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Question Paper Code : 71779

M.E. DEGREE EXAMINATION, JUNE/JULY 2013.

First Semester

Structural Engineering

ST 9202/ST 912/UST 9102/10211 SE 103 — STRUCTURAL DYNAMICS

(Regulation 2009/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate between vibration and oscillation.
2. Define dynamic load factor.
3. Explain eigen vector normalisation.
4. Give three examples for two degree freedom systems.
5. Plot frequency-response curve for a damped system.
6. Define mode shape and modal participation factor.
7. How will you approximate two a lowest natural frequencies of the system using Rayleigh-Ritz method?
8. Define Narrow-band and Wide-band random processes.
9. Define base isolation.
10. Write a short note on Gust phenomenon.

PART B — (5 × 16 = 80 marks)

11. (a) Define various types of damping and derive the expressions for

    (i) Under damped system (6)

    (ii) Critically damped (5)

    (iii) Over damped system. (5)

Or

(b) When a 50 kg machine, placed on an undamped isolator, is subject to a harmonic excitation at 125 Hz, its steady-state amplitude is observed as 1.8 mm. When the machine is attached to two of these isolators in series and subjected to the same excitation, its steady-state amplitude is 1.2 mm. What is the stiffness of one of these isolators?

12. (a) For a two degree of freedom shown in fig. 1, the system parameters are given by $m_1 = m_2 = 25$ N; $C_1 = C_2 = 5$ Ns/m and $K_1 = K_2 = 4$ N/m. Determine the Eigen values, mode shapes and the equation of motion of the two masses.

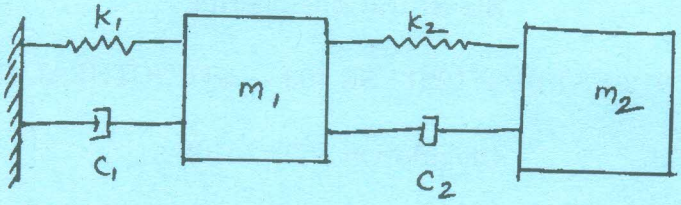

Fig. 1

Or

(b) Determine the natural frequencies of the system shown in fig. 2

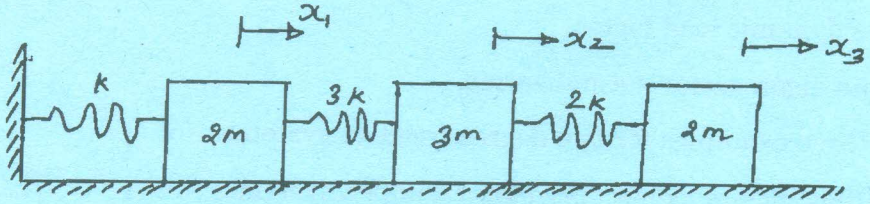

Fig. 2

13. (a) Use modal superposition to determine the response of the system of fig. 3.

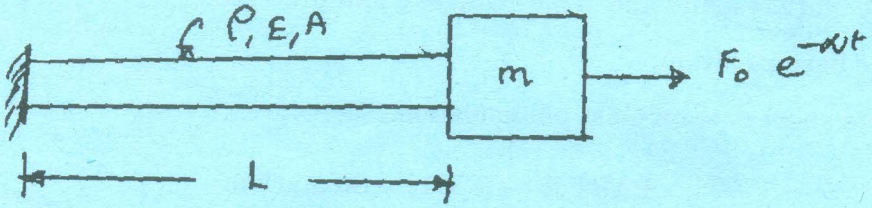

Fig. 3

Or

(b) Determine the lowest natural frequency of longitudinal motion for the system of Fig. 4. Take

$A = 3 \times 10^{-6}$ m^2

$E = 200 \times 10^9$ N/m^2

$\rho = 7800$ kg/m^3

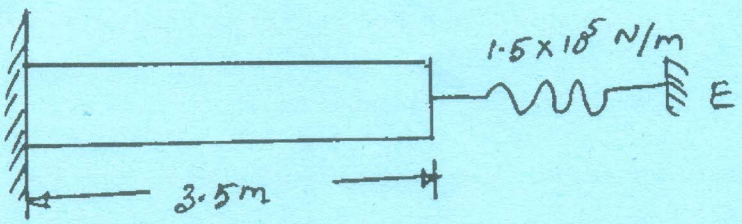

Fig. 4

14. (a) Determine the mean square value and the autocorrelation function for the narrow-band random process $x(t)$, where spectral density function is shown in Fig. 5

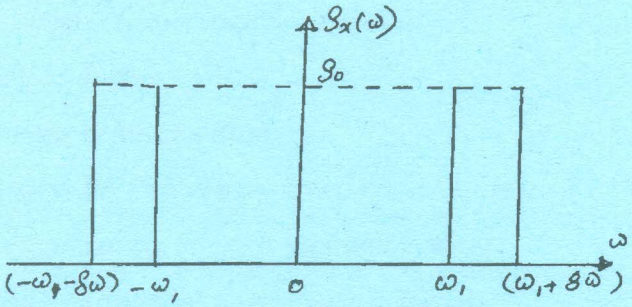

Fig. 5

Or

(b) Derive the equation for the response of a single degree of freedom system subject to a random excitation.

15. (a) A 100 kg turbine operates at 2000 r/min. What percent isolation is achieved if the turbine is mounted on four identical springs in parallel, each of stiffness 2×10^5 N/m?

Or

(b) Explain the principle of base isolation techniques.
