# STRUCTURAL ANALYSIS - II
# (CIVL 3101)

**Time Allotted : 3 hrs** **Full Marks : 70**

***Figures out of the right margin indicate full marks.***

***Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.***

***Candidates are required to give answer in their own words as far as practicable.***

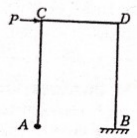
## Group – A
## (Multiple Choice Type Questions)

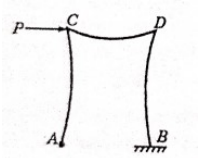
1. Choose the correct alternative for the following: **10 × 1 = 10**

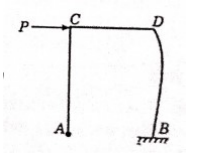
(i) Moment Distribution method is
(a) interactive (b) finite difference
(c) iterative (d) none of these.

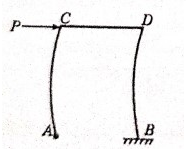
(ii) When the far end of the beam member is hinged, carry over factor at the far end is
(a) 0.05 (b) 0.0 (c) 1.0 (d) none of these.

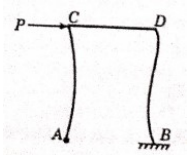
(iii) The deflection curve for the portal frame shown below is



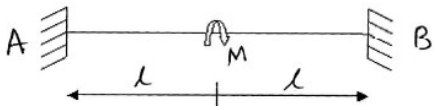

(a) 


(b) 


(c) 


(d) 


(iv) The fixed end moment $M_{FAB}$ for the beam shown below is

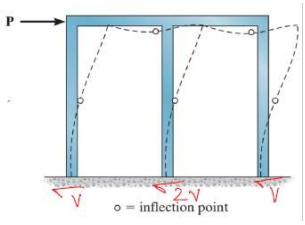



(a) 0 (b) M/2 (c) M/4 (d) 2M.

(v) Application of Winkler-Bach equation in curved beams is done when
(R = Radius of curvature, D = diameter)
(a) R>=6D (b) R>= 4D (c) R< 5D (d) R> 5D.

(vi) In plastic analysis, the shape factor of circular section is:
(a) 1.5 (b) 1.6 (c) 1.7 (d) 2.5.

(vii) The following diagram is based on portal frame. Select which of the following methods frame analysis matches with this diagram.




(a) Cantilever method (b) Kani's method

(c) Substitute method (d) Portal method.

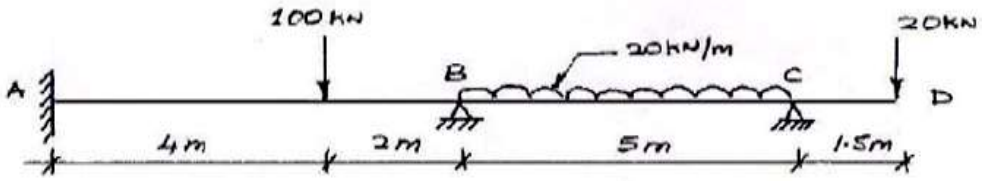
(viii) For the evaluation of the fully plastic moment, we make the following assumptions
(a) Plane section remains plane both before and after bending.
(b) The material is homogenous and isotropic.
(c) Hooke's law is applicable in elastic range.
(d) All of the above.

(ix) For approximate analysis of lateral loads, the portal method is applicable for
(a) only vertical loading on building frame
(b) only lateral loading on building frame
(c) both vertical as well as lateral loading on building frame
(d) none of these.

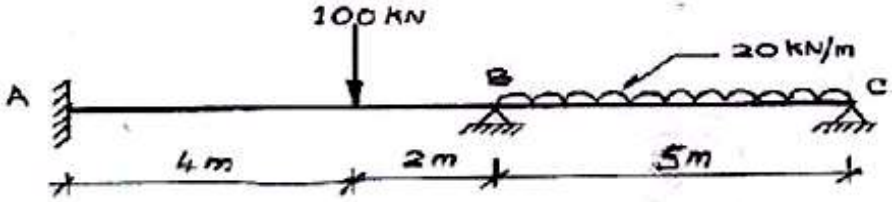
(x) Study the following statements:
**Statement I:** The displacement method is more useful when degree of kinematic indeterminacy < degree of static indeterminacy.
**Statement II:** The displacement method is more useful when degree of kinematic indeterminacy > degree of static indeterminacy.
**Statement III:** The force method is more useful when degree of static indeterminacy > degree of kinematic indeterminacy.
**Statement IV:** The force method is more useful when degree of static indeterminacy < degree of kinematic indeterminacy.
(a) Statement II and III (b) Statement I and III
(c) Statement II and IV (d) Statement I and IV.

