

Fig Q3(b)

(10 Marks)

4. A periodic torque having a maximum value of 0.588 Nm at a frequency of 4 rad/s is impressed upon a flywheel suspended from a wire. The wheel has a moment of inertia 0.12 kg-m^2 of wire has a stiffness 1.176 N/rad/m a viscous dashpot applies a damping couple of 0.392 Nm at an angular velocity of $\dot{\theta} \text{ rad/s}$. Calculate :
- Maximum angular displacement from rest position
 - Maximum couple applied to dashpot
 - The angle by which the angular displacement lags the torque
 - Critical damping co-efficient
- (20 Marks)
5. a. Explain the working of vibrometer with an example. (08 Marks)
 b. A rotor of mass 4 kg is mounted midway on a 10 mm diameter, horizontal shaft simply supported on a span of 0.5 m the outer of gravity of the rotor is 0.025 mm away from the geometric centre of the rotor. The shaft rotates at 2500 rpm . Find the amplitude of steady state vibration and dynamic force transmitted to the bearings. Take $E = 205 \text{ GPa}$. (12 Marks)
6. a. In the 2-DOF system shown in Fig Q6(a), if $m_1 = m$ and $m_2 = 2m$ and $k_1 = k_2 = k_3 = k$. Find the natural frequencies and mode shapes.

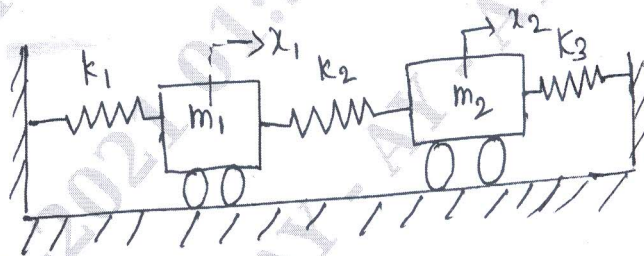


Fig Q6(a)

(10 Marks)

- b. Write the equations of motion for the spring mass pendulum system shown in Fig Q6(b). For the case $m_1 = m_2 = m$, find the natural frequencies.

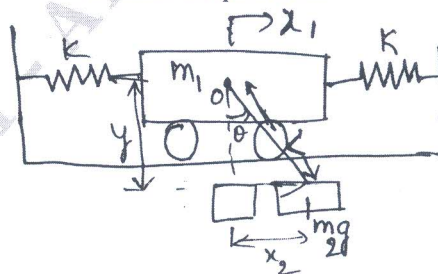


Fig Q6(b)

(10 Marks)

- 7 a. A car and its suspension system all idealized as a damped spring mass system, with natural frequency 0.5Hz and damping coefficient 0.2. Suppose the car drives at speed V over a road with sinusoidal roughness. Assume the roughness wavelength is 10m and its amplitude is 20cm. At what speed does the maximum amplitude of vibration occur and what is the corresponding vibration amplitude? (12 Marks)
- b. Explain the predominant sources of vehicle vibration. (08 Marks)
- 8 Consider the system shown in Fig Q8, write the equations of motion using influence coefficient. Find the natural frequencies and mode shape by matrix iteration. (20 Marks)

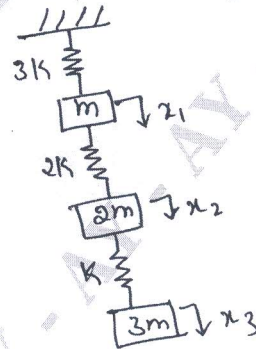


Fig Q8

(20 Marks)
