

[END-TERM EXAMINATION  
B. TECH. CSE-AI / ECE-AI SEMESTER: IV

(May, 2024) OFFLINE MODE

Code: BAI 204	Optimization Techniques & Decision Making
Time : 3 Hours	Maximum Marks :60
Note: Q.1 is compulsory. Attempt one question each from the Units I, II, III & IV.	

Q1		(5*4 =20)	
	(a) Discuss two applications of optimization in engineering. Explain the steps and general structure of optimization algorithms.		
	(b) A logistics company must decide which routes to use for transporting goods from warehouses to retail stores. There are five possible routes, each with different costs and capacities. Develop an integer programming model to minimize transportation costs while ensuring that all demand is met and each route is used at most once.		
	(c) What is crossover in the context of genetic algorithms, and how does it combine genetic information from two parent solutions to generate offspring? Explain the applications of Ant Colony Optimization problems?		
	(d) Explain the steps in Decision Analysis and the applications of decision trees in optimization methods in engineering.		
UNIT-I			
Q2	Explain classification of optimization problems based on the nature of the equations involved, and give an example for each type of optimization problem in engineering.	(10)	
Q3	Define and explain role of constraints in defining feasible region. Illustrate how constraints are incorporated into the formulation of optimization problems using an example.	(10)	
UNIT-II			
Q4	a) A manufacturer produces two products A and B. Both products are processed on two different machines. The available capacity of first machine is 12 hours and that of second machine is 9 hours per day. Each unit of A requires 3 hours on both machines and each unit of B requires 2 hours on first machine and 1 hour on second machine. Each unit of A is sold at Rs 7 profit and that of B at a profit of Rs 4 per unit. Compute maximum profit using Graphical Method. b) Discuss the limitations of the Graphical Method compared to more advanced solution techniques like the Simplex Method.	(10)	
Q5	a) Discuss conditions under which Simplex method terminates b) Discuss the possibility of an unbounded solution in linear programming and how Simplex method detects it?	(10)	

### UNIT-III

- Q6 a) Explain how Genetic Algorithms are applied to solve Knapsack Problem, highlighting the encoding, fitness function, selection, crossover, and mutation (10)
- b) Compare and contrast different selection mechanisms in Genetic Algorithms
- Q7 a) Design Ant Colony Optimization algorithm for Traveling Salesman Problem, outlining the pheromone update rule, ant movement strategy, and construction of solutions. (10)
- b) Implement a simple PSO algorithm to optimize a basic mathematical function, specifying the initialization, update rules, termination condition, and parameter settings

### UNIT-IV

- Q8 A glass factory that specializes in crystal is developing a substantial backlog and for this the firm's management is considering three courses of action: To arrange for subcontracting ( $S_1$ ), to begin overtime production ( $S_2$ ), and to construct new facilities ( $S_3$ ). The correct choice depends largely upon the future demand, which may be low, medium, or high. By consensus, management ranks the respective probabilities as 0.10, 0.50 and 0.40. A cost analysis reveals the effect upon the profits. This is shown in the table below: (10)
- | Demand     | Probability | Course of Action          |                           |                                 |
|------------|-------------|---------------------------|---------------------------|---------------------------------|
|            |             | $S_1$<br>(Subcontracting) | $S_2$<br>(Begin Overtime) | $S_3$<br>(Construct Facilities) |
| Low (L)    | 0.10        | 10                        | -20                       | -150                            |
| Medium (M) | 0.50        | 50                        | 60                        | 20                              |
| High (H)   | 0.40        | 50                        | 100                       | 200                             |
- Formulate this situation in the form of a decision tree and indicate the most preferred decision and its corresponding expected value.
- Q9 The following matrix gives the payoff (in Rs) of different strategies (alternatives)  $S_1$ ,  $S_2$  and  $S_3$  against the four states of nature (events)  $N_1$ ,  $N_2$ ,  $N_3$  and  $N_4$ : (10)

Strategy	State of Nature			
	$N_1$	$N_2$	$N_3$	$N_4$
$S_1$	4,000	-100	6,000	18,000
$S_2$	20,000	5,000	400	0
$S_3$	20,000	15,000	-2,000	1,000

Indicate the decision taken under the following approaches:  
 (i) Maximin criterion (ii) Maximax criterion (iii) Equal probability  
 (iv) Regret criterion (v) Hurwicz criterion where the degree of optimism is 0.7