CS/B.Tech/Even/CE/4th Sem/CE-402/2014
2014
Structural Analysis

Time Allotted : 3 Hours   *Full Marks : 70*

The figure in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable

GROUP – A
(Multiple choice type questions)

1. Choose the correct alternatives for any *ten* of the following :

   10X1=10

   i. The Strain energy due to torsion or twisting moment is given by

   (a) $U = \int \frac{T^2}{2GJ} dl$

   (b) $U = \int \frac{T}{2GJ} dl$

   (c) $U = \int \frac{T^2}{GJ} dl$
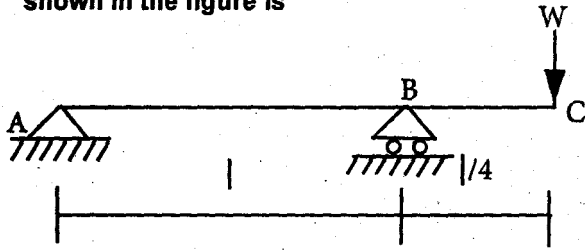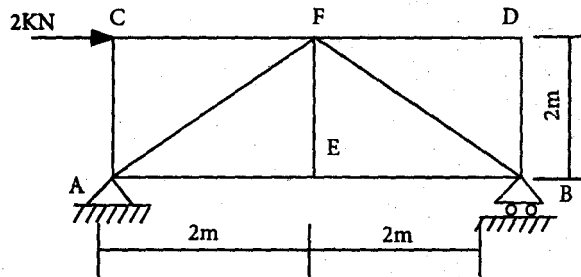
   (d) $U = \int \frac{T}{GJ} dl$

ii) The slope at the support 'A' of the overhanging beam shown in the figure is

(a) $\dfrac{W l^2}{2E}$ (b) $\dfrac{W l^2}{4E}$
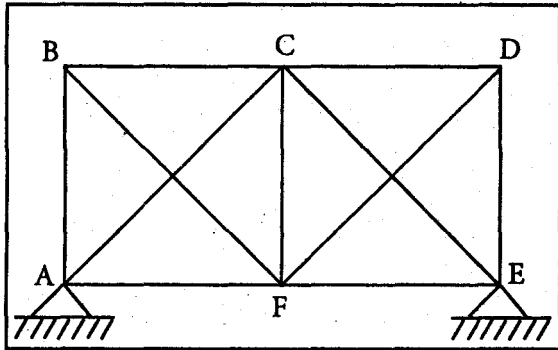
(c) $\dfrac{W l}{3E}$ (d) $\dfrac{W l}{6E}$

iii) A simply supported truss shown in the figure carries a load as shown. The force in member 'BE' is

(a) $\sqrt{2}$ KN(tensile)

(b) $\sqrt{2}$ KN(compressive)

(c) 1KN(tensile)

(d) 1KN(compressive)

iv) Determine the Degree of Indeterminacy for the truss in the given figure :

(a) 2   (b) 3   (c) 1   (d) 0

v) The Castigliano's second theorem can be used to compute deflections –

(a) In statically determinate structures only

(b) for any type of structure

(c) at point under the load only

(d) for beams and frames only

vi) The influence line for bending moment at point P within the span of a simply supported beam is

(a) Straight line with constant ordinate over the span of the beam

(b) parabolic over the span of the beam

(c) triangle, maximum at point P and zero at ends

(d) triangle, maximum at support

vii) In moment distribution method, the sum of distribution factors of all members meeting at any joint is always

(a) less than 1   (b) greater than 1

(c) 1   (d) zero

viii) A moment *M* is applied at the propped end of a cantilever beam of span *L* and flexural rigidity *EL*. The moment at the fixed end will be

(a) 2 *M*

(b) M

(c) *M*/2

(d) *M*/3

ix) A parabolic two hinged arch carrying u.d.l will have zero bending moment at all sections

(a) only if it has uniform cross-section throughout

(b) only if it has M.I. of the cross-section varying with secant of the slope of the arch axis

(c) for only variation of cross-section

(d) under no circumstances

x) Degree of Static Indeterminacy in a pin-jointed plane truss is given by :

(a) m+2j–r

b) m+r–2j

c) 3m+r–3j

d) 3m+3j–r

xi) A three hinge arch of span '*l*' and rise 'h' subjected to a uniformly distributed load of 'w' per unit length over the whole span. The horizontal thrust at each support is –

(a) $Wl^3/8h$

(b) $Wl^2/8h$

(c) $Wh^2/8l$

(d) $Wl^2/8$

xii) Rotational stiffness of a prismatic member AB at end A when the far end is hinged is :

(a) 4EI/L

(b) 3EI/L

(c) 2EL/L

(d) EI/L

Group-B
(Short type answer questions)
Answer any *three* of the following
$$3 \times 5 = 15$$

