

Sem-V / Mech / c-scheme / Nov 25 / Date - 21/11/25 PP - 95434  
1/2

Time: 3 hrs

Marks: 80

Note :

- Question No.1 is compulsory.
- Solve ANY THREE questions from the remaining five questions.
- Figure to the right indicates full marks.
- Assume suitable data wherever required, but justify the same.

- |  | Marks |
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| <b>Q. 1</b>  |       |
| Solve ANY FOUR from the following.   |       |
| a) Show the dual of the following primal-<br>Maximize $9x_1 + 10x_2$<br>S.T. $3x_1 + 3x_2 \leq 21$<br>$3x_1 + 4x_2 \leq 24$<br>$x_1, x_2 \geq 0$   | (5)   |
| b) Show the constraint surface diagram with the following:<br>Feasible region, unbounded region, Infeasible region   | (5)   |
| c) What do you understand by full factorial and fractional factorial design?   | (5)   |
| d) A company manufactures two products X and Y which requires the resources as machines M1 and M2 having the capacities of 50 and 25 hours respectively. Product X requires 1 hour of machine M2. Product Y requires 2 hours of machine M1 and 2 hours of machine M2. The profit contribution of products X and Y are Rs. 5 and Rs 4 respectively. Show the problem formulation for profit maximization. | (5)   |
| e) State bellman's principle of optimality and briefly explain concept of dynamic programming  | (5)   |
| <b>Q. 2</b>  |       |
| a) Solve the following Simplex problem<br>$Z_{max} = 6X_1 + 5X_2$<br>S.T. $X_1 + X_2 \leq 8$<br>$X_1 - X_2 \leq 4$<br>$X_1, X_2 \geq 0$  | (10)  |
| b) What is integer linear programming? How does the optimal solution of an integer programming problem compare with that of the linear programming problem?  | (5)   |
| c) Explain the Monte Carlo technique of simulation.  | (5)   |

- Q.3 a) Apply SAW to select suitable land (L1, L2,...) for waste material dumping, (10)  
 having criteria as Cost (C1), distance from residential area (C2), distance (C3)  
 from water resources as rivers, dams etc., and distance from main road (C4).  
 Assume C1 as non-beneficial (NB), and rest all criteria as beneficial (B)

No	Alternative	C1(Rs in Cr) 0.35 (NB)	C2(Kms) 0.25 (B)	C3 (kms) 0.25 (B)	C4(kms) 0.15 (NB)
1	L1	4	3	5	4
2	L2	2	4	3	3
3	L3	4	4	2	3
4	L4	4	3	4	3

- b) Classify optimization problems in detail. (10)
- Q.4 a) Apply Kuhn – Tucker method and solve (10)  
 Maximize  $Z = 10x_1 + 4x_2 - 2x_1^2 - x_2^2$   
 S.T.  $2x_1 + x_2 \leq 5$   
 $x_1, x_2 \geq 0$
- b) Describe step by step procedure of Genetic Algorithm. Draw a flow chart (10)  
 showing how a GA works. What are the termination conditions used in GA.
- Q.5 a) A factory can manufacture two products A & B. The profit on one unit of A is (05)  
 Rs. 80 and one unit of B is Rs. 40. The maximum demand of A is 6 units per  
 week and of B it is 8 units per week. The manufacturer has set up a goal of  
 achieving a profit of exactly Rs. 640 per week. Show only the formulation of  
 the problem as goal programming.
- b) Elaborate concept of goal programming (05)
- c) Describe the procedure of AHP method step wise in detail. (10)
- Q.6 a) Write a note on Design of Experiment. (5)
- b) Summarize the term 'Normalization' in MADM and list its different types. (5)
- c) Explain the concept of Taguchi loss function with an example. (5)
- d) Explain the terms 'Stationary Point' and 'Point of Inflection' with a graph. (5)

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