Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH (CE)/SEM-6/CE-604/2011

2011
STRUCTURAL ANALYSIS - III

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 the following : $10 \times 1 = 10$

i) In the matrix method of structural analysis ..... are considered as basic unknowns.

a) displacements b) bending moments

c) shear forces d) axial forces.

ii) In portal method of analysis the horizontal shear in any interior column is assumed as ..... of that in an exterior column.

a) twice b) thrice

c) equal d) half.

iii) The maximum value of Dynamic magnification factor which is obtained corresponding to tuning factor η is

a) > 1 b) = 1

c) < 1 d) = 0.

iv) Which of the following statements is true with regard to flexibility matrix method of analysis ?

a) The method is used to analyse determinate structure.

b) The method is used only to manual analyse of indeterminate structure.

c) The method is used for analysis of flexible structure.

d) The method is used for analysis of indeterminate structure with lesser degree of freedom.

v) Deflection of a cantilever beam at a and b applied with moment M at the support is

a) $\frac{ML^2}{EI}$ b) $\frac{ML^2}{2\,EI}$

c) $\frac{ML^2}{3\,EI}$ d) $\frac{ML^2}{4\,EI}$.

vi) A weight of 10N is attached to the end of a spring of stiffness 0.7kN/mm. The critical damping constant is

a) 0.529 Ns/m b) 1.673 Ns/m

c) 52.92 Ns/m d) 26.46 Ns/m.

vii) If ξ = 6%, then the logarithmic decrement is

a) 0.377 b) 0.378

c) 0.375 d) 0.376.

viii) The unit of angular natural frequency is

a) hertz b) cycles/second

c) rad / sec d) none of these.

ix) In structural dynamics, the stiffness is related to

a) displacement b) velocity

c) acceleration d) force.

x) The flexibility of an element can be defined as

a) flexural moment per unit rotation

b) rotation for unit moment

c) flexibility for unit translation

d) none of these.

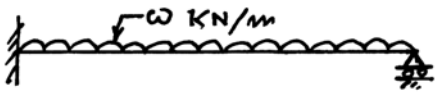
GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

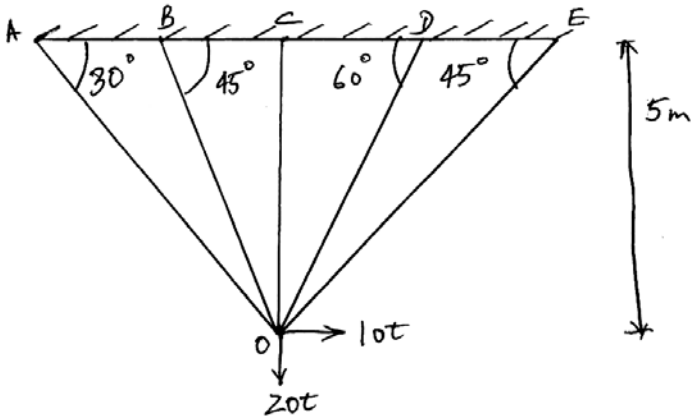
2. Draw the ILD of deflection at 'L/3' from one end of a simply supported beam of span 'L'. Show typical ordinates.

3. Compute the support reaction of the propped cantilever beam shown in figure below :



4. Prove the Muller-Breslau Principle.

5. Develop the stiffness matrix for the pin jointed truss as shown in the Fig. The cross-sectional area of each member is 2000 mm^2. Take E = 200 kN/mm^2.



6. Derive an expression for the eqivalent stifness of the system of Fig.-1. Also find the natural frequency of the system in free vibration.

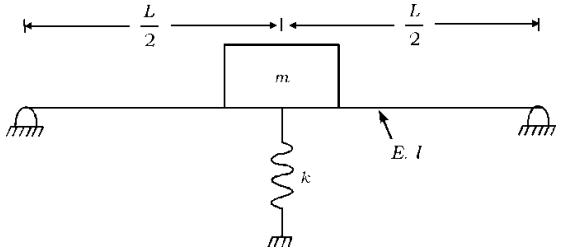


Fig.-1

7. Write short notes on the following :

   i) Critically Damped System

   ii) Logarithmic decrement.

   iii) Flexibility matrix with an example.

   iv) Shape function.