## Group – B

2. (a) Analyze the continuous beam ABCD by Slope-deflection method and draw Bending Moment Diagram. Take EI constant.

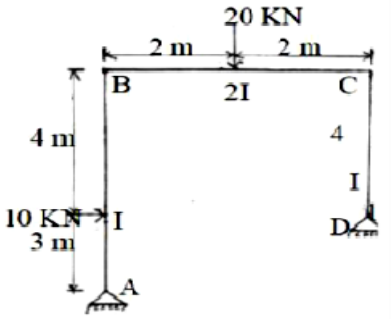



(b) Analyze two span continuous beam ABC by Slope-deflection method. Draw Bending Moment Diagram and Shear Force Diagram. Take EI is constant.




**6 + 6 = 12**

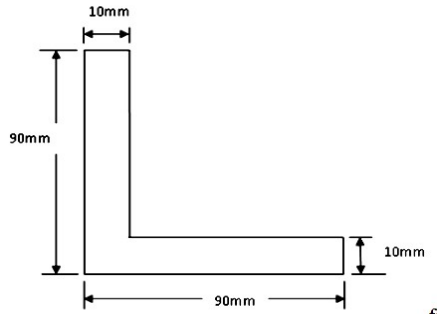
3. Analyze the frame shown in fig. below by Moment Distribution method. Draw Bending Moment Diagram. Take EI is constant. Beam CD is 4 m.



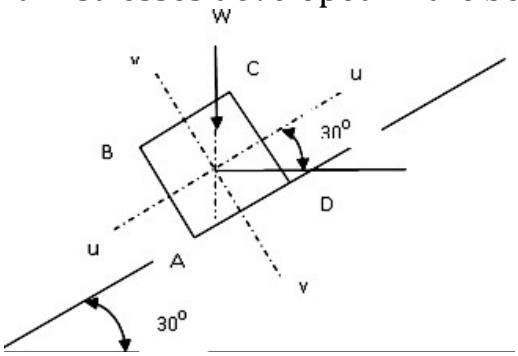

**12**

## Group – C

4. (a) A 90mm × 90mm × 10mm equal angle is placed with the one leg vertical as shown below. It is subjected to a sagging bending moment of 700 N-m on the horizontal axis. Determine the stresses induced at points P1 and P2. P1 is at the left top corner point and P2 is at the right bottom corner.

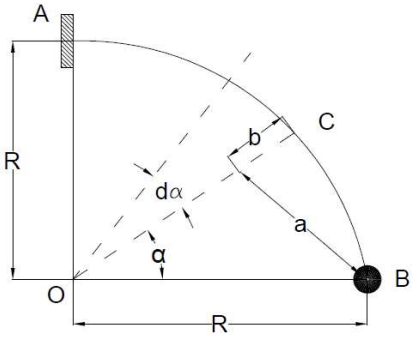



(b) A wooden beam of cross section 150 mm × 150mm is used as shown in Fig. to support a sloping Mangalore tiled roof. It has an effective span of 5m and carries a uniformly distributed load of 4kN/m acting vertically downward. Determine the maximum stresses developed in the beam.

