Reg. No. : | | | | | | | | | | |

Question Paper Code: 22062

M.E. DEGREE EXAMINATION, OCTOBER 2014.

Second Semester

Structural Engineering

01PSE203 – STRUCTURAL DYNAMICS

(Regulation 2013)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. Distinguish between static problem and dynamic problem.
2. Define: Logarithmic decrement and write the expressions for the same.
3. Define: Degree of Freedom
4. Define: Mode shape and normal mode.
5. State the Eigen value problem. What are the methods used to extract the Eigen values?
6. State the orthogonality and normality principles.
7. Write down the governing differential equation for the free and forced flexural vibration of continuous systems.
8. State the law of conservation of energy.
9. What are the methods to find the dynamic responses of structures due to wind?
10. What do you mean by Gust phenomenon?

PART - B (5 x 14 = 70 Marks)

11. (a) (i) A vibrating system consist of a mass 10 kg . spring constant 240N/m and a damper with a damping coefficient of 10N-s/m Determine

    (i) Logarithmic decrement

(ii) Damped period of vibration

(iii) Number of cycles after which the final amplitude is reduced to one tenth if the initial amplitude. (8)

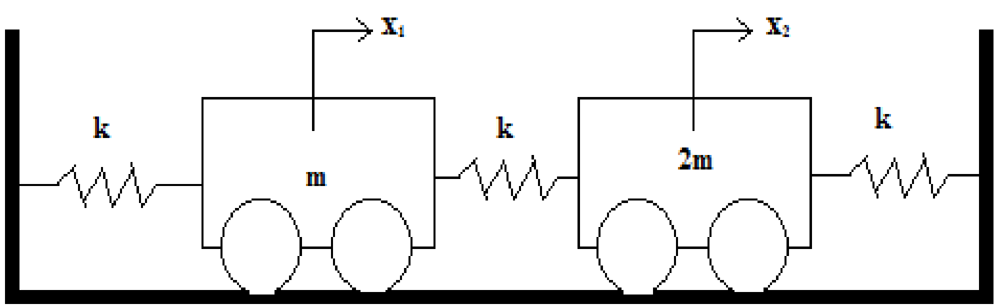
(ii) For a SDOF system, having a mass 10kg and spring constant 15 kN/m, the amplitude decreases to 0.25 of the initial value after 6 consecutive cycles. Find the damping coefficient of the damper. (6)

Or

(b) (i) Compare the decay curves for the various types of damping. (8)

(ii) The peak amplitude of the roof of a one storey building under free vibration reduces from 0.3 m to 0.1 m in 5 cycles. The time elapsed for 5 cycles in 12 sec. Estimate the natural period, natural frequency and damping ratio. (6)

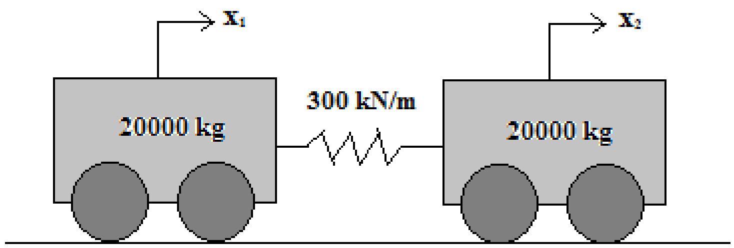
12. (a) Determine the natural frequencies and modes shapes for the two degree of freedom system shown in the figure.



(14)

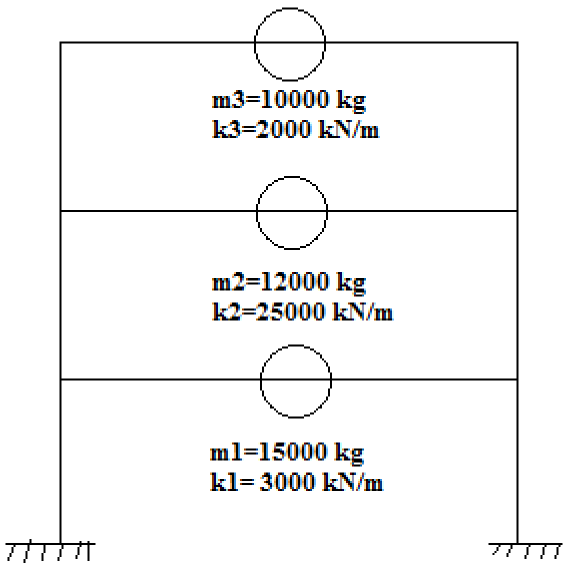
Or

(b) An electric train made up of two cars each weighing 20000kg is connected by coupling of stiffness equal to 300kN/m. Determine the natural frequency and corresponding mode shapes for the system.



(14)

13. (a) Calculate the natural frequency and corresponding mode shapes for the system as shown in the figure. Also verify the orthogonal conditions.



(14)

Or

(b) A 3 storied shear frame is having combined stiffness of ground floor, first floor and second floor Columns each 3000kN/m. Weight of each floor is 30kN. Find the natural frequencies and mode shapes using any of the approximate methods. (14)

14. (a) Determine the first two natural frequency of the uniform cantilever beam using the Rayleigh – Ritz method by assuming $\phi(x) = C_1 X^2 + C_2 X^3$. (14)

Or

(b) Determine, from first principles the first three natural frequencies and mode shapes of a simply supported R.C circular beam of 500mm diameter with a span 12.5m. Take EI = 9000kN/m^2 and unit material as 25kN/m^3. (14)

15. (a) Explain the steps involved in the vibration analysis of a multi-storied building subjected to earthquake loading. (14)

Or

(b) What is meant by nonlinear response history analysis and what are the factors to be considered in computing seismic demands? (14)

PART - C (1 x 10 = 10 Marks)

16. (a) Determine the first two frequency by Rayleigh- Ritz method , assuming

$$[\bar{\phi}] = \begin{Bmatrix} 1 & 1 \\ 0.8 & -0.8 \\ 0.4 & -1.2 \end{Bmatrix} \quad [K] = \begin{Bmatrix} 2k & -2k & 0 \\ -2k & 4k & -2k \\ 0 & -2k & 5k \end{Bmatrix} \quad [M] = \begin{Bmatrix} m & 0 & 0 \\ 0 & m & 0 \\ 0 & 0 & m \end{Bmatrix}$$

(10)

Or

(b) With a case study, explain the practical application of structural dynamics for structures subjected to impact loads. (10)