GROUP – C

(Long Answer Type Questions)

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

8. Analyse the continuous beam of Fig. 2 by using Flexibility Method.

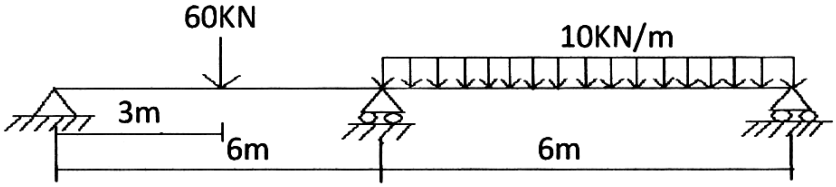


Fig. - 2

9. Analyse the structure by matrix method as shown in the Fig. 3

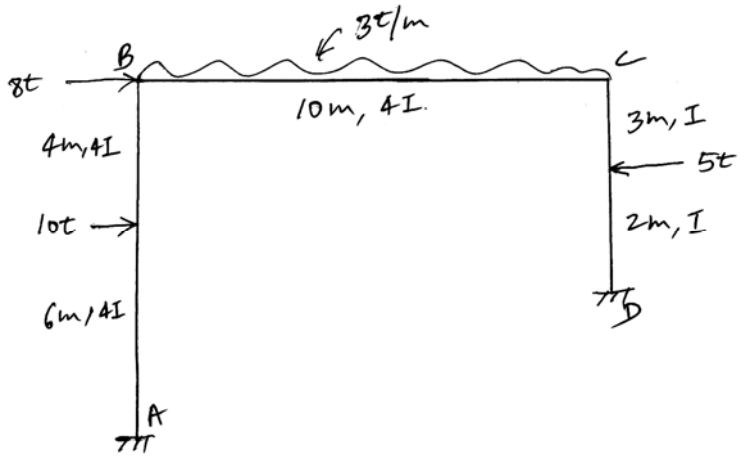


Fig. - 3

10. Use the Portal method, analyse the building frame subject to horizontal forces as shown in the Fig 4. Sketch the Bending moment diagram.

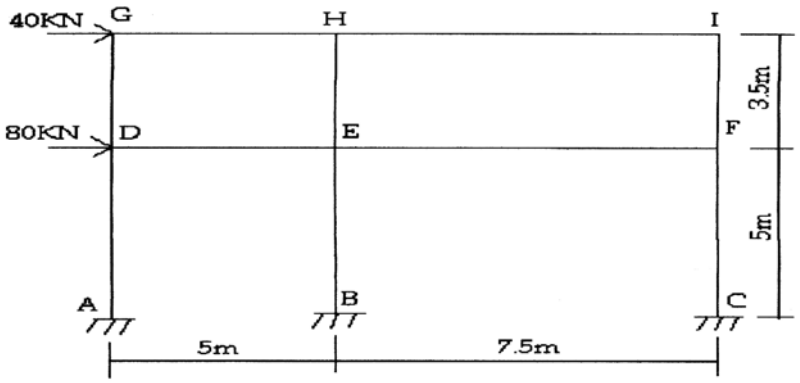


Fig. - 4

11. Analyse the beam by using stiffness method. EI is same for each span. Supports are roller in nature.

UDL Load = 3.5kN/m. Length of each span = 4.0m, E = 200kN/cm^2 and I = 0.2m^4. (Fig. - 5)

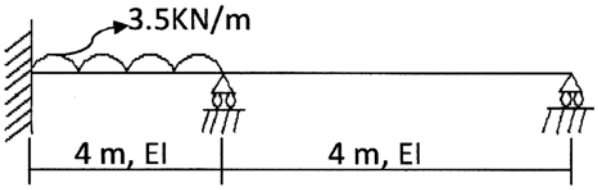


Fig. - 5

12. Find out the deflection of cantilever beam at free end of span 'L' with a point load 'P' at the free end, using finite difference method. Also calculate the error in percentage with the actual value. You have to show the actual value of the deflection calculation.

13. The steel rigid frame supports a rotating machine which exerts a horizontal force at the girder level of 50000 sin 11tN. Assuming 4 per cent critical damping, 5000 kg mass acting at beam level and columns mass less, determine

    i) Steady state amplitude of vibration

    ii) Transmissibility of the motion to the girder

    iii) The max. shearing force in the supporting columns

    iv) Damped natural frequency

    v) Logarithmic decrement

    vi) Dynamic magnification factor

    vii) Max. bending moment

    viii) Max. shearing stress in the columns

ix) Max. relative displacement

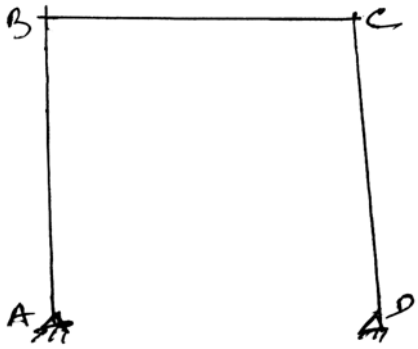
x) Time interval between consecutive max. amplitudes

Take length of the beam = 4m

Length of the columns = 4m

$E = 2.1 \times 10^{11}$ N/m^2

I for columns = 1500×10^{-7} m^4



14 Analyse the frame as shown in the figure below by portal or cantilever method. Assume constant EI for all beams and columns. Draw the relevant BMD and SFD.