Reg No.:_____ Name:_____

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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Fifth Semester B.Tech Degree (S, FE) Examination June 2024 (2015 Scheme)



**Course Code: EC363**

**Course Name: OPTIMIZATION TECHNIQUES**

Max. Marks: 100 Duration: 3 Hours

**PART A**

***Answer any two full questions, each carries 15 marks.*** Marks

1 a) Examine $f(x) = 6x^5 - 4x^3 + 10$ for extreme points (5)

b) Optimize $f(x_1, x_2, x_3) = 4{x_1}^2 + 2{x_2}^2 + {x_3}^2 - 4x_1 x_2$, subject to constraints (10)

$$x_1 + x_2 + x_3 = 15$$

$$2x_1 - x_2 + 2x_3 = 20$$

using method of Lagrange multipliers.

2 a) State the duality principle and write the dual of the following LPP (8)

Maximize $Z=6x_1 + 8x_2$

Subject to the constraints

$$5x_1 + 2x_2 \leq 20$$

$$x_1 + 2x_2 \leq 10$$

and $x_1, x_2 \geq 0$

b) Solve the following LPP using Big M method (7)

Maximize $Z=-2x_1 - x_2$

Subject to the constraints

$$3x_1 + x_2 = 3$$

$$4x_1 + 3x_2 \geq 6$$

$$x_1 + 2x_2 \leq 4$$

and $x_1, x_2 \geq 0$

3 a) A small manufacturer employs 5 skilled men and 10 semi-skilled men for making a product in two qualities; a deluxe model and an ordinary model .The production of a deluxe model requires 2-hour work by a skilled man and 2-hour work by a semi-skilled man .The ordinary model requires 1-hour work by a skilled man and 3-hour (10)

work by a semi-skilled man. According to worker union's rules ,no man can work more than 8 hours per day. The profit of the deluxe model is Rs.1000 per unit and that of the ordinary model is Rs.800 per unit. Formulate a linear programming model for this manufacturing situation to determine the production volume of each model such that the total profit is maximized.

b) Determine whether the following function is convex or concave (5)

$$f(X) = 3{x_1}^2 + 2{x_2}^2 + {x_3}^2 - 2x_1x_2 - 2x_1x_3 + 2x_2x_3 - 6x_1 - 4x_2 - 2x_3$$

## PART B

***Answer any two full questions, each carries 15 marks.***

4 a) Find an IBFS to the following transportation problem by LC method (7)

| | $D_1$ | $D_2$ | $D_3$ | $D_4$ | $D_5$ | Supply |
|---|---|---|---|---|---|---|
| $O_1$ | 73 | 40 | 9 | 79 | 20 | 8 |
| $O_2$ | 62 | 93 | 96 | 8 | 13 | 7 |
| $O_3$ | 96 | 65 | 80 | 50 | 65 | 9 |
| $O_4$ | 57 | 58 | 29 | 12 | 87 | 3 |
| $O_5$ | 56 | 23 | 87 | 18 | 12 | 5 |
| Demand | 6 | 8 | 10 | 4 | 4 | |

b) Solve the following Transportation problem using MODI Method (8)

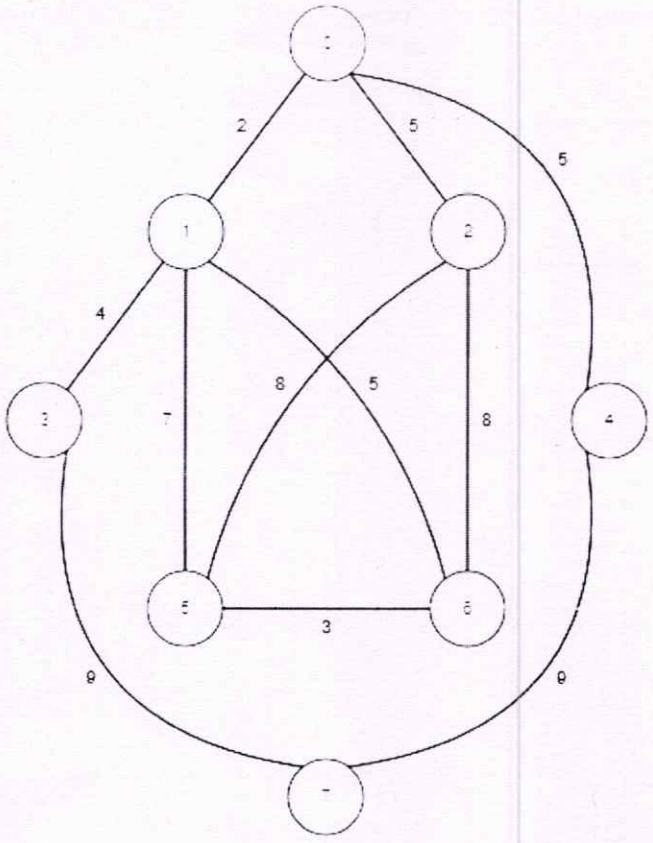
| | $D_1$ | $D_2$ | $D_3$ | $D_4$ | Supply |
|---|---|---|---|---|---|
| $O_1$ | 1 | 2 | 1 | 4 | 30 |
| $O_2$ | 3 | 3 | 2 | 1 | 50 |
| $O_3$ | 4 | 2 | 5 | 9 | 20 |
| Demand | 20 | 40 | 30 | 10 | |

