Code : 011511

B.Tech. 5th Semester Exam., 2014

STRUCTURAL ANALYSIS—I

Time : 3 hours   Full Marks : 70

Instructions :

(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

   (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 read 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) $4EI / L$

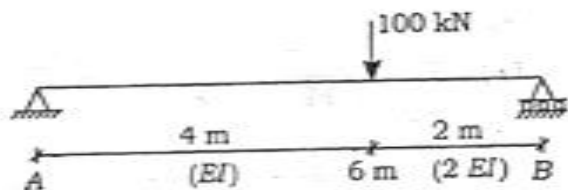2. Calculate the reactions at the supports for the frame shown below :
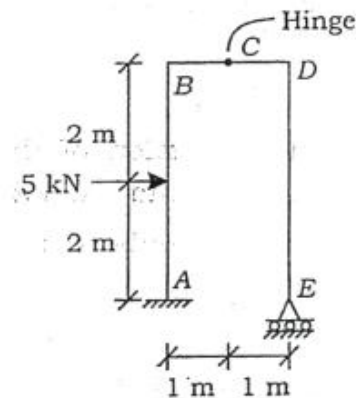
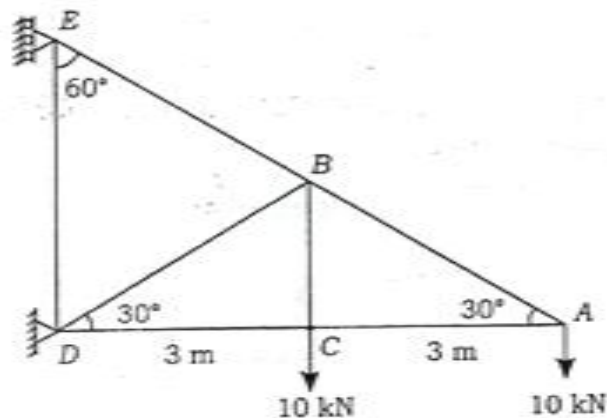
3. Draw the SF and BM diagrams for the frame shown below :

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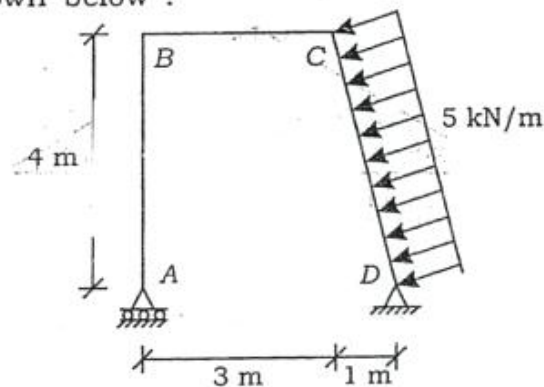
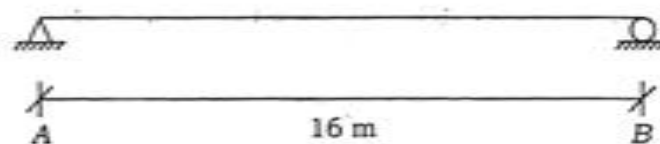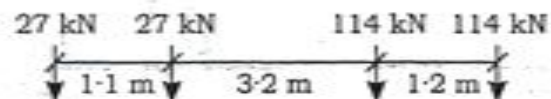**4.** Calculate the maximum deflection in the beam and its location :

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5. Determine the deflection of the point A of the truss $E = 2 \times 10^5$ N/mm^2 and A = cross section = 100 mm^2 (all the members) :
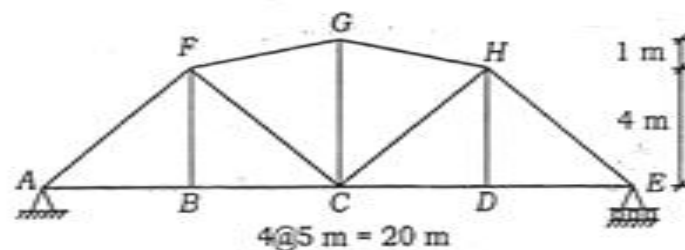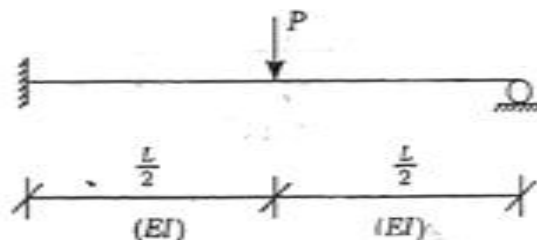
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6. Determine the absolute maximum shear and moment for the beam as shown below, when a standard IRC class-A driving vehicle traverse in either direction :
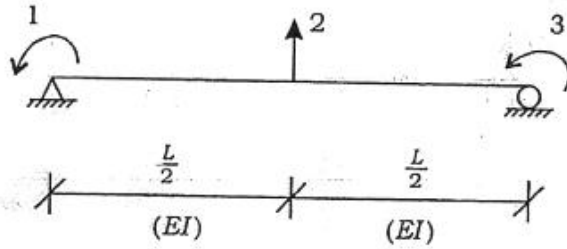

7. Draw the IL for the forces in members CD, CH and GH :

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

(Continued)

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

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