COURSE HANDOUT

Design and Analysis of Algorithm (MCA -204)

MCA- 2ND SEMESTER

ACADEMIC YEAR (2024-25)

Dr.Archana Sharma

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Department of Computer Applications

Model Institute of Engineering & Technology (Autonomous)

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Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Sessional	Final Exam	Total
MCA-204	Design & Analysis of Algorithms	PCC	4	4	0	0	40	60	100

COURSE OUTCOMES

At the end of the course the student will be able to:	
CO1	Understand written algorithms in terms of their composite steps and transformations
CO2	Understand the design and analysis of various algorithms.
CO3	Apply important algorithmic design paradigms.
CO4	Analyze and compare the algorithms on the basis of asymptotic complexity.
CO5	Gain understanding of applicability of algorithms in devising optimal solutions to given problems in diverse domains.

Section-A

Unit-I

Review of Algorithms and Data Structures: Introduction to algorithm analysis: Introduction to algorithms, Algorithm Specifications, performance analysis. Recursion and Induction: recursive procedures, recurrence relations, induction proofs, proving correctness. Randomized Algorithms: Basic of Probability Theory, Description of Randomized algorithms, Identifying the repeated Elements, Partiality Testing, Advantages and Disadvantages of using randomized algorithms.

(10Hrs)

UNIT–2: Basics of Analysis: Asymptotic Bounds, Concept of Efficiency of an Algorithm, Well Known Asymptotic Functions & Notations, Well Known Sorting Algorithms, Comparison of Sorting Algorithms, Best-Case and Worst-Case Analyses, Average-Case Analysis, Amortized Analysis

(10Hrs)

UNIT–3: Design Techniques-I: Divide-and-Conquer, General Method, Multiplication of two n-bit numbers, Binary Search, Merge Sort, Quick Sort, Stassen's Matrix multiplication, Exponentiation, Dynamic Programming, General Method, The Problem of Making Change, The Principle of Optimality, Chained Matrix Multiplication.

(10Hrs)

Section B

UNIT–4: Design Techniques-II : Backtracking, General method, n-queen's problem, Sum of subsets problem, Greedy Algorithms, General Method, Knapsack problem, Job sequencing with deadlines, Minimum Spanning Trees, Kruskal's Algorithm, Prim's Algorithm, Dijkstra's Single Source Shortest Path Algorithm

(10Hrs)

UNIT–5: Classification of Problems & Graphs Algorithms: Non-Deterministic Algorithms, Complexity classes, Introduction to NP-Completeness, Establishing NP-Completeness of Problems, NP-Completeness Proofs, NP-Hard Problems, Graphs Algorithms: Traversing Trees, Depth-First Search, Breadth-First Search, Best-First Search & Topological Sort.

(10Hrs)

Textbooks

S.No	Name of the Books	Name of the Author	Publisher Name	Edition (Pub.Yr.)
1	Introduction to Algorithms	T.Cormen, C. Lieserson, .Rivest, C.Stein	Prentice-Hall/India	3rd (2009)

2.	Algorithms	S. Dasgupta, C. Papadimitriou, Umesh Vazirani	McGraw Hill Education	1st (2017)

Reference Books

S.No	Name of the Books	Name of the Author	Publisher Name	Edition (Pub.Yr.)
1	Fundamentals of Computer Algorithms	Ellis Horowitz, Sartaj Sahni	Universities Press	2nd (2008
2	Algorithms Design: Foundations, Analysis, and Internet Examples	Michael T. Goodrich, loberto Tamassia	Wiley	1st (2006)

