BICEE-021

B.Tech. IN CIVIL ENGINEERING (BTCLEVI)

Term-End Examination

00195

December, 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 scientific calculator is permitted.*

1. Solve the following set of equations by Gauss Elimination Method : 14

$$x + y + z = 3$$

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

$$3x + 4y + 4z = 11$$

2. Solve the problem by integer linear programming

Maximize $z = 3x_1 + x_2$

Subject to $2x_1 - x_2 \leq 6$

$3x_1 + 9x_2 \leq 45$

$x_1, x_2 \geq 0$

x_1 and x_2 are integers. 14

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

(b) Locate the stationary points of f(x) and find out if the function is convex, concave or neither at the points of optima based on testing rules.

$$f(x) = \frac{2x_1^3}{3} - 2x_1x_2 - 5x_1 + 2x_2^2 + 4x_2 + 5$$ 7

4. Minimize $f = x_1^2 + x_2^2 + 60x_1$ subject to the constraints

$$g_1 = x_1 - 80 \geq 0$$
$$g_2 = x_1 + x_2 - 120 \geq 0$$

using Kuhn – Tucker condition. 14

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

Minimize $z = -3x_1 - 5x_2$

$$2x_1 - 3x_2 \leq 15$$
$$x_1 + x_2 \leq 3$$
$$4x_1 + x_2 \geq 2$$
$$x_1 \geq 0$$
x_2 unrestricted 14

6. Define any ***two*** of the following : *2×7=14*

(a) Finite Element Method

(b) Shape Function

(c) Duality Theorem

(d) Kuhn – Tucker Theorem

7. Analyze the rigid frame shown in Fig. 1 by Direct Stiffness Matrix Method. Assume E = 200 GPa $I_{zz} = 1 \cdot 33 \times 10^{-4}$ m^4 and A = 0·04 m^2. The flexural rigidity EI and axial rigidity EA are same for both the beams. *14*

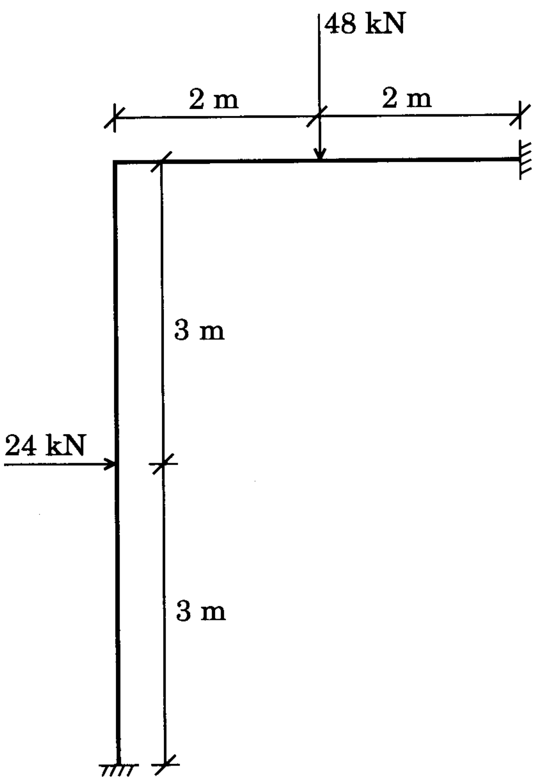

Fig. 1