5 a) Solve the following 2x3 game graphically (8)

Player B

Player $A \begin{bmatrix} 1 & 3 & 11 \\ 8 & 5 & 2 \end{bmatrix}$

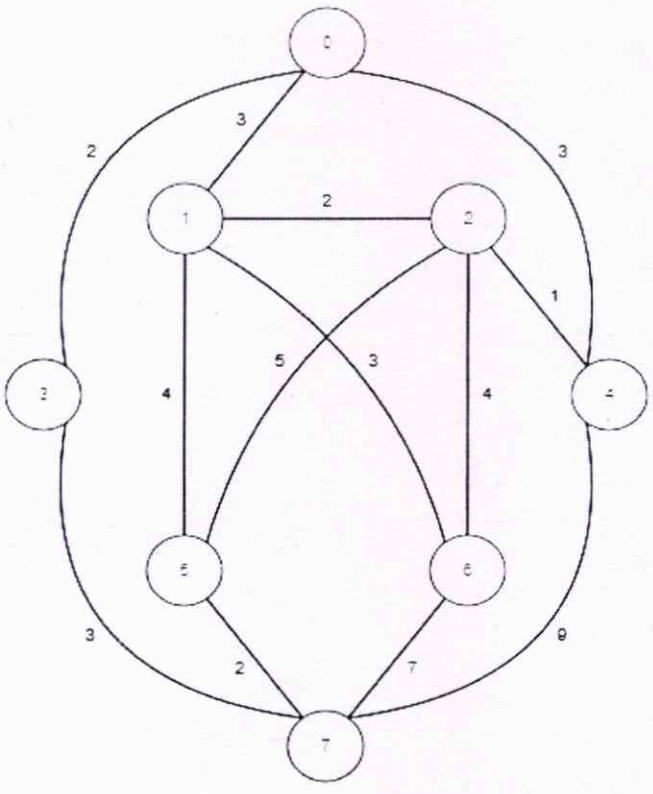
b) Using Dijkstra's method find the shortest path from node 1 to node 7 from the following network path model. (7)




6 a) Find the IBFS of the following TP using (i)NWC method (ii)LC method (7)

| | $D_1$ | $D_2$ | $D_3$ | Supply |
|---|---|---|---|---|
| $O_1$ | 1 | 2 | 6 | 7 |
| $O_2$ | 0 | 4 | 2 | 12 |
| $O_3$ | 3 | 1 | 5 | 11 |
| Demand | 10 | 10 | 10 | |

b) Find the minimum spanning tree to the following network by PRIM's algorithm (8)




## PART C

***Answer any two full questions, each carries 20 marks.***

7 a) Consider the function $f(x) = x^4 - 14x^3 + 60x^2 - 70x$.Use Fibonacci search method to find the value of $x$ that minimizes the function $f$ over the range[0,2] .Locate this value of x to within the range 0.3. (10)

b) Explain in detail Hooke-Jeeves pattern search method (10)

8 a) Explain the following terms (10)

a) Mutation with some suitable application

b) Cross over

c)Reproduction

b) Minimize $f(x, y) = x - y + 2x^2 + y^2 + 2xy$ starting from the point $X = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$ using Cauchy 'steepest -descent method. (10)

9 a) Explain the advantages of testing function and mutation in Genetic algorithms (10)

b) Explain the length of the binary string to represent a design variable in genetic algorithm (10)

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