

22541

23124

3 Hours / 70 Marks

Seat No.

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- Instructions* –
- (1) All Questions are *Compulsory*.
 - (2) Answer each next main Question on a new page.
 - (3) Illustrate your answer with neat sketches wherever necessary.
 - (4) Figures to the right indicate full marks.
 - (5) Assume suitable data, if necessary.
 - (6) Use of Non-programmable Electronic Pocket Calculator is permissible.
 - (7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

- 1. Attempt any FIVE of the following: **10****
- a) List advantages of Integral control action (Any two).
 - b) State Routh's stability criteria.
 - c) Define Poles and Zero's of a system with example.
 - d) Give classification of control actions.
 - e) Define :-
 - i) Relative stability
 - ii) Critical stable system
 - f) Draw generalized block diagram of servo system.
 - g) Define order of system. Give practical example of 2nd order system.

P.T.O.

2. Attempt any THREE of the following: 12

- State how AC servomotor differ from normal two phase induction motor (Any four points).
- Find the state space representation for transfer function –

$$\frac{C(S)}{R(S)} = \frac{25}{S^2 + 6S + 25}$$
- Draw electronic PJ controller. State the components used.
- Derive unit step response of 1st order system.

3. Attempt any THREE of the following: 12

- Describe time response in terms of transient and steady state response with neat diagram.
- Define Damping. Draw time response of 2nd order system.
- Draw Border plot for the system with open loop transfer function

$$G(S) 1 + (S) = \frac{10}{S(S + 1)(S + 5)}$$
- Compare open loop and closed loop control system (any 4 points).

4. Attempt any THREE of the following: 12

- Define following terms related to proportional controller –
 - Proportional Band
 - Offset
- Compare AC servomotor and DC servomotor (any 4 points).
- Obtain transfer function of given electrical network
Figure No. 1.

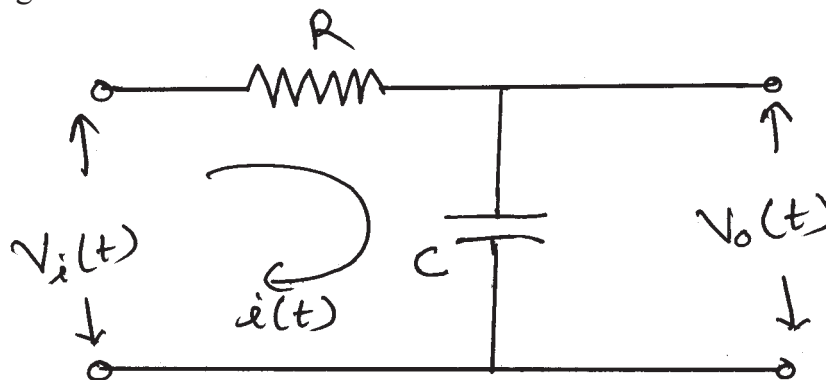


Fig. No. 1

- d) For unity feedback system whose open loop transfer function is –

$$G(S) \frac{K(S+1)}{S(S^2+6S+8)}$$

Determine :-

- Type of system
 - K_p , K_v , K_a .
- e) List advantages and disadvantages of frequency response analysis.

5. Attempt any TWO of the following:

12

- a) A unity feedback system is characterized by the open loop transfer function.

$$G(S) \frac{K(S+13)}{S(S+3)(S+7)}$$

using Routh's criteria calculate range of K for system to be stable.

- b) Derive transfer function of given block diagram in Figure No. 2.

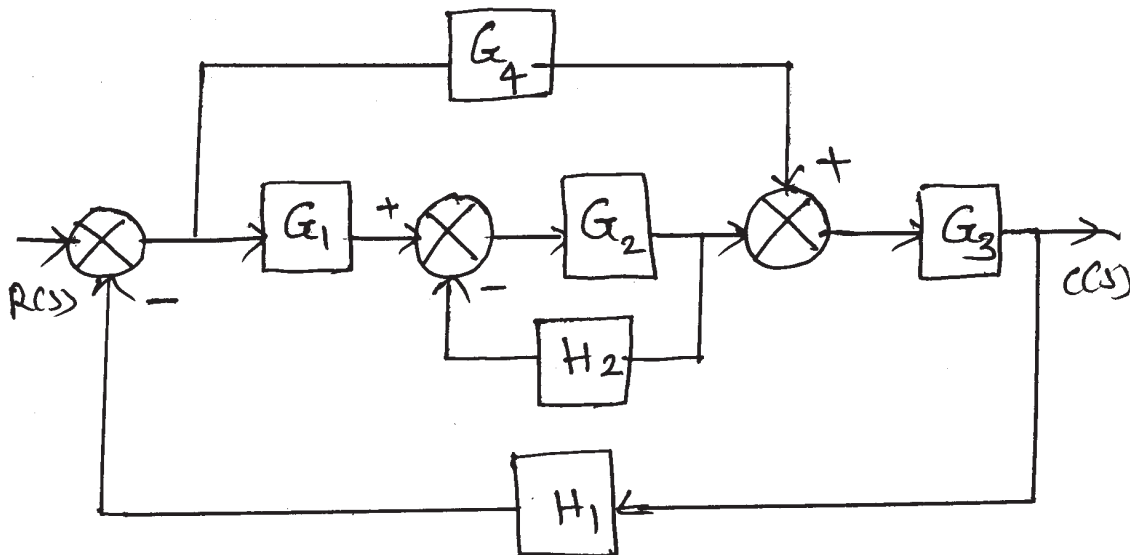


Fig. No. 2

- c) Draw neat diagram of PID controller using OP-AMP. State its output voltage equation.

6. Attempt any TWO of the following:**12**

- a) Determine stability of the system whose characteristic equation is given as

$$S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$$

- b) Transfer function of a system is given by –

$$\frac{(CS)}{R(S)} = \frac{100}{S^2 + 5S + 100}$$

Calculate :-

- i) Damped frequency of oscillation
 - ii) Peak time (t_p)
 - iii) Peak overshoot (% M_e)
 - iv) Settling time (t_s)
- c) Draw neat diagram of synchro as error detector. Define electrical zero position. Describe working of it.
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