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BICEE-021

B.Tech. CIVIL ENGINEERING (BTCLEVI)

Term-End Examination

00246

June, 2016

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. (a) Explain Gauss elimination method. *7*

(b) Solve the following equations by Gauss elimination method : *7*

$$10x_1 - 4x_2 + 8x_3 = 10$$

$$-4x_1 + 2x_2 + 2x_3 = 2$$

$$8x_1 + 2x_2 = 12$$

2. (a) Define concave and convex functions used in structural optimization. *6*

(b) Use the above definitions and show that $f(x) = x^2$ is convex. *8*

3. (a) Describe geometric programming and express its general mathematical form. *4*

(b) State and explain the necessary conditions for optimality in geometric programming. *10*

4. (a) Explain primal-dual relationship in linear programming. 6

(b) Write the dual to the following linear programming problem : 8

Maximize $z = x_1 - x_2 + 3x_3$

Subject to,

$$x_1 + x_2 + x_3 \leq 10$$

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

$$2x_1 - 2x_2 - 3x_3 \leq 6$$

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

5. Using displacement method, calculate the end deflection and rotation of a cantilever beam loaded uniformly as shown in Figure 1. EI is constant.

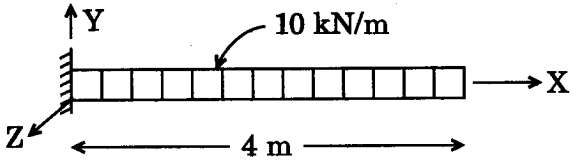

Figure 1

Note that the structure has two degrees of freedom — one rotation and other translation at the free end. 14

6. (a) In analyzing a plane truss, what are the assumptions made ? 4

(b) Find the forces in members of the truss shown in Figure 2. *10*

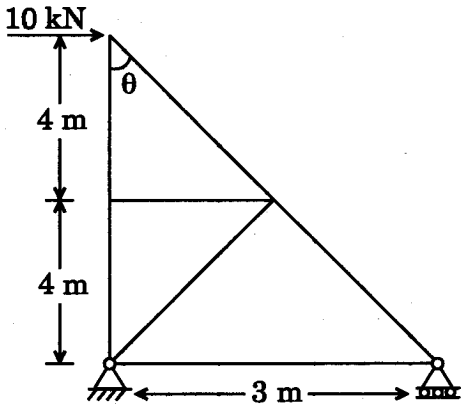

Figure 2

7. Write short notes on any ***two*** of the following : *2×7=14*

(a) Branch and Bound Method in Integer Programming

(b) Any four major applications of Linear Programming in Structural Analysis

(c) Cholesky Method in Structural Analysis

(d) Finite Element Method