PVP 12

Code: ME6T6C

III B.Tech - II Semester – Regular Examinations – May 2015

MECHANICAL VIBRATIONS
(MECHANICAL ENGINEERING)

Duration: 3 hours Marks: 5X14=70

Answer any FIVE questions. All questions carry equal marks

1. a) Explain the various elements of vibration system. Compare the system parameters of a rectilinear and torsional system. 6 M

   b) Show that the simple harmonic motions (SHM) with frequency p and 2p when added will result in a period function of frequency 'p'. Generalize the above for 'n' number of harmonic functions with frequencies p, 2p, np, etc. 8 M

2. a) Determine the equivalent stiffness of the system as shown in Figure 1. 10 M

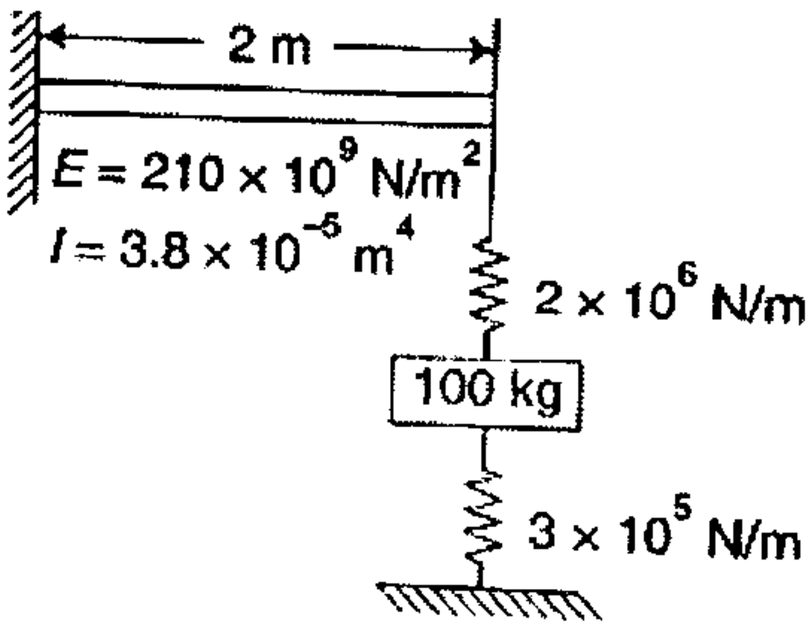

Figure 1

b) A spring mass system has spring constant of 'k' kg/cm and weight of mass 'W' kg. It has natural frequency of vibration as 12 c.p.s. An extra 2 kg weight is coupled to 'W' and natural frequency reduced by 2 c.p.s. Find 'k' and 'W'. 4 M

3. a) A gun barrel having a mass 560kg is designed with the following data: Initial recoil velocity 36 m/sec; Recoil distance on firing 1.5 m. Calculate i) spring constant, ii) damping coefficient, and iii) time required for the barrel to return to a position 0.12 m from its initial position. 12 M

b) Define logarithmic decrement. 2 M

4. a) What is transmissibility? At what frequency ratio, damping is useful in isolating forces. 6 M

b) A machine part having a mass of 2.5 kg vibrates in a viscous medium. A harmonic exciting force of 30 N acts on the part and causes a resonant amplitude of 14 mm with period of 0.22 seconds. Find damping coefficient. If the frequency of the exciting force is changed to 4Hz, determine the increase in the amplitude of the forced vibrations upon the removal of the damper. 8 M

5. a) Two rotors A and B are attached to the end of a shaft 50 cm long. Weight of the rotor A is 300 kg and its radius of gyration is 30 cm and the corresponding values of B are 500 kg and 45 cm respectively. The shaft is 7 cm in diameter for first 25 cm, 12 cm diameter for the next 10 cm and 10 cm diameter for the remaining length of its length measured from rotor A to B. Modulus of rigidity for the shaft material is 84×10^9 N/m^2. Find 10 M

i) the position of each node and

ii) the frequency of torsional vibration.

b) Explain principal mode of vibration. 4 M

6. A single rotor of mass 7 kg is mounted midway between bearings on a steel shaft 10 mm diameter. The bearings span is 0.4 m. It is known that CG of the rotor is 0.025 mm from its geometric axis. If the system rotates at 1000 r.p.m, find out the amplitude of vibration, the dynamic load transmitted to the bearings and the maximum stress in the shaft, when

i) the shaft is vertically supported,

ii) the shaft is horizontally supported. Neglect the weight of the shaft and the damping in the system.

14 M

7. A 40 mm diameter shaft is 2.5 m long has a mass of 15 kg per metre length. It is simply supported at the ends and carries three masses of 90kg, 140kg and 60kg at 0.8 m, 1.5 m, and 2 m respectively from the left support. Take E= 200GPa. Determine the natural frequency of the

transverse vibration of the system by using Rayleigh's method. 14 M

8. Derive frequency equation for a beam with both ends free and having transverse vibration. 14 M