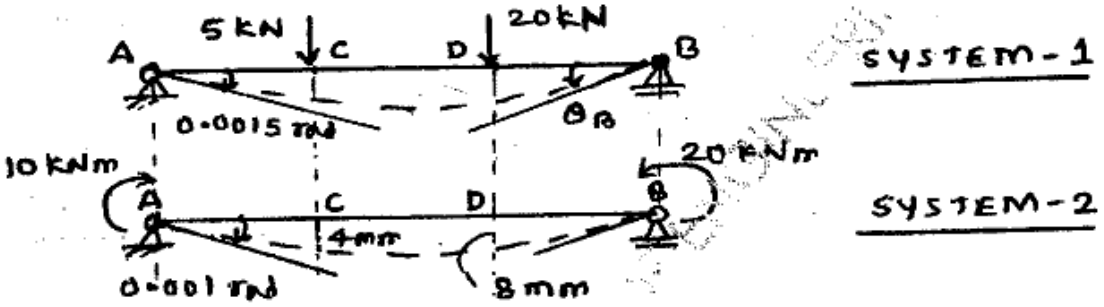
(OLD COURSE)

Maxmum Marks-100 Duration-3 hrs

N.B. 1) Question No. 1 is **compulsory.** Attempt **any four** out of remaining **six** questions.
2) Figures to the **right** indicate full marks.
3) Assume suitable data if needed but justify the same.

Q.1 a) State & explain Mohr's theorems I & II to determine displacement in a structure. (4)
b) Explain the necessity of stiffening girder in a cable-suspension bridge. (4)
c) Define the terms- i) Effective length of column ii) Slenderness ratio. (4)
d) Explain the terms- i) Unsymmetrical bending ii) Product of inertia. (4)
e) Two system of loads & displacements for a simply supported beam are as shown in figures Find the displacement ' θ_B ' using appropriate energy theorem. (4)



Q.2 a) A suspension cable bridge of span 90 m and central dip of 9 m is strengthened by a 3-hinged stiffening girder. The girder is hinged at each end & also at mid span. If the girder carries a dead load of 15 KN/m along with a point load of 120 KN at a section 15 m to the left of central hinge, calculate maximum & minimum tension in the cable. Also draw SFD & BMD for stiffening girder indicating salient points. (12)

b) A simply supported beam of span 4 m carries udl of 12 KN/m over the entire span. If the beam c/s is rectangular of size 250 mm X 500 mm and the plane of loading is inclined at 30 ^{0} (clockwise) with the minor principal axis, find the maximum tensile & maximum compressive stress produced on the cross section. Also locate the neutral axis. (8)

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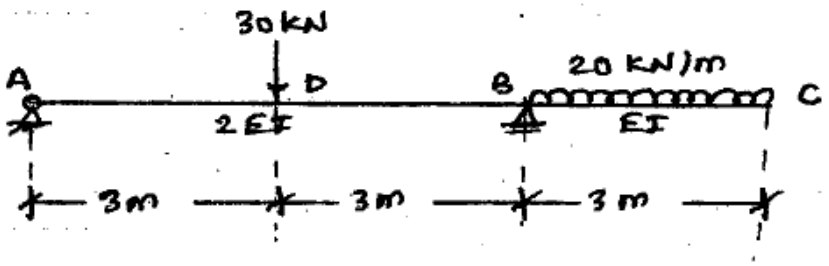
Q.3 An overhanging beam is loaded & supported as shown in figure-



a) Find slopes at A and B & deflections at point D and C using Moment Area Method. (10)

b) Verify above obtained displacements values by Conjugate Beam Method. (8)

c) Draw deflected shape of the beam. (2)

Q.4 a) A parabolic arch ADCB of span 30 m and central rise 4 m is hinged at its ends and the third hinge is provided at left quarter point 'D' on the arch rib. If the arch carries udl of 10 KN/m on right half portion CB along with a point load of 20 KN at 'D', find-

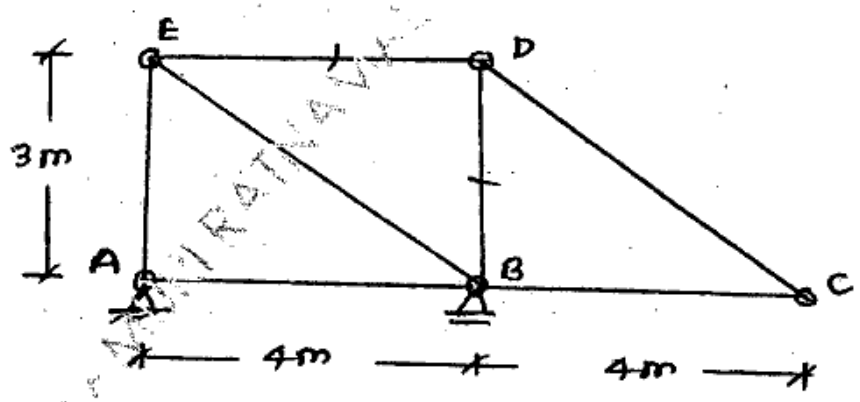
i) Support reactions. (3)

ii) NT, RSF and BM at right quarter point. (6)

iii) Maximum BM in portion CB (3)

