Total No. of Questions : 6]

SEAT No. :

P3970

[Total No. of Pages : 3

[4860] - 36
M.E. (Civil) (Structures)
STRUCTURAL DYNAMICS
(2008 Pattern)

Time : 4 Hours] *[Max. Marks : 100*

Instructions to the candidates:

1) *Answer any two questions from each section.*
2) *Answers to the two sections should be written in separate answer books.*
3) *Figures in bold to the right, indicate full marks.*
4) *If necessary, assume suitable data and indicate clearly.*
5) *Use of electronic pocket calculator is allowed.*

SECTION - I

Q1) a) What is damping? Explain the various types of damping with suitable examples. **[5]**

b) Derive the expression for logarithmic decrement. **[10]**

c) Prove that the natural frequency of oscillation for the mass m shown in Fig. 1 is independent of θ. **[10]**

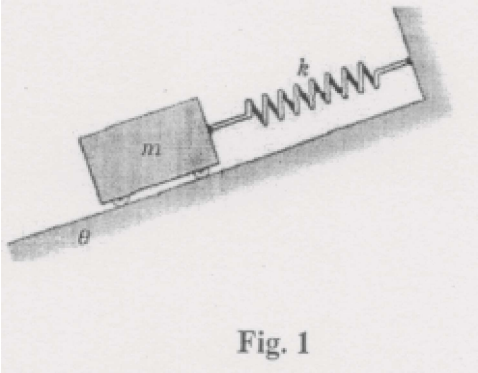

Fig. 1

P.T.O.

Q2) a) For the two cantilever beams whose free ends are connected to springs as shown in Fig. 2, determine the equivalent spring constant k_e for the system. **[10]**

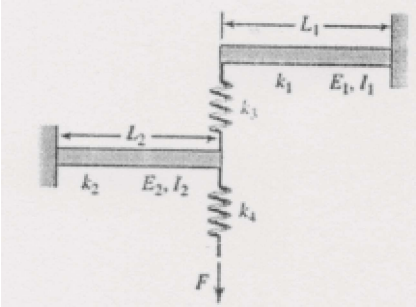

Fig. 2

b) A wide-base truck tire is characterized with a stiffness of 1.23×10^6 N/m, an undamped natural frequency of 30Hz, and a damping coefficient of 4400 Ns/m. In the absence of forcing, determine the response of the system assuming non-zero initial conditions, evaluate the damped natural frequency of the system and discuss the nature of the response. **[10]**

c) Explain equivalent spring constant with suitable example. **[5]**

Q3) a) Use the Duhamel integral to determine the response of an undamped SDOF system to a loading specified by the triangular pulse as shown in Fig. 3. Obtain the expressions that are valid for $t < td$ and for $t > td$. The system is initially at rest. **[15]**

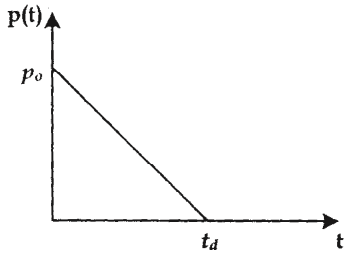

Fig. 3

b) Find the total response of a single degree of freedom system with m = 10 kg, c = 20 Ns/m, k = 4,000 N/m. The initial conditions are $x_0 = 0.01$ m, $\dot{x} = 0$, $F_0 = 100$ N and $\omega = 10$ rad/s. **[10]**

SECTION - II

Q4) a) Explain orthogonality of modes. **[10]**

b) Find the natural frequencies and mode shapes of a spring-mass shown in Fig. 4. **[15]**

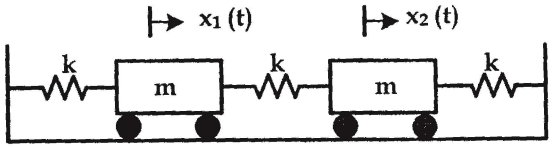

Fig. 4

Q5) a) Write a note on constant acceleration method. **[15]**

b) What are shear buildings? Explain the governing equation of motion for a three storey shear building. **[10]**

Q6) a) Derive Rayleigh's quotient for a continuous system. **[10]**

b) Find the natural frequency and the free vibration solution of a bar fixed at one end and free at the other. **[15]**