

Con. 9432-13.

GS-7065

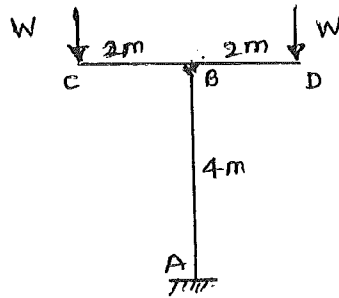
(3 Hours)

[Total Marks : 100

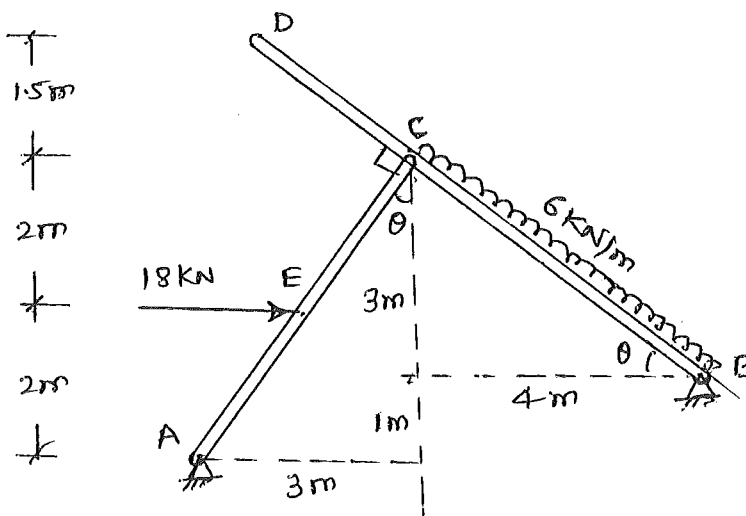
- N.B. 1) Question No. 1 is **compulsory**. Attempt **any four** questions out of remaining **six** questions.
 2) Figures to the **right** indicate full marks.
 3) Assume suitable data if needed but justify the same.

Q.1 Answer following questions-

- a) State the internal forces acting at any section of a i) Cable ii) Beam iii) Arch iv) Pin-jointed frame v) Rigid-jointed frame. (05)
 b) A straight uniform bar of circular cross section is subjected to pure bending. Compare the strain energy in flexure with the torsional strain energy when the same bar is subjected to a constant torsional moment of magnitude equals to that of bending moment. Take $E=2.5G$. (05)
 c) A symmetrical cable of span 100 m with central dip 12 m is loaded with udl of 24 KN/m. Find the maximum & minimum tension in the cable. (05)
 d) Find the value of load 'W' at which the column AB just buckles. Note that the member 'CD' is rigidly connected to the column at 'B' as shown in figure. $EI = \text{CONSTANT}$ (05)



- Q.2 a) In the plane frame loaded & supported as shown in figure, the member AC is pin connected at 'C' to the other member BD. Find the support reactions and draw AFD, SFD & BMD, constructing clearly the FBD of member AC and BCD. (14)

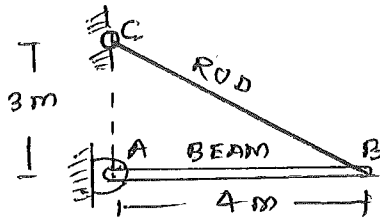


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b) A beam AB is supported by a rod BC which is hinged at points 'B' and 'C' as shown. Construct ILD for tension in the rod and find its maximum value due to a load of 15 kN moves along AB. (06)



Q.3 a) A three hinged stiffening girder of a suspension bridge of span 90 m is subjected to udl of 50 kN/m over left half portion of span along with a point load of 100 kN at 60 m from left support. The supporting cable has a central dip of 9 m. Calculate maximum SF and BM in the girder. Also draw SFD & BMD for the girder. (12)

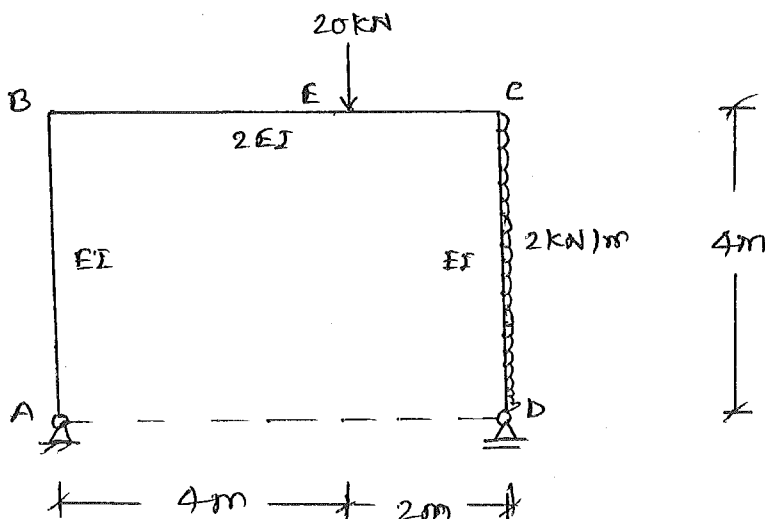
b) A simply supported girder of span 30 m, is traversed by a series of wheel loads 150 kN, 200 kN, 250 kN and 200 kN spaced at distances 3 m, 3 m and 2 m respectively. The load system moves from left to right with 200 kN load leading. Find the location & magnitude of absolute maximum bending moment anywhere in the girder. (08)

