

S'20 : 1 FN : CV 411 (1434)

**ADVANCED STRUCTURAL ANALYSIS**

*Time : Three hours*

*Maximum Marks : 100*

*Answer FIVE questions, taking ANY TWO from Group A,  
ANY TWO from Group B and ALL from Group C.*

*All parts of a question ( a, b, etc. ) should be  
answered at one place.*

*Answer should be brief and to-the-point and be supple-  
mented with neat sketches. Unnecessary long answer may  
result in loss of marks.*

*Any missing or wrong data may be assumed suitably  
giving proper justification.*

*Figures on the right-hand side margin indicate full marks.*

✓ Group A

2 3j-mtr

1. (a) Explain degrees of freedom of different types of structural elements. 10
- (b) Explain the static and kinematic indeterminacy of various structural components. 10
2. (a) Distinguish between the element and global stiffness matrices. 10
- (b) Derive the stiffness matrix of a two noded truss element of length  $L$ , and axial rigidity  $AE$ . 10

( Turn Over )

3. Using the stiffness method, analyse the beam supported and loaded as shown in Figure (1). Assume the flexural rigidity is constant. 20

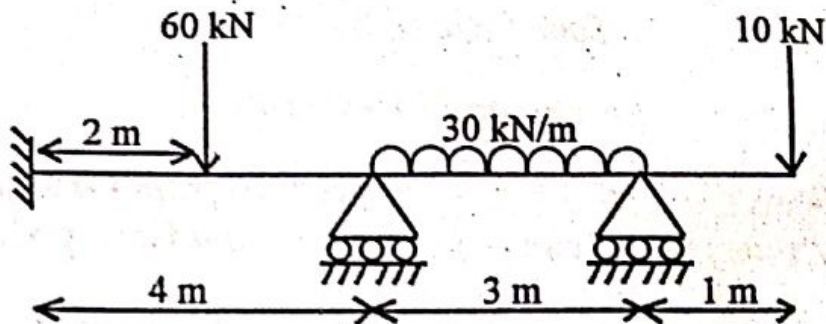


Figure (1)

4. Analyse the beam shown in Figure (2) if the downward settlements of supports B and C are  $200/EI$  and  $100/EI$  respectively (in kN-m units). use Flexibility method. 20

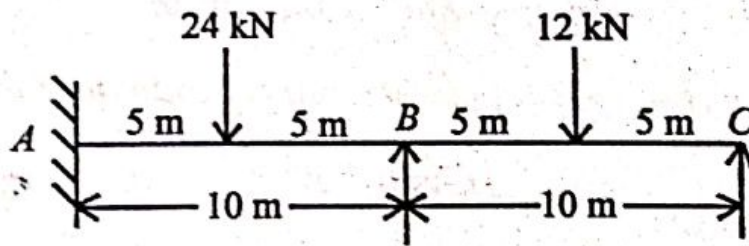


Figure (2)

### Group B

5. The stress tensor at a point is given by :

$$[\sigma] = \text{KPa}$$

With respect to xyz co-ordinate system. If the system is rotated about Z-axis in the anticlockwise direction through  $30^\circ$  the new stress components. 20

✓ 6. The state of stress at a point is given by  $\sigma_x = 20$  MPa,  $\sigma_y = -10$  MPa,  $\sigma_z = 5$  MPa,  $\tau_{xy} = 4$  MPa,  $\tau_{yz} = 5$  MPa,  $\tau_{xz} = 6$  MPa. If  $E = 2 \times 10^5$  N/mm<sup>2</sup>,  $G = 0.84 \times 10^5$  N/mm<sup>2</sup>. Determine the strain components. 20

✓ 7. Discuss in detail the various theories of failure normally adopted to find the yield criteria. 20

✗ 8. (a) What are the difference between plate and shell? What are its assumptions? 10

(b) Discuss the membrane theory of shells. 10

### Group C

✓ 9. Answer short notes of the following : 5 × 4

✓ (i) Difference between flexibility and stiffness

✓ (ii) Beam Element

(iii) Stress invariants

✓ (iv) Fatigue Failure

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