

17538

16117

3 Hours / 100 Marks

Seat No.

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- Instructions :**
- (1) All questions are compulsory.
 - (2) Illustrate your answers with neat sketches wherever necessary.
 - (3) Figures to the right indicate full marks.
 - (4) Assume suitable data, if necessary.
 - (5) Use of Non-programmable Electronic Pocket Calculator is permissible.
 - (6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. (A) Attempt any THREE : 12

- (a) Define control system and explain it with the help of suitable example.
- (b) Define :
 - (i) Transient response
 - (ii) Steady state response
- (c) Define stability. Explain the importance of stability in a system.
- (d) Explain why derivative action cannot be used alone.

(B) Attempt any ONE : 6

- (a) Explain any three rules of block diagram reduction technique.
- (b) What is frequency response analysis ? State its advantages. (any four)

2. Attempt any TWO : 16

(a) A system has $G(s) \cdot H(s) = \frac{K}{S(S+2)(S+4)(S+8)}$,

where K is positive. Determine the range of K for stability.

- (b) Draw and explain synchro as error detector. State its applications.

- (c) Obtain the transfer function for system in fig. (1) using block reduction technique.

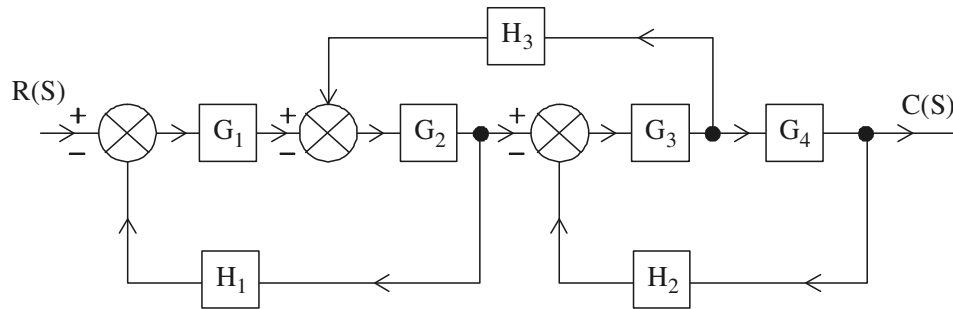


Fig. (1)

3. Attempt any FOUR :

16

- Compare open loop and closed loop control system. (four points)
- What is damping ? Explain the effect of damping on the response of second order system.
- Determine the stability of a system using Routh's criterion.

$$S^5 + S^4 + 2S^3 + 2S^2 + 3S + 5 = 0$$

- Draw and explain potentiometer as an error detector.
- Draw the op-amp based PI controller. Derive its output equation.

4. (A) Attempt any THREE :

12

- Explain proportional controller. Draw its response graph.
- What is gain margin & phase margin ? What should be the values of gain margin & phase margin for a good system ?
- A unity feedback system has $G(S) = \frac{40(S+2)}{S(S+1)(S+4)}$.

Determine :

- Type of system
 - All error coefficients
- (d) Compare stepper motor with DC servo motor. (Any four points)

(B) Attempt any ONE :**6**

- (a) Explain the characteristics of D.C. servomotor.
- (b) Explain the different standard input test signal. Give their laplace transform.

5. Attempt any FOUR :**16**

- (a) What is AC servomotor ? Explain its torque speed characteristics.
- (b) What is composite controller ? State their applications.
- (c) $S^3 + 4S^2 + S + 6 = 0$, state how many roots are in right half of s-plane.
- (d) A second order system is given by $\frac{C(S)}{R(S)} = \frac{25}{S^2 + 6S + 25}$.

Find its

- (i) ω_n
- (ii) ω_d
- (iii) Rise time
- (iv) Peak time
- (e) Define (i) peak overshoot (ii) settling time of a second order system and label it on time domain response.
- (f) Draw bode plot for the system with open loop transfer function

$$G(S)H(S) = \frac{20}{S(1+2S)}$$

6. Attempt any FOUR :**16**

- (a) Define poles and zero. How system stability is affected by location of poles and zeros in s-plane ?
- (b) Analyze the first order system for an unit step function.
- (c) What is Type O system ? Derive the steady state error and error coefficients for step input.
- (d) What is the difference between critically stable and unstable system.
- (e) For unity feedback system $G(s) = \frac{K}{S(1 + 0.4S)(1+0.25S)}$. Find the marginal value of K.
