Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(CE)/SEM-6/CE-604/2012

2012
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 any *ten* of the following : $10 \times 1 = 10$

   i) The rotational stiffness of a beam when far end is hinged is

   a) $\frac{3EI}{L}$ b) $\frac{2EI}{L}$

   c) $\frac{4EI}{L}$ d) none of these.

   ii) If $\xi = 6\%$ then the logarithmic decrement is

   a) 0·377 b) 0·378

   c) 0·375 d) 0·376.

   iii) According to Müller Breslau principle for any reaction or stress component of a beam is obtained as a

   a) S. F. diagram for the beam

   b) B. M. diagram for the beam

   c) Deflection diagram for the beam

   d) None of these.

iv) In the horizontal load analysis the point of contraflexure lies at ..... point of the beam in the framed structure.

a) middle b) end

c) one third d) none of these.

v) A system is said to have underdamped condition when

a) $c > c_{cr}$ b) $c = c_{cr}$

c) $c < c_{cr}$ d) All of these.

vi) Flexibility and stiffness matrices for the system are

a) equal b) inverse

c) not related d) direct.

vii) The displacement function in case of truss element in finite element approach is

a) $a_1 + a_2 x$ b) $a_1 x + a_2 x^2$

c) $a_1 + a_2$ d) none of these.

viii) Influence line for B.M. at left hand support of a fixed beam is given by the equation, measuring x distance from left hand support

a) $\frac{x(l-x)^2}{l^2}$ b) $\frac{x(l+x)^2}{l^2}$

c) $\frac{x^2(l-x)^2}{l^2}$ d) none of these.

ix) The degree of relative isolation is

a) Transmissibility b) Resonance

c) Damping d) Vibration.

x) The flexibility of an element can be defined as

a) Flexural movement per unit rotation

b) Rotation for unit moment

c) Flexibility for unit translation

d) none of these.

xi) The elements of flexibility matrix of a structure

a) are independent of the choice of coordinates

b) are dependent of the choice of coordinates

c) are always dimensionally homogeneous

d) both (a) and (c).

xii) Damped frequency can be represented as

a) $\omega_D = \omega\sqrt{1-\xi^2}$ b) $\omega_D = \omega\sqrt{1-\xi^3}$

c) $\omega_D = \omega\sqrt{1+\xi^2}$ d) $\omega_D = \omega\sqrt{1-\xi}$.

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

a) displacements b) bending moments

c) shear forces d) axial forces.

xiv) 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.

GROUP – B

(Short Answer Type Questions)

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

2. What are the assumption modes in the cantilever method and portal method analysis of plane frames under horizontal loads ?

3. Determine the expression for free undamped vibration of the SDF system. Also give the significance of nature of frequency.

4. Generate the Global Stiffness matrix for spring system as shown in Fig. 1 :

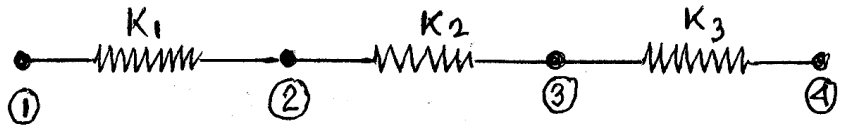

Fig. 1

5. A system shown in the Fig 2 has $k_1 = k_2 = 8 \times 10^4$N/m and $k_3 = 3 \times 10^5$N/m and mass (m) = 250 kg. Determine the natural frequency of the system.

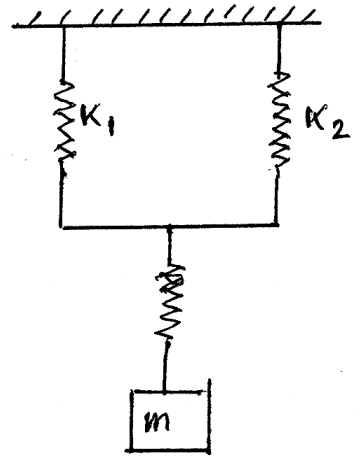

Fig.2

6. Derive the expression for Dynamic Magnification Factor.

7. Is it possible to develop ILD for any structural response in any redundant beam structure both qualitatively and quantitatively by making application of Muller Breslau principle alone ? If yes, then develop the qualitative as well as quantitative ILD for the Prop Reaction in a Propped Cantilever Beam, of span L, purely by MBP.

GROUP – C

(Long Answer Type Questions)

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

8. Analyze the frame show in Fig. 3 by using Flexibility Method.

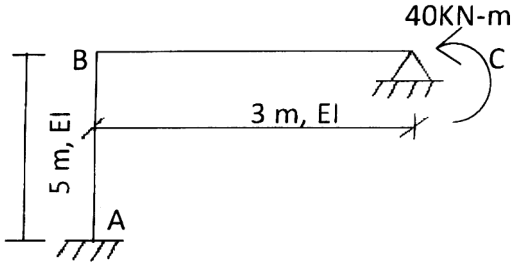

Fig.3

9. Analyze the continuous beam shown in Fig 4 by flexibility matrix method.

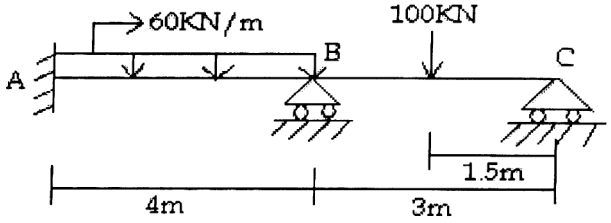

Fig. 4

10. Derive the global stiffness matrix and force vector for the truss shown in Fig. 5. After that apply the boundary conditions and show how the matrices will be. All the members have cross-sectional area *A* and modulus of elasticity *E*.