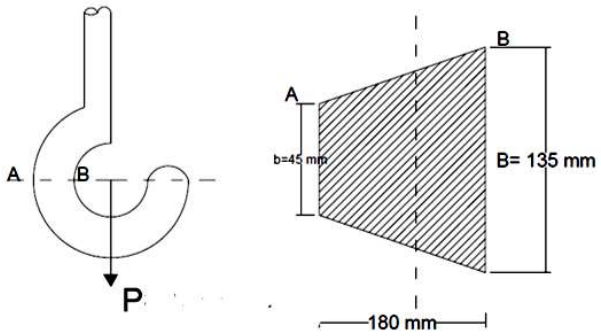



**6 + 6 = 12**

5. (a) A quarter circle beam of radius curved in plan is fixed at end A and free at end B as shown. It carries a vertical P at it's free end. Determine the deflection at the free end and sketch the shear force, bending moment and torsional moment diagrams. Assume flexural rigidity (EI)= twice the torsional rigidity (GJ).



(b) The figure below shows a crane hook lifting a load of 100 kN. Determine the maximum compressive and tensile stresses in the critical section of the crane hook. Distance form point B to centre of curvature of the hook crane is 100 mm.




**6 + 6 = 12**

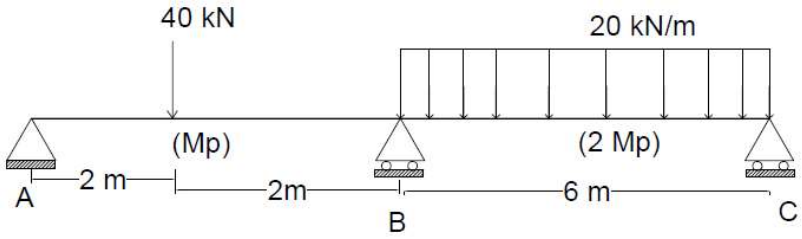
## Group – D

6. (a) A mild steel unsymmetrical I section of 200mm width upper flange and thickness 20mm and lower flange of 250mm width and 20mm thickness. Web of width 10mm and overall depth is 250mm.Calculate the shape factor. Find the fully plastic moment if $\sigma_y = 250 N/mm^2$.

(b) Determine shape factor of a Triangular section.

**7 + 5 = 12**

7. (a) Calculate the plastic moment capacity required for the continuous beam with load shown in the fig below. The load factor is 1.5.

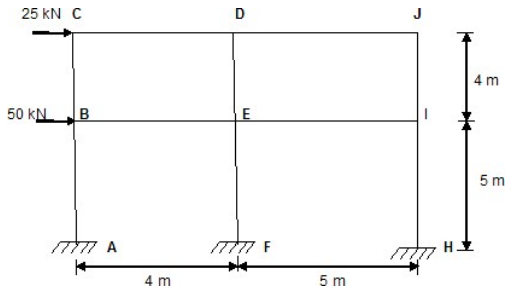



(b) Find shape factor of a T section having Flange of width 100mm and thickness 10mm. Web of width 10mm and thickness 90mm.

**7 + 5 = 12**

## Group – E

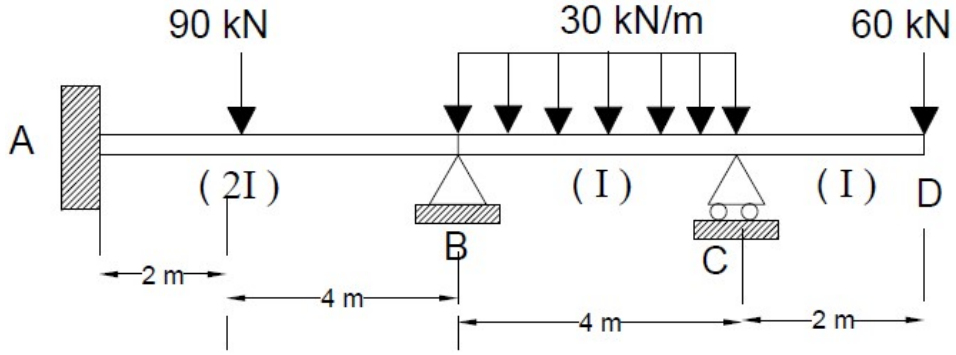
8. (a) Write the assumptions involved in Cantilever method of multi-storied frame analysis subjected to Lateral loads.




(b) Analyse the building frame shown below using Portal method. Draw the complete SFD and BMD.

**2 + 10 = 12**

9. Analyse the continuous beam ABCD shown in the figure by stiffness matrix method. Also draw the BMD.

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| Department & Section | Submission link: |
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