Also draw BMD for the arch (2)

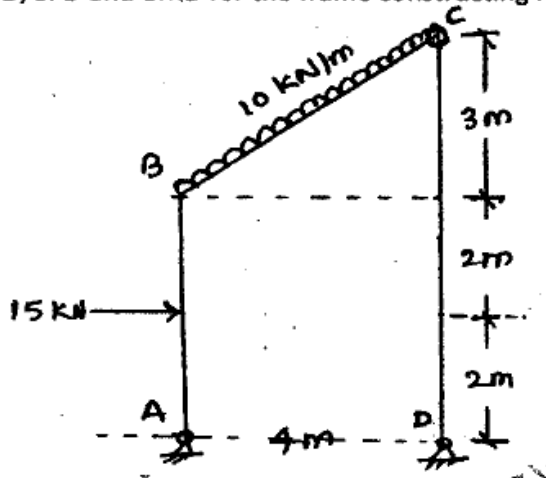
b) Construct ILD for axial force in truss members ED & DB as shown in figure 3(b) (6)



Q.5 a) For the plane frame loaded and supported as shown-

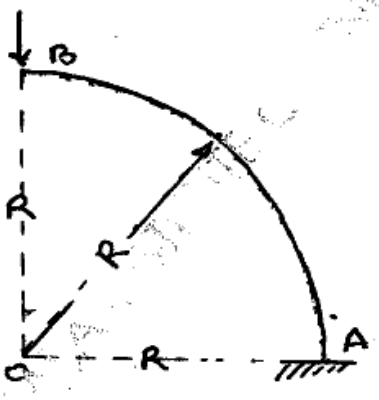
i) Find reactions at supports. (2)

Ii) Draw AFD, SFD and BMD for the frame constructing FBD of each member. (12)



C-Internal Hinge

b) Using strain Energy Method, find vertical deflection at the free end 'B' of a bent cantilever loaded as shown. (6)



Q.6 a) A simply supported girder of span 40 m is traversed by a train of wheel loads 120KN, 150KN, 200KN & 100 KN spaced at 2 m, 1 m and 1 m distances respectively, from left to right with 100 KN load leading. Find the location & magnitude of absolute maximum BM anywhere in the girder. (10)

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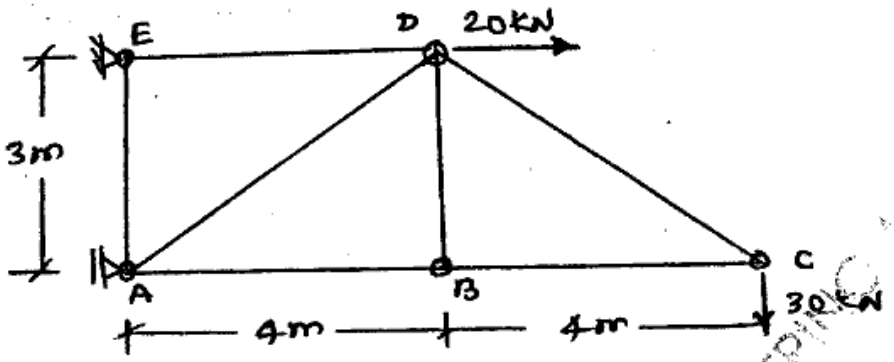
b) Using Castigliano's theorem or Virtual work method, calculate the vertical deflection of joint 'B' of a pin-jointed truss loaded and supported as shown in figure. (10)
Assume E = 200 GPa & c/s area of each member = 1200 mm^2.



Q. 7 a) Derive the expression for maximum normal stress produced in a uniform strut of length 'L', hinged at both ends and subjected to longitudinal load 'P' at each end acting at an eccentricity 'e'. (8)
b) For the rigid jointed plane frame loaded shown in figure, find the rotation θ_A at hinge support 'A' and horizontal movement Δ_x at roller support 'D'. Use Unit load method. EI = Constant for all members. (12)