

GUJARAT TECHNOLOGICAL UNIVERSITY
ME Semester –I Examination Feb. - 2012

Subject code: 710902N

Date: 13/02/2012

Subject Name: Dynamics of Machinery

Time: 10.30 am – 01.00 pm

Total Marks: 70

Instructions:

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

- Q.1 (a)** The forward path transfer function of a unity feedback system is given by **07**

$$G(s) = \frac{K}{s(s+4)(s^2+4s+20)}$$

Sketch the root locus as K varies from zero to infinity.

- (b)** (i) For a closed loop transfer function **07**

$$G(s) = \frac{K}{s(1+0.4s)(1+0.25s)}$$

Find the range of K for stability and also find K_{max} and ω_{max}.

- Q.2 (a)** Explain Holzer's method with the help of a significant example. **07**

- (b)** Derive the equation of three dimensional acoustic sound waves. State & justify the assumptions made for it. **07**

OR

- (b)** Explain the normal modal harmonic analysis **07**

- Q.3 (a)** Explain jumping speed, spring surge and wind up. Explain different factors which affect the jumping speed. **07**

- (b)** List out classical methods and approximate methods for the vibration analysis and explain one method from each. **07**

OR

- Q.3 (a)** What do you mean by Control system? Explain liquid level controller of first order with a neat sketch. **07**

- (b)** A circular cam of 110mm diameter with its centre displaced at 40mm from the camshaft is used with a flat surface follower. The line of action of the follower is vertical & passes through the shaft axis. The mass of the follower is 4kg & is pressed downwards with a spring of stiffness 6N/mm. In the lowest position, the spring force is 70N. Derive an expression for the acceleration of the follower as a function of cam rotation from the lowest position of the follower. Also, find the speed at which the follower begins to lift from the cam surface. **07**

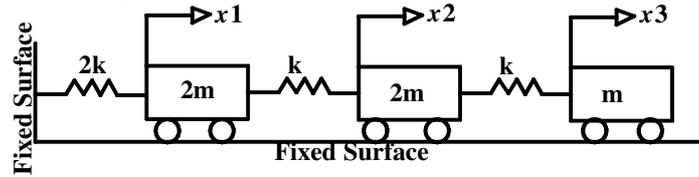
- Q.4 (a)** The characteristic equation for certain feedback control system are given below. In each case, determine the range of values of K for the system to be stable. **07**

$$s^4 + 20Ks^3 + 5s^2 + 10s + 15 = 0$$

- (b)** Derive the expression for the jumping speed of non rigid cams. **07**

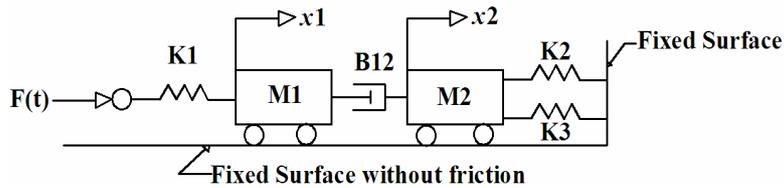
OR

- Q.4 (a)** Determine the natural frequencies and mode shapes of the system shown in figure below by matrix inversion method. **07**



- (b)** Obtain the conditions for the magnification factor for the force transmissibility and motion transmissibility for a single degree of freedom system. Also draw their frequency response curve. **07**

- Q.5 (a)** Obtain the overall system function for a mathematical model for the system shown in following figure. **07**



- (b)** Explain Nyquist criteria giving one suitable example. **07**

OR

- Q.5 (a)** Explain in detail Robotic Control System with neat sketch. **07**
(b) The forward path transfer function of a unity feedback system is given by **07**

$$G(s)H(s) = \frac{K}{s(s+6)(s^2+4s+13)}$$

Sketch the root locus as K varies from zero to infinity.
