Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(CE)/SEM-5/CE-504/2009-10

2009

STRUCTURAL ANALYSIS – II

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

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

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

i) If a semi-circular beam fixed at both the ends is loaded with a concentrated load at the mid-point of the semi-circle then

a) B.M., T.M. & S.F will be zero at the mid-point

b) T.M. & S.F will be zero at the mid-point

c) B.M. & S.F. will be zero at the mid-point

d) none of these.

ii) Moment distribution method is

a) interactive b) finite difference

c) finite element d) none of these.

iii) Influence line of horizontal thrust in a two hinged arch is

a) constant b) triangular

c) parabolic d) trapezoidal.

iv) Length of the cable under *u.d.l.* having supports at same level & distance between two supports *'L'* and central dip *d* is

a) $L + d^2/L$ b) $L + 2d^2/L$

c) $L + 8d^2/3L$ d) none of these.

v) 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.

vi) Influence line for horizontal thrust in a three hinged arch is

a) constant b) triangular

c) parabolic d) trapezoidal.

vii) The area of analogous column of propped cantilever of length *L* and constant EI is equal to

a) L/EI b) EI/L

c) L/3EI d) Infinity.

viii) The slope-deflection method of structural analysis is a

a) displacement method b) force method

c) hybrid method d) none of these.

ix) A rectangular portal will have horizontal sway

a) only if it is subjected to horizontal load

b) only if its geometry is non-symmetric

c) only if its loading is unsymmetric

d) none of these.

x) Which of the following methods of structural analysis is force method ?

a) Slope-deflection b) Column analogy

c) Moment distribution d) Conjugate beam.

xi) In Kani's method, the sum of the rotation factors of all the members meeting at a joint is

a) 1 b) – 1

c) 1/2 d) – 1/2.

xii) Maximum tension in the cable having supports at same level, under *u.d.l* of w/unit horizontal length, when l is the length between supports and d is given by

a) $\frac{wl}{8d}\sqrt{(d^2 + l^2)}$ b) $\frac{wl}{8d}\sqrt{(16d^2 + l^2)}$

c) $\frac{wl}{8d}\sqrt{(8d^2 + l^2)}$ d) $\frac{wl}{8d}\sqrt{(4d^2 + l^2)}$.

xiii) A parabolic two hinged arch carrying *u.d.l* will have zero bending moment at all sections

a) only if it has uniform cross-section through out

b) only if it has M.I of the cross-section varying with secant of the slope of the arch axis

c) for any variation of cross-section

d) under no circumstances.

xiv) In a suspension cable supported at different level and subjected to *u.d.l.* per unit horizontal run

a) the tension anywhere in the cable is constant

b) the tension is minimum at the lower support

c) the tension is minimum at the mid-span section

d) the tension is minimum at the lowest section.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. A two hinged semicircular arch of radius R carries a concentrated load, W at the crown. Show that the horizontal thrust at each support is $\frac{W}{\pi}$. Assume uniform flexural rigidity.

3. A flexible cable weighing 10 kN/m hangs between two supports 50 m horizontally apart. The cable also support a point load of 1200 kN at a point 15.0 m horizontally from the left support and 3.0 m below this support. Assuming that the weight of the cable is spread uniformly on the horizontal span, find the maximum tension of the cable.

4. Find the fixed end moments for the fixed beam loaded as shown in *fig. 1* using column analogy method. Assume *EI* = constant.

Fig. 1

5. A metal rod of circular cross-section of radius *r* has a shape of semicircle of radius *R*. The rod is bent sharply at *B* and extends along a radius to the centre *C* of the semicircle. The rod is fixed at *A* and carries a load *P* at the free end *C* as shown in *fig. 2*. Find the deflection at the free end.

Fig. 2

6. *Fig. 3* shows a three-hinged arch consisting of two quadrantal Part *AC* and *CB* of radii R_1 and R_2 . The arch carries a concentrated load *W* on the crown. Find the horizontal thrust at each support.

Fig. 3

7. Analyze the rigid frame shown in *fig. 4* below by moment distribution method. *EI* is constant throughout the whole frame.

Fig. 4

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

8. Analyze the continuous beam *ABC* shown below by slope deflection method, take *EI* is constant for *fig. 5*.

Fig. 5

9. A semicircular beam *ABC* is supported on three equally spaced supports *A*, *B* and *C* as shown in *fig. 6*. Considering to be the load per unit length of the beam, find out Maximum bending moment and Twisting moment.

Fig. 6

10. A uniform cross-section semicircular curved beam of radius R, is fixed at A & B as shown in *fig.* 7. The beam is subjected to uniformly distributed load, w over the entire span. Plot the BMD & twisting moment diagrams.

Fig. 7

Semicircular beam with *u.d.l.*

11. Analyse the portal frame showin in *fig. 8.* Apply 'Moment distribution method'.

Fig. 8

12. Analyse the box culvert shown in *fig. 9*. Apply 'slope deflection method'.

Fig. 9

13. a) A fixed beam *AB* of span 6m carries point loads 120 kN and 90 kN at distances 2m and 4 m from the left end *A*. Determine the fixing moments at the ends by 'column analogy method.'

    b) Find the support moments at *A*,*B*,*C* and *D* for the continuous beam shown in *fig. 10* by Kani's method.

Fig. 10