Roll No. | | | | | | | | | | | | | Total No. of Pages : 03

Total No. of Questions : 18

B.Tech. (Automation & Robotics) (2012 & Onwards) (Sem.–7)

MECHANICAL VIBRATIONS

Subject Code : BTME-803

M.Code : 71808

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions**

SECTION-A

Write briefly :

1. Define the magnification factor.
2. What are principal co-ordinates?
3. What is the difference between vibration isolation and vibration absorber?
4. Define influence coefficient.
5. What do you mean by continuous system?
6. What do you understand by mode orthogonality?
7. What is structural damping?
8. Define whirling speed of shafts.
9. The damped natural frequency (ω_d) of a system is 86.6Hz, while the maximum amplitude occurs at an exciting frequency (ω_p) of 70.7 Hz. Find the damping factor (ξ) and the undamped natural frequency (ω_n).
10. Define viscous damping.

SECTION-B

11. What is the difference between deterministic and random vibration? Give two practical examples of each.
12. A simply supported beam of square cross section 5 *mm* × 5 *mm* and length 1 *m*, carrying a mass of 2.3 *kg* at the middle, is found to have a natural frequency of transverse vibration of 30 rad/s. Determine the Young's modulus of elasticity of the beam.

13. What assumptions are made in finding the natural frequency of a single-degree-of freedom system using the energy method?

14. A spring-mass system, with a spring stiffness of 5,000 N/m, is subjected to a harmonic force of magnitude 30 N and frequency 20 Hz. The mass is found to vibrate with an amplitude of 0.2 m. Assuming that vibration starts from rest $x_0 = \dot{x}_0 = 0$, determine the mass of the system.

15. Find the natural frequencies of a simply supported beam subjected to an axial compressive force.

SECTION-C

16. A heavy machine, weighing 3000 N, is supported on a resilient foundation. The static deflection of the foundation due to the weight of the machine is found to be 7.5 cm. It is observed that the machine vibrates with an amplitude of 1 cm when the base of the foundation is subjected to harmonic oscillation at the undamped natural frequency of the system with an amplitude of 0.25 cm. Find :

    a. The damping constant of the foundation.

    b. The dynamic force amplitude on the base, and

    c. The amplitude of the displacement of the machine relative to the base.

17. Find the steady-state response of the system shown in Fig.1, when the mass m_1 is excited by the force $F_1(t) = F_{10}coswt$. Also, plot its frequency-response curve.

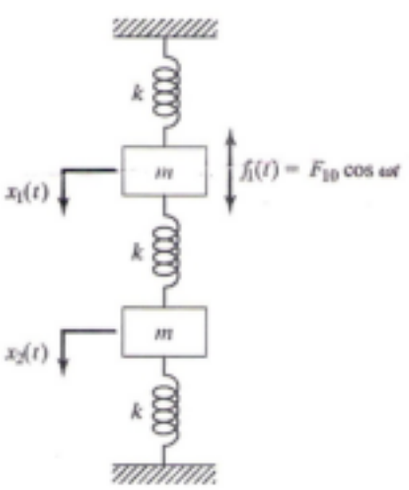

FIG-1

18. Determine the eigenvalues and eigenvectors of a vibrating system for which

$$m = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix} \text{ and } k = \begin{bmatrix} 1 & -2 & 1 \\ -2 & 4 & -2 \\ 1 & -2 & 1 \end{bmatrix}.$$

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.