

B.Tech. 5th Semester Exam., 2014

STRUCTURAL ANALYSIS—I

Time : 3 hours

Full Marks : 70

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- (i) All questions carry equal marks.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.

1. Choose the correct one (any seven) :

- (a) In a pin-jointed truss, the members may be subjected to bending, if
 - (i) the material of the truss does not obey Hooke's law
 - (ii) the truss is statically indeterminate
 - (iii) the loads are not applied at the nodes
 - (iv) there is support settlement
- (b) Point of contraflexure occurs in a structure, when
 - (i) bending moment is zero
 - (ii) bending moment changes sign
 - (iii) shear force is zero
 - (iv) All of the above

- (c) In a vertically loaded propped cantilever, any settlement of the prop would
 - (i) reduce the hogging BM at the fixed end
 - (ii) increase the hogging BM at the fixed end
 - (iii) affect only SF and not BM values
 - (iv) affect neither BM nor SF values

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- (d) A simply-supported beam of 8 m span is loaded by a u.d.l. and has maximum deflection of 16 mm. If the span is halved (i.e., 4 m) and the loading is doubled, the maximum deflection will be

- (i) 2 mm
- (ii) 4 mm
- (iii) 8 mm
- (iv) 16 mm

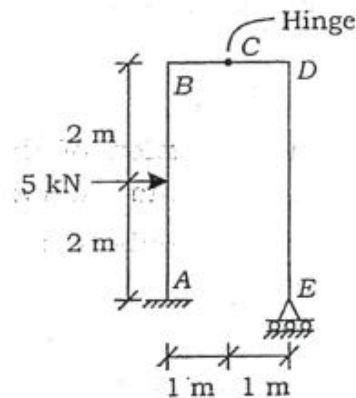
The fixed support in a real beam becomes — in the conjugate beam.

- (i) roller support
- (ii) hinged support
- (iii) free support

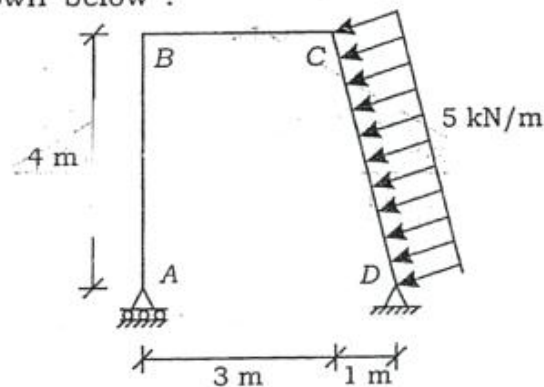
- (f) Castigliano's theorem for deflection, i.e., $\frac{\partial U}{\partial P} = \delta$ (deflection) is true for
- (i) linearly elastic material
 - (ii) rigid material
 - (iii) non-linearly elastic material
 - (iv) any material, elastic or inelastic
- (g) The maximum bending moment due to train of wheel loads on a simply-supported girder
- (i) always occurs at the centre of span
 - (ii) always occurs under the wheel load
 - (iii) Both (i) and (ii)
 - (iv) occurs at the $\frac{1}{4}$ th of any support
- (h) Three-moment equation is applicable, when
- (i) the beam is prismatic
 - (ii) there is no settlement of support
 - (iii) there is no discontinuity within the span
 - (iv) the spans are equal
- (i) The theorem of three moments expresses the condition of
- (i) equilibrium of forces
 - (ii) slope compatibility
 - (iii) Maxwell's reciprocal theorem

- (j) The rotational stiffness of a cantilever beam at its free end is
- (i) EI/L
 - (ii) $2EI/L$
 - (iii) $3EI/L$
 - (iv) $4EI/L$

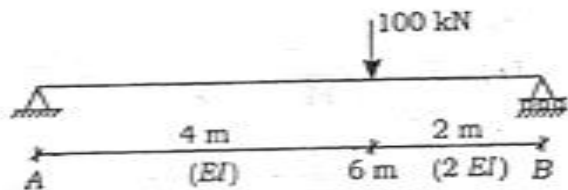
2. Calculate the reactions at the supports for the frame shown below :



3. Draw the SF and BM diagrams for the frame shown below :

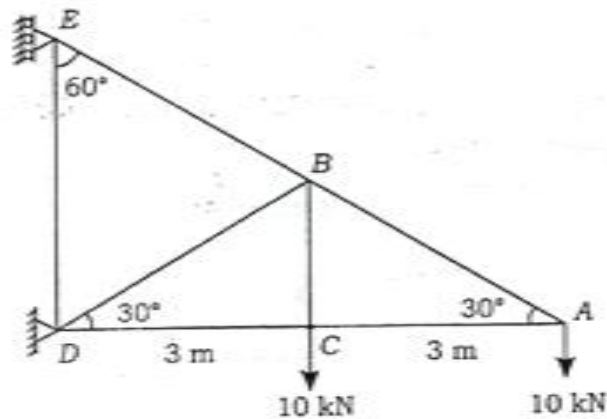


4. Calculate the maximum deflection in the beam and its location :

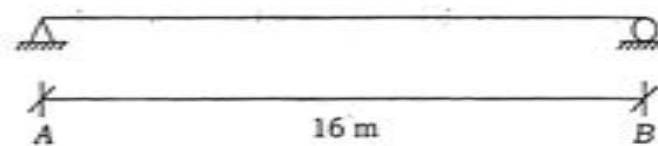
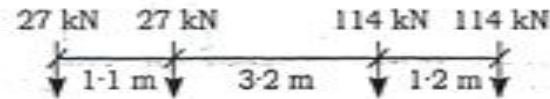


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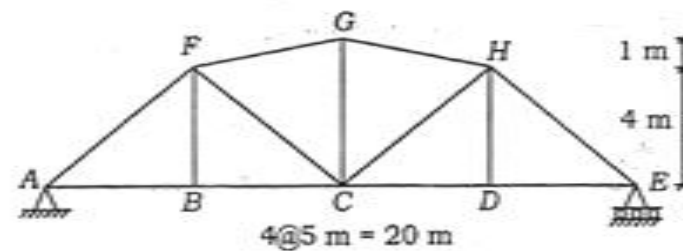
5. Determine the deflection of the point A of the truss $E = 2 \times 10^5 \text{ N/mm}^2$ and $A =$ cross section = 100 mm^2 (all the members) :



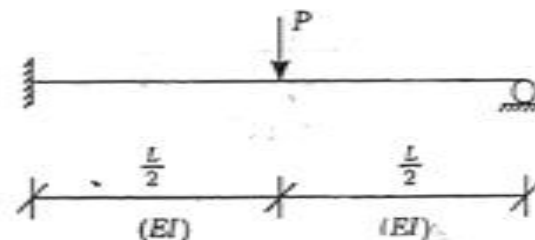
6. Determine the absolute maximum shear and moment for the beam as shown below, when a standard IRC class-A driving vehicle traverse in either direction :



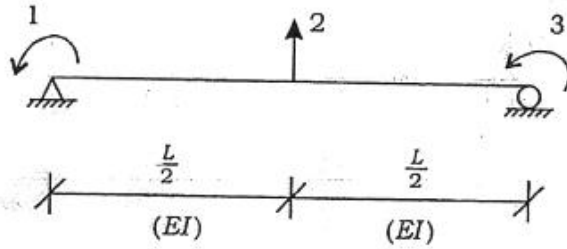
7. Draw the IL for the forces in members CD, CH and GH :



8. Using the method of consistent displacements, determine the reactions of the beam as shown below :



9. Generate the flexibility matrix f for the coordinates 1, 2 and 3 of the beam as shown below :



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