COURSE PLAN

Unit-I Review of Algorithms and Data Structures

S.No	Topics	Recommended Books
1	Introduction to algorithms, Algorithm Specifications,	Book 1, Ch.1, Book (reference)1, Ch.1
2	Performance analysis.	Book (reference)1, Ch.1
3	Recursive procedures	Book (reference)1, Ch.1
4	Recurrence relations, induction proofs, proving correctness	Book 1 (reference), Ch.1, Book 1, Ch.4
5	Description of Randomized algorithms	Book 1 (reference), Ch.1
6	Basic of Probability Theory, Identifying the repeated Elements, Partiality Testing	Book 1 (reference), Ch.1
7	Advantages and Disadvantages of using randomized algorithms.	Book 1 (reference), Ch.1
	Unit-II Basics of Analysis	
8	Asymptotic Bounds,	Book 1, Ch.1
9	Concept of Efficiency of an Algorithm, Well Known Asymptotic Functions & Notations,	Book 1, Ch.1
10	Well Known Sorting Algorithms	Book 1, Ch.2
11	Comparison of Sorting Algorithms	Book 1, Ch 2
12	Best-Case and Worst-Case Analyses, Average-Case Analysis,	Book 1, Ch.3
13	Amortized Analysis	Book 1, Ch.17
	Unit-III Design Techniques-I	
14	Divide-and-Conquer, General Method	Book (reference)1, Ch.3
15	Multiplication of two n-bit numbers	Book (reference)1, Ch.3

16	Binary Search	Book (reference)1, Ch.3
17	Merge Sort	Book 1 (reference), Ch.3
18	Quick Sort	Book 1 (reference), Ch.3
19	Stassen's Matrix multiplication	Book 1 (reference), Ch.3
20	Exponentiation,	
21	Dynamic Programming, General Method	Book 1 (reference), Ch 5, Book 1, Ch.15
22	The Problem of Making Change, The Principle of Optimality,	Book 1 (reference), Ch.5
23	Chained Matrix Multiplication.	Book 1 (reference), Ch.5, Book 1, Ch.15
Unit-IV Design Techniques-II		
24	Backtracking, General method,	Book 1 (reference), Ch.7
20	n-queen's problem	Book 1 (reference), Ch7
21	Sum of subsets problem	Book 1 (reference), Ch.7
22	Greedy Algorithms, General Method	Book 1 (reference), Ch.4
23	Knapsack problem	Book 1 (reference), Ch.4
24	Job sequencing with deadlines	Book 1 (reference), Ch.4
25	Minimum Spanning Trees, Kruskal's Algorithm	Book 1 (reference), Ch.4
26	Prim's Algorithm	Book 1 (reference), Ch.4
27	Dijkstra's Single Source Shortest Path Algorithm	Book 1 (reference), Ch.4
Unit-V Classification of Problems & Graphs Algorithms		
28	Non-Deterministic Algorithms	Book 1 (reference), Ch.11
29	Complexity classes	Book 1 (reference), Ch.11
30	Introduction to NP-Completeness	Book 1, Ch.34, Book 1 (reference), Ch.11
31	Establishing NP-Completeness of Problems, NP-Completeness Proofs	Book 1, Ch.34, Book 1 (reference), Ch.11
32	NP-Hard Problems	Book 1 (reference), Ch.11
33	Graphs Algorithms: Traversing Trees	Book 1, Ch.22,
34	Depth-First Search	Book 1, Ch.22, Book 1 (reference), Ch.6
35	Breadth-First Search,	Book 1, Ch.22, Book 1 (reference), Ch.6
36	Best-First Search	Book 1, Ch.22,
37	Topological Sort.	Book 1, Ch.22,

ADDITIONAL WEB RESOURCES

1.	Design and Analysis of Algorithms | Udemy
2.	https://onlinecourses.nptel.ac.in/noc25_cs23/preview

GRADING AND ASSESSMENT

- **Sessional Test**: 20 marks
- **Assignment**: 10 marks

- **Attendance**: 10 marks
- **Final Examination**: 60 marks

COURSE POLICIES

- **Attendance**: Minimum 75% attendance is mandatory to appear in the final examination of the course.
- **Academic Integrity**: MIET's academic integrity policies apply. Plagiarism will not be tolerated.
- **Late Submissions**: Assignments and projects must be submitted by the specified timelines.

FACULTY INFORMATION

- **Office Hours**

  Monday (12:55 PM - 1:45 PM)
  Friday (12:55 PM - 1:45 PM)

- **Contact Information**
  Archana.bca@mietjammu.in