Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 10877

M.E./M.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Second Semester

Manufacturing Engineering

MF 4201 – OPTIMIZATION TECHNIQUES IN MANUFACTURING

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Suppose the monthly profit a manufacturer realizes from selling q" units is given by

$$P(q) = -5q^2 + 1300q - 15000$$

dollars. What is the maximum monthly profit?

2. Classify the optimization problems according to their complexity.

3. Mention the general rules for formulating a dual linear programming problem from its primal.

4. In the context of network simplex method, define basic and non basic arcs.

5. What do you mean by separable and/or non-linear convex programming?

6. Write the Kuhn-Tucker necessary and sufficient conditions in non-linear programming.

7. Define the following dynamic programming terms: (a) Stage (b) State variable (c) Decision variable (d) Immediate return

8. What is the effect of the integer' restriction of all the variables on the feasible space of integer programming problem?

9. What are neural networks? How they are used in optimization?

10. What is meant by Meta-heuristic?

PART B — (5 × 13 = 65 marks)

11. (a) State the optimization problem and explain its elements

Or

(b) What is meant by a mathematical model of a real situation? Discuss the importance of models in the solution of operations research problems.

12. (a) Use the revised simplex method to solve the following linear programming problem:

Maximize $Z = 3x_1 + 5x_2$

Subject to the constraints

(i) $x_1 \leq 4$

(ii) $x_2 \leq 6$

(iii) $3x_1 + 2x_2 \leq 18$

and $x_1, x_2 \geq 0$

Or

(b) Solve the following goal programming problem

Minimize $Z = P_1 d_1^- + P_2 d_4^+ + 5P_3 d_2^- + 3P_3 d_3^- + P_4 d_1^+$

Subject to the constraints

(i) $x_1 + x_2 + d_1^- - d_1^+ = 80$

(ii) $x_1 + d_2^- = 70$

(iii) $x_2 + d_3^- = 45$

(iv) $x_1 + x_2 + d_4^- - d_4^+ = 90$

and $x_j, d_i^-, d_i^+ \geq 0; i = 1, 2, 3, 4; j = 1, 2$

13. (a) Use Wolfe's method to solve the quadratic programming problem:

Maximize $Z = 4x_1 + 6x_2 - 2x_1^2 - 2x_1x_2 - 2x_2^2$

Subject to the constraint

$x_1 + 2x_2 \leq 2$ and $x_1, x_2 \geq 0$

Or

(b) When n > m + 1 solve the following non linear programming problem: Minimize $f(x) = 5x_1\, x_2^{-1} + 2x_1^{-1}\, x_2 + 5x_1 + x_2^{-1}$ using the geometric programming method.

14. (a) Solve the following all-integer programming problem using the branch and bound method.

Maximize $Z = 3x_1 + 5x_2$

Subject to the constraints

(i) $2x_1 + 4x_2 \leq 25$

(ii) $x_1 \leq 8$

(iii) $2x_2 \leq 10$

and $x_1, x_2 \geq 0$ and integers.

Or

(b) Solve the following Integer linear programming problem using Gomory's cutting plane method.

Maximize $Z = x_1 + x_2$

Subject to the constraints

(i) $3x_1 + 2x_2 \leq 5$

(ii) $x_2 \leq 2$

and $x_1, x_2 \geq 0$ and are integers.

15. (a) Write on important parameters which influence the performance of simulated — annealing and Tabu search methods. Suggest suitable values for those parameters.

Or

(b) Write short notes on: (i) Genetic algorithm (ii) Fuzzy system

PART C — (1 × 15 = 15 marks)

16. (a) Four types of machine tools are to be installed (purchased) in a production shop. The costs of the various machine tools and the number of jobs that can be performed on each are given below.

Machine tool type	Cost of machine tool (Rs)	Number of jobs that can be performed
1	35000	9
2	25000	4
3	20000	3
4	10000	2

The total amount available is Rs 100000. To determine the number of machine tools of various types to be purchased to maximize the number of jobs performed, develop an optimization model as integer programming problem as dynamic programming problem. Solve the same by any one method.

Or

(b) Choose an engineering field of your choice and identify the product/system/process that may require optimal design. Clearly indicate the objective, decision/design variables and constraints. Formulate the mathematical model and categorize the type of problem. Also suggest suitable solution technique and demonstrate the same with at least one iteration.

———————