[Graph Paper

B. Tech. (ME) 7th Semester (F-Scheme)
Examination, July–2022
MECHANICAL VIBRATIONS
Paper–ME-409-F

Time allowed : 3 hours] *[Maximum marks : 100*

Note: *Attempt **five** questions in all selecting **one** from each section. **Question no. 1 is compulsory.** All questions carry equal marks.*

Section-A

1. (i) Derive an equation of work done per cycle by harmonic force.

(ii) Represent the following complex number in exponential form

(a) $3 + j4$ (b) $3 - j4$

(c) $-3 + j4$ (d) $-3 - j4$

(iii) Runge- Kutta Method

(iv) Coordinate Coupling

(v) Rayleigh's Method 5×4=20

Section-A

2. Add the following vector analytically and check the solution graphically. 20

$X_1 = 4 \cos(\omega t + 10°)$

$X_2 = 6 \sin(\omega t + 60°)$

3. Write differential equation of motion for single degree of freedom having damped, free vibrations. Also discuss about the solution for under damping. 20

Section-B

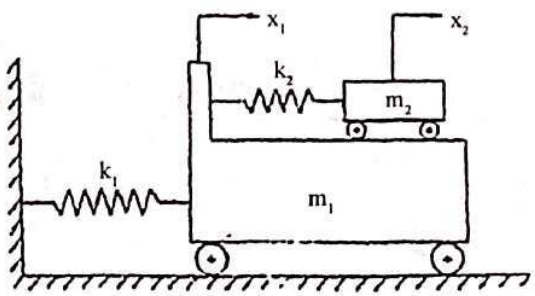
4. Draw the phase plane plot and displacement -time plot for a spring mass system subjected to a rectangular pluse of duration τ. 20

5. Write short note on :
   (i) Vibration Isolation
   (ii) Viscous damping
   (iii) Vibration Measuring Instruments 20

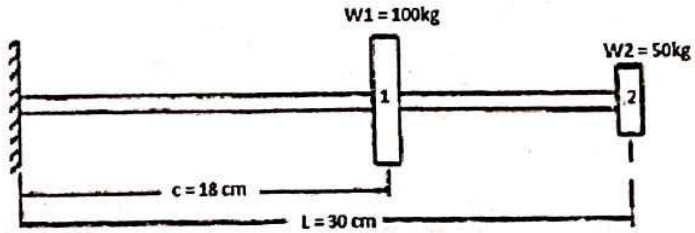
Section-C

6. Write down the differential equation of motion for the system shown in figure. The quantities x_1, and x_2 are absolute displacements. Find two natural frequency when

   $k_1 = 100$ kg/cm, $k_2 = 20$ kg/cm, $m_1 = 0.20$kg-sec²/cm, $m_2 = 0.20$kg-sec²/cm. 20



7. Explain Dunkerley's method to evaluate the natural frequency of structures. Solve the problem by Dunkerley's method. Take E= $2*10^6$ kg/cm^{-2} and I = 40 cm^4. 20



Section-D

8. Derive a suitable expression for longitudinal vibrations for a rectangular uniform cross section bar of length 'L' fixed at one end and free at the other end. 20

9. Find normal function and derive equation for torsional vibration of rod. 20

Encl : Graph Paper]