

13/06/2025 TE MECH SEM-V C-SCHEME OT QP CODE: 10082978

Time: 3 Hours

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.

Q. 1 Solve ANY FOUR from the following.

- Show the formulation of a generalized transportation problem. (5)
- Show the conditions for the Positive definite, Positive semi-definite, Negative definite and Negative semi-definite functions. (5)
- Show the flowchart for the genetic algorithm. (5)
- Solve and decide the definiteness of the function
 $f(x) = -3x_1^2 + 2x_2^2 - 3x_3^2 - 10x_1x_2 + 4x_2x_3 + 6x_1x_3$ (5)
- Illustrate 'Design of Experiment'. (5)

Q. 2 a) Calculate maximum and minimum values of the function (10)

$$f(x) = 3x^4 - 4x^3 - 24x^2 + 48x + 15$$

b) Solve the following LPP by the simplex method. (10)

Minimize $7x_1 + 5x_2$

S.T. $x_1 + x_2 \geq 4$

$5x_1 + 2x_2 \geq 10$

$x_1, x_2 \geq 0$

Q. 3 a) Solve using the Lagrange's multiplier method the following NLPP (10)

Optimize $Z = 6x_1^2 + 5x_2^2$

S. T. $x_1 + 5x_2 = 7$

$x_1, x_2 \geq 0$

b) List the non-traditional optimization techniques and explain any one in detail. (10)

Q. 4 a) A person has to select a house from given 3 alternatives he has with the details as given in the table. He considers 3 attributes of price, near to market and near to school with weights as 0.625, 0.125 and 0.25 respectively. Select the best alternative of house by SAW method. (10)

Alternative / Criteria	Price (Rs. Lakhs)	Near Market (km)	Near School (km)
House 1	100	1.5	2.75
House 2	140	1.0	3.5
House 3	80	1.7	3.0

b) Classify optimization problems in detail. (10)

Q. 5 a) Apply Dynamic Programming to solve the following problem **(10)**

$$\text{Minimize } Z = x_1^2 + x_2^2 + x_3^2$$

$$\text{S.T. } x_1 + x_2 + x_3 = 15$$

$$x_1, x_2, x_3 \geq 0$$

b) Describe the procedure of AHP method step wise in detail. **(10)**

Q. 6 a) A company manufactures 2 products, radios and transistors, which must be **(10)**

processed through assembly & finishing departments. Assembly has 90 hours available, finishing can handle up to 72 hours of work. Manufacturing one radio requires 6 hours in assembly and 3 hours in finishing. Each transistor requires 3 hours in assembly and 6 hours in finishing. If profit is Rs. 120 per radio and Rs. 90 per transistor, determine the best combination of radios and transistors to realize profit of Rs. 2100.

b) A sample of 100 arrivals of a customer at a retail sales depot is according to the following distribution. **(10)**

Time between arrivals (mins.)	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Frequency	2	6	10	25	20	14	10	7	4	2

A study of the time required to service customer by adding up the bills, receiving payments and placing packages yields the following distribution.

Service time (mins.)	0.5	1.0	1.5	2.0	2.5	3.0
Frequency	12	21	36	19	7	5

Estimate the average of customer waiting time and average of idle time of the server by simulation for the next 10 arrivals.

Use random number for arrivals: 93, 22, 53, 64, 39, 07, 10, 63, 76, 35

Use random number for service: 78, 76, 58, 54, 74, 92, 38, 70, 96, 92

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