

22531

22223

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) 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) Name any two types of PLC Counter instruction.
- b) Define : Delay time and setting time.
- c) Give two examples of manmade closed loop control system.
- d) Compare Modular PLC and Fixed PLC on any two parameters.
- e) The transfer function of a system is given by

$$\frac{C(S)}{R(S)} = \frac{10(S + 8)}{S(S + 4)}$$

Obtain its

- i) Poles
- ii) Zeroes
- f) Give any two application of Servo System.
- g) State the mathematical expression and principle of proportional control action.

P.T.O.

- 2. Attempt any THREE of the following:** **12**
- a) Define transfer function. Derive an expression for transfer function of simple form of closed loop system.
 - b) Illustrate proportional - Integral - Derivative control (PID) action with output equation and nature of output response.
 - c) Describe sinking and sourcing concept in DC input modules of PLC.
 - d) Draw the functional block diagram of PLC and state the function of each block.
- 3. Attempt any THREE of the following:** **12**
- a) For a system with characteristics equation $S^5 + 4S^4 + 10S^2 + 5S + 24 = 0$, Examine the stability by Routh's stability criterion.
 - b) State four points of information associated with a timer instruction of PLC.
 - c) Give importance of PLC in automation.
 - d) Draw and describe Neutral zone in ON-OFF controller mode.

4. Attempt any THREE of the following:

12

- a) State the names and uses of input and output devices that can be interfaced with PLCs.
- b) Plot a graph of Proportional-Integral (PI) controller mode output as a function of time for the given error in Fig. No. 1.
- $K_p = 5$, $K_I = 1.0$, S^{-1} and $P_I(0) = 20\%$

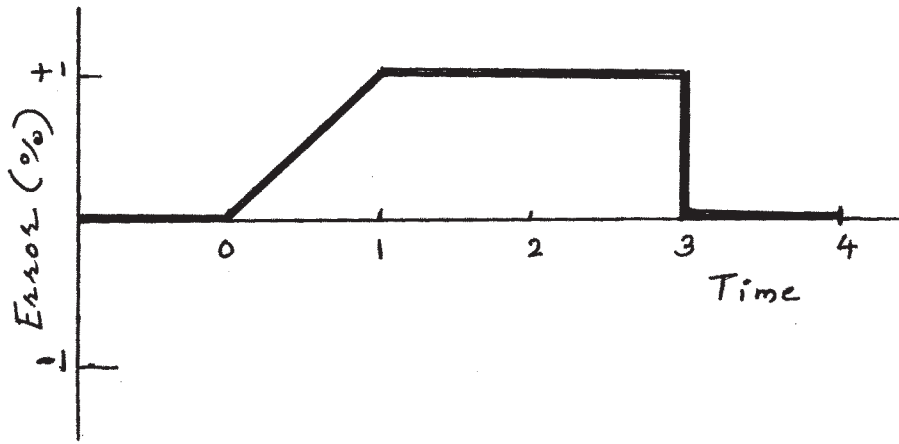


Fig. No. 1

- c) Define damping. Draw time response of under damped system and over damped system.
- d) Obtain transfer function for the system given in Fig. No. 2, using block diagram reduction technique.

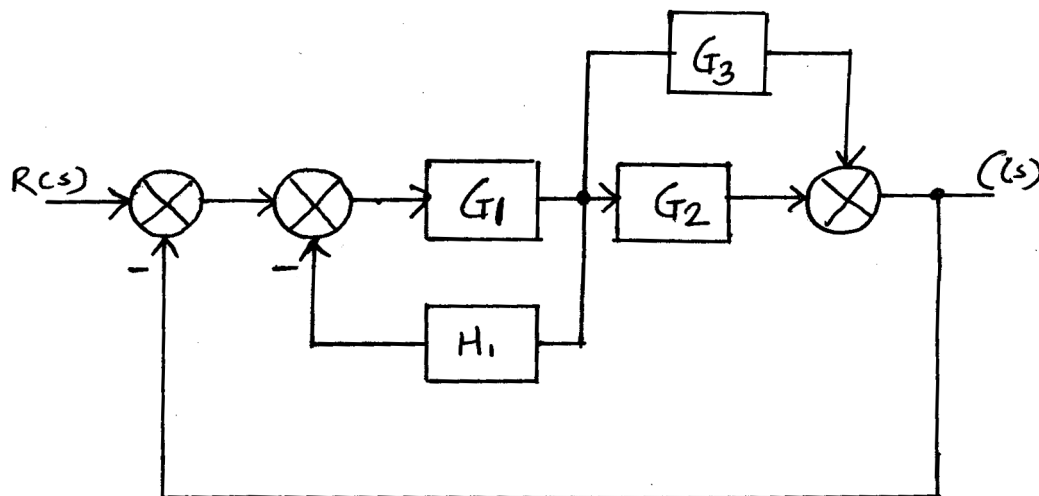


Fig. No. 2

- e) Draw and describe the block diagram of AC discrete input module of PLC.

P.T.O.

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

- a) For a unity feedback system having open loop transfer function

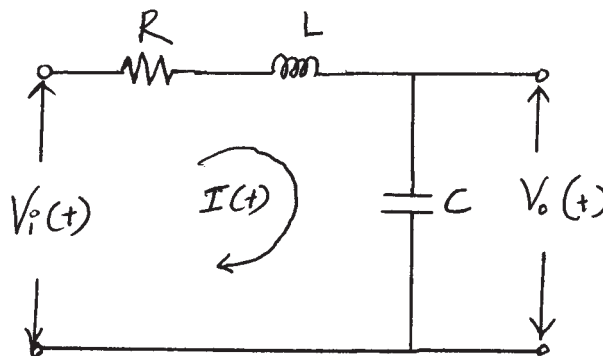
$$G(S) = \frac{10(S + 1)}{S(S^3 + 12S^2 + 20S)}$$

Determine

- i) Type of system
 - ii) Error constant K_p , K_v and K_a
- b) With respect to PLC
- i) Draw PLC scan cycle
 - ii) Describe memory organization of PLC
- c) Draw the ladder diagram to verify : OR gate, AND gate and EX-OR Gate logic.

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

- a) Draw ladder diagram for ON and OFF of lamps for the following conditions.
- i) START push button switch ON Green and RED Lamp and
 - ii) STOP push button switch OFF Green Lamp first and after 20 seconds Red Lamp
- b) Derive transfer function for the system given in Fig. No. 3 and find damping factor(ζ) and damped frequency of oscillations (ω_n) if $R = 1\Omega$, $C = 1F$ and $L = 1H$.

**Fig. No. 3**

- c) Define stability and sketch root locations in s-plane for stable system, unstable system and critically stable system.