(**3 Hours**)　　　　　　　(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　Answer **any four** from following-
(a) For a 3-hinged symmetrical parabolic arch subjected to UDL over the entire span, prove that the radial shear force at every section is zero.　　5
(b) Write Prof.Perry's formula, explaining the terms involved. Also state the importance of this formula over Secant formula.　　5
(c) State & explain Moment Area Theorem-II. Also draw the conjugate beams for following real beams shown below-　　5


(d) Explain with neat sketches the terms-(i) Unsymmetrical bending (ii) Shear centre. Also state their significance in structural analysis.　　5
(e) Write the BM equation needed as per Macaulay's method for the beam loaded as shown-　　5
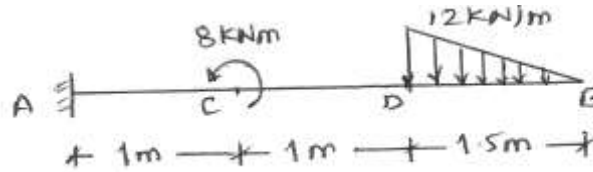

(f) State and explain-
i.　Principle of superposition　　5
ii.　Castigliano's theorem.

Q.2　(a) For a rigid jointed plane frame shown in figure, find support reactions and draw FBD for all four members. Also draw AFD, SFD and BMD for the frame, indicating important points. Note that there is internal hinge at 'B'.　　10
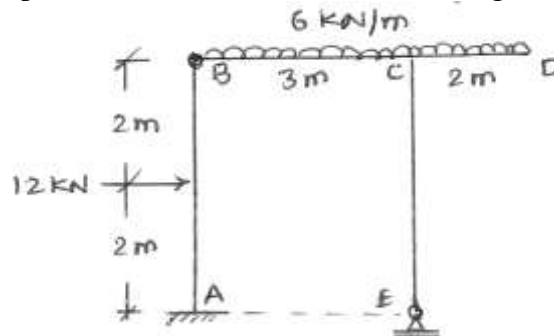
(b) A pin jointed truss is loaded and supported as shown in figure. Determine the 10
horizontal deflection of joint 'C' using Unit Load Method.
Take axial rigidity AE = 30,000 KN for all members.
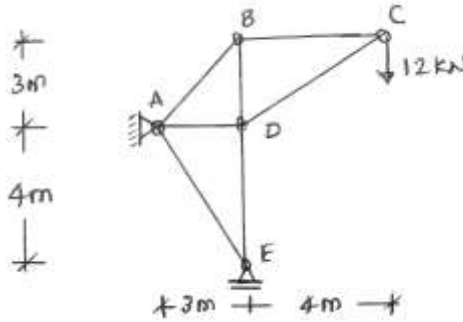

Q.3 (a) An unsymmetrical 3-hinged parabolic arch is loaded as shown in figure. 10
Find-
   i.   The position of third hinge at 'C' above the right support.
   ii.   Support reactions. .
   iii. The position & magnitude of max +ve and max -ve BM in the arch.
         Also draw BMD for the arch.
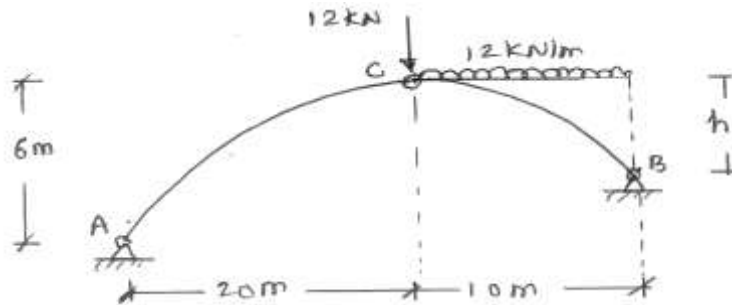
Q.3 (b) A hollow circular column of length 6 m, external diameter 200 mm and 10
internal diameter 150 mm is fixed at both ends. If the column carries a load of 180
KN applied at distance 45 mm from column axis, determine extreme fibre stresses.
Also sketch the stress distribution diagram. Take E for column material as 96 GPa.

Q.4 (a) Using Moment Area Method **OR** Conjugate beam method, determine the 10
location and magnitude of maximum deflection in a non-prismatic simply
supported beam loaded as shown.
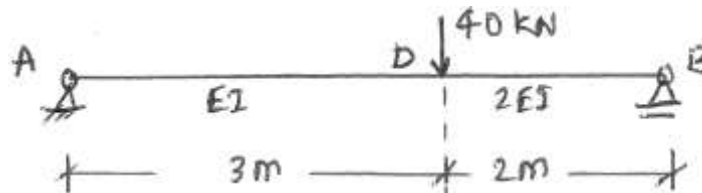
(b) A simply supported girder of span 24 m is traversed by a series of five wheel 10
loads   10 KN,20 KN, 20 KN, 25 KN and 15 KN spaced at distances 3 m, 2 m, 2
m and 3 m respectively. If the load system is moving from left to right with 15 KN
as leading load, find the location & magnitude of absolute maximum BM in the
girder.

Q.5 (a) A 3-hinged stiffening girder of a suspension bridge of span 120 m is subjected   12
to two point loads of 180 KN and 240 KN at distances 30 m and 80 m respectively
from left support. The supporting cable has a central dip of 12 m. Draw SFD &
BMD for the girder, indicating important points. Also find maximum & minimum
cable tension.

(b) The T-shaped cross section of a 4 m long simply supported beam has flange &   8
web dimensions 120 mm x 20 mm and 20 mm x 180 mm respectively. The beam
carries a central point load of 40 KN inclined at angle 30^0 (clockwise) with vertical
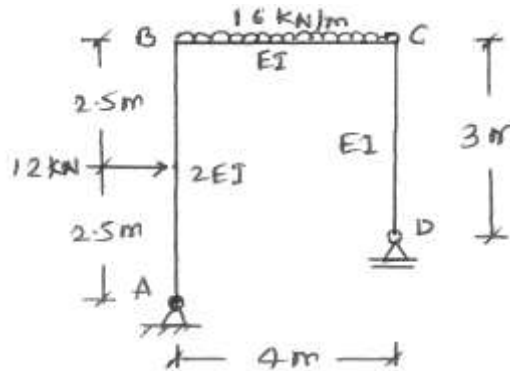axis of cross section. Find maximum compressive and maximum tensile stresses.

Q.6 (a) Draw ILD for axial force in bottom chord member GH of a warren truss shown   4
in figure.
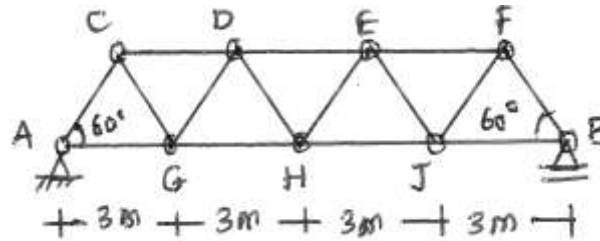
(b) A rod AB of uniform cross section is fixed at 'A' and is bent in vertical plane   6
to give the shape of quadrant of a circle of radius 'R'. At free end B a vertical load
W (downward) is applied. Determine-
   i.   Strain energy stored in the rod due to bending moment
   ii. Vertical deflection at B. Assume EI=Constant.

(c) Determine horizontal deflection at joint 'B' in a rigid jointed plane frame   10
loaded as shown in figure. Take EI = 40,000 KNm^2. Use Virtual work method.

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