**(Compulsory Question)**

9. (a) Compare signal flow graph and bock diagram reduction technique.

   (b) Define steady state error and error coefficient.

   (c) What do you mean by transfer function ? State its properties.

   (d) Define angle of departure and breakaway point.

   (e) Define STM with its properties.

   (f) Define nyquist stability criterion.

   (g) A close loop control system has the characteristics equation given by $s^3 + 4.5s^2 + 3.5s + 1.5 = 0$. Investing its stability using Routh-Hurwitz criterion.

   (h) What is the effect on stability of system when poles and zeros are added ?

   (i) Derive steady state error for Type I system for unit ramp input.

   (j) Define state variables and state vectors. **2×10=20**



Roll No. ..... Total Pages : 04

# July-22-00382

## B. Tech. EXAMINATION, 2022

Semester VI (CBCS)

CONTROL SYSTEMS

EC-603

*Time : 3 Hours* *Maximum Marks : 60*

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**Note** : Attempt *Five* questions in all, selecting *one* question from each Section A, B, C and D. Q. No. 9 is compulsory.

### Section A

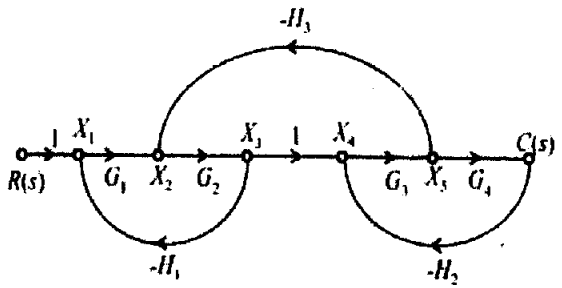
1. What do you understand by Control System ? Draw and explain block diagram of control system for open loop and close loop systems. **10**

2. Define Feedback ? Explain feedback control systems and effects of feedback in detail. **10**

## Section B

3. Draw transient response for 2nd order system with step input. Define and derive expression for rise time, peak time, maximum overshoot and settling time. **10**

4. Write and explain Mason's Gain Formula. For the signal flow graph shown below, find transfer function using Mason's Gain formula. **10**




## Section C

5. Plot the root loci for the closed loop control system with : **10**



$$G(s)=\frac{K}{s(s+1)(s^2+4s+5)},\quad H(s)=1$$

6. Draw the bode plot for the transfer function $G(s)=\frac{1000}{s(1+0.1s)(1+0.001s)}$. Determine gain crossover frequency, phase crossover frequency, phase margin, gain margin and stability of the system. **10**

## Section D

7. Why compensator networks are required ? Explain briefly phase lead lag conpensator network. **10**

8. What do you understand by controllability and observability ? Consider the following system, test for its controllability and observability : **10**

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

$$y(t)=\begin{bmatrix}0 & 1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}$$