No. of Printed Pages : 5

BICEE-004

B.Tech. CIVIL ENGINEERING (BTCLEVI)

00525 **Term-End Examination**

June, 2019

BICEE-004 : STRUCTURAL OPTIMIZATION

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any **seven** questions. All questions carry equal marks. Use of scientific calculator is permitted. Assume missing data suitably, if any.*

1. (a) Differentiate between Design variable and Pre-assigned variable.

(b) Find the maximum value of

$$z = 2x_1 + 3x_2$$

subject to

$$x_1 + x_2 \leq 30$$

$$x_2 \geq 3$$

$$x_2 \leq 12,$$

$$x_1 - x_2 \geq 0$$

$$0 \leq x_1 \leq 20.$$

5+5

2. (a) A plant manufactures two products, A and B. The profit contribution of each product has been estimated as ₹ 20 for product A and ₹ 24 for product B. Each product passes through three departments of the plant. The time required for each product and total time available in each department are as follows :

Department	Hours required		Available hours during the month
	Product A	Product B	
1	2	3	1500
2	3	2	1500
3	1	1	600

The company has a contract to supply at least 250 units of product B per month. Formulate the problem as a Linear Programming Model.

(b) Differentiate between constrained and unconstrained optimization problems. *5+5*

3. Solve the following LPP using Dynamic Programming method : *10*

Maximize $z = 35x_1 + 25x_2$

subject to $4x_1 + 8x_2 \leq 24$

$15x_1 + 5x_2 \leq 40$

$x_1, x_2 \geq 0$

4. (a) Apply graphical method to solve the LPP.

Maximize $z = x_1 - 2x_2$

subject to $-x_1 + x_2 \leq 1$

$6x_1 + 4x_2 \geq 24$

$0 \leq x_1 \leq 5; \quad 2 \leq x_2 \leq 4$

(b) State the limitations of Fibonacci method. *5+5*

5. (a) Describe the distinction between a local minimum and a local maximum in unconstrained optimization problem.

(b) The total profit (in ₹) of a beam manufacturing firm (of standard length) from manufacturing and sale of a particular number of beams is given by

$$y = -\frac{x^2}{400} + 2x - 80,$$

where y is the total profit (in ₹) and x is the number of beams.

What is the profit per beam when a number of beams are sold to set maximum profit ? *5+5*

6. Solve the following LPP by the method of dynamic programming : *10*

Maximize $z = 2x_1 + 5x_2$

subject to $2x_1 + x_2 \leq 430$

$2x_2 \leq 460$

$x_1, x_2 \geq 0.$

7. (a) What is the need of dynamic programming, and how is it different from linear programming ? State some applications of dynamic programming.

(b) Use the method of Lagrangian multipliers to solve the following non-linear programming problem. Does the solution maximize or minimize the objective function ? *5+5*

Optimize :

$$z = 2x_1^2 + x_2^2 + 3x_3^2 + 10x_1 + 8x_2 + 6x_3 - 100$$

subject to

$$x_1 + x_2 + x_3 = 20$$

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

8. (a) Briefly explain the reasons behind the use of partial derivatives while optimizing a multivariable function.

(b) What do you understand by "Interpolation Method" in multi-variable optimization technique ? *5+5*

9. (a) What do you understand by a design space in optimization problem ?

(b) Express the mathematical form of Quadratic programming problem. *5+5*

10. Write short notes on any ***two*** of the following : *5+5*

(a) Unimodal Function

(b) Cubic Interpolation Methods

(c) Grid Search Method

(d) Design Constraints in the Construction of Water Dam