B.E. Electrical (Electronics & Power) Engineering / Electronics & Telecommunication / Communication Engg. / Electronics Engg. Sixth Semester

EP603 / ET603 / EN603 - Control Systems-I / Control System Engineering

P. Pages : 3 **GUG/W/18/1684**

Time : Three Hours Max. Marks : 80

Notes :
1. All questions carry equal marks.
2. Answer **five** questions among the internal choices.
3. Due credit will be given to neatness and adequate dimensions.
4. Illustrate your answers wherever necessary with the help of neat sketches.
5. Use of Non-Programmable calculator is permitted.

1. a) Define 'Open Loop' and 'Closed Loop' control system. Give some examples. **6**

b) Obtain the transfer function $\frac{C(s)}{R(s)}$ for the following system as shown in Fig. (1). **10**

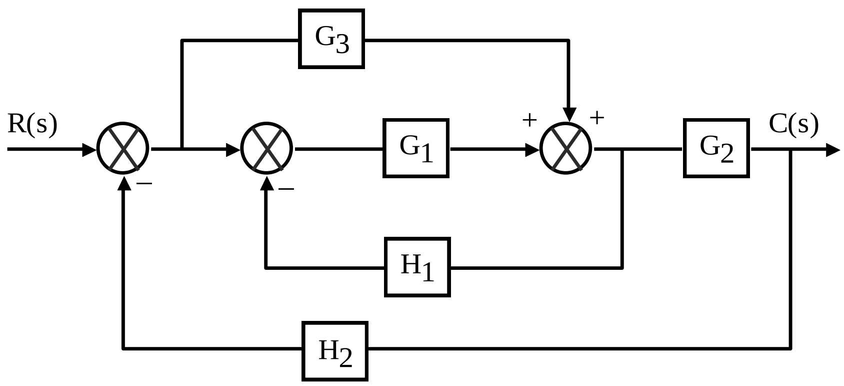

Fig. (1)

OR

2. a) Explain the different terms related with the signal flow graph. Also explain the Mason's gain formula. **6**

b) For the block diagram shown in Fig. 2. Draw signal flow graph & hence find the closed loop transfer function using Mason's gain formula. **10**

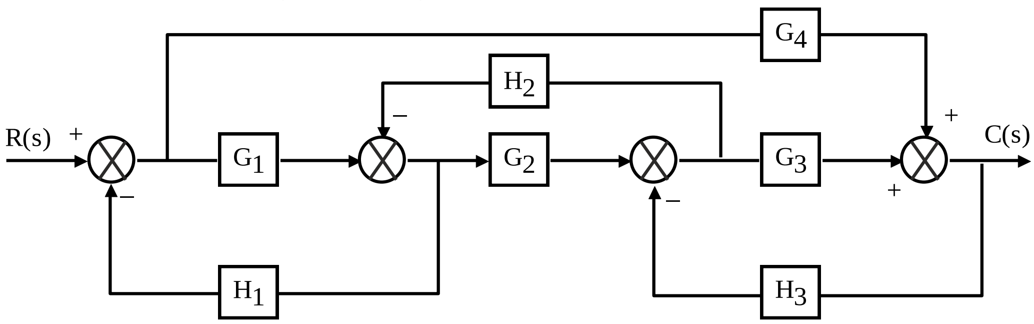

Fig. (2)

3.	a)	Define the terms: i) Delay time ii) Rise time iii) Peak time iv) Peak overshoot v) Setting time	**6**
	b)	For a unity Feedback system: $G(s)=\frac{200}{s(s+2)}$ Find time domain specifications and output for a unit step input.	**10**

OR

4.	a)	Define and derive the expression for Rise time. Unit step as the input subjected.	**6**
	b)	$G(s)=\frac{10(s+1)}{s^2(s+2)(s+10)}$ for unity feedback system, determine: i) Type of the system ii) All error constants iii) Steady state error for $r(t)=1+4t+\frac{t^2}{2}$.	**10**
5.	a)	Define "Stability" of any control system. Explain its types with examples.	**8**
	b)	Determine the stability for $s^6+2s^5+8s^4+12s^3+20s^2+16s+16=0$. by using Routh's criteria.	**8**

OR

6.		Sketch the root locus for the open loop transfer function of a unity feedback control system given below and determine: $G(s)=\frac{K}{s(s+1)(s+3)}$ i) The value of K for $\xi = 0.5$ ii) The value of K for marginal stability iii) The value of K at S = -4.	**16**
7.	a)	Define: i) Resonance Peak ii) Resonant frequency iii) Bandwidth iv) Gain Margin v) Phase Margin	**6**
	b)	Sketch Bode Plot for the following. $G(s)\,H(s)=\frac{10}{s(s+1)(s+5)}$ Determine the gain cross over frequency, phase margin, gain margin. Comment on stability of the system.	**10**

OR

8. a) Explain Nyquist stability criterion and its significance. **6**

b) Sketch the polar plot for the following transfer function. **10**

$$G(s)\cdot H(s)=\frac{10}{s(s+1)(s+2)}$$

9. a) Comment on the following statement: **6**

"Transfer function is unique but state variables are non-unique".

b) The closed Loop transfer function of the system is given below: **10**

$$\frac{C(s)}{R(s)}=\frac{24}{(s+1)(s+2)(s+3)}$$

Derive two different state models for the system.

OR

10. a) Define: **4**

i) State variables ii) State space

iii) State iv) State trajectory

b) Explain different types of state model. **4**

c) Determine the system transfer function using the following state equation. **8**

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}-5. & -1\\ 3 & -1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}2\\ 5\end{bmatrix}U$$

$$Y=\begin{bmatrix}1 & 2\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}.$$

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