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VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (Mech. Engg.) III Year II-Semester Old Examinations, May-2019

Mechanical Vibrations

Time: 3 hours Max. Marks: 70

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

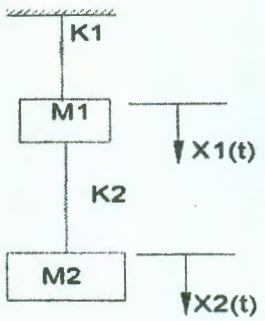
Part-A (10 × 2 = 20 Marks)

1. What happens to the energy dissipated by damping?
2. Why is it important to find the natural frequency of a vibrating system?
3. What is a node?
4. What are principle coordinates? What is their use?
5. What is mode shape? How is it computed?
6. What is an eigen value problem?
7. What is the speed of torsional waves in a solid steel ($G = 80x10^9$ N/m^2, $\rho = 7800$ kg/m^3) shaft of 20mm diameter?
8. What is the main difference in the nature of frequency equation of discrete system and continuous system?
9. What is the importance of vibration measurement?
10. How to define Frequency Response Function and its uses in vibration measurement?

Part-B (5 × 10 = 50 Marks)

11. A vibratory body of mass 150 kg is supported on a spring of stiffness 1050 kN/m has a rotating unbalancing force of 525 N at a speed of 6000 rpm. If the damping factor is 0.3 determine i) Amplitude of vibration and phase angle ii) Transmissibility ratio [10]

12. a) Determine the equation of motion and natural frequency of a 2-deegree of freedom spring-mass system given below [5]



b) Derive an expression for the orthogonality principle for a general 2-degree of freedom vibrating system from energy considerations. [5]

13. a) State Lagrange's equations. [3]

b) Determine the natural frequency and mode shapes of uniform thin slender rod having one end fixed and other end free. Show first three principle mode shapes. [7]

Contd... 2

14. a) Determine the natural frequency and mode shapes of torsional oscillation of a uniform shaft of length L, mass density ρ, and cross-sectional polar moment of inertia J. The shaft is fixed at one end and free at the other end. [7]

    b) How does a continuous system differ from discrete system in the nature of its equation of motion? [3]

15. a) A vibration pickup has a sensitivity of 40 mV/cm/s between 10Hz to 2000Hz. If 1g acceleration is maintained over this frequency range, what will be the output voltage at 10Hz and 2000Hz? [6]

    b) Discuss on the statement, "Spectrum analyzers are also known as FFT-analyzers". [4]

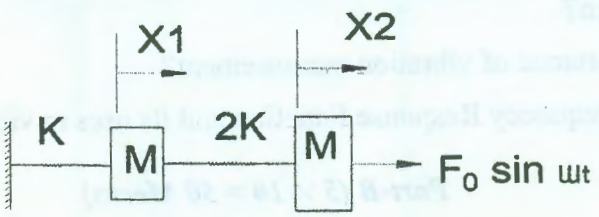
16. a) What methods are available for solving the governing equations of a vibrating problem? [5]

    b) How do you determine the degrees of freedom of lumped mass system? [5]

17. Answer any ***two*** of the following:

    a) Write the equations of motion of a multidegree-of-freedom system in matrix form using i) flexibility matrix ii) stiffness matrix. [5]

    b) Determine the steady state response of the system given below. [5]



    c) Mention the instruments used to measure the displacement and acceleration. [5]