

11819

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) Preferably, write the answers in sequential order.

**Marks**

1. (A) Attempt any THREE : 12

- (a) Draw the block diagram of DC servo system.
- (b) Classify the different modes of process control actions.
- (c) Name any four I/P and O/P devices each used with PLC.
- (d) Draw the block diagram of process control system.

(B) Attempt any ONE : 6

- (a) Draw block diagram of AC output module. Draw its wiring diagram.
- (b) Derive the transfer function of the following block diagram in Fig. 1 :

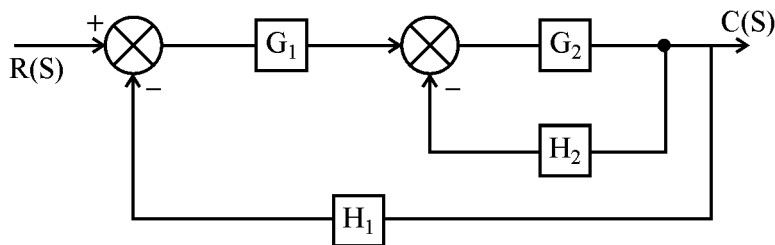


Fig. 1

## 2. Attempt any TWO :

16

- (a) For a unity feedback system, the TF is given by  $\frac{C(s)}{R(s)} = \frac{25}{s^2 + 6s + 25}$ .

Find (i) rise time (ii) peak time (iii) peak overshoot (iv) settling time.

- (b) An unity feedback system has  $G(S)$ ,

$$G(S) = \frac{10(S+1)}{S^2(S+2)(S+10)}$$

Find,

- (i) Type of system  
 (ii) Error coefficient  $k_p$ ,  $k_v$  &  $k_a$ .  
 (iii) Steady state error for I/P,

$$r(t) = 1 + 4t + t^2/2.$$

- (c) Draw block diagram of PLC. Write function of each block.

## 3. Attempt any FOUR :

16

- (a) Derive the transfer function of given network. Refer Fig. 2.

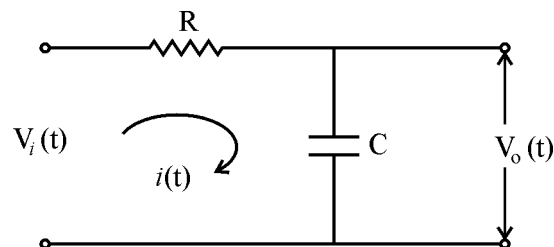


Fig. 2

- (b) Describe the role of PLC in automation.  
 (c) Define transfer function. Derive the expression of T.F. of closed loop system.  
 (d) For system, characteristic equation is  $s^4 + 22s^3 + 10s^2 + s + k = 0$ . Find  $K$ .  
 (e) Define the term scanning cycle, speed of execution in PLC.

4. (A) Attempt any THREE : 12

- (a) Explain with diagram sinking and sourcing concept in DC input modules.
- (b) Define pole and zero. Give its S-plane representation.
- (c) Compare proportional and integral controller on the basis of equation, advantages, response to error and application.
- (d) Write any four logical instructions in PLC.

(B) Attempt any ONE : 6

- (a) Draw block diagram of AC input module.
- (b) Describe PID control action w.r.t. equation and response to error.

5. Attempt any TWO : 16

- (a) List and explain the timer instructions of PLC.
- (b) Consider the system with characteristic equation

$$s^4 + 6s^3 + 26s^2 + 56s + 80 = 0.$$

Determine stability of the system using Routh's criteria.

- (c) A unity feedback system has

$$G(S) = \frac{40(s+2)}{s(s+1)(s+4)}$$

Determine all error coefficients.

**6. Attempt any FOUR :****16**

- (a) Draw the ladder diagram for
    - (i) AND gate
    - (ii) NAND gate
  - (b) State Routh's stability criteria.
  - (c) List any two rules of block diagram reduction technique.
  - (d) Explain on-off controllers with neat diagram.
  - (e) Compare open loop and closed loop system.
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