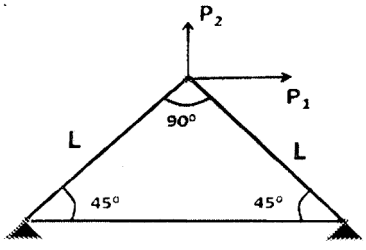

Fig. 5

11. Compute the natural frequency of vibration of a horizontal cantilever beam *AB* of span *L* carrying a concentrated load *W* at the free end, if the total mass of the beam, made of isotopic homogeneous material is *M*, uniform Flexural rigidity of the beam is *EI*.

12. Applying finite different method, determine the propped end reaction R_B and the deflections at all the quarter points of the propped beam structure shown in Fig 6. The flexural rigidity *EI* is uniform :

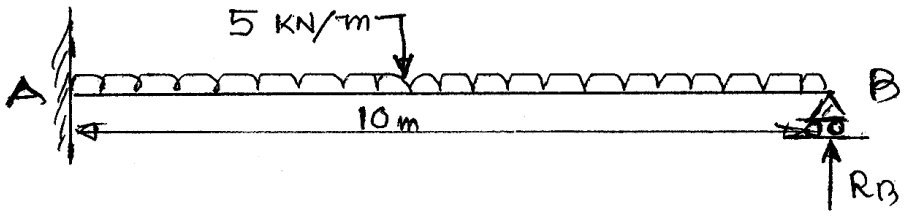

Fig. 6

13. Analyze the portal frame of Fig - 7 by stiffness method :

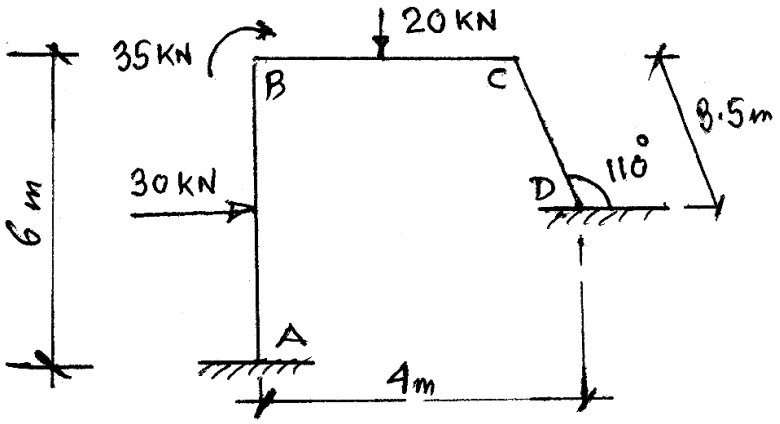

Fig. 7

14. a) Still rigid frame of Fig. 8 supports rotating machine which exerts a horizontal force at the girder level of 50,500 sin $12t$ N. Assuming n = 0·972, find out the following :

(i) Critical damping ratio

(ii) Transmissibility of rotating machine

(iii) Steady-state amplitude of vibration

(iv) Dynamic magnification factor.

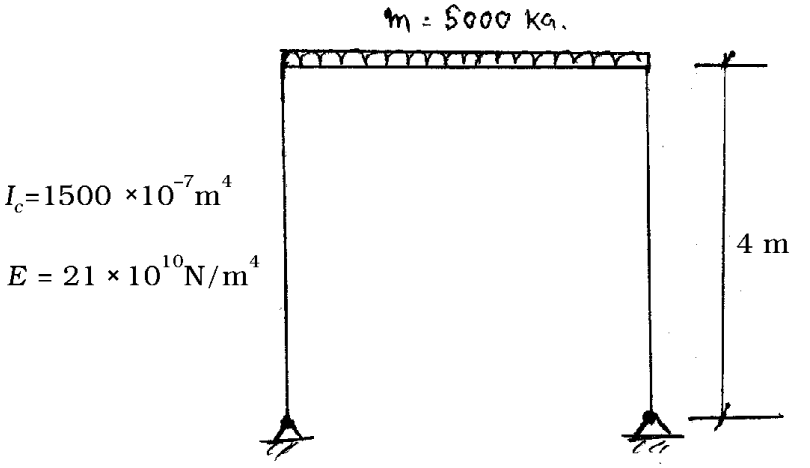

Fig. 8

b) Calculate the natural angular frequency in sideway for the frame of Fig. 9 and also the natural period of vibration. If the initial displacement is 25 mm and initial velocity is 25 mm/s, what is the amplitude and displacement at t = 15 sec ?
Given $EI_{AB} = EI_{CD} = 30 \times 10^{12}$ N-mm^2.

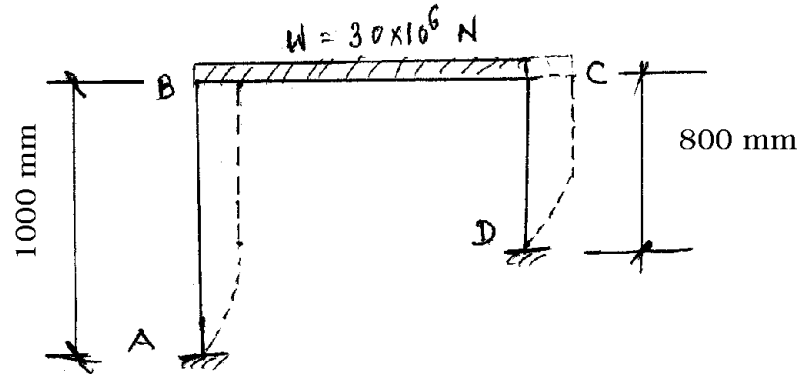

Fig. 9