\,\bar{y}\,\bar{z} \mid \bar{x}\,\bar{y}\,z \mid \bar{x}\,\bar{y}\,\bar{z}$

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