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BICEE-004

B.Tech. IN CIVIL ENGINEERING (BTCLEVI)

Term-End Examination

00285

December, 2014

BICEE-004 : STRUCTURAL OPTIMIZATION

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any* ***seven*** *out of* ***ten*** *questions. Use of scientific calculator is permitted. Assume any missing data.*

1. (a) State five engineering applications of optimization. *5*

(b) Explain the terms 'design constraints' and 'objective function' in optimization problem with suitable examples. *5*

2. Determine the maximum and minimum values of the function *10*

$$f(x) = 12x^5 - 45x^4 + 40x^3 + 5.$$

3. A manufacturing company is engaged in producing three types of products A, B and C.

The production department produces, each day, components sufficient to make 50 units of A, 25 units of B and 30 units of C. The management is confronted with the problem of optimizing the daily production of the products in the assembly department, where only 100 man-hours are available daily for assembling the products. The following additional information is available :

Type of product	Profit contribution per unit of product (₹)	Assembly Time per product (hours)
A	12	0·8
B	20	1·7
C	45	2·5

The company has a daily order commitment for 20 units of product A and a total of 15 units of products B and C. Formulate this problem as a linear programming model so as to maximize the total profit. *10*

4. Find the maximum of the function

$$f(x) = 2x_1 + x_2 + 10$$

subject to,

$$g(x) = x_1 + 2x_2^2 = 3$$

using the Lagrange multiplier method. *10*

5. (a) What is random walk method ? *3*

(b) Find the minimum of $f = x(x - 1{\cdot}5)$ by starting from 0·0 with initial step size of 0·05. *7*

6. (a) Describe the Quadratic interpolation method. *5*

(b) Describe the Direct root method. *5*

7. Determine x_1 and x_2 so as to maximize

$z = 12x_1 + 21x_2 + 2x_1x_2 - 2x_1^2 - 2x_2^2$

subject to, $x_1 \leq 8$, $x_1 + x_2 \leq 10$, $x_1, x_2 \geq 0$. *10*

8. Minimize

$f(x) = 7x_1 x_2^{-1} + 3x_2 x_3^{-2} + 5x_1^{-3} x_2 x_3 + x_1 x_2 x_3$,

$x_1, x_2, x_3 \geq 0$, using the geometric programming method. *10*

9. (a) How does dynamic programming conceptually differ from linear programming ? *3*

(b) Solve the following linear programming by dynamic programming approach. *7*

Maximize $z = 8x_1 + 7x_2$

subject to

$2x_1 + x_2 \leq 8$

$5x_1 + 2x_2 \leq 15$

$x_1, x_2 \geq 0$

10. (a) Briefly explain the concept of 'Reproduction' in Genetic operators. *3*

(b) What do you understand by 'Direct Method' in constrained optimization technique ? *2*

(c) Describe the steps/procedure being following in 'Random Search Method'. *5*