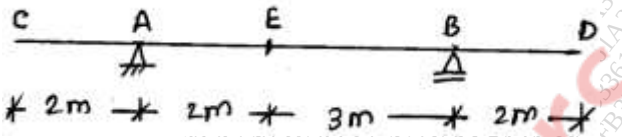
(3 Hours) **(Max. Marks-80)**

N.B.

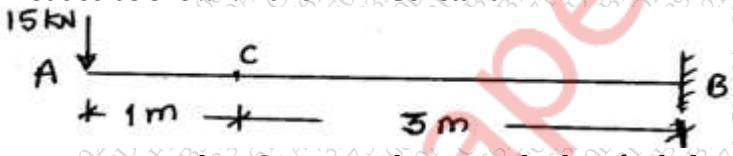
1) **Question no.1 is compulsory. Attempt any three out of remaining five questions.**
2) **Figures to the write indicate full marks.**
3) **Assume suitable data if needed but justify the same.**

Q.1 Attempt **any five** from following-

a) For the beam shown in figure, draw qualitative ILD for V_A, V_B, SF_E and BM_E. 4



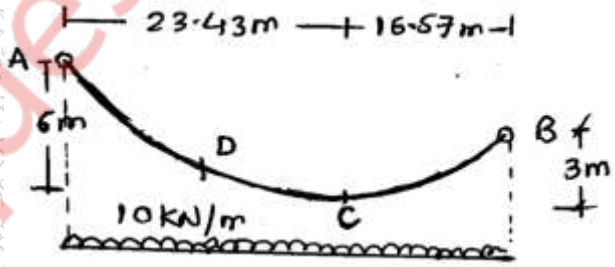
(b) Using Maxwell's reciprocal theorem, find the deflection at point 'C' for the cantilever beam loaded as shown. Take EI = Constant 4



(c) State the propositions used in Conjugate beam method to find slope & deflection and convert the following beams in to conjugate beams. 4

(d) Define the term product of inertia. Also state its importance in structural analysis. 4

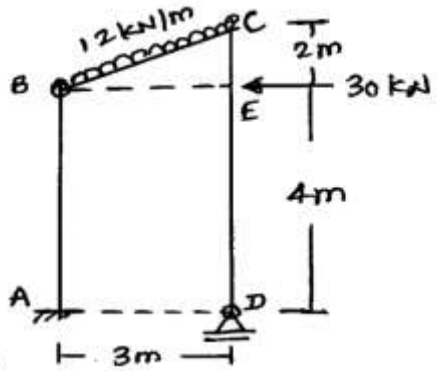
(e) In an unsymmetrical cable of span 40 m is loaded as shown, find cable tension T at point 'D', located 15 m away from left support 'A'. 4



(f) Based on basic approaches, classify the various methods used to find displacement in structures. Which one of these methods is most versatile in your opinion? Give reason for your choice. 4

TURN OVER

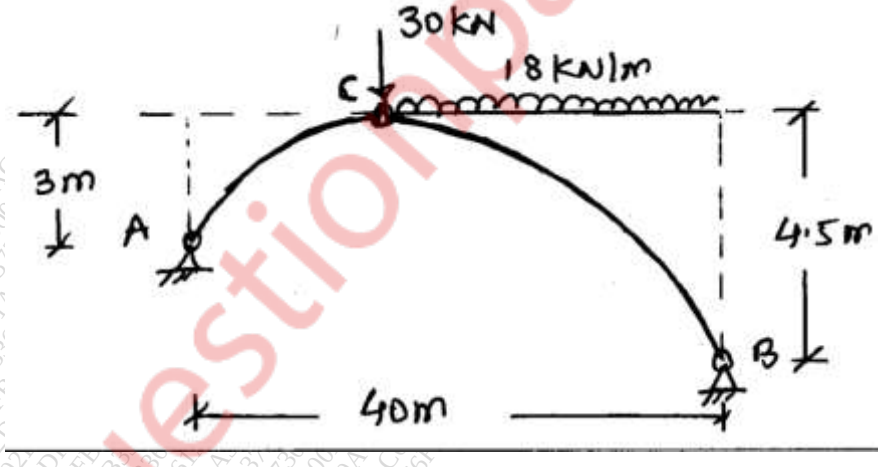
Q.2 (a) For a rigid jointed plane frame shown in figure, find support reactions and draw FBD for all three members. Also draw AFD, SFD and BMD for the frame, indicating important points. Note that there is internal hinge at 'B'. 10



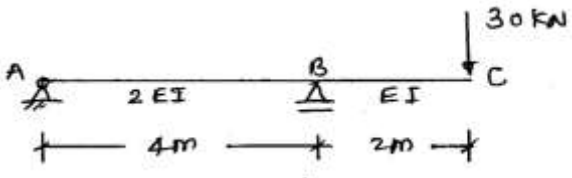
(b) An unsymmetrical 3-hinged parabolic arch is loaded as shown in figure. Locate the position of third hinge C and determine- 10

1) Support reactions.
2) NT and RSF at section 'D' 10 m away from A.
3) Location & magnitude of maximum BM in portion CB

Also draw BMD for the arch.

