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

Question Paper Code: 53P62

M.E. DEGREE EXAMINATION, NOV 2017

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. Define Degree of Freedom?

7. Define Eigen value and Eigen vector.

8. Define MDOF system.

9. List out the forces acting on beam element.

10. Define stiffness coefficient.

PART C - (5 x 16 = 80 Marks)

11. (a) Determine the dynamic response of a structure subjected to blast loading using Duhamel Integral Technique. The properties of the structure are natural frequency=5Hz, mass=20units. The blast force varies linearly from 0 to 600 units in 0.03sec, and then reduces linearly to zero at 0.12sec. Give the values of the response at 0.03, 0.06, 0.09, 0.12, 0.15, 0.20 and 0.30sec. Plot the response time history. (16)

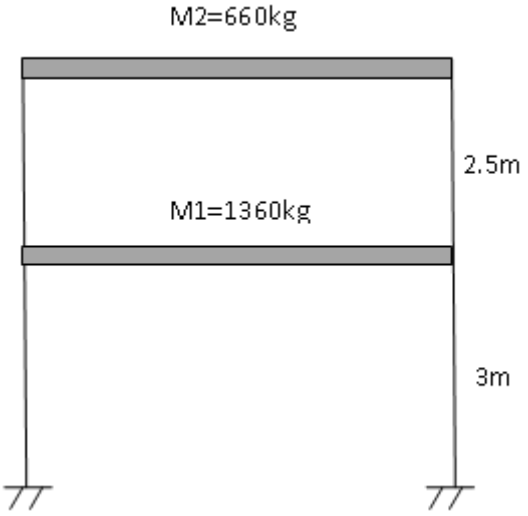
Or

(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) Develop the expression for the free vibration of an undamped 2DOF system. (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

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

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) Discuss Newmark's β method for numerical evaluation of dynamic response of single degree of freedom system. (16)

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

Or

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

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