

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID: 5888

Roll No.

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B.Tech.

SEM V ODD SEMESTER THEORY EXAMINATION

2010-11

AUTOMATIC CONTROL SYSTEM

Time : 3 Hours

Total Marks : 100

Note :- Attempt all questions. All questions carry equal marks.

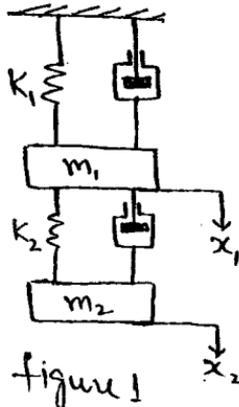
1. Attempt any two parts of the following : (10×2=20)

(a) (i) List the major advantages and disadvantages of open-loop control systems.

(ii) List the important properties of signal flow graphs.

Give the Mason's gain formula for signal flow graphs.

(b) Using the force-voltage analogy, obtain an electrical analog of the mechanical system of figure 1.



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- (c) Derive the transfer function of the electrical system shown in figure 2. Draw a schematic diagram of an equivalent mechanical system.

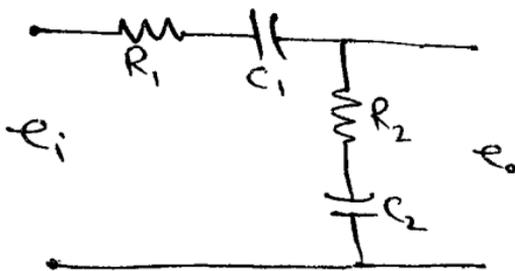


figure.2

Attempt any **two** parts of the following : (10×2=20)

- (a) Consider a system shown in figure 3. Find static position error constant k_p , and static velocity error constant k_v . Show that steady state activating error for unit-ramp input is zero for type 2 or higher systems.

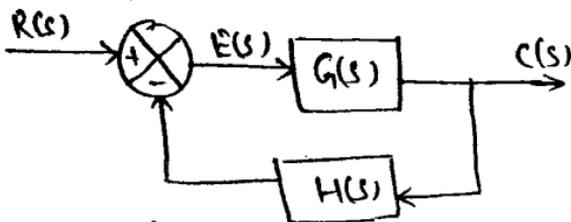


figure.3

- (b) Find the step response for second order system. Also discuss condition of underdamped, critically damped and overdamped.
- (c) Explain the control action of PID controller. Also discuss effects of integral and derivative control actions on system performance.

3. Attempt any two parts of the following : (10×2=20)

- (a) Sketch the root loci for the system of figure 4. The gain K is assumed to be positive. Show that for small or large values of K the system is overdamped and for medium values of K it is underdamped.

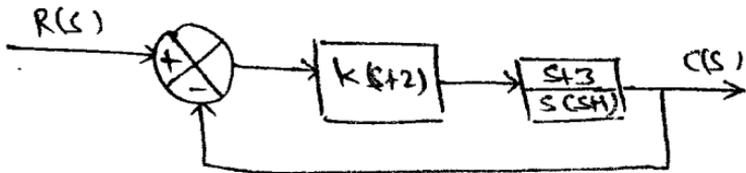


figure 4

(b) Write notes on following :

- (i) Asymptotic and conditional stability
- (ii) Nyquist stability criterion
- (iii) Routh's stability criterion.

(c) Using the inverse polar plot, determine the range of gain K for stability of control system shown in figure 5.

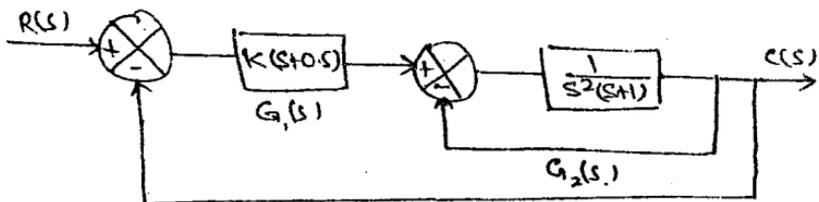


figure 5

4. Attempt any two parts of the following : (10×2=20)

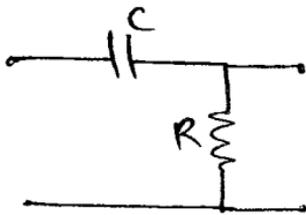
- (a) Show that the lead network and lag network inserted in cascade in an open loop acts as proportional-plus-derivative control in the region of small ω and proportional-plus-integral control in the region of large ω , respectively.

(b) Explain the following :

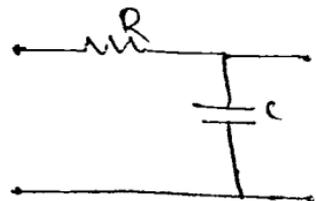
(i) Electronic lag-lead compensator using operational amplifiers.

(ii) Mechanical lag-lead network.

(c) (i) Draw the Bode diagrams of the lead network and lag network shown in figure 6(a) & (b) respectively.



(a)
Fig. 6



(b)

(ii) Give root-locus approach to control system design. Also discuss the effect of addition of poles and zeroes.

5. Attempt any **two** parts of the following : (10×2=20)

(a) Consider the system described by :

$$\ddot{y} + 3\dot{y} + 2y = v$$

Derive a state-space representation of the system.

(b) (i) Consider the system described by :

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -4 & -1 \\ 3 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \end{bmatrix} V$$

$$y = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} -x_1 \\ x_2 \end{bmatrix}$$

Obtain the transfer function of the system.

(ii) Comment on following :

(i) Effect of pole zero cancellation in transfer function.

(ii) Controllability and obsoervability.

(c) Write notes on :

(i) Neural Networks

(ii) Fuzzy logic control.