Registration No: -

Total Number of Pages : 03 **B.Tech**

PME7J001

7th Semester Regular Examination 2018-19

MECHANICAL VIBRATION

BRANCH : MECH

Time : 3 Hours

Max Marks: 100

Q.CODE : E059

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.

The figures in the right hand margin indicate marks.

Part- I

Q1 **Short Answer Type Questions (Answer All-10)** **(2 x 10)**

a) Differentiate between oscillation and vibration with suitable example.
b) What is meant by a semi-definite system
c) Why viscous damping is preferred in analysis over others?
d) What is meant by vibration isolation? Why is it necessary?
e) What is mode shape? Explain with an example of a two degree of freedom system
f) Why a dynamic vibration absorber is used? What is advantage of using damped dynamic vibration absorber?
g) What is logarithmic decrement?
h) Explain how spring mass affects the natural frequency of a undamped system.
i) What is meant by the term magnification factor?
j) How a tuned dynamic vibration absorber is different from a unturned one?

Part- II

Q2 **Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Give a brief note on different types of damping used in vibration
b) Derive the Expression for amplitude of vibration, phase lag and magnitude of impressed force for single degree of freedom damped forced vibration system
c) Explain the working principle of frequency measuring instruments with neat sketch.
d) Explain Frahm's dynamic vibration absorber and plot the frequency response of a dynamic absorber system.
e) Derive the differential equation of motion of a spring mass system by (a) Newton's second law of motion, (b) D'Alembert's principle.
f) Explain the frequency response curve of a forced vibration system with harmonic excitation.
g) From first principle justify how the reciprocating unbalance problem may be treated as rotating unbalance problem.
h) Obtain the absolute and relative amplitude ratio of a forced vibration system with base excitation.
i) Explain influence coefficients. What is the advantage of using these coefficients?
j) Explain the term mode shape taking an example of 2 degree of freedom system.
k) Derive the frequency equation of lateral vibration of fixed-fixed beam from first principle.
l) What is Rayleigh's quotient?

Part-III

Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a)** Find the modal matrix for the semi-definite system shown in Figure 1 **(16)**

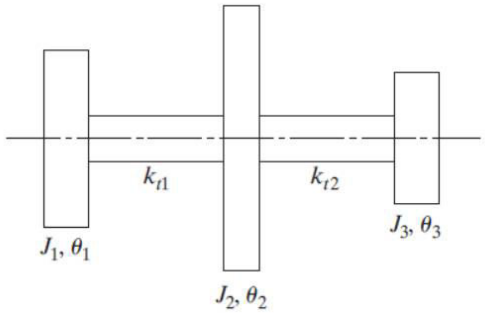

Figure 1

b) Derive the frequency equation for the longitudinal vibration of the systems shown in Figure 2

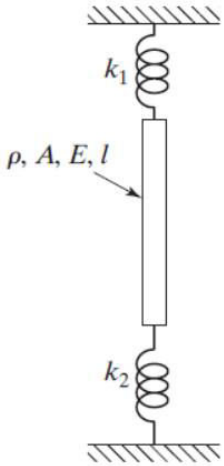

Figure 2

Q4 Figure 3 shows a steel stepped cantilever beam. The steps have square cross sections of size 10 cm X 10 cm, and 5 cm X 5 cm each with a length of 125 cm each. Assuming the Young s modulus as E= 215 GPa and the density 8000 kg/m^3, for the material of the beam, determine the fundamental natural frequency of bending vibration of the beam using Rayleigh s method. Assume the deflection of the beam as $y(x) = C\left(1 - \cos\frac{\pi}{2l}\right)$, where C is a constant. **(16)**

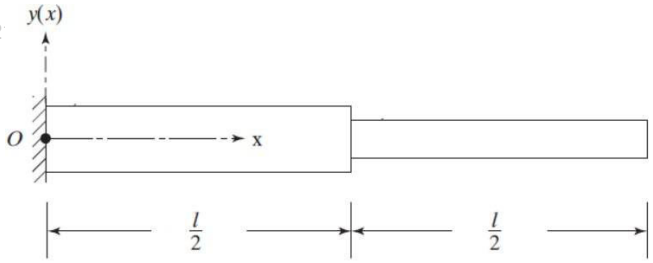

Figure 3

Q5 A vibration pickup has been designed for operation above a frequency level of 100 Hz without exceeding an error of 2%. When mounted on a structure vibrating at a frequency of 100 Hz, the relative amplitude of the mass is found to be 1 mm. Find the suspended mass of the pickup if the stiffness of the spring is 4000 N/m and damping is negligible. **(16)**

Q6 Find the natural frequencies of the system shown in Figure 4, with m_1= m, m_2= 2m, k_1= k, k_2= 2k. Determine the response of the system when k = 1000N/m, m = 20kg, and the initial values of the displacements of the masses m1 and m2 are 1 and -1, respectively. **(16)**

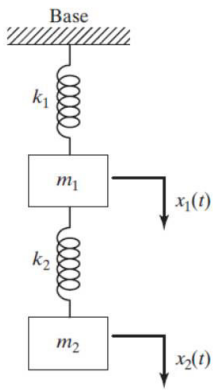

Figure 4