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10ME72

Seventh Semester B.E. Degree Examination, July/August 2022
Mechanical Vibrations

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. What are the types of vibrations? Briefly explain. **(06 Marks)**

b. Explain the beats phenomenon and obtain its resultant motion. **(07 Marks)**

c. Obtain the periodic functions in terms of series of sines and consines of a Fourier series. **(07 Marks)**

2 a. Find the natural frequency of a spring-mass system with considering mass of the spring. **(10 Marks)**

b. Calculate the natural frequency of a system shown in Fig Q2(b). Using Newton's law of motion.

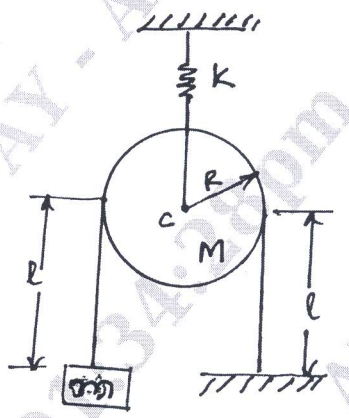

Fig Q2(b) **(10 Marks)**

3 a. Discuss the underdamped system with derivation of response equations and curves. **(12 Marks)**

b. A vibrating system having a mass of 3kg, spring stiffness of 100N/m and damping coefficient of 3N-s/m. Determine the damping ratio, damped natural frequency, logarithmic decrement, ratio of two consecutive amplitudes and number of cycles after which the original amplitude is reduced to 20%. **(08 Marks)**

4 a. Analyse the forced vibration with constant harmonic excitation and obtain an equation in non-dimensional form. **(10 Marks)**

b. A vibrating body is supported by six isolators each having stiffness to 32000 N/m and six dashpots each have 400Ns/m. The vibrating body is to be isolated by a rotating device having an amplitude of 0.06mm and 600rpm. Take m = 30kg. Determine amplitude of vibration of the body and dynamic load on each isolator. **(10 Marks)**

PART – B

5 a. Explain the vibrometer and accelerometer with sketch. **(10 Marks)**

b. Obtain an expression for whirling of shaft with air damping. **(10 Marks)**

6 a. Discuss the principle modes of vibration and natural frequencies of the system shown in Fig Q6(a). Assume $K_1 = K_2 = K_3 = KN/m$, $m_1 = m_2 = m$ kg.

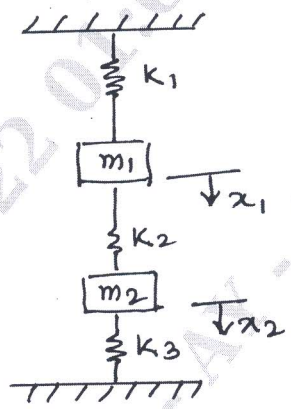

Fig Q6(a) **(12 Marks)**

b. Explain combined rectilinear and angular modes of systems with an expression. **(08 Marks)**

7 a. Calculate the influence coefficient of a dynamic system consisting of 3-equal masses attached to fact string shown in Fig Q7(a).

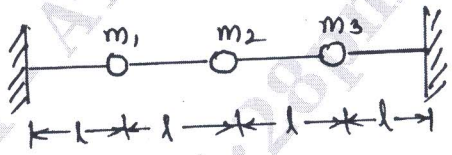

Fig Q7(a) **(08 Marks)**

b. Use the Stodola method to find the fundamental mode of vibration and its natural frequencies of system shown in Fig Q7(b)

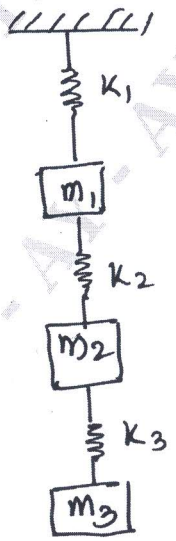

Fig Q7(b) **(12 Marks)**

8 a. Discuss the basic methods of machine condition monitoring. **(10 Marks)**

b. Explain the experimental modal analysis of modal parameters. **(10 Marks)**

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