Registration No. : [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Total number of printed pages – 3

B. Tech

PEME 5401

Seventh Semester Back Examination – 2014

MECHANICAL VIBRATION

BRANCH : MECH

QUESTION CODE : L 165

Full Marks – 70

Time : 3 Hours

*Answer Question No. 1 which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

   (a) Compare and contrast between Longitudinal vibrations and Transverse vibration along with diagrams and examples.

   (b) Define free vibration and forced vibration along with diagrams examples.

   (c) What is degree of freedom of vibratory system ? Explain with examples.

   (d) Compare and contrast between over damped and under damped vibration through graphical representation.

   (e) What is magnification factor ? Explain in graphical form.

   (f) Explain coulomb Damping and Equivalent viscous Damping and establish the relation between them.

   (g) What is sharpness of Resonance ? Explain.

   (h) Differentiate the characteristics and application between the vibrometer and accelerometer.

   (i) Explain 'Logarithmic Decrement' and represent motions under different types of damping in one graph.

   (j) Explain static coupling and dynamic coupling. State the conditions for existence of static coupling and dynamic coupling.

P.T.O.

2. (a) A vibrating system consisting of a mass of 2 kg and a spring of stiffness 20N/cm is viscously damped such that the ratio of any two consecutive amplitudes is 1.00 and 0.98. determine (i) the natural frequency of the damped system, (ii) The logarithmic decrement, (iii) the damping factor and (iv) the damping coefficient. 7

(b) A spring-mass system with viscous damping is displaced from the equilibrium position and released. If the amplitude diminished by 5% each cycle, what fraction of the critical damping does the system have ? 3

3. (a) Derive the expression for energy dissipation by damping in avibrating system. 4

(b) A machine of 150 Kg mass is supported on springs of total stiffness 800 KN/m and has an unbalanced rotating element, which results in a disturbing force of 400N at a speed of 3500 rpm. Assuming a damping factor of $\zeta = 0.20$ determine (i) its amplitude, (ii) the transmissibility and (iii) the transmitted force. 6

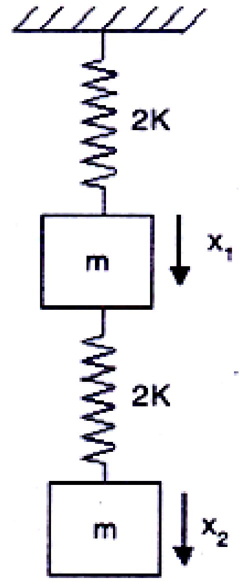
4. (a) An aircraft instrument of mass 10 kg is to be isolated from the engine vibrations. The engine runs at speeds ranging from 1088 rpm to 2000 rpm. Natural rubbing isolators with negligible damping are used. Determine the rubber stiffness for 90% isolation. 4

(b) A weight attached to a spring of stiffness 6000 N/m has a viscous damping device. When the weight is displaced and released, the period of vibration is 2 sec and the ratio of consecutive amplitudes is 4 to 1.0. Determine the amplitudes and phase when a factor F = 2cos3t acts on the system. 6

5. (a) A solid disk weighing 4.5 kg is keyed to the center of a 12 mm steel shaft 60 cm between bearings. Determine the lowest critical speed. (Assume the shaft to be simply supported at the bearings) 5

(b) A refrigerator unit weighing 30 kg is to be supported by three springs of stiffness 'k' N/mm each. If the unit operates at 580 rpm, what should be the value of the spring constant 'k', if only 10% of the shaking force of the unit is to be transmitted to the supporting structure ? 5

6. Write the equations of motion for the system and determine its natural frequencies and mode shapes. 10



7. (a) Determine the natural frequencies of uniform Beam of length 'l' clamped at both ends. 5

   (b) Determine the expression for the natural frequencies of a free – free bar in lateral vibration. 5

8. Determine the natural frequencies and mode shapes of the system. (Using Holzer's method) 10