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VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (Mech. Engg.: CBCS) III Year II-Semester Advanced Supplementary (Old) Examinations, July-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. Differentiate discrete and continuous systems.
2. Define logarithmic decrement.
3. What is coordinate coupling?
4. What is resonance?
5. Give two examples each for a multi degree of freedom longitudinal and torsional vibrating systems.
6. Express orthogonality principle for a multi degree of freedom system.
7. List different boundary conditions for a vibrating beam.
8. How many natural frequencies does a continuous system have?
9. State three methods of representing frequency-response data.
10. List the types of preamplifiers used in vibration measurement.

Part-B (5 × 10 = 50 Marks)

11.a) What is critical damping and what is its importance? [4]

b) Determine the natural frequency of a free-undamped spring mass system. [6]

12.a) Find the equations of motion of the following system shown in fig.1 [6]

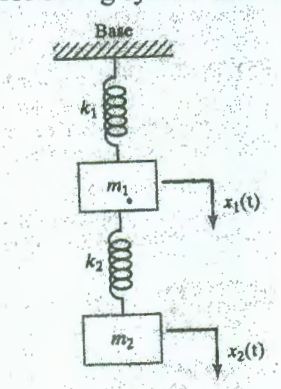

FIGURE 1

b) Differentiate between free and forced vibrations with respect to two degree of freedom systems. [4]

13.a) Define the flexibility and stiffness influence coefficients. What is the relation between them? [5]

b) A 2-degree of freedom system whose mass matrix is M =[100 40 ; 40 150] has a normalized mode shape of $X_1 = [\ 0.0341 \quad 0.0682\ ]^T$. Determine the normalized mode shape for the second mode. [5]

Contd... 2

14.a) Determine the characteristic equation for longitudinal oscillation of a bar of length L, elastic modulus E, and mass density ρ that is fixed at one end and free at the other end. [6]

b) Give examples of systems with nonlinear vibrations. [4]

15.a) Explain FFT analysis and its applications [4]

b) Explain working principle of an accelerometer with a neat sketch. [6]

16.a) In a spring mass vibrating system, the natural frequency of vibration is 3.56 Hz. When the amount of suspended mass is increased by 5kg, the natural frequency is lowered to 2.9Hz. Determine the original unknown mass and the spring constant. [5]

b) Explain the working principle of dynamic vibration absorber. [5]

17. Answer any *two* of the following:

a) Explain Rayleigh's method for the analysis of multi degree of freedom systems. [5]

b) Briefly explain the concept of random vibrations. [5]

c) Discuss vibration monitoring. [5]