Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER 2012

Subject code: 710902N **Date: 09/01/2013**

Subject Name: Dynamics of Machinery

Time: 02.30 pm – 05.00 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)**	What do you meant by control system? How the open loop and closed loop control systems differ from each other? Support your answer with suitable examples.	**07**
	(b)	Explain briefly about the classical and approximate methods of vibration analysis. Discuss about one of the approximate methods in detail.	**07**
Q.2	**(a)**	State the various methods used for noise measurement. Explain any two of them.	**07**
	(b)	What do you meant by 'jump', 'jump speed' and 'jump criteria' in the context of high speed cam-follower mechanism? Why it is necessary to carry out the dynamic analysis in case of high speed cam-follower mechanism?	**07**
		OR	
	(b)	What do you meant by stability of a control system? State the different criteria used to investigate the stability of the control system. Explain any one of them.	**07**
Q.3	**(a)**	Derive the suitable expression of transverse vibration for the beam of length l with uniform cross section carrying a uniformly distributed load and fixed at both the ends in usual notations.	**07**
	(b)	Explain the normal modal harmonic analysis.	**07**
		OR	
Q.3	**(a)**	Formulate the mathematical model of the cam and follower system considering their elasticity.	**07**
	(b)	The open loop transfer function of unity feed back system is $G(s) = \dfrac{K}{s(s^2 + s + 1)(s + 2)}$. Estimate the value of K so that the closed loop system is fully stable.	**07**
Q.4	**(a)**	For small angle of oscillations, derive the equations of motion of the system shown in Fig. 1.	**07**
	(b)	Write a short note on 'noise control'.	**07**
		OR	
Q.4	**(a)**	A dwell-rise-dwell cam-follower system has a rise of 40 mm with uniform velocity for 102° of cam rotation. The retaining spring having a stiffness of 32000 N/m and assembled with sufficient pre-compression. The follower train has equivalent mass of 0.5 kg and equivalent stiffness of 7,50,000 N/m. Using Johnson's numerical method, determine the follower response when the cam rotates at 3000 rpm.	**07**
	(b)	Comment about the stability of the control system whose characteristic	**07**

equation is $s^5 + 1.5s^4 + 2s^3 + 4s^2 + 5s + 10 = 0$.

If the system is found to be unstable, how many roots it has with positive real part?

Q.5 **(a)** Determine the natural frequencies of the system shown in the Fig. 2. **07**

(b) Discuss about the auto correlation functions and their properties. **07**

OR

Q.5 **(a)** An eccentric cam of 200 mm of diameter and eccentricity of 40 mm. It provides motion to the spring loaded follower of mass 2.5 kg whose axis is perpendicular to the axis of the cam and passes through its center. The retaining spring has stiffness of 25 N/mm and assembled with initial compression of 30 mm. Determine the speed of the cam at which the follower looses the contact with the cam when cam has rotated through 135° from its lowest position. Also calculate the limiting speed of the cam to avoid the same. **07**

(b) The forward path transfer function of a unity feed back system is $G(s) = \dfrac{K}{s(s+4)}$. **07**

Sketch the root locus as K varies from 0 to infinity.

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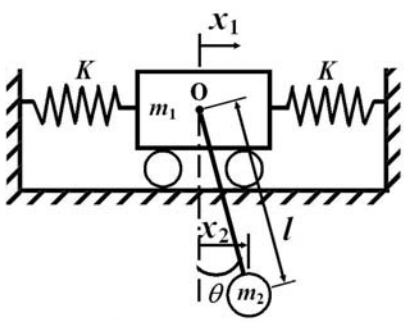

Fig. 1, Q.4(a)

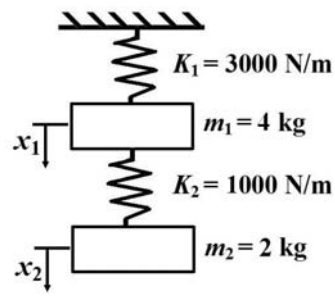

Fig. 2, Q.5(a)

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