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BICEE-021

00585

B.Tech. CIVIL ENGINEERING (BTCLEVI)

Term-End Examination

June, 2014

BICEE-021 : COMPUTATIONAL METHODS IN STRUCTURAL ENGINEERING

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. All questions carry equal marks. Use of calculator is permitted.*

1. Define the following : *14*

(a) Isoparametric elements

(b) Shape function

(c) Constant strain triangle (C.S.T.)

(d) Finite element method

2. Solve the following set of equations by Gauss Elimination method. *14*

$$y + z = 2$$
$$2x + 3z = 5$$
$$x + y + z = 3$$

3. (a) Locate the stationary points of $f(x) = 12x^5 - 45x^4 + 40x^3 + 5$ and find out if the function is convex, concave or neither at the points of optima base on testing rules. 7

(b) Discuss the properties of convex and concave function. 7

4. Minimize $f = x_1^2 + 2x_2^2 + 3x_3^2$ subject to the constraints

$$g_1 = x_1 - x_2 - 2x_3 \leq 12$$
$$g_2 = x_1 + 2x_2 - 3x_3 \leq 18$$

using Kuhn-Tucker conditions. *14*

5. Transform the general form of a linear programming problem given below to its standard form and solve it *14*

Minimize $z = -3x_1 - 5x_2$

Subject to $2x_1 - 3x_2 \leq 15$

$$x_1 + x_2 \leq 3$$
$$4x_1 + x_2 \geq 2$$
$$x_1 \geq 0$$
$$x_2 \text{ unrestricted.}$$

6. Solve the problem by integer linear programming. *14*

Maximize $z = 3x_1 + x_2$

Subject to $2x_1 - x_2 + y_1 = 6$

$3x_1 + 9x_2 + y_2 = 45$

$x_1, x_2, y_1, y_2 \geq 0$

x_2 should be an integer.

7. Invert matrix [a] given by equation

$$[a] = \begin{bmatrix} 30 & -10 & 0 \\ -10 & 15 & -5 \\ 0 & -5 & 5 \end{bmatrix}$$

by Choleski Method. *14*