Reg. No. : [ ]

Y 5381

M.E. DEGREE EXAMINATION, MAY/JUNE 2008.

First Semester

Structural Engineering

ST 132 — STRUCTURAL DYNAMICS

(Regulation 2002)

Time : Three hours | Maximum : 100 marks

Assume any missing data suitably.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define : Damping, Degrees of Freedom.

2. What is the effect of damping on structures?

3. Why dynamics problems are considered as an eigen value problem?

4. What are the properties of mass and stiffness matrices?

5. What is modal mass matrix?

6. What is the use of logarithmic decrement?

7. How is the magnification factor related to the frequency ratio?

8. What is a response spectrum?

9. What is a rigid body mode?

10. What is the difference between Rayleigh's method and Rayleigh-Ritz method?

PART B — (5 × 16 = 80 marks)

11. (a) (i) A spring mass system has a natural period of 0.21 sec. What will be the new period if the spring constant is increased by 50%? (6)

(ii) A spring mass system has a natural frequency of 10 Hz. When the spring constant is reduced by 800 N/m, the frequency is altered by 45%. Find the mass and spring constant of the original system. (10)

Or

(b) An automobile is driven along a road whose elevation varies sinusoidally. The distance from peak to trough is 0.2 m and the distance along the road between the peaks is 35 m. If the natural frequency of the automobile is 2 Hz and the damping ratio of the shock absorbers is 0.15, determine the amplitude of vibration of the automobile at a speed of 60 km/hr. If the speed of the automobile is varied, find the most unfavourable speed for the passengers.

12. (a) Find the frequencies and mode shapes of the system shown in Fig. 1

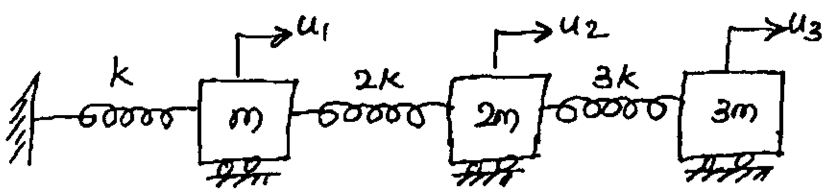

Fig. 1

Or

(b) The mass matrix $[m]$ and stiffness matrix $[k]$ of a uniform are

$$[m] = \frac{\rho A L}{4}\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix} \text{ and } [k] = \frac{2AE}{L}\begin{bmatrix} 1 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 1 \end{bmatrix}$$

where 'ρ' is the mass density, 'A' C.S. area, 'E' - Young's modulus and 'L' length of the member. Find the natural frequencies and mode shapes.

13. (a) Find the fundamental frequency and mode shape of the shear frame shown in Fig. 2.

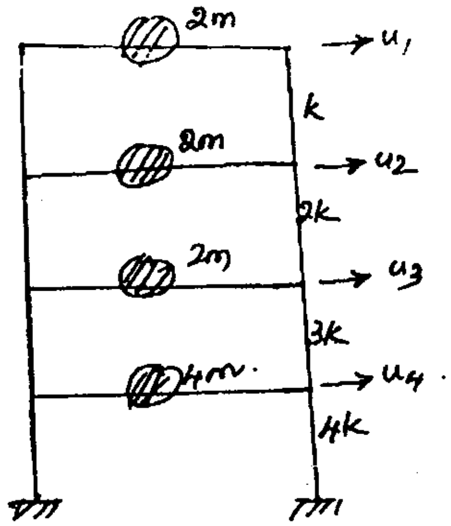

Fig. 2

Or

(b) In the two storey building shown in Fig. 3, if $E(t) = 20$ kN, determine the displacements at top and bottom storey level.

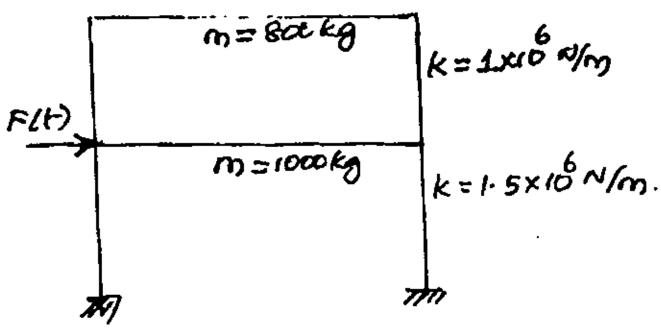

Fig. 3

14. (a) Determine the frequencies and mode shapes of a uniform simply supported beam subjected to free flexural vibrations. Plot the first three mode shapes.

Or

(b) Derive the frequency equation for the longitudinal vibration of a stepped bar having two different cross sectional areas A_1 and A_2 over lengths L_1 and L_2 respectively. Assume fixed-free end conditions.

15. (a) Write short notes on the following :

(i) Wind induced vibrations. (8)

(ii) Impact loads on structures. (8)

Or

(b) Describe deterministic earthquake analysis of structures.