Mechanical Vibrations
(ME-408, MAY 2007)

Time: 3 Hrs
Max Marks: 60

Note: Section A is compulsory. Attempt any four questions from Section B and any two from Section C.

Section-A

1. a) What are three elementary parts of a vibrating system?
   b) What is logarithmic decrement?
   c) Define the term magnification factor.
   d) How can we make a system vibrate in one of its natural mode?
   e) What is basic assumption in deriving Dunkerlay's formula?
   f) How does a continuous system differ from a discrete system in the nature of its equation of motion?
   g) What are the various methods available for vibration control?
   h) What are vibrometers?
   i) What is generalized mass matrix?
   j) What are common types of damping?

Section-B

2. A simply supported beam of square cross section 5 mm x 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 vibrations of 30 rad/s. Determine the Young's modulus of elasticity of the beam.
3. A system of beams supports a motor of mass 1200 kg. The motor has an unbalanced mass of 1 kg located at 6.0 cm radius. It is known that resonance occurs at 2210 rpm. What amplitude of vibration can be expected at the motor's operating speed of 1440 rpm, if the damping factor is assumed to be less than 0.1.
4. Calculate the natural frequency of a shaft of diameter 10 cm and length 300 cm carrying two discs of diameters 125 cm and 200 cm respectively at its ends and weighing 480 N and 900 N respectively. Modulus of the rigidity of the shaft may be taken a 2×10^{11} N/m^2.
5. Draw a neat sketch of centrifugal pendulum absorber and explain its working.
6. A simple pendulum of Length L, bob mass m, and rod mass M is vibrating in the vertical plane. Calculate the frequency of free vibrations.

Section-C

7. Writing the equation of motion for a damped free vibration system, derive expressions for amplitude in case of (i) Over damped system (ii) Under damped system (iii) Critically damped system. Represent the above three systems graphically also.
8. Calculate the natural frequency and mode shapes of the vibrating string as shown in figure below, by influence coefficient method.
   Figure.
9. Explain following:
   (i) Dunkerley's method (ii) Vibration Isolation