Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-I Remedial Examination April 2010

Subject code: 710902 **Subject Name: Dynamics of Machinery**

Date: 07 / 04 / 2010 **Time: 12.00 noon – 02.30 pm**

Total Marks: 60

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q-1 (a) Differentiate between a closed loop and open loop systems. Explain simple liquid level controller giving neat sketch. **06**

(b) (i) Explain phenomenon of resonance. **06**
(ii) Define and derive equations of transmissibility.
(iii) Explain study of vibration in context of high speed machines.

Q-2 (a) State and justify the assumptions made for the governing equation of acoustic sound wave. What are the major considerations made for deriving the equation. **06**

(b) Explain the terms **06**
(i) Octave (ii) Antiresonance (iii) Piston phone

OR

(b) Briefly state the common techniques for noise control and vibration control. **06**

Q-3 (a) The forward path transfer function of a control system is given by **06**

$$G(s) = \frac{K}{s\,(1+sT_1)(1+sT_2)}$$

If the system is closed through unity negative feed back set up the characteristic equation and used the Routh criterion to determine an expression for the maximum value of K to ensure stability.

(b) Consider a closed loop control system with negative feed back and having **06**

$$G(s) = \frac{2}{s(1+s)} \quad \text{and} \quad H(s) = \frac{1}{1+0.5s}$$

Write down an expression for the open loop transfer function .Sketch the Nyquist diagram and comment upon the stability of the system.

OR

Q-3 (a) Find the inverse Laplace transform of $F(s) = \dfrac{s^4 + 2s^3 + 3s^2 + 4s + 5}{s(s+1)}$ **06**

(b) Add the noise of six machines which individually make a noise level of 78, 81,81,79,72, 65 dB respectively. **06**

Q-4 (a) Derive the frequency equation for the system as shown in **fig. 1.** Assume the cord passing over the cylinder does not slip. **04**

OR

(a) For small angles of oscillation, derive the equation of motion of the system as shown in **fig.2.** **04**

(b) Use matrix iteration to determine the natural frequencies of the system shown in **fig. 3** **08**

OR

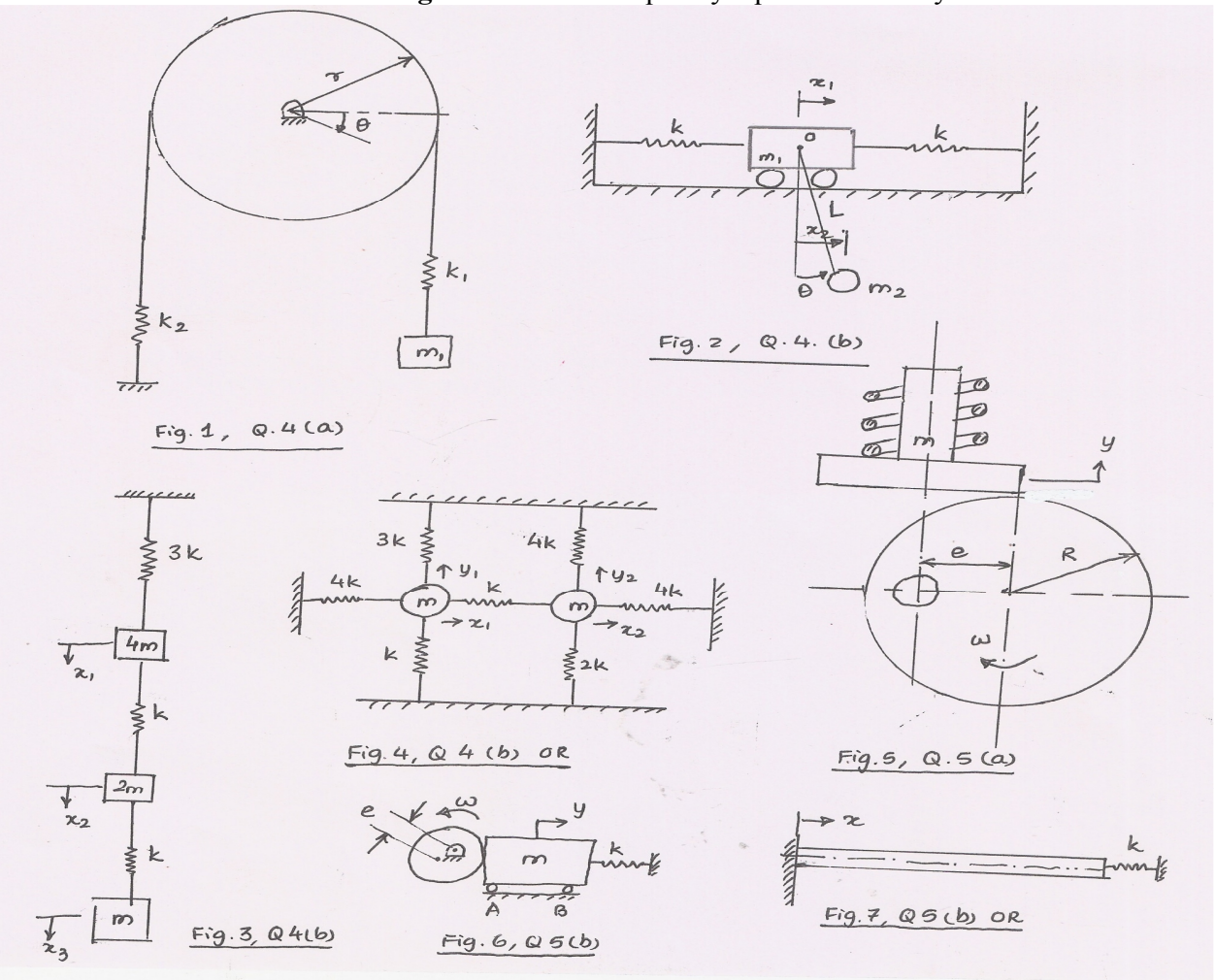
(b) The motion of the two masses shown in **fig.4** is restricted to the plane of the paper. For small angles of oscillation, the motion in the perpendicular direction can be taken independent of each other. Calculate the natural frequencies, the inertia matrix, the stiffness matrix, and the dynamic matrix. **08**

Q-5 (a) Develop mathematical model for cam-follower system (one-degree of freedom lumped parameter model of a cam-follower system). Refer **fig. -5**. **06**

OR

(a) An eccentric plate circular cam of 150mm diameter and eccentricity of 37.5mm provides motion to a spring loaded follower of mass 1.75kg whose axis is perpendicular to the axis of cam and passes through its centre. The spring has stiffness of 24 N/mm. It is found that at certain speed, the follower ceases to have contact with the cam when the cam has moved through 120 degree from its lower position. Determine this speed. The initial compression of spring is 31.25mm.Dteremine also the limiting angular speed of the cam to avoid cam jump. **06**

Q-5 (b) Derive equations & analyze an eccentric cam (circular disk with the cam – shaft hole drilled off centre) Refer **fig. 6.** **06**

OR

(b) A bar of length L is fixed at one end and connected at the other end by a spring of constant *k* as shown in **fig.7.** Derive the frequency equation of the system. **06**