*Total number of printed pages – 4* **B. Tech**

**PECE 8410**

## Eighth Semester Examination – 2008

### STRUCTURAL DYNAMICS

**Full Marks – 70**

**Time : 3 Hours**

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

*The figures in the right-hand margin indicate marks.*

1. Answer any ten questions : 2×10

   (a) Distinguish between harmonic motion and periodic motion

   (b) Define the following terms :

   (i) Frequency (ii) Time period

   (c) Give two examples of dynamic loadings.

   (d) Write down the equation of motion of a simple spring-mass system with damping.

   (e) A mass of 4 kg is attached to the end of a spring with a stiffness of 1.2 N/mm. Determine the critical damping coefficient.

   (f) Find the equivalent spring factor for springs attached in series and parallel.

   (g) Differentiate between ‘‘under damped system’’ and ‘‘over damped system’’.

   (h) What is logarithmic decrement ?

   (i) Differentiate between lumped mass and consistent mass.

   (j) What do you mean by resonant frequency ?

   (k) What is viscous damping ?

   (l) Give two examples of bending vibration.

2. A vibrating system with a natural frequency of 5 Hz starts with an initial amplitude of 18 mm

and an initial velocity of 180 mm per second. Calculate (i) natural period (ii) amplitude (iii) acceleration and (iv) time taken to reach the first peak. 10

3. A mass 5 kg hangs from a spring and makes damped vibrations. The time of 50 complete oscillations is found to be 20 second and the ratio of the first downward displacement to the sixth is found to be 2.2. Find the stiffness of the spring in kN/m and the damping force in N/m/sec. 10

4. The stiffness matrix and mass matrix of a two degree freedom system are given by

$$[K] = \begin{bmatrix} 10 & 8 \\ 8 & 10 \end{bmatrix} \text{ and } [M] = \begin{bmatrix} 15 & 0 \\ 0 & 15 \end{bmatrix}$$

Determine the natural frequencies and corresponding modes of vibration. 10

5. Derive the differential equation of motion of single degree freedom damped system subjected to harmonic loading. Also find out the solution of the differential equation of motion. 10



6. Determine the expression for the natural frequencies of torsional oscillations of a uniform rod of length 1 clamped at the middle and free at the two ends. 10

7. Using Lagrange's method, determine the equation of motion for the multi degree freedom system. 10

8. Write short notes on (any two) : 5×2

   (i) Dynamic load factor

   (ii) Ritz Method

   (iii) Structural Damping.

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