STRUCTURAL ANALYSIS – II
(CIVL 3101)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

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

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

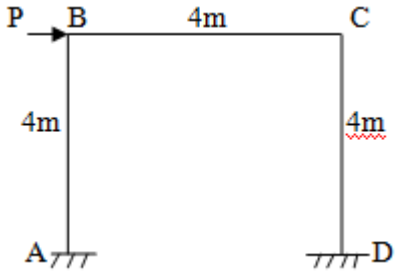
(i) When far end of a beam member is hinged, carry over factor at the far end is
(a) 0.05 (b) 0.0 (c) 1.0 (d) None of these

(ii) Which of the following methods of structural analysis is force method?
(a) Slope-deflection (b) Column analogy
(c) Moment distribution (d) Conjugate beam

(iii) Unsymmetrical bending occurs when
(a) The beam cross-section is unsymmetrical
(b) Shear centre does not coincide with the neutral axis
(c) Beam is subjected to an additional bending moment
(d) Bending moment diagram is unsymmetrical.

(iv) When a curved bar is bent by transverse forces acting in its plane of symmetry, the forces acting upon the portion of the bar to one side of any cross-section may be reduced to
(a) A couple (b) A force
(c) Couple and a force (d) None of the above

(v) For the portal frame shown in fig.



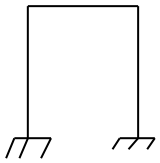
(a) $\frac{M_{BC}+M_{CB}}{4}$ +P =0 (b) $\frac{M_{AB}+M_{BA}}{4}$ +P=0

(c) $\frac{M_{AB}+M_{BA}}{4}+\frac{M_{CD}}{4}$ +P =0 (d) $\frac{M_{CD}}{4}$ +P=0

(vi) A simply supported beam of span 6m carries an udl of 25kN/m . The plastic moment capacity of the same is

(a) 146.8 kN.m (b) 112.5kN.m
(c) 102.5kN.m (d) 125.45kN.m

(vii) For the case of portal frame as shown in figure in approximate analysis the inflection point occur at which points of the members?



(a) End points (b) Mid points
(c) Quarter points (d) None of the above

(viii) Portal method is most suitable for buildings having
(I) high elevation (II) low elevation (III) uniform framing (IV) non uniform framing
Correct answer is

(a) (I) and (III) (b) (I) and (IV)
(c) (II) and (III) (d) (II) and (IV)

(ix) In beam analysis using the stiffness method in general, each element
(a) must be free from load
(b) have a prismatic cross section
(c) must be free from load and have a prismatic cross section both
(d) none of the above

(x) The ratio of plastic moment 'Mp' of a member by yield strength 'σy' of its material is called

(a) Semi plastic section modulus (b) Elastoplastic section modulus
(c) Plastic section modulus (d) Elastic section modulus

Fill in the blanks with the correct word

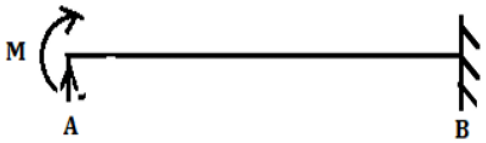
(xi) Portals can be pin supported, _____ or supported by partial fixity.

(xii) The cantilever method is based on the same action as a long cantilevered _____ subjected to a transverse load.

(xiii) In beam analysis using the stiffness method if we consider the effects of both bending and shear, then each node on a beam can have _____ degrees of freedom.

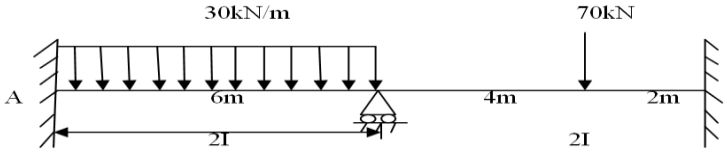
(xiv) If the number of possible plastic hinges are 4 and the degree of indeterminacy of the structure is 2, then the number of possible independent mechanism(s) 'n' will be _____.

(xv) Carryover Moment at end B due to moment M applied at end A for the given propped cantilever beam is ____



Group - B

2. (a) Analyze the continuous beam shown in figure below by moment distribution method.

