

22531

21222R

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) list any two relay instructions of PLC and draw their symbol.
- b) Define pole and zero. Give its s-plane representation.
- c) Give two practical examples of:
 - i) Open loop system
 - ii) Closed loop system
- d) Define following terms with respect to PLC:
 - i) Scan time
 - ii) Speed of execution
- e) A system is given by differential equation:

$$\frac{d^2y}{dx} + 4\frac{dy}{dx} + 8y = 8x$$

Where y is output and x is input. Determine the transfer function of the system.

P.T.O.

- f) Compare time varying and time in-varying system on the basis of:
- Definition and
 - Example
- g) Find the output of derivative controller mode if error is zero.

2. Attempt any THREE of the following: 12

- Define transfer function. Derive the expression of T.F. of closed loop system.
- Draw electronic PID controller. State its equation.
- Describe sinking and sourcing concept in DC input modules of PLC.
- State any four input and output devices which can be interfaced with PLC.

3. Attempt any THREE of the following: 12

- a) Transfer function of second order system is given as:

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

Determine:

- Rise time
 - Peