

K. J. Somaiya Institute of Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)

Jan-Feb-2026

~~Nov-Dec-2025~~

B. Tech Program: Artificial Intelligence and Data Science Scheme III
~~Regular~~ **Supplement** Examination: SY Semester: III

Course Code: AIC303 and Course Name: Design and Analysis of Algorithms

Date of Exam: ~~02/12/2025~~ 05/02/26 Duration: 02.5 Hours

Max. Marks: 60

Instructions:

- (1) All questions are compulsory.
- (2) Draw neat diagrams wherever applicable.
- (3) Assume suitable data, if necessary.

Q. No.	Question	Max. Marks	CO	BT level											
Q 1	Solve any two questions out of three: (05 marks each)	10													
a)	Explain the Bellman-Ford Algorithm for finding the single-source shortest path. How does it differ from Dijkstra's algorithm?		CO4	U											
b)	Explain how time complexity and space complexity affect the performance of an algorithm. Give suitable examples.		CO1	U											
c)	Explain the N-Queen problem using the backtracking approach.		CO5	U											
Q 2	Solve any two questions out of three: (05 marks each)	10													
a)	Solve the recurrence relation $T(n)=2T(n/2)+n$ using the Master Method and find its time complexity.		CO1	AP											
b)	Explain the Graph Coloring problem using backtracking.		CO5	U											
c)	Solve the Fractional Knapsack problem using the Greedy Method. Given items with the following profits and weights, find the maximum profit for a capacity of 50. <table border="1" style="margin: 5px auto; border-collapse: collapse;"> <thead> <tr> <th>Item</th> <th>Profit</th> <th>Weight</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>60</td> <td>10</td> </tr> <tr> <td>2</td> <td>100</td> <td>20</td> </tr> <tr> <td>3</td> <td>120</td> <td>30</td> </tr> </tbody> </table>		Item	Profit	Weight	1	60	10	2	100	20	3	120	30	CO3
Item	Profit	Weight													
1	60	10													
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Q.3	Solve any two questions out of three. (10 marks each)	20													
a)	Define & differentiate between P, NP, NP-Complete, and NP-Hard classes. Draw the relationship diagram among them.		CO1	U											
b)	Apply the concept of Branch and Bound to solve the Travelling Salesperson Problem (TSP).		CO5	AP											

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c)	<p>Apply Floyd-Warshall Algorithm to find all-pairs shortest paths for the given graph.</p> <table border="1"> <thead> <tr> <th>From / To</th> <th>A</th> <th>B</th> <th>C</th> <th>D</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>0</td> <td>3</td> <td>∞</td> <td>7</td> </tr> <tr> <td>B</td> <td>8</td> <td>0</td> <td>2</td> <td>∞</td> </tr> <tr> <td>C</td> <td>5</td> <td>∞</td> <td>0</td> <td>1</td> </tr> <tr> <td>D</td> <td>2</td> <td>∞</td> <td>∞</td> <td>0</td> </tr> </tbody> </table>	From / To	A	B	C	D	A	0	3	∞	7	B	8	0	2	∞	C	5	∞	0	1	D	2	∞	∞	0		CO4	AP
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Q.4	Solve any two questions out of three. (10 marks each)	20																											
a)	Explain the algorithm to find both the minimum and maximum elements in an array. Derive its time complexity.		CO2	U																									
b)	<p>Apply Kruskal's and Prim's algorithms to find the Minimum Cost Spanning Tree (MST) of the given graph. Compare both algorithms based on their working and efficiency.</p> <table border="1"> <thead> <tr> <th>Edge</th> <th>Weight</th> </tr> </thead> <tbody> <tr> <td>A-B</td> <td>4</td> </tr> <tr> <td>A-C</td> <td>3</td> </tr> <tr> <td>B-C</td> <td>1</td> </tr> <tr> <td>B-D</td> <td>2</td> </tr> <tr> <td>C-D</td> <td>4</td> </tr> <tr> <td>C-E</td> <td>5</td> </tr> <tr> <td>D-E</td> <td>7</td> </tr> </tbody> </table>		Edge	Weight	A-B	4	A-C	3	B-C	1	B-D	2	C-D	4	C-E	5	D-E	7	CO3	AP									
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c)	Compare the Naïve String Matching algorithm, Rabin-Karp algorithm, and Knuth-Morris-Pratt (KMP) algorithm in terms of working, time complexity, and efficiency. Also, briefly explain how the Genetic Algorithm differs from these deterministic approaches.	CO6	AP																										
