

[Total No. of Questions - 9] [Total No. of Printed Pages - 3]

Dec-24-0378 (CBCS)  
EE-502 (Linear Control System)  
B.Tech. 5th

Time : 3 Hours

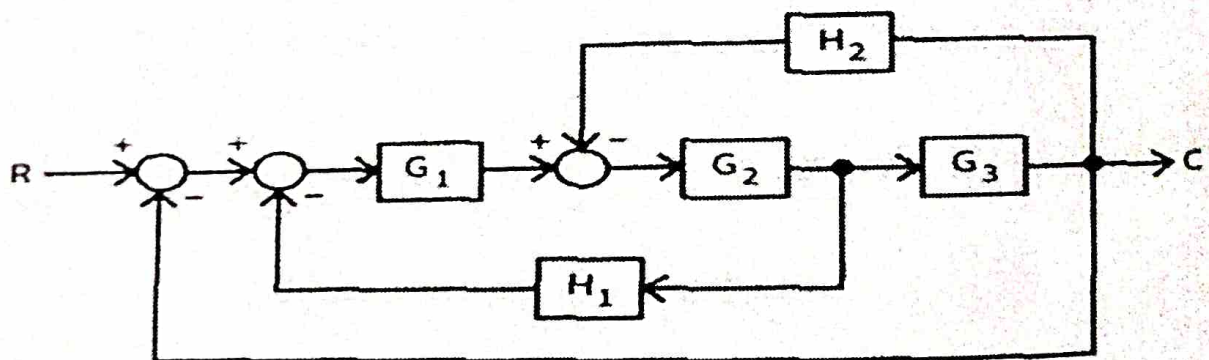
Max. Marks : 60

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 each from section A, B, C and D. Section E is compulsory.

### SECTION - A

- How to construct SFG from differential equations? (5)
  - Derive the expression for closed loop transfer function. (5)
- Determine the ratio  $C/R$  for the system shown in figure by using Block Reduction Technique and by using SFG. (10)



### SECTION - B

- Explain the specification of transient response of second order system with unit step input. Derive the expression for Maximum overshoot of a second order system. (10)
- State Routh-Hurwitz criterion. State necessary but not sufficient conditions for stability. (5)

- (b) Define steady-state error. Derive the values of static error coefficients and steady-state error for type one system with unit step input. (5)

### SECTION - C

5. Sketch the Bode plot for the transfer function

$$G(s) = \frac{16(1+0.5s)}{s^2(1+0.125s)(1+0.1s)}$$

From the graph, determine Phase crossover frequency, Gain crossover frequency, P.M., G.M., stability of the system. (10)

6. Consider the transfer function

$$G(s)H(s) = \frac{60}{(s+1)(s+2)(s+5)}$$

Using Nyquist stability criterion determine whether the closed loop system is stable or not. (10)

### SECTION - D

7. Design a lag compensator for a system whose open loop transfer function is

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

To meet the following specification: Damping ratio = 0.5; settling time  $t_s = 10$  sec; velocity error constant  $K_v > 5$ . (10)

8. Write a detailed note on servo motor used as control system components. Distinguish between AC and DC servomotor. (10)

12

3

EE-502

**SECTION - E (Compulsory)**

9. Attempt all questions.
- (a) What is Control System?
  - (b) Define Transfer Function.
  - (c) Define characteristic equation of a transfer function.
  - (d) Define Phase crossover frequency and Gain crossover frequency.
  - (e) What is polar plot?
  - (f) Define Relative stability and Absolute stability.
  - (g) Define frequency response.
  - (h) Write short note on different type of compensations.
  - (i) Write a short note on potentiometers.
  - (j) What are the advantages of Laplace transform?

(10×2=20)