Total No. of Questions : 8]

SEAT No. :

P5286

[Total No. of Pages : 3

[5562]-138
M.E.(Civil - Structures Engineering)
STRUCTURAL DYNAMICS
(2017 Pattern) (Semester - I) (501002)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q. 7or Q.8.***
2) ***Neat diagram must be drawn wherever necessary.***
3) ***Figure to the right indicates full marks.***
4) ***Assume suitable data, if necessary and clearly state.***
5) ***Use of cell phone is prohibited in the examination hall.***
6) ***Use of electronic pocket calculator is allowed.***

Q1) a) Explain types of vibrations. **[4]**

b) A machine of mass is mounted on a simply supported steel beam of length (l) = 2 m having a rectangular cross section with depth = 0.10 m, width = 1.20 m and Young's modulus E = 2.06 × 1011N/mm^2. To reduce the vertical deflection of the beam, a spring of stiffness (k) is attached at mid-span, as shown in Fig. 1. Determine the value of (k) needed to reduce the deflection of the beam by 75 % of its original value. **[5]**

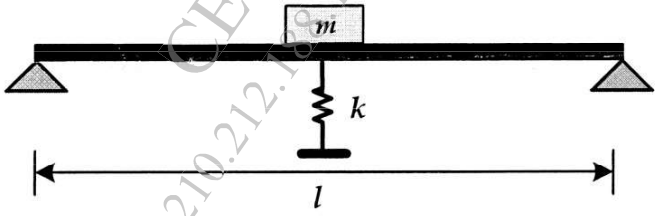

Fig. 1

OR

Q2) a) A damped spring - mass system with values of c = 100 kg/s, m = 100 kg, and k = 910 N/m, is subject to a force of 10 Cos (3t) N. The system is also subject to initial conditions: x_0 = 1 mm and v_0 = 20 mm/s. Compute the total response, x (t), of the system. **[5]**

b) Derive the expression for logarithmic decrement. **[4]**

P.T.O.

Q3) a) Explain Pulse loading using Duhamel integral. **[5]**

b) A 100 kg mass is suspended by a spring of stiffness 30×10^3 N/m with a viscous damping constant of 1,000 Ns/m. The mass is initially at rest and in equilibrium. Calculate the steady-state displacement amplitude if the mass is excited by a harmonic force of 80 N at 3 Hz. **[4]**

OR

Q4) a) A building frame is modelled as an undamped SDOF system as shown in Fig. 2(a). Find the response of the frame if it is subjected to a blast loading which is represented as a triangular pulse as shown in Fig. 2(b). **[5]**

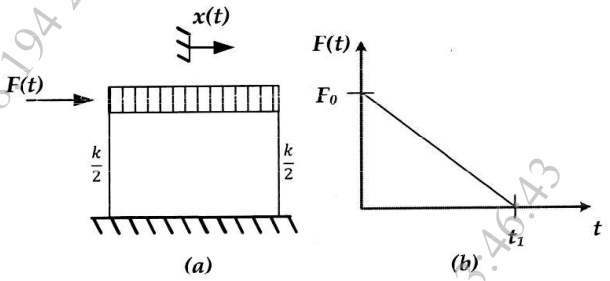

Fig. 2

b) Derive the equation for force transmitted to foundation. **[4]**

Q5) a) Show that modes are orthogonal to each other. **[8]**

b) Obtain the characteristic equation of motion for the system shown in Fig. 3. **[8]**

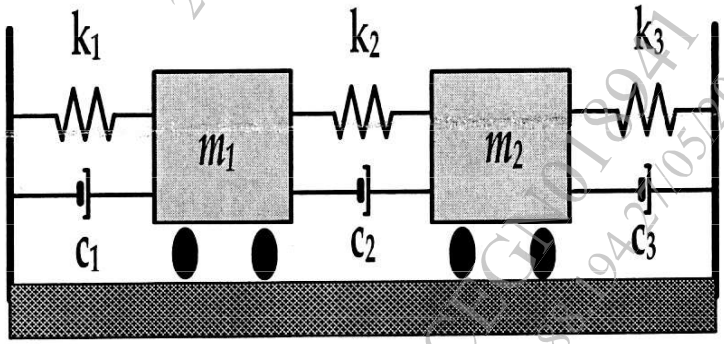

Fig. 3

OR

Q6) a) What are mode shapes? Give suitable examples. **[7]**

b) Find the eigenvalues and eigenvectors for the system shown in Fig. 4 for $m_1 = m_2 = m_3 = m$ and $k_1 = k_2 = k_3 = k$. **[9]**

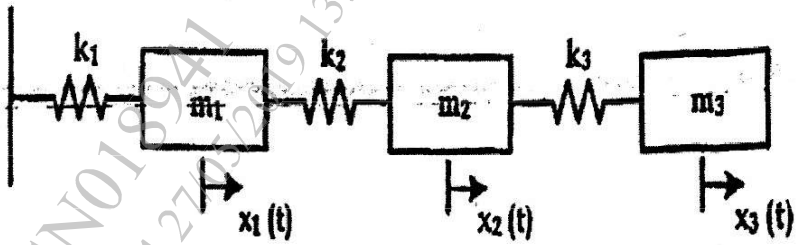

Fig.4

Q7) a) Find the natural frequency and mode shapes for transverse vibrations of cantilever beam. **[8]**

b) Determine the equation of motion for transverse vibration of a uniform beam fixed at one end and simply supported at the other end. **[8]**

OR

Q8) a) Explain transverse vibration. **[8]**

b) What is the difference between the finite element method and the Rayleigh-Ritz method for Free vibration analysis of Continuous system. **[8]**

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