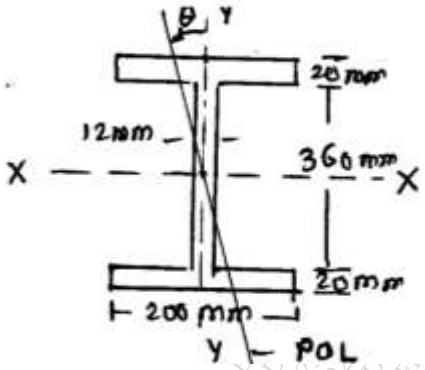


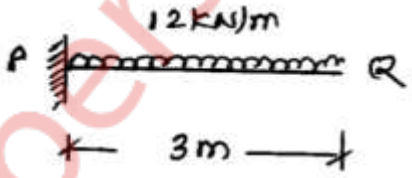
Q.3 (a) Using Moment Area Method **OR** Conjugate beam method, determine in terms of EI,the slope and deflection at the free end 'C' of an overhanging beam loaded as shown. 12



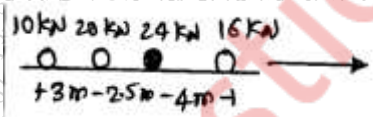
Q.3 b) A hollow circular column of length 6 m, external diameter 200 mm and internal diameter 160 mm is fixed at on end & hinged at the other end. If the column carries a load of 160 KN applied at distance 40 mm from column axis, determine extreme fibre stresses. Take E for column material as 120 GPa. 8

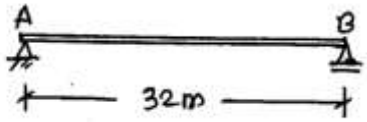
Q.4 a) Figure shows the symmetrical I-section of a cantilever beam of span 3 m. Flange size 200 mm x 20 mm & web size 12 mm x 360 mm.. The beam is loaded with UDL of intensity 12 KN/ m over the entire span as shown but the plane of loading is inclined at an angle $\theta = 32^0$ with vertical axis. Locate the neutral axis and find the maximum compressive & tensile stresses produced at critical section. Also sketch the bending stress distribution diagram. 10





(b) A simply supported girder of span 32 m is traversed by a series of four wheel loads 10 KN, 20 KN, 24 KN and 16 KN spaced at distances 3 m, 2.5 m and 4 m respectively. If the load system is moving from left to right with 16 KN as leading load, find maximum BM under 24 KN load. Is it absolute maximum BM? Give reason. 10

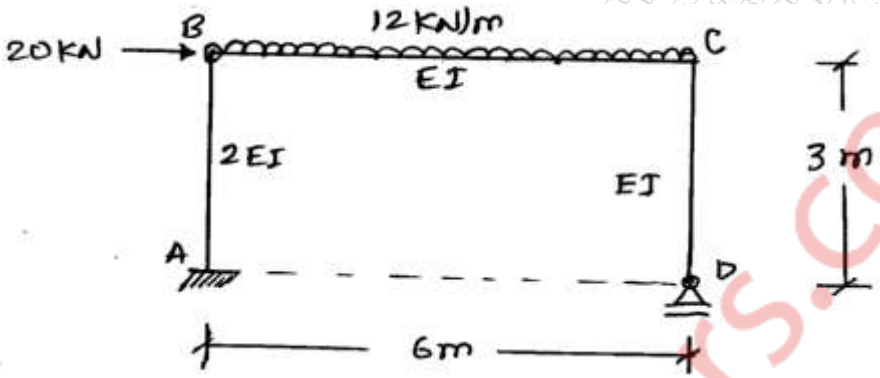




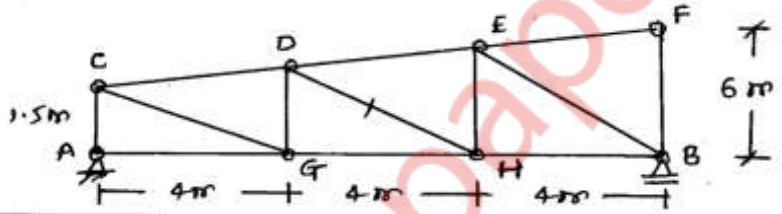
Q.5 (a) A 3-hinged stiffening girder of a suspension bridge of span 120 m is subjected to a live load of length 25 m and intensity 30 KN/m moving from left to right. Draw SFD and BMD for the girder, when the head of live load just touches the central hinge on the girder. 12

TURN OVER

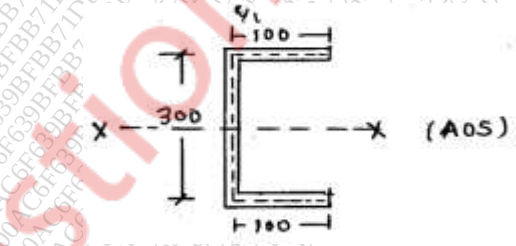
(b) Determine horizontal movement of roller support at 'D' in a rigid jointed plane frame loaded as shown. Use Virtual work method. Note that there is an internal hinge at 'B'. 8



Q.6 (a) Draw ILD for axial force in member DH of a bridge truss of spam 12 m as shown in figure. 4



(b) Locate the shear centre for thin walled channel section as shown in figure. Assume the uniform section as 10 mm. Cross sectional dimension are in mm 6



Q.6 (c) Using Unit load method or any other Energy method, determine vertical deflection of joint 'E' of the pin jointed truss loaded as shown in figure. Take AE= Constant for all the members. 10