**Registration No :** | | | | | | | | | | |

**Total Number of Pages : 03** **B.Tech**
**PME7J001**

**7th Semester Regular / Back Examination 2019-20**
**MECHANICAL VIBRATION**
**BRANCH : MECH**
**Max Marks : 100**
**Time : 3 Hours**
**Q.CODE : HRB043**

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

**a)** A spring mass system has time period of 0.25 sec. What will be time period if spring constant is increased by 50%?
**b)** Obtain the governing equation of motion of a spring mass system by Rayleigh's principle.
**c)** Explain the concept of hysteresis. What is the area under hysteresis curve?
**d)** What is critical damping? Explain its importance.
**e)** What is transmissibility ratio? Draw response curve between transmissibility ratio against frequency ratio for different values of damping ratio.
**f)** What do you mean by transient response and steady state response?
**g)** What is the difference between accelerometer and vibrometer?
**h)** State the principal of orthogonality of mode shapes.
**i)** How will you differentiate between multi degrees of freedom system and continuous system?
**j)** Write down the general solution of one dimensional wave equation and explain the terms.

## Part- II

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

**a)** Represent the periodic motions given in Fig.1 by harmonic motion.

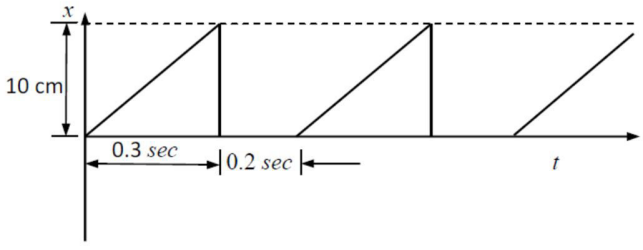


**Fig.1**

**b)** Find the natural frequency of the system shown in Fig.2.

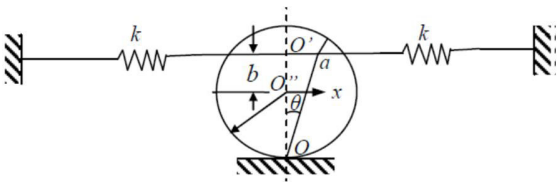


**Fig. 2**

**c)** A spring mass damper system is defined by the following parameter m=3 kg, k=100 N/m, C=3 N-s/m. Determine

a. Critical damping constant
b. Damping ratio
c. Frequency of damped oscillation
d. Logarithmic decrement

No of cycles after which the initial amplitude is reduced to 20%.

**d)** Define logarithmic decrement and derive its expression for damped free vibration.

**e)** Explain the basic working principle of vibration absorber with neat sketch.

**f)** A machine of mass 75 kg is mounted on an isolator having stiffness $1200\times10^3$ N/m and a damping factor 0.2. A reciprocating part of 2 kg has 80 mm stroke. If the crank speed is 3000 r.p.m. , determine-

a. the amplitude of machine
b. the phase angle
c. the force transmitted to the foundation.

**g)** A vibrometer having the amplitude of vibration of the machine part as 4 mm and damping ratio 0.2, performs harmonic motion, if the difference between the maximum and minimum recorded value is 10 mm, determine the natural frequency of vibrometer, if the frequency of the vibration part is 12 rad/sec.

**h)** Find the fundamental frequency of vibration of the system as shown in the Fig. 3 given below. Take K=1 N/m and m=4 kg.

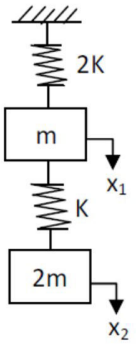


**Fig. 3**

**i)** What is Co-ordinate coupling? Explain through diagram and derive the expression for the natural frequencies of the system.

**j)** Discuss the method for finding the natural frequency of torsional vibration for a two rotor system.

**k)** Estimate the fundamental natural frequency of a simply supported beam of length *l* carrying three identical equally spaced masses ($m_1$=$m_2$=$m_3$) by Dunkerley's Formula. Take *E* and *I* as modulus of elasticity and moment of inertia of the beam.

**l)** What is the main difference in nature of frequency equations of a discrete system and a continuous system?

## Part-III

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

**Q3** A body of mass 5kg is supported on a spring of stiffness 1960 N/m and has a dashpot connected to it, which produces a resistance of 0.98 N at velocity 0.5 m/s. Find **(16)**

a) natural frequency of the system
b) damping ratio
c) Displacement of mass, 0.5 sec after it was displaced through 20 mm and released.

**Q4** A machine weighs 18 kg and is supported on spring and dashpots. The total stiffness of springs is 12 N/mm and damping coefficient is 0.2 Ns/mm. The system is initially at rest and a velocity of 120 mm/s is imparted to the mass. Determine- **(16)**

a) Natural frequency of system
b) Damped frequency of system
c) Damping factor
d) The displacement and velocity of mass as a function of time
e) The displacement and velocity after 0.5 sec.

**Q5** Find out the natural frequency of the following system shown in Fig.4 by Holzer's method & draw the mode shapes. **(16)**

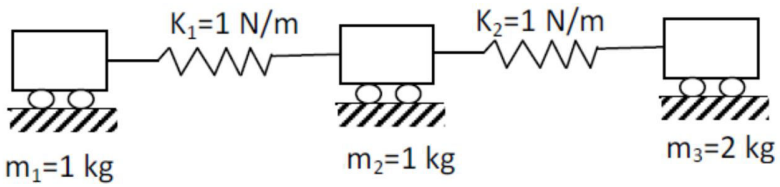


**Fig. 4**

**Q6** Derive the expression of one dimensional wave equation and find out its general solution. **(16)**