

314337

12526

3 Hours / 70 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

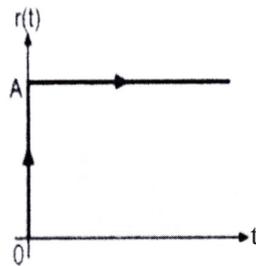
- 1. Attempt any FIVE of the following :** **10**
- a) Define time variant system with any one example.
- b) Distinguish between absolute and relative stability.
- c) List different types of control actions.
- d) Define neutral zone with reference to ON-OFF control action.
- e) Define servo system.
- f) Compare DC servo motor with normal DC motor.
(Any two points)
- g) Draw block diagram of closed loop control system.

P.T.O.

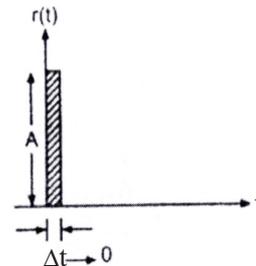
2. Attempt any THREE of the following :

12

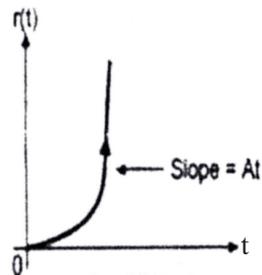
- a) Compare open loop and closed loop control system on the basis of –
- Feedback
 - Accuracy
 - Stability
 - Bandwidth
- b) Identify the given graphical signals and write its Laplace transform. (Refer Figure No. 1)



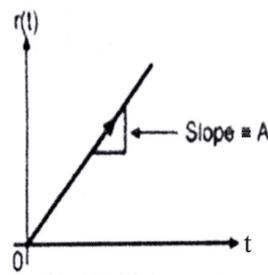
(i)



(ii)



(iii)



(iv)

Fig. No. 1

- c) For the given characteristic equation
- $$S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$$
- Determine stability using Routh's criterion.
- d) Compare P, I and D control actions on the basis of Nature of input, response to error, mathematical equations and applications.

3. Attempt any THREE of the following :**12**

- a) 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
- b) Draw the S-plane with pole, zero location for stable, unstable, marginally stable control system and critically stable control system.
- c) Explain PI control action with output equation, operation and its response.
- d) Compare AC and DC position control system on the basis of –
- i) Speed
 - ii) Torque
 - iii) Stability
 - iv) Applications

4. Attempt any THREE of the following :**12**

- a) List any four block diagram reduction rules with neat sketch.
- b) Draw unit step response of second order system and label –
 - i) Peak time
 - ii) Rise time
 - iii) Settling time
 - iv) Peak overshoot
- c) Define Stability. List different types of systems based of stability.

- d) The Step response of the controller is shown in fig. 2
Show the effect when K_i value is increased and decreased.

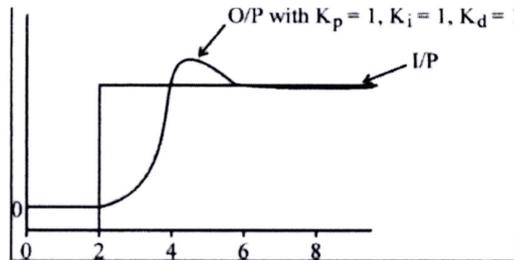


Fig. No. 2

- e) Derive transfer function of given RC circuit. refer fig No.3

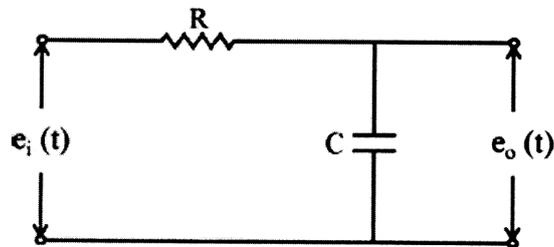


Fig. No. 3

5. Attempt any TWO of the following :

12

- a) Find the system which is critically damped and over-damped from the following : (Refer Figure No. 4)

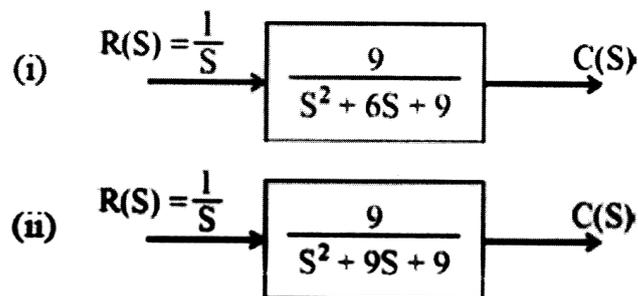


Fig. No. 4

- b) For the characteristic equation
 $S^4 + 20KS^3 + 5S^2 + (10 + K)S + 15 = 0$
 Determine the value of K for stable system.
- c) Explain construction of variable reluctance stepper motor with diagram.

6. Attempt any TWO of the following :

12

- a) Find transfer function of given block diagram.
 (Refer Figure No. 5)

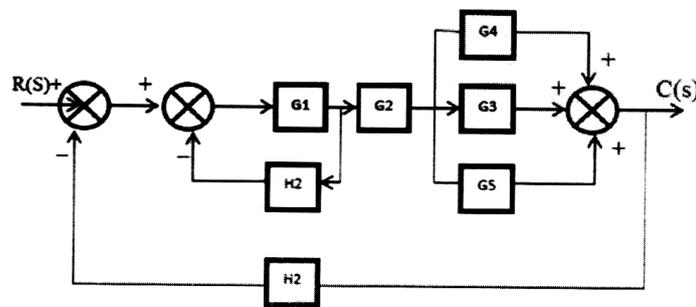


Fig. No. 5

- b) Define –
- Poles
 - Zeros
 - Order of system
 - Transfer function of a system.
- Also draw graphical representation of poles and zeros.
- c) Identify servo component that is used as error detector in AC servo system with neat diagram and explain it.