Registration No. : | | | | | | | | | | |

Total number of printed pages – 3

B. Tech

PEME 5401

Seventh Semester Examination – 2013

MECHANICAL VIBRATION

BRANCH : MECH

QUESTION CODE : C-224

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 between free vibrations and forced vibrations with examples.

(b) Compare between Longitudinal vibrations and Transverse vibrations with diagrams.

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(c) What is Rayleigh's energy method ? Explain.

(d) Compare between Coulomb damping and Viscous damping.

(e) What is Magnification factor ? Explain through graph.

(f) What is Critical Speed ? Explain various factors for causing Critical Speed.

(g) What is Logarithmic Decrement ? Explain through graph.

(h) What is Transmissibility ? Explain through diagram.

(i) Explain the Sharpness of the Resonance through diagrams.

(j) Explain the terms Dynamical Coupling and Static Coupling of a Two-Degree of-Freedom System.

P.T.O.

2. A vibrating system is having a mass of 20 kg.It is suspended from a spring which deflects 10 mm under weight of the mass .Determine the natural frequency of the free vibration. What is the viscous damping force needed to get the aperiodic motion at a speed of 1 mm/s ? If when damped to this extent, an excitation force of maximum value of 110 N and vibrating at 5 Hz is made to act on the body, calculate the amplitude of the ultimate motion. 10

3. (a) A washing machine unit having a mass of 40 kg is to be supported on three springs, each having a spring constant **K**. The unit operates at 500 rpm. Determine the value of stiffness **K** if only 10% of the shaking force is allowed to be transmitted to the supporting structure. 6

(b) The following data are given for a vibrating system with viscous damping : m = 4.5 kg, k = 5250 N/m, and c = 21 Ns/m.Determine the logarithmic decrement and the ratio of any two successive amplitudes. 4

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4. A vibrating system is supported on four springs. It has a mass of 100 kg. The mass of reciprocating parts is 2 kg which move through a vertical stroke of 100 mm with simple harmonic motion. Neglecting damping, find out the combined stiffness of the springs so that the force transmitted to the foundation is 1/20 th of the impressed force. The system crank shaft rotates at 1000 rpm. If, under actual working conditions, the damping reduces the amplitudes of successive vibrations by 30%, find

(i) the force transmitted to the foundation at 1000 rpm.

(ii) the force transmitted to the foundation at resonance.

(iii) the amplitude of vibrations at resonance. 10

5. (a) Derive Euler's Equations of Transverse Vibrations of Beams with fundamental assumsions. 5

(b) Determine the natural frequencies of vibrations of a uniform beam clamped at both ends. 5

6. (a) Determine the natural frequencies of vibrations of a uniform beam simple supported at both ends. 5

(b) Derive the fundamental equations of Over damping, Critical damping and Under damping of Free damped vibration and compare through graphs. 5

7. (a) What is Degrees of freedom of the system ? Explain through diagrams. 2

(b) Develop the equation of motion, determine natural frequencies and mode shapes of a two degree freedom systems as shown in the figure. 8

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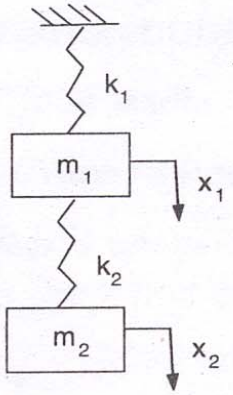

8. Use Holzer's Method to determine the natural frequencies for Torsional Vibration of the system as shown in the figure when $J_1 = J_2 = J_3 = 1$ and $Kt_1 = Kt_2 = 1$. 10