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

Question Paper Code: 42161

M.E. DEGREE EXAMINATION, MAY 2016

First Semester

Structural Engineering

14PSE101 - STRUCTURAL DYNAMICS

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. Free vibrations can be defined as oscillations about a system's equilibrium position that occur in the absence of an

   (a) External excitation (b) Internal excitation
   (c) Both (a) and (b) (d) None of these

2. _____is mainly concerned with finding out the behavior of a physical structure when subjected to force.

   (a) Structural analysis (b) Structural dynamics
   (c) Dynamic displacements (d) All the above

3. The mode shapes are _____which means that the displacements associated with two different vibration modes.

   (a) Hexagonal (b) Parallel
   (c) Orthogonal (d) None of these

4. The _____is a widely used method used to approximate eigen values and eigen vectors.

   (a) Rayleigh–Ritz method (b) Eigen method
   (c) Numerical method (d) None of these

5. Abbreviation of MDOF

(a) Multiple Degrees of Freedom (b) Multiple Direction of Freedom
(c) Multiplex Degrees of Freedom (d) None of these

PART - B (5 x 3 = 15 Marks)

6. State Hamilton's principle.

7. Differentiate free and forced vibration in two D.O.F systems.

8. Define mode superposition.

9. What are the uses of mathematical modeling?

10. What is the principle involved in direct integration schemes?

PART - C (5 x 16 = 80 Marks)

11. (a) A simple model of a fan is made up of four (weightless) rigid bars and four point masses as shown in figure 1. The bars are rigidly connected to each other and attached to a frictionless joint. A torsion spring with the spring constant $k\theta$ (*Nm/rad*) is connected to the bars in the joint. Determine the equation of motion and the natural frequency of the system. (16)

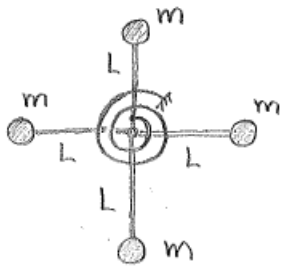

Figure 1

Or

(b) Write the differential equation of the inverted pendulum shown in figure 2 and determine its natural frequency. (16)

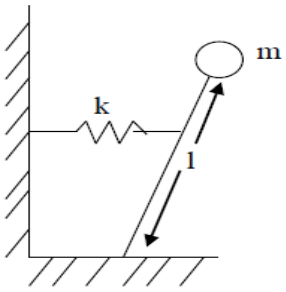

Figure 2

12. (a) Show that the displacement of a critically damped system due to initial displacement u_0 and velocity u_0. (16)

Or

(b) A machine of weight 1,000 *kg* is mounted on a steel beam of negligible weight at centre. The rotor in the machine generates a harmonic force of 3,000 *kg* at a frequency 60 *rad/sec*. Assume 10% damping, calculate amplitude of motion of machine, force transmitted to supports and phase angle. Span of beam 3*m*, E =2 x 10^5 *Mpa* and I of beam 5000 cm^4. (16)

13. (a) Determine the amplitude of motion of three masses shown in figure 3 when a harmonic force $F(t) = F_o \, Sin \, \omega t$ is applied . *Take m=1.5kg, K= 1500N/m,* F_o *= 10N* ω*= 10 rad/s*. Use mode superposition method. (16)

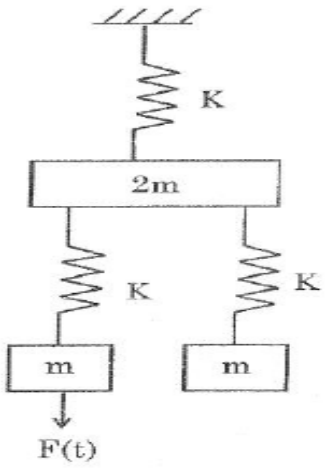

Figure 3

Or

(b) Calculate the first three frequencies of axial vibration of a bar fixed at one end. (16)

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

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

(16)

Or

(b) For the multistory building shown in figure 4. Obtain frequencies and modes of vibration. Assume $m = 5 \times 10^4$ *kg*, $k = 5 \times 10^4$ *kN/cm*.

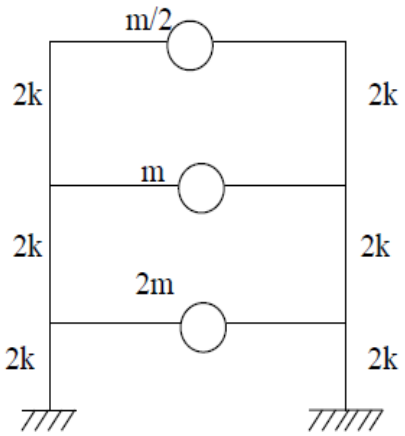

Figure 4

(16)

15. (a) Explain in detail about Wilson Theta method. (16)

Or

(b) Write down step by step procedure of numerical integration techniques. (16)