Printed Pages—5 **TEC504**

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

PAPER ID : 3088 **Roll No.** | | | | | | | | | | |

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.

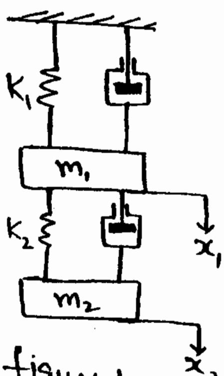


figure 1

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

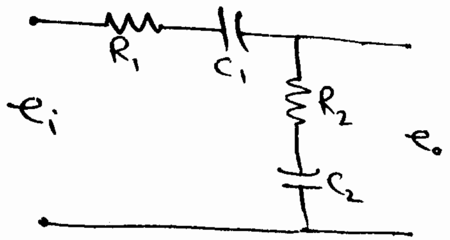


figure.2

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.

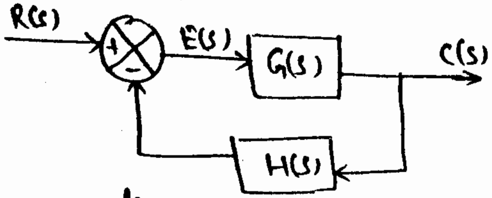


figure.3

(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.

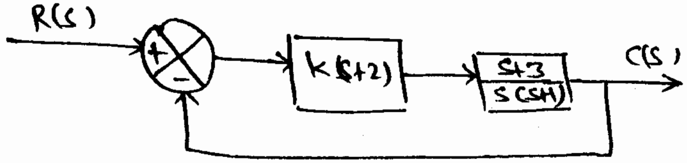


figure 4

(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.

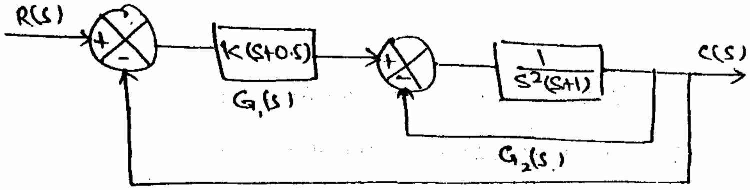


figure.5

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

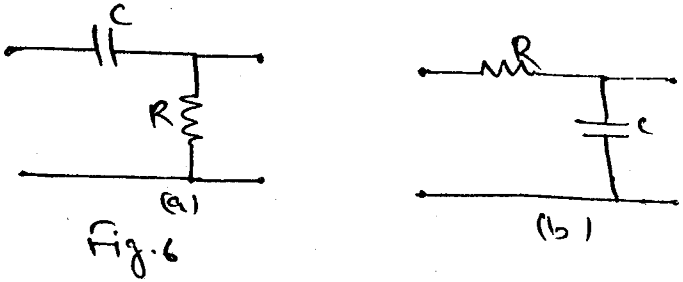
(a) Show that the lead network and lag network inserted in cascade in an open loop acts as proportional-plus-derivative control in the region of small w and proportional-plus-integral control in the region of large w, respectively.

(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.



(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 :

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

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.