RVK/KW/13/3295/3626

Faculty of Engineering & Technology

Eighth Semester B.E. (Mech. Engg.)/Eighth Semester B.E.P.T. (Mech.) Examination

VIBRATIONS

Elective—III

Sections—A & B

Time—Three Hours] [Maximum Marks—80

INSTRUCTIONS TO CANDIDATES

(1) All questions carry marks as indicated.

(2) Answer **THREE** questions from Section A and **THREE** questions from Section B.

(3) Due credit will be given to neatness and adequate dimensions.

(4) Assume suitable data wherever necessary.

(5) Illustrate your answers wherever necessary with the help of neat sketches.

(6) Use of Drawing instruments and non-programmable calculator is permitted.

SECTION—A

1. (a) Define the following :

(i) Amplitude

(ii) Frequency

(iii) Period. 3

(b) Enlist three examples of forced vibrations. 3

(c) Determine the natural frequency of the system of Figure 1(c). 7

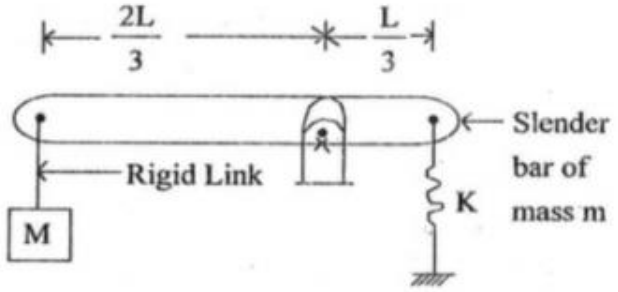

Figure 1(c)

2. (a) Use the convolution integral to determine the response of an undamped 1-degree-of-freedom system of natural frequency w_n and mass m, when subject to a time-dependent excitation of the form $F(t) = Foe^{-\alpha t}$. The system is at rest in equilibrium at $t = 0$. 9

(b) Explain in detail Impulse response. 4

3. (a) Use Lagrange's equation to derive the differential equations governing the motion of the system

shown in Figure 3(a). Use θ, x_1 and x_2 as generalized co-ordinates. 8

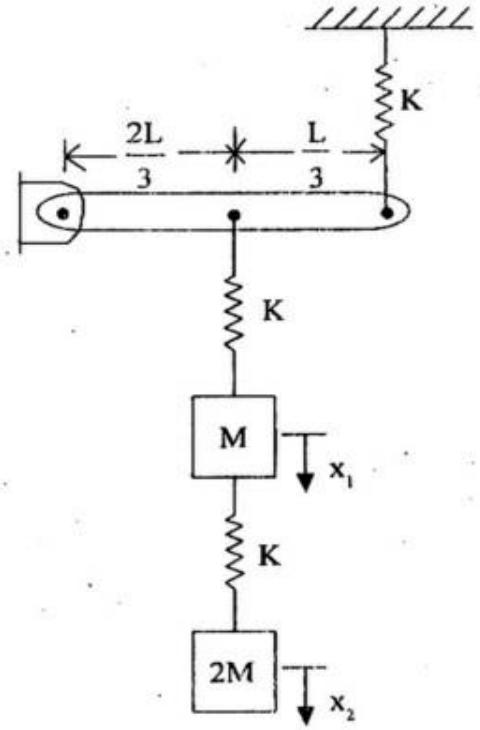

Figure 3(a)

(b) Explain in detail vibration absorber. 5

4. Using Holzer method, determine the natural frequencies of the spring mass system as shown in Figure 4. 13

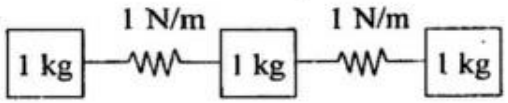

Figure 4

5. Write short notes on (any **FOUR**) : 14

(i) Range-Kutta method

(ii) Expansion theorem

(iii) Dankerley's method

(iv) Energy method for MDOFS

(v) Orthogonality Principle.

SECTION—B

6. (a) A uniform bar of length L is fixed at one end and the free end is stretched uniformly to L_0 and released at t = 0. Find the resulting longitudinal vibration. Take A—Area of cross section, E—Young's modulus. 10

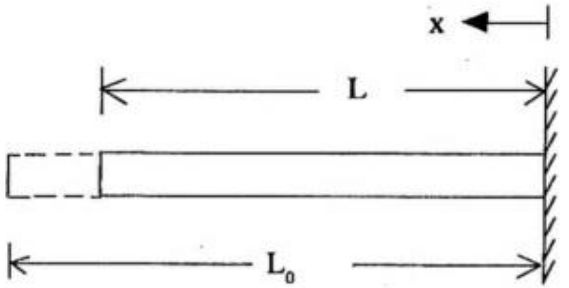

Figure 6(a)

(b) Enlist examples of continuous system. 3

7. Determine the steady-state vibration of a uniform shaft of length L, when an external torque $T_o \sin \omega t$ is

applied to the free end as shown in Figure 7. Take : G—Modulus of Rigidity. 13

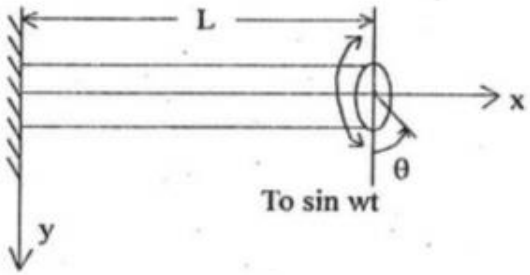

Figure 7

8. (a) Derive the element stiffness matrix for the bar element. 8

   (b) What is the role of transformation matrices in the finite element method ? 5

9. (a) Explain the role of vibration based condition monitoring to extend the life span of rotating machineries. 7

   (b) Explain digital vibration measurements. 6

10. Write short notes (any **FOUR**) : 14

    (i) Hamilton principle

    (ii) Shape function for rod and beam elements

    (iii) Vibration pick-ups

    (iv) Rayleigh-Ritz method

    (v) Spectrum analyzer.