4E 2039

Roll No. _______________ [Total No. of Pages : 4

4E 2039

B.Tech. IV Semester (Main/Back) Examination 2012

Civil Engineering

4CE6.2 Optimization Techniques/Methods

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt any **Five questions** selecting **one question** from **each unit**. All questions carry **equal marks**. (Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly.) Units of quantities used/calculated must be stated clearly.*

Unit - I

1. a) Describe and distinguish between :

1) Integer Programming and Real programming

2) Linear and Nonlinear Programming

3) Dynamic and Quadratic programming

4) Constrained and unconstrained optimization. **(2×4=8)**

b) Use Simplex method to maximize $f(x) = 5x_1 + 7x_2$

Subjected to :-

$x_1 + x_2 \leq 4$

$3x_1 + 8x_2 \leq 24$

$10x_1 + 7x_2 \leq 35$

$x_1, x_2 \geq 0$ **(8)**

OR

1. a) A horizontal cantilever beam-column of rectangular cross-section has to carry an axial load of 10Kg and a transverse vertical load of 5 Kg at the free end. It has to be designed to avoid the possibility of yielding and buckling and for minimum weight. By assuming that the beam-column can bend only in the transverse force plane (vertical plane), formulate the optimization problem. Assume the material as steel with density of 0.00784 Kg/cm^3. Young's modulus of 2.1×10^6 Kg/cm^2, and a yield stress of 2100 Kg/cm^2. The width of the beam should be at least 1 cm and must not be greater than twice the depth. **(12)**

   b) For the given below linear programming problem, Find its dual?

   Maximize $f(x) = 4x_1 + 10x_2 + 12x_3$

   Subjected to :-

   $5x_1 + 6x_2 - x_3 \leq 3$

   $-2x_1 + x_2 + 4x_3 \leq 4$

   $x_1 - 5x_2 + 3x_3 \leq 1$

   $-3x_1 - 3x_2 + 7x_3 \leq 6$

   $x_1, x_2, x_3 \geq 0$ **(4)**

Unit - II

2. The manager of an agriculture farm of 80 hectares learns that for effective protection against insects, he should spray at least 15 units of chemical A and 20 units of chemical B per hectare. Three brands of insecticides are available in the market which contains these chemicals. One brand contains 4 units of A and 8 units of B per kg and costs ₹50/- per kg, the second brand contains 12 and 8 units respectively and costs ₹ 80/- per kg and third brand contains 8 and 4 units respectively and costs ₹60/- per kg. It is also learnt that more than 2.5 kg per hectares of insecticides will be harmful to the crops. Determine the quantity of each insecticide he should buy to minimize the total cost of insecticides for the whole farm.

   a) Make a mathematical model of the above problem. **(4)**

   b) Find the solution by Simplex big-M method. **(12)**

OR

2. Find the solution of the below given problem by two-phase Simplex method.

Minimize $f(x) = 5x_1 - 6x_2 - 7x_3$

Subjected to :-

$$x_1 + 5x_2 - 3x_3 \geq 15$$

$$5x_1 - 6x_2 + 10x_3 \leq 20$$

$$x_1 + x_2 + x_3 = 5$$

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

(16)

Unit - III

3. a) Find the basic feasible solution of the below given transportation problem between the three origin and four destinations by Least cost method. **(8)**

	D_1	D_2	D_3	D_4	Orig.
O_1	10	2	20	11	15
O_2	12	7	9	20	25
O_3	4	14	16	18	10
Dest.	5	15	15	15	

b) Check the solution for optimality. If it is not optimum, find the optimum solution. **(8)**

OR

3. Calculate the minimum transportation cost for the given transportation problem. **(16)**

	Stores			
Factory	A	B	C	Available
F_1	10	8	8	8
F_2	10	7	10	7
F_3	11	9	7	9
F_4	12	14	10	4
Capacity	10	10	8	

Unit - IV

4. a) Prove that the convex function is unimodal. **(4)**

b) Find the solution of the below given problem (Two iterations) by steepest descent method from the point $X_1 = \begin{Bmatrix} 0.0 \\ 0.0 \end{Bmatrix}$

Minimize $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1 x_2 + x_2^2$ **(12)**

OR

4. a) Derive Kuhn-Tucker necessary conditions for an optimal solution to a nonlinear programming problem. **(6)**

b) Obtain the necessary and sufficient conditions for the optimum solution of following Nonlinear programming problem

Minimize $Z = f(x_1, x_2) = 3e^{2x_1+1} + 2e^{x_2+5}$

Subjected to the constraints : $x_1 + x_2 = 7$ and $x_1, x_2 \geq 0$ **(10)**

Unit - V

5. Solve the following LPP by using dynamic programming. **(16)**

Minimize $Z = 10x + 25y$

Subjected to :-

$x \leq 30$

$y \leq 40$

$3x + 2y \leq 100$

$x, y \geq 0$

OR

5. Solve the following problem by dynamic programming. **(16)**

Minimize $f(u_1, u_2, u_3) = u_1^2 + u_2^2 + u_3^2$

Subjected to :

$u_1 + u_2 + u_3 \geq 100$

$u_2, u_3 \geq 0$