

22531

12425

03 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) Define the terms -
  - i) Transient Response
  - ii) Steady State Response
- b) Define 'Control Action'. Give its classification.
- c) Define with respect to control system -
  - i) Order of a system
  - ii) Characteristic equation
- d) State any four benefits of PLC
- e) List any four Data handling instructions used in PLC programming.
- f) Define Servo system and state any two applications of it.
- g) Find poles and zeros of the system represented by,

$$\frac{C(S)}{R(S)} = \frac{8(S+2)}{S(S+1+3j)(S+1-3j)}$$

P.T.O.

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

- a) Draw the block diagram of a closed system and derive its 'Transfer function' for negative feedback.
- b) Explain On-Off controller with respect to block diagram, equations, advantages and disadvantages.
- c) Draw and explain the working of 'AC Discrete input Module' in the PLC.
- d) Draw the block diagram of PLC and explain the function of 'Output Module' in it.

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

- a) For the given transfer function

$$\frac{C(S)}{R(S)} = \frac{100}{S^2 + 15S + 100}$$

Determine -

- i) Damping ratio ( $\zeta$ )
  - ii) Peak time ( $t_p$ )
  - iii) Peak Overshoot (%  $M_p$ )
  - iv) Settling time ( $t_s$ )
- b) Explain  $T_{ON}$  and  $T_{OFF}$  Timer instructions of PLC programming, with its components and status bits.
  - c) Explain the function of CPU and Memory related to PLC.
  - d) Describe the function of PID control action with respect to equation and response to error.

4. Attempt any THREE of the following:

12

- a) Derive the transfer function of the RLC series circuit, shown in the diagram.

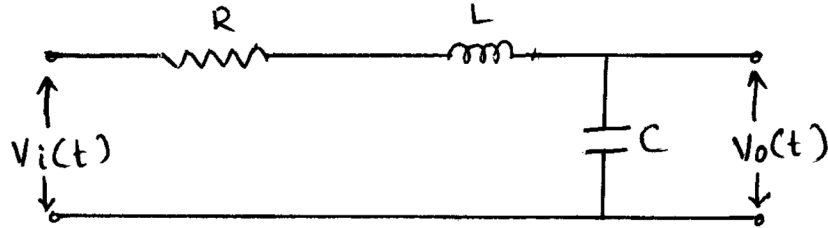


Figure No. 1

- b) Explain Discrete and Analog I/O addressing for PLC programming.
- c) Determine stability of the system, with characteristics equation  $S^5 + S^4 + 3S^3 + 9S^2 + 16S + 10 = 0$  using Routh's Criteria.
- d) Draw the block diagram of PD controller and state its advantages (any two)
- e) List any four input and output devices used with PLC.

5. Attempt any TWO of the following:

12

- a) A unity feedback system has transfer function,

$$G(S) = \frac{20(S+2)}{S(S+1)(S+4)}$$

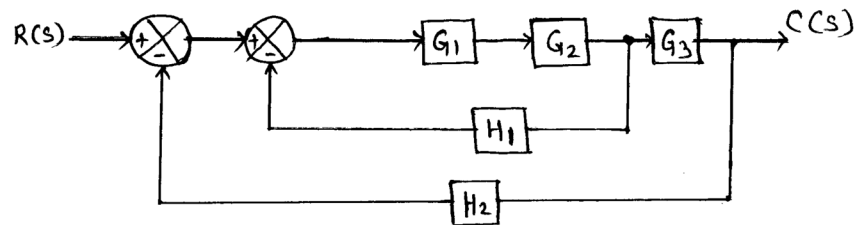
Determine -

- i) Type of feedback system
  - ii) All Error coefficients  $K_p$ ,  $K_v$ ,  $K_a$
  - iii) Steady state error  $e_{ss}$ , for ramp input with magnitude 4.
- b) i) Draw and explain 'Memory Organization' in PLC.
- ii) State different storage files in the RAM of PLC.
- c) Draw Ladder diagram of two motor operation for following conditions -
- i) Start push button starts motor M1 after 10 seconds and motor M2 after 20 seconds.
  - ii) When stop push button is pressed, motor M1 will stop, But motor M2 will stop after 15 seconds.

P.T.O.

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

- Explain EQV, GRT and LES comparison instructions in PLC programming with examples.
- Find the closed loop transfer function of the given block diagram by using the 'Reduction Technique'.

**Figure No. 2**

- Derive the expression for the output response of a 1<sup>st</sup> order system for unit step input.
  - Draw the unit step response of a first order system.