Q.4 a) A three hinged symmetrical parabolic arch ACB hinged at the ends A & B and at the crown 'C' is of span 30 m with central rise 7.5 m. It is loaded with udl of intensity 20 kN/m over right half portion of arch along with a point load of 15 kN at the crown. Find-

- i) Support reaction (02)
 - ii) BM, NT and RSF at right quarter span point 'E' (06)
 - iii) Position and magnitude of maximum BM in part AC. (02)
- Also draw BMD for the arch. (02)

b) A hollow circular column section of external diameter 200 mm with metal thickness 20 mm is 5.5 m long having one end fixed and other hinged. It carries a load of 100 kN at an eccentricity of 25 mm from column axis. Find the maximum & minimum stresses induced in the c/s. Also draw stress distribution diagram at no tension condition Take $E = 200 \text{ GPa}$. (08)

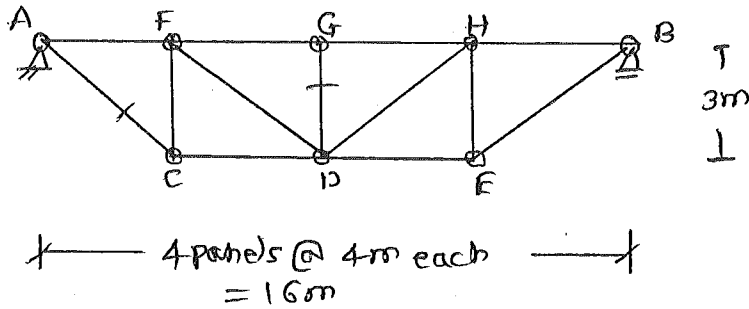
Q.5 a) For the rigid jointed plane frame loaded & supported as shown, find the horizontal movement of roller support at 'D'. Use **Virtual Work Method**. (12)



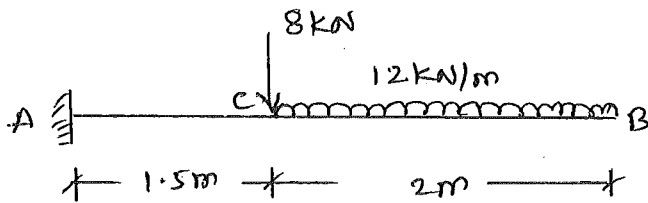
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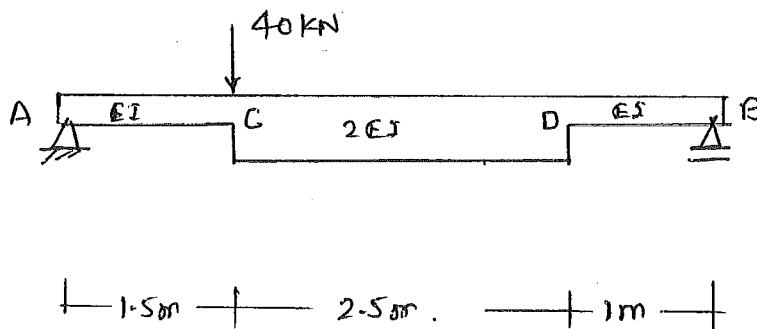
b) Draw ILD for axial force in the members 'AC' and 'DG' of a simply supported bridge truss shown in figure. Also find the maximum values of these forces if a load of 90 KN moves along the top chord members. (08)



Q.6 a) A cantilever beam of span 3.5 m is loaded as shown in figure. Find the slope and deflection at the free end 'B'. Use Moment Area Method. $EI = \text{constant}$ (10)

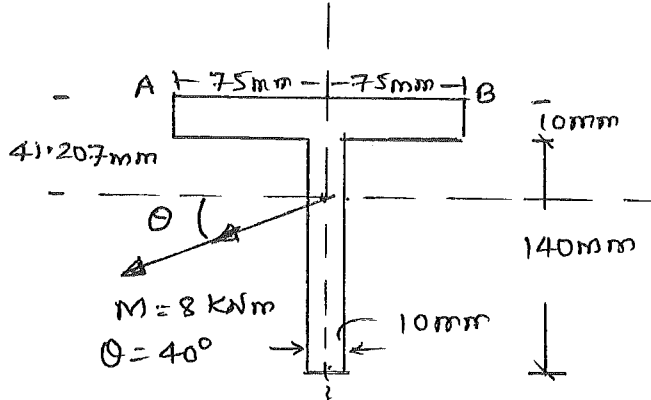


b) Using Conjugate Beam Method, determine slope at 'A' and deflection ^{at} 'C' of a non-prismatic simply supported beam loaded as shown in figure. Take $EI = 6000 \text{ KN m}^2$. (10)



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Q.7a) Figure shows the cross section of a Tee beam with its c.g. 41.207 mm below the top surface AB. The c/s is subjected to a sagging bending moment of 8 KNm acting in a plane shown in figure. Find the maximum compressive & tensile stresses induced in the c/s. Also locate the neutral axis position. (08)



b) Using unit load method or any other energy method, find the vertical deflection of joint 'E' of a pin jointed truss loaded & supported as shown in figure. Take $AE = \text{Constant}$ for all members. (12)
 $A = 1000 \text{ mm}^2$ $E = 2 \times 10^5 \text{ N/mm}^2$

