

22472

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 answers 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) Draw the general block diagram of closed loop control system.
- b) Sketch the step-signal and ramp signal.
- c) Define relative stability.
- d) Compare PD and PID controllers. (Any two points)
- e) Define first order of the system and write one example.
- f) State Routh's stability criterion.
- g) List different modes of control action.

P.T.O.

2. Attempt any THREE of the following :

12

- a) Compare open loop and closed loop control system on the basis of block diagram transfer function, stability and applications.
- b) Define the terms
 - i) Poles
 - ii) Zeros
 - iii) Order of system and
 - iv) Characteristic equation
- c) A system has poles as $S = -3$, $S = -2$ and zero at $s = -1$. Represent the system in S plane.
- d) Draw the block diagram of servo system. List any two advantages of servo system.

3. Attempt any THREE of the following :

12

- a) List the types of stepper motor and Give four applications of stepper motor rotary encoder.
- b) Compare PI and PD controller (Any four points)
- c) Find the transfer function of the following RC circuit (Refer Figure No. 1.)

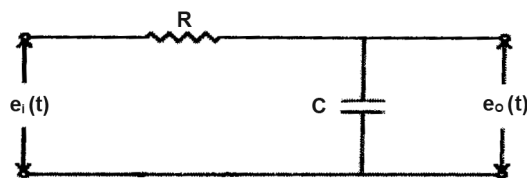


Fig. No. 1

- d) Define On-OFF controller. Describe its working principle using one example.
- e) Explain working of Potentiometer as an error detector. Give any two applications.

4. Attempt any THREE of the following :

12

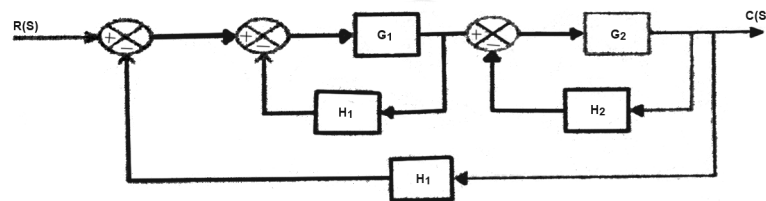
- Find the transfer function of closed loop control system with negative feedback.
- Sketch output time response relationship of second order system for step input. Define rise time and peak time.
- Determine the stability of the system having characteristics equation :

$$s^4 + 2s^3 + 8s^2 + 4s + 3 = 0$$
- Draw the block diagram of process control system. State function of each blocks.

5. Attempt any TWO of the following :

12

- Apply the block diagram reduction rules to obtain Transfer Function $C(S) / R(S)$ of the following block diagram.
(Refer Figure No. 2)

**Fig. No. 2**

- For a given transfer function :

$$\frac{C(S)}{R(S)} = \frac{10(S+8)}{S(S+4)(S^2+5S+6)}$$

Find

- poles
 - zeros
 - plot them on S-plane
 - Characteristics equation
- Describe characteristics of DC servo motor. Compare DC servo motor with normal motor.

6. Attempt any TWO of the following :

12

a) For system, characteristic equation is

$$S^4 + 22S^3 + 10S^2 + S + K = 0$$

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

b) Describe with sketches the PID Controller.

c) What is Rotary Encoder? Give four applications of rotary encoder.
