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

Question Paper Code: 53U01

M.E. DEGREE EXAMINATION, MAY 2018

Third Semester

Structural Engineering

15PSE301 – STRUCTURAL DYNAMICS

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. The sudden falling of a heavy steel ball comes under the category of which type of load?

   (a) Sinusoidal Load (b) Random Load
   (c) Transient Load (d) Harmonic Load

2. The type of vibration which can happen in an unsymmetrical structure is

   (a) Shearing Vibration (b) Torsional Vibration
   (c) Axial Vibration (d) Flexural Vibration

3. Which of the following is not an application for the modal superposition method

   (a) 3D cable stayed bridge (b) A double layered 3D cable network
   (c) Un stiffened suspension bridge (d) A Portal frame

4. If the stiffness matrix is not diagonal, the structure is said to be

   (a) Dynamically coupled (b) Statically coupled
   (c) Both statically and dynamically coupled (d) None of these

5. The Newmark's β integration method is based on the assumption that the _____ varies linearly between two instants of time.

   (a) Displacement (b) Velocity
   (c) Acceleration (d) All the above

PART B - (5 x 3 = 15 Marks)

6. What is stiffness?

7. Define Eigen value and Eigen vector.

8. Write the uncoupled stiffness matrix.

9. List out the forces acting on beam element.

10. How is dynamic equilibrium established?

PART C - (5 x 16 = 80 Marks)

11. (a) A delicate instrument is to be mounted on a factory floor using some suspension system. The floor is subjected to vibration amplitude of 3mm at 20Hz during normal usage. If the amplitude of vibration of the instrument is to be limited to 0.015mm for satisfactory operation. What is the required natural frequency of the instrument on its suspension? Assume damping as 5%. (16)

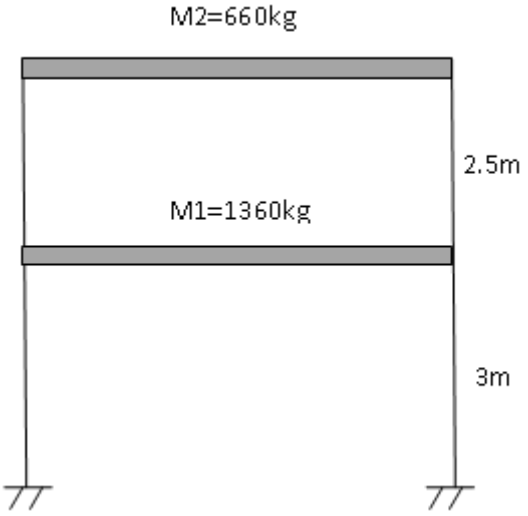
Or

(b) Derive the expression for the free vibration of a beam with distributed mass and stiffness. Determine its first five natural frequencies when both ends of this beam are simply supported. (16)

12. (a) Explain the coulomb-damped free vibration with derivation. Also discuss practical applications of coulomb-damped free vibration. (16)

Or

(b) Determine the natural frequencies for the two degrees of freedom system, as shown in the figure. Take E=2.5 * 10^4N/mm^2 and I =5 *$10^5$$mm^4$. (16)



13. (a) Write a short note on the SRSS method used in dynamic analysis of MDOF systems. (16)

Or

(b) The free vibration properties of a cantilever beam as shown in the figure. It supports three equal lumped masses. A harmonic forcing function P(t)-200sin5t kN is acting at all the mass points. Determine the displacement response of all the masses using mode superposition procedure. Frequencies for the first three modes are 3.6rad/s, 24rad/s and 77rad/s respectively. The normal modes are

$$\begin{Bmatrix}0.05\\0.41\\0.91\end{Bmatrix}\begin{Bmatrix}0.28\\0.87\\-0.4\end{Bmatrix} and \quad \begin{Bmatrix}0.95\\-0.28\\0.07\end{Bmatrix}.$$ (16)

14. (a) Determine the first two frequencies of the cantilever beam by Rayleigh Ritz method by assuming $\emptyset = \begin{pmatrix}1.0 & 1.0\\0.55 & -0.65\\0.35 & -1.2\end{pmatrix}$. (16)

Or

(b) Find the fundamental frequency for a uniform, simply supported beam by assuming the static deflection curve. (16)

15. (a) Explain Wilson-Theta method. (16)

Or

(b) Write step by step numerical integration techniques. (16)

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