TME-501   1212

Odd Semester Examination, 2017-18

B.TECH. (SEMESTER-V)

MECHANICAL VIBRATION

Time: 03:00 Hours   Max Marks: 100

Note: Attempt **all** questions.

1. Attempt **any four** questions: [5x4=20]

    (a) Derive an expression for Logarithmic decrement.

    (b) Add the two harmonic motions as given below and express the resultant in the form
         of $x = A \sin(wt + \varphi)$ where $x_1 = 3\sin(wt + 30^0)$, $x_2 = 2\cos(wt - 15^0)$.

    (c) Discuss various types of damping models used in a mechanical vibration system.

    (d) A vibration system consists of a mass m and a spring of stiffness K. It has natural
         frequency of 12Hz. The natural frequency decreases by 2Hz when an extra mass of
         2kg is attached to m. Find K and m?

    (e) How to determine natural frequency by using energy method? Also discuss
         D'Alembert's principle in brief.

2. Attempt **any four** questions: [5x4=20]

    (a) What do you mean by vibration isolation and transmissibility?

    (b) A motor of mass 1200kg has an unbalanced mass of 1kg located at a radius of 6cm.
         The motor is supported on a system of beams. The resonance occurs at 2210rpm.
         Calculate the amplitude of vibration at an operating speed of 1440rpm. Assume
         damping factor of less than 0.1

    (c) A harmonic motion has amplitude of 2mm and the time period of 0.25seconds.
         Determine the maximum velocity and acceleration.

    (d) Describe the methods of frequency measuring instruments.

(e) Discuss steady state vibrations and plot the following graphs

    i. Magnification factor v/s frequency ratio

    ii. Phase lag v/s frequency ratio

3. Attempt **any two** questions: [10x2=20]

(a) Draw a neat sketch of centrifugal pendulum absorber and explain its working.

(b) Determine the natural frequency of torsional vibrations of a shaft with two circular discs of uniform thickness at the ends. The masses of discs are 500kg and 1000kg and their outer diameters are 125cm and 190cm respectively. The length of shaft is 300cm and its diameter is 10cm. Take modulus of rigidity for material of the shaft is $G = 0.83 \times 10^{11}$ N/m^2.

(c) Describe the analysis of double pendulum. Also obtain the principal modes and natural frequencies for the double pendulum.

4. Attempt **any two** questions: [10x2=20]

(a) Derive an expression for longitudinal vibration for a rectangular uniform cross sectional bar of length l fixed at one end and free at the other end.

(b) What do you mean by lateral vibration of beams? Also derive an equation for the same with neat diagram.

(c) Discuss the equation of motion, amplitude ratio, natural frequencies and mode shapes for torsional vibration of multi rotor system.

5. Attempt **any two** questions: [10x2=20]

(a) The vibration of a cantilever are given by the equation $y = Y[1-\cos(\pi x/2l)]$. The mass of cantilever $m = 6 \cdot 10^4$ Kg, length (l)= 30m, second moment of area about bending axis I= 0.02m^4, modulus of elasticity of material E= $2 \cdot 10^{11}$ N/m^2. Calculate the frequency of cantilever using Rayleigh's method.

(b) What do you mean by Whirling of uniform shaft. Also discuss critical speed of shaft with single disk with damping.

(c) Explain the procedure for determining natural frequencies and modes shapes of torsional systems by Holzer method.

*****

TME-501/1820   2