SEMESTER: II						
Course Code	:	MCA222TB	**ANALYSIS AND DESIGN OF ALGORITHM**	CIE Marks	:	100
Credits L-T-P	:	3-1-0	*(Theory)*	SEE Marks	:	100
Hours	:	45L+45EL+30T	*(Professional Core Course)*	SEE Duration	:	3 Hours

UNIT - I	**9 Hours**
The Role of Algorithms in Computing: Algorithms, Algorithms as a technology, Insertion sort analyzing algorithms, designing algorithms, Characterizing Running Times, Big O-notation omega-notation, and theta-notation, Asymptotic notation: formal definition, Standard notations and common functions. Mathematical Analysis of substitution method to solve Non-Recursive and Recursive Algorithms	

UNIT - II	**9 Hours**
Divide and Conquer: Binary Search, Merge Sort, Quick Sort and its performance. **Decrease and Conquer:** Analysis of running time complexity- Topological Sorting, Depth First Search using stack, Breadth First Search using Queue	

UNIT - III	**9 Hours**
Greedy Method: Representation of Graphs, Knapsack Problem, Minimum-Cost Spanning Trees: Prim's Algorithm, Kruskal's Algorithm; Single Source Shortest Paths **Space-Time Tradeoffs:** Introduction, sorting by Counting, Input Enhancement in String Matching. **Limitation of Algorithmic Power**: Lower-Bound Arguments, Decision Trees	

UNIT - IV	**9 Hours**
Advanced Design and Analysis Techniques: Dynamic Programming- Elements of dynamic programming, longest common subsequence, Optimal binary search trees. Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest Paths Problem **Sorting and Order Statistics:** Sorting in Linear Time, Medians and Order Statistics, Heapsort.	

UNIT - V	**9 Hours**
Amortized Analysis: Aggregate analysis, The accounting method, The potential method, Dynamic tables. Backtracking: n – Queens problem, Hamiltonian Circuit Problem, Subset – Sum Problem Branch and Bound-Assignment Problem, Travelling Salesman Problem	

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Apply the basic concepts of algorithm design and analysis. Use mathematical techniques to evaluate and compare the efficiency of algorithms
CO2	:	Design efficient algorithms using appropriate algorithmic strategies. Select the right technique based on problem characteristics
CO3	:	Analyze the efficiency of algorithms and justify the performance using time complexity. Compare alternative solutions using asymptotic analysis
CO4	:	Evaluate algorithmic approaches and apply them to solve real-world optimization and decision problems effectively

Reference Books
1. Anany Levitin, Introduction to the Design and Analysis of Algorithms‖, Person Education, 3rd Edition, 2021, ISBN-13: 9780137541133
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, ‖Introduction to Algorithms‖, The MIT Press, Cambridge, Massachusetts London, England, 4th Edition, 2022, ISBN: 9780262046305
3. George T. Heineman, ―Learning Algorithms: A Programmer‘s Guide to Writing Better Code, O‘Reilly Media Inc 1st Edition, 2021, ISBN: 9781492091066
4. Lekh Raj Vermani and Shalini Vermani, ―An Elementary Approach to Design and Analysis of Algorithms, World Scientific Publishing Europe Ltd., 2019, ISBN-13:978-1786346759

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)		
CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component **[20 (Q) + 40 (T) + 40 (EL) = 100 marks)**		
Sl.No.	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. **THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom‘s Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.** **Students should score minimum 40% in TEST to clear CIE**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. **Phase I (15) & Phase II (25) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE	**100**

RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)		
Q.NO.	**CONTENTS**	**MARKS**
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
	MAXIMUM MARKS FOR THE SEE	**100**