BICEE-021

B.Tech. CIVIL ENGINEERING (BTCLEVI)
Term-End Examination
December, 2016

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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) Describe the objective of structural analysis. **4**

   (b) Discuss relative merits and demerits of matrix analysis of structures — Force methods and displacement methods. **10**

2. Solve the following integer programming using the branch and bound method : **14**

   Maximize $z = 2x_1 + 3x_2$

   Subject to,

   $6x_1 + 5x_2 \leq 25$

   $x_1 + 3x_2 \leq 10$

   and $x_1, x_2 \geq 0$ and integers.

3. Analyse the truss shown in Figure 1 for the bar forces. The 10 kN load at the joint is 30° inclined to the vertical. *14*
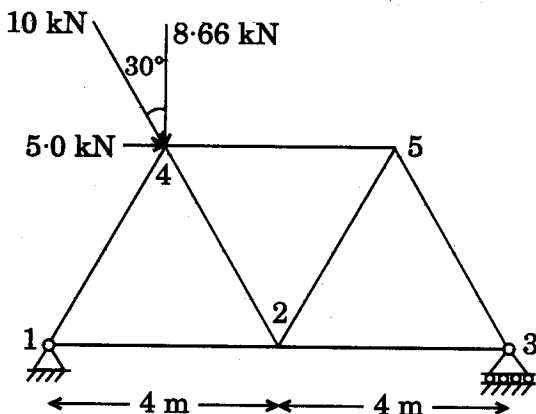
10 kN \ | 8·66 kN

\30°|

5·0 kN → ✳ 4

5

2

1 ⟳

3 ⟳

← 4 m → ← 4 m →

Figure 1

4. For the truss of Figure 2, determine the vertical and horizontal displacements of joint B and the horizontal displacement at C. *14*

$P_2 = 2 P$

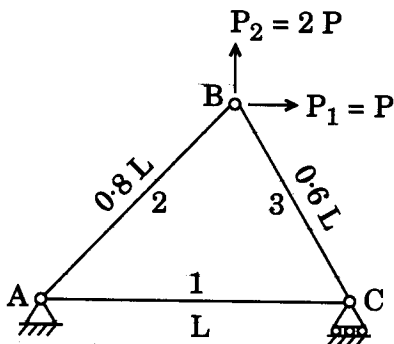B ⟶ $P_1 = P$

0·8 L / 2

3 \ 0·6 L

A ⟳ 1 C ⟳

L

Figure 2

5. (a) Describe the role of sensitivity analysis in Linear Programming. *4*

(b) A company wants to produce three products : A, B and C. The per unit profit on these products is ₹ 4, ₹ 6 and ₹ 2, respectively. These products require two types of resources, manpower and raw material. The Linear Programming Model for determining the optimal product mix is as follows : *4*

Maximize $z = 4x_1 + 6x_2 + 2x_3$

Subject to,

$x_1 + x_2 + x_3 \leq 3$ (Manpower required)

$x_1 + 4x_2 + 7x_3 \leq 9$ (Raw material available)

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

where x_1, x_2 and x_3 = number of units of products A, B and C respectively to be produced.

Find the optimal product mix and the corresponding profit of the company.

(c) In the above question, what will be the new optimal mix when per unit profit from product C is increased from ₹ 2 to ₹ 10 ? *6*

6. State and explain the Kuhn-Tucker necessary conditions to achieve relative maximum for Linear Programming Problem. *14*

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

   (a) Static vs Kinematic Matrix in Structural Analysis

   (b) Duality in Optimization

   (c) Geometric Programming