B.E.-Electrical Engineering & (E. & P.) / Electronics Telecommunication / Communication Engg. / Electronics Engg. Sem VI

EE / ET / EN 603 - Control Systems - I / Control System Engineering

P. Pages : 3 **GUG/S/18/5361**

Time : Three Hours * 1 4 1 5 * Max. Marks : 80

Notes : 1. All questions carry equal marks. However the students may avail internal choice.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.
5. Use of Non-programmable calculator is permitted.

1. a) Define control system? Explain & Define open loop & closed loop system with suitable examples. **6**

b) Determine the overall transfer function relating C (s) & R (s) for the system whose block diagram is shown in fig. (1). **10**

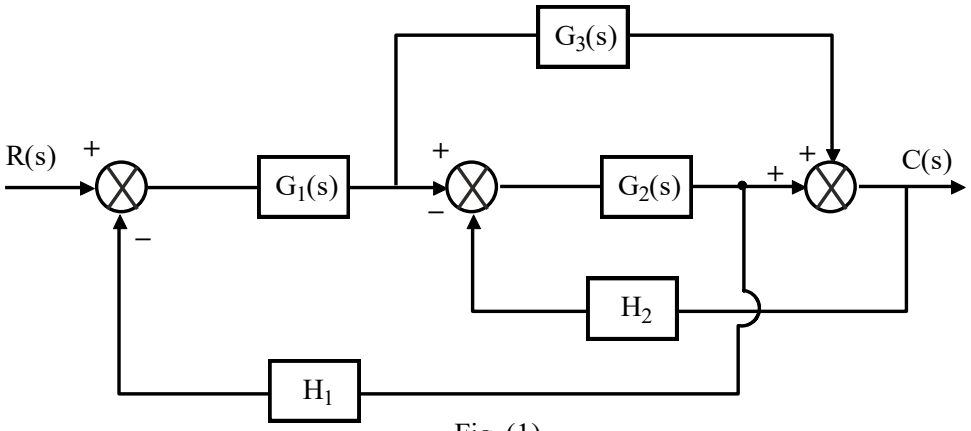
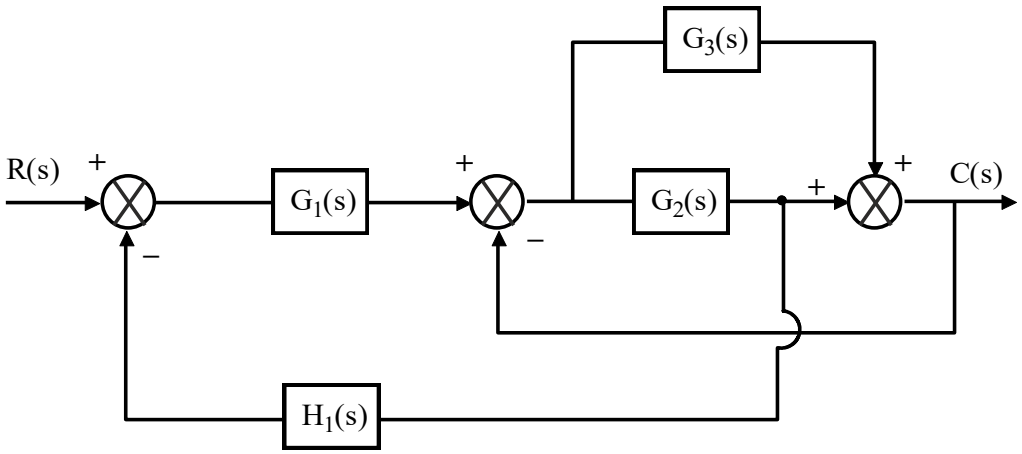


Fig. (1)

OR

2. a) State and explain Mason's Gain formula. **6**

b) Draw a signal flow graph for a system whose block diag. is as shown in fig (2). Determine the overall transfer function. **10**



3. a) Define the following **6**

i) Delay time
ii) Rise time
iii) Peak time
iv) Maximum overshoot.
v) Settling time

b) A second order system has a transfer function given by **10**

$$\frac{C(s)}{R(s)} = \frac{25}{s^2 + 8s + 25}$$

Find the time response specification, delay time, rise time, peak time, Maximum overshoot & settling time. Also find the output response of the system.

OR

4. a) Derive generalised expression for static error coefficients Kp, Kv & Ka. **6**

b) A unity feedback system is as shown below **10**

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

Find

i) Types of system.

ii) All error coefficient.

iii) Error for ramp input with magnitude 4.

5. a) Define the term. **8**

i) Absolute stability.

ii) Conditional stability.

iii) Relative stability.

b) Find the stability of control system using Routh's criterion. **8**

$s^5 + 4s^4 + 10s^2 + 5s + 24 = 0$

OR

6. Sketch the root locus for the open loop transfer function of a unity feedback control system given below and determine **16**

i) The value of K for E = 0.5.

ii) The value of K for marginal stability.

iii) The value of K at S = 4.

$$G(s) = \frac{K}{s(s+1)(s+3)}$$

7. a) Draw the Bode plot for the transfer function. **12**

$$G(s) = \frac{50}{s(1+0.25s)(1+0.1s)}$$

From the graph determine.

i) Gain crossover frequency.

ii) Phase crossover frequency.

iii) G.M and P.M.

iv) Stability of the system.

b) Define phase margin and Gain Margin. **4**

OR

8. a) Sketch the polar plot for the transfer function. **10**

$$G(s) = \frac{10}{s(s+1)(s+4)}$$

b) Derive the expression for resonant frequency. **6**

9. a) Define the term. **6**

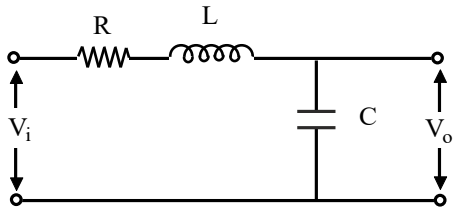
i) State

ii) State variable

iii) State space

iv) State trajectory.

b) Find the state model of following RLC ckt using physical variable method. **10**



OR

10. a) A feedback system has a closed loop transfer function given by **8**

$$\frac{Y(s)}{U(s)} = \frac{10(s+4)}{s^3 + 4s^2 + 3s}$$

Obtain the canonical state model to represent the transfer function.

b) State advantages and Disadvantages of **8**

i) Physical Variable method.

ii) Phase variable method.

iii) Canonical Variable Method.

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