2. Describe the Betti'e law and Maxwell's reciprocal theorem
   5

3. Determine the mid span deflection and end slope of a simply supported beam of length L carrying a concentrated point load W at its mid span. Use castigliano's theorem. Assume EI = constant.
   5

4. State and prove Moment-Area Theorems with sketch.
   5

5. A cable of span 20m and dip 4m carries a uniformly distributed load of 20kN/m over the whole span. Find the
i. Maximum tension in the cable   ii. Minimum tension in the cable   iii. Length of the cable.   5

6. Analyze a two span continuous beam totally loaded by an UDL of w/m Length, by using stiffness method. Length of each span=L/2. Both supports are fixed. EI is constant.

Group – C
(Long Answer Type Questions)
### Answer any three Questions
$$3 \times 15 = 45$$

7. A three hinged parabolic arch of span 42 m and rise 14 m carries two vertical concentrated loads of values 160 kN each acting symmetrically at a distance of 14m from the nearest support. The moment of inertia of any cross-section of the arch is I=I_c Sec   where I_c is the M.I. at the crown and   is the slope of the arch rib axis. Draw the BM disgrams, showing values of maximum BM and location of point of contra flexure. Also find SF and normal thrust at the load point.   [15]

1036   5   [Turn over]

8. Determine the deflection at centre point C and slopes at ends A and B of the simply supported beam AB shown in figure below by both the Moment-Area and Conjugate Beam Methods. Given that, $E = 205 \times 10^6$ kN/m² and $I = 80 \times 10^6$ mm⁴.   [15]
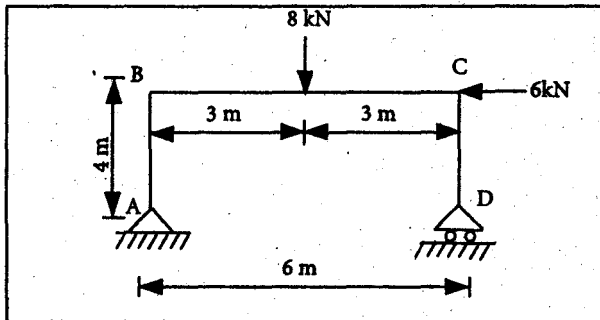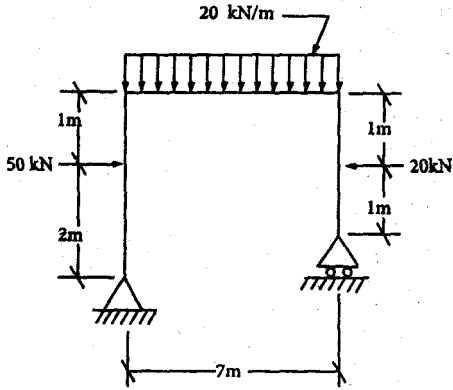

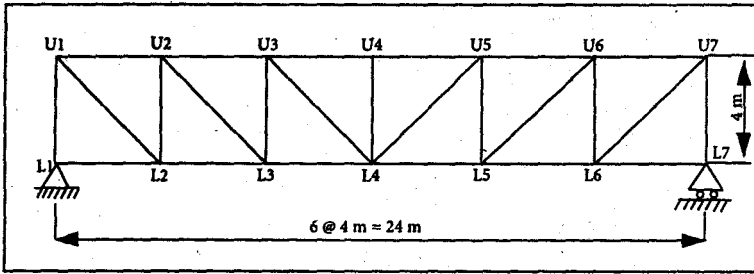9. Analyze the following problem by three moment equations (EI Constant: No settlement of supports).

15
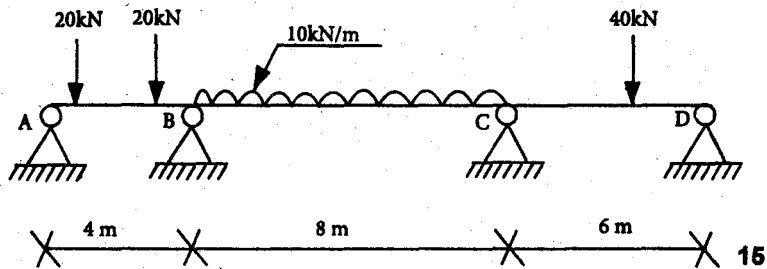
10.   Analyze the portal frame shown in fig. Also sketch SFD, BMD and axial force diagram.

[15]

11. Draw the influence line diagram the forces in the following members U_1L_1, U_2L_2, U_2L_3, U_4L_4, U_2U_3 of the through type bridge truss shown in the figure below. Consider the unit load to be moving at the level of lower chord.

[15]

_____X-X-X_____