

Seventh Semester B.E. Degree Examination, June/July 2016
Mechanical Vibration

Time: 3 hrs.

Max. Marks: 100

Note: Answer FIVE full questions, selecting at least TWO questions from each part.

PART - A

- 1 a. Define the following terms :
 (i) Periodic motion (ii) Degree of freedom (iii) Resonance (iv) Phase difference. (04 Marks)
- b. Add the following motion analytically and check the solutions graphically.
 $x_1 = 3\sin(8t + 30^\circ)$, $x_2 = 2\cos(8t - 15^\circ)$ (08 Marks)
- c. Represent the periodic motions given by following Fig Q1(c) by harmonic series.

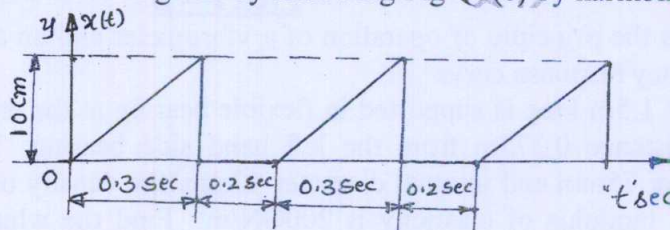


Fig. Q1(c)

(08 Marks)

- 2 a. Find out the natural frequency of the system shown in Fig. Q2 (a) by using (i) Newton's method (ii) Energy method. (10 Marks)

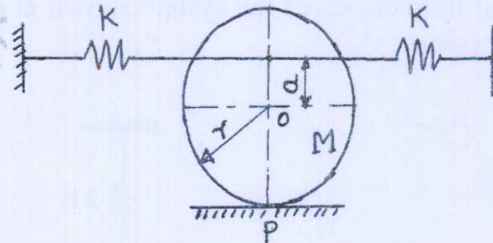


Fig. Q2(a)

- b. Determine the natural frequency of spring mass system taking the mass of the spring into account. (10 Marks)
- 3 a. Set up differential equation for a spring mass damper system and obtain the complete solution for the under damped condition. (08 Marks)
- b. Derive the equation of motion for the system shown in Fig. Q3(b). If $m = 1.5\text{kg}$, $K = 4900\text{N/m}$, $a = 6\text{cm}$, $b = 14\text{cm}$, determine the value of "C" for which the system is critically damped. (06 Marks)

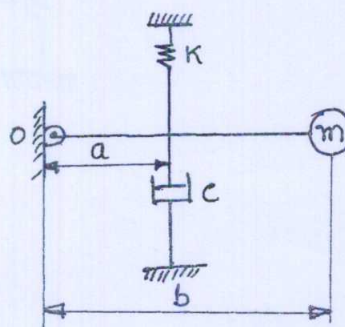


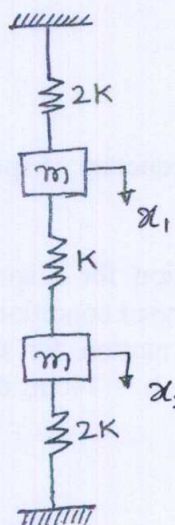
Fig. Q3(b)
 Rod is stiff and of negligible mass

- c. In a spring mass system, the mass of 10kg makes 40 oscillations in 20 seconds without damper. With damper, the amplitude decreases to 0.20 of the original value after 5 oscillations. Find out (i) stiffness of the spring (ii) Logarithmic decrement (iii) Damping factor (iv) Actual damping coefficient. (06 Marks)
- 4 a. Define the term "Transmissibility", and derive the expression for transmissibility ratio due to harmonic excitation. (08 Marks)
- b. A machine mass on ton is acted upon by an external force 2450N at a frequency of 1500rpm. To reduce the effects of vibration, isolator of rubber having a static deflection of 2mm under the machine load and an estimated damping factor of 0.2 are used. Determine:
- Force transmitted to the foundation
 - Amplitude of vibration of the machine
 - Phase lag of the transmitted force with respect to the external force. (12 Marks)

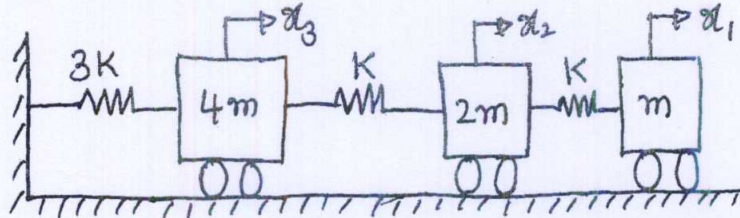
PART - B

- 5 a. Discuss the principle of operation of a vibrometer and an accelerometer. Draw the relevant frequency response curve (10 Marks)
- b. A shaft 1.5m long is supported in flexible bearing at the ends carries a wheel of 50kg mass at a distance 0.375m from the left hand side bearing. The shaft is hollow of external diameter 75mm and internal diameter 40mm. the density of the shaft material is 7.7 Mg/m^3 and its modulus of elasticity is 200 GN/m^2 . Find the whirling speed of shaft, taking into account the mass of the shaft. (10 Marks)
- 6 a. What is dynamic vibration absorber? Explain briefly the dynamic vibration absorber with diagram and equations. (10 Marks)
- b. Find the natural frequencies of the system shown in Fig. Q6(b). Also draw the mode shapes and locate the node. (10 Marks)

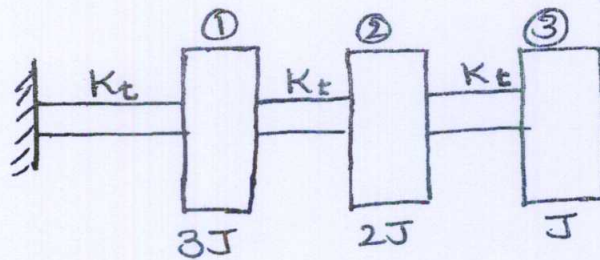
Fig. Q6(b)



- 7 a. Determine the natural frequency of the system shown in Fig. Q7(a), by using Holzer's method. Assume $K = 1\text{N/m}$, $m = 1\text{kg}$. (10 Marks)



- b. Determine the first natural frequency of the system shown in Fig. Q7 (b), by using matrix iteration method. (10 Marks)



- 8 Write a short notes on any FOUR

- Dynamic testing of machines
- Machine condition monitoring
- Orthogonality of principal modes
- Machine vibration monitoring
- Experimental modal analysis.

(20 Marks)
