B.Tech 6th Semester (ME) F-Scheme Examination,

May–2017

AUTOMATIC CONTROL

Paper-ME-308-F

Time allowed : 3 hours] *[Maximum marks : 100*

Note : ***Question No.1 is compulsory.*** *Attempt* ***one*** *question from each section. In all* ***five*** *questions are to be attempted.*

1. (a) Why negative feedback is preferred in a closed loop system ?

(b) What is the necessary condition for stability ?

(c) Define Damping Ratio.

(d) Mention the nature of transient response of second order control system for different types of Damping.

(e) What is steady state error for unit step input and unit ramp input in case of type zero system ?

(f) Define phase margin and gain margin.

(g) What is state transition matrix ?

(h) Write Mason's Gain Formula.

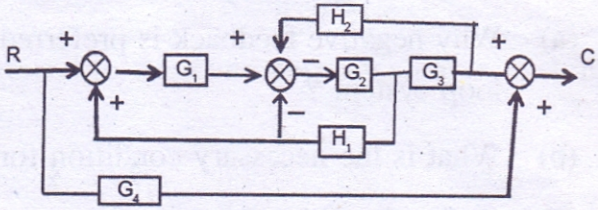
(i) What is dominant pole pair ?

(j) What is order of the system whose transfer function is

$$G(S) = \frac{K}{S^2(S+2)}$$ 2×10=20

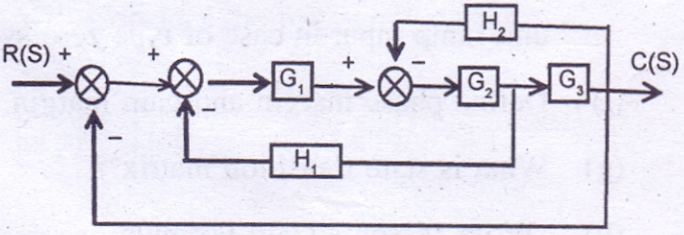
Section-A

2. (a) Determine the transfer function C/R for the system given below. Use Mason's gain formula 10



(b) What is control system ? Describe its classification in detail. 10

3. (a) Determine the ratio C(S)/R/(S) for the given system shown below : 10



(b) Discuss the effect of feedback on a control system. 10

Section-B

4. The open loop transfer function of a unity feedback control system is given by :

$$G(S) = \frac{25}{S(S+5)}$$

Calculate

(a) The natural frequency of oscillation, damped frequency of oscillation, damping factor, damping ratio and maximum overshoot of a unit step I/P.

(b) Steady state error for a unit ramp input.

(c) If damping ratio is to be made 0.75 using a tachometer feedback. Calculate tachometer constant. 20

5. (a) Sketch the polar plot of $G(S) = \frac{10}{S(S+1)}$ 10

(b) Write short note on proportional control and proportional-cum-integral control. 10

Section-C

6. (a) Investigate the stability using Routh-Hurwitz criterion for following characteristic equation :

$S^5 + S^4 + 2S^3 + 2S^2 + 11S + 10 = 10$ 10

(b) Using Nyquist criterion determine the stability of feedback system which has following open loop transfer function :

$$G(S).H(S) = \frac{K}{S^2(1+ST)}$$ 10

7. Plot the root locii for closed loop control system with

$$G(S) = \frac{K}{S(S+1)(S^2+4S+S)}, \quad H(S) = 1$$ 20

Section-D

8. Determine the time response for a system given below. 20

$$\dot{x}_1 = -x_1$$

$$\dot{x}_2 = x_1 - x_2 + U(t)$$

and $x(o) = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$

9. (a) Explain the hold circuit used in sampling. 8

(b) Consider the following system : 12

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -0.5 & 0 \\ 0 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} U(t)$$

$$Y(t) = [0\ 1] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Test this system for controllability & Observability.