

- (vii) What are principal stress and strains?
- (viii) Write the stiffness matrix for two-dimensional truss element.
- (ix) State Kirchhoff's plate theory.
- (x) State bending theory for cylindrical shell.

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S'09: 1 FN: CV411 (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.

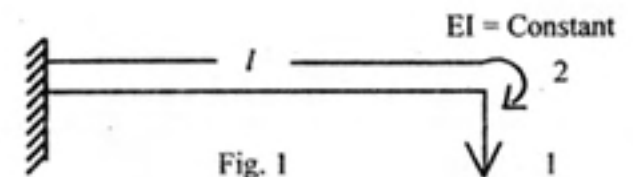
Answer should be brief and to-the-point and be supplemented with neat sketches. Unnecessary long answer may result in loss of marks.

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

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

Group A

1. Develop the stiffness matrix for the beam element with respect to two co-ordinates shown in Fig. 1. Take EI as constant. 20



2. Develop the flexibility matrix for the structure with coordinates as shown in Fig. 2. Take EI as indicated in Fig. 2. 20

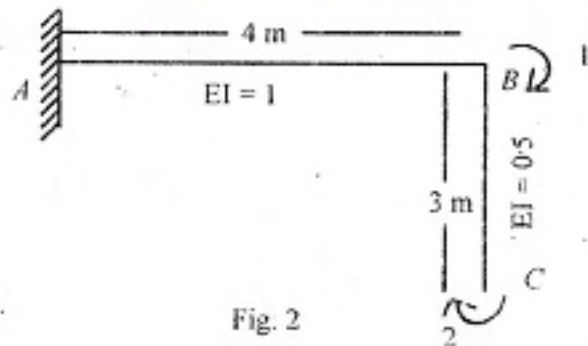


Fig. 2

3. Analyse the portal frame as shown in Fig. 3 by the stiffness method. $EI = \text{constant}$. 20

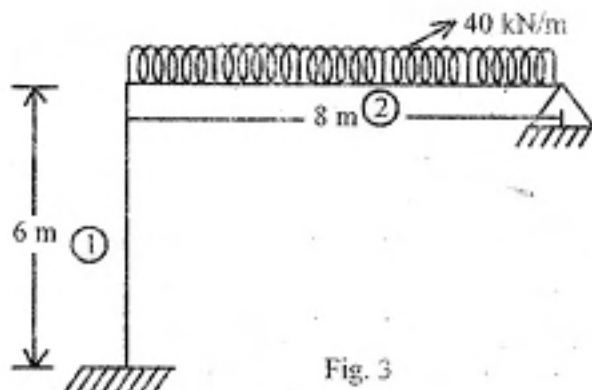


Fig. 3

4. Using the flexibility matrix method, analyse the beam as shown in Fig. 4. 20

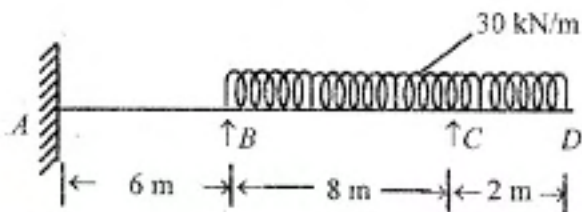


Fig. 4

5. The stress tensor at a point is given by

$$\sigma = \begin{bmatrix} 40 & 20 & 30 \\ 20 & 30 & 40 \\ 30 & 40 & 20 \end{bmatrix} \text{ MPa}$$

Calculate the deviator and spherical stress tensors. 20

6. Briefly describe the failure criteria of stress-strain relations for anisotropic and isotropic elastic materials. 20
7. Derive the differential equation for thin plate bending theory with their assumptions. 20
8. Derive the bending theory for circular cylindrical shells. 20

Group C

9. Briefly answer the following: 10 × 2
- (i) State the properties of flexibility and stiffness matrices.
 - (ii) What is influence coefficients?
 - (iii) What are the factors that influence the stiffness or flexibility property of a structure?
 - (iv) Why is stiffness method also called either equilibrium method or displacement method?
 - (v) Briefly describe the isotropic body.
 - (vi) What is yield criteria?