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May-24-0392

MA-401 (Optimization and Calculus of Variations)
(Common for B.Tech. all Branches)

B.Tech. 4th (CBCS)

Time : 3 Hours

Max. Marks : 60

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt Five Questions in all, selecting one question each from sections A, B, C and D. Section E is compulsory.

SECTION - A

1. (a) Minimize $Z=20x+10y$
Subject to constraints $\{x+2y \leq 40, 3x+y \geq 30$
 $4x+3y \geq 60, x, y \geq 0$
by Graphical Method. (5)
- (b) Explain the following concept in the context of Linear Programming Problem:
(a) Convex Set.
(b) Objective function.
(c) Feasible solution. (5)
2. Use Simplex Method to solve the following Linear Programming Problem
Maximize $Z=3x_1+2x_2$
Subject to constraints $-x_1+2x_2 \leq 4$
 $3x_1+2x_2 \leq 14$
 $x_1-x_2 \leq 3, x_1, x_2 \geq 0$ (10)

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SECTION - B

3. Find the Optimal solution of the following Transportation Problem. (10)

	D	D	D	D	Supply
A	3	1	7	4	250
B	2	6	5	9	350
C	8	3	3	2	400
Demand	200	300	350	150	

4. Solve the following Linear Programming Problem by the method of Dynamic Programming.

Max. $Z=8x_1+7x_2$

Subject to constraints $2x_1+x_2 \leq 8$

$5x_1+2x_2 \leq 15$ and $x_1, x_2 \geq 0$ (10)

SECTION - C

5. A project consists of the following activities with time estimates noted against each:

Activity	1-2	1-3	2-3	2-5	3-4	3-6	4-5	4-6	5-6	6-7
Time	15	15	3	5	8	12	1	14	3	14

- (a) Draw a diagram of Project.
(b) Determine Critical Path.
(c) Find total float for each activity.
(d) Determine project duration. (10)

[P.T.O.]

6. Solve the following Non-Linear Programming by Lagrange's Multiplier Method:

$$\text{Min. } Z = 2x_1^2 + 2x_2^2 + 2x_3^2 - 24x_1 - 8x_2 - 12x_3$$

$$\text{Subject to } x_1 + x_2 + x_3 = 11$$

$$\text{and } x_1, x_2, x_3 \geq 0 \quad (10)$$

SECTION - D

7. (a) Find the Extremal of the functional $\int_0^{\pi/2} (y'^2 - y^2 + 2xy) dx$ that satisfy the boundary conditions $y(0)=0, y(\pi/2)=0$ (5)
- (b) Find the curve passing through the points (x_1, y_1) and (x_2, y_2) which when rotated about the x-axis gives minimum surface area. (5)
8. (a) Find the plane curve of fixed length having maximum area. (5)
- (b) Find the extremal of the functional $\int_0^2 y'^2 dx$ under the constraint $\int_0^2 y dx = 1$ given $y(0)=0$ and $y(2)=1$. (5)

SECTION - E (Compulsory)

9. Attempt all the questions:
- (a) Write Euler Lagrange Equation.
- (b) Define constraints in L.L.P.
- (c) What is basic feasible solution for T.P?
- (d) Write the main features of Critical Path.
- (e) Write about PERT in short.

- (f) Define Degeneracy of transportation problem.
- (g) Define Slack variable in the context of liner programming problem.
- (h) Define the Calculus of variables.
- (i) Define Artificial Variable and Surplus Variable.
- (j) Explain the meaning of Duality in Linear Programming problem. (10×2=20)