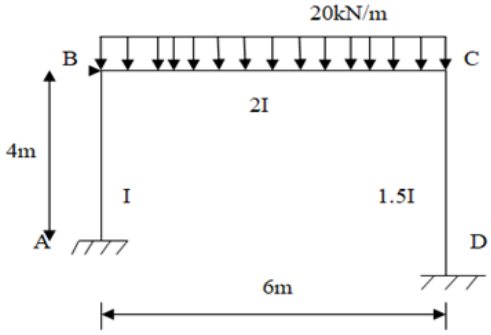


[(CO1)(Analyse/HOCQ)]

(b) The two hinged stiffening girder of a suspension bridge have a span of 100m, the dip of the supporting cable being 10m. If the girder is subjected to two point loads 200kN and 400kN at a distance of 20m and 80m from the left end. Find the maximum tension in the cable. *[(CO2)(Evaluate/HOCQ)]*

9 + 3 = 12

3. Analyze the frame shown in the figure below using Slope-Deflection method.

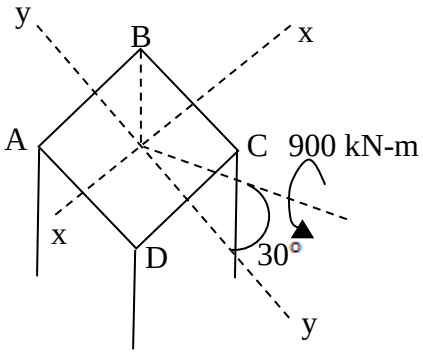


[(CO1)(Analyse/HOCQ)]

12

Group - C

4. A rectangular beam is subjected to unsymmetric bending as shown in figure below. The value of the bending moment applied is 900kN-m and it is applied at angle 30^0 from y-y axis which is a symmetrical axis. The sides AB=CD=150mm and the sides BC= AD=140mm. Find bending stress (σ) at each corner of the beam. *[(CO4)(Analyse/HOCQ)]*



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5. Determine the numerical value of the ratio $\sigma max/\sigma min$ for the case of a curved beam of rectangular cross section in pure bending if radius of curvature is 15cm and height of the cross section is 10cm. *[(CO3)(Analyse/HOCQ)]*

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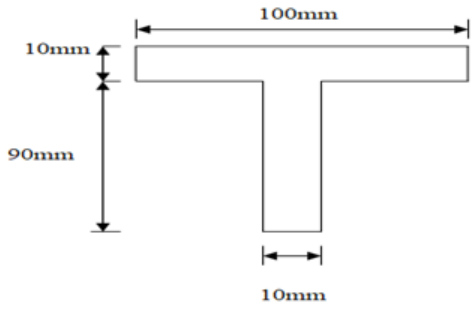
Group - D

6. (a) Briefly describe the various steps of "Plastic Bending of a beam section" with a neat diagram. *[(CO5) (Remember/LOCQ)]*

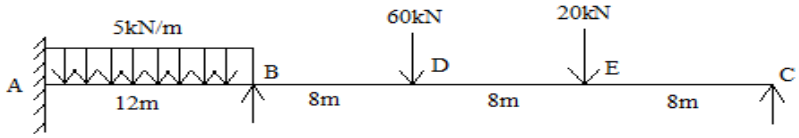
   (b) Find shape factor of a T section having Flange of width 100mm and thickness 10mm. Web of width 10mm and thickness 90mm.



[(CO4)(Apply/IOCQ)]

5 + 7 = 12

7. A continuous beam ABC is loaded as shown in figure below. Determine required Mp if the load factor is 3.2.

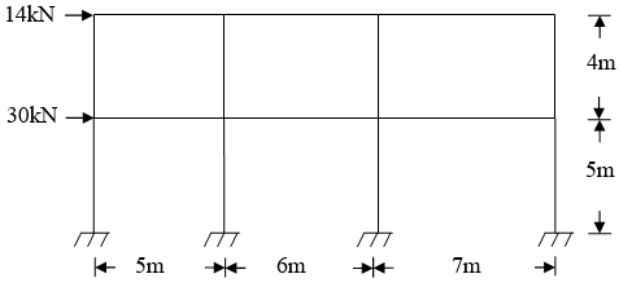


[(CO4)(Analyze/IOCQ)]

12

Group - E

8. Analyse the frame by using Cantilever Method shown in figure below. Area of columns are same.



[(CO6)(Analyse/HOCQ)]

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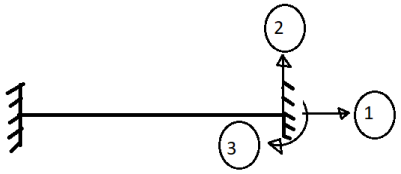
9. Develop the flexibility matrix for the given co-ordinate. The length of the fixed beam as shown in figure below is L, area is A, modulus of elasticity is E and moment of inertia is I.



[(CO6)(Analyse/HOCQ)]

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Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	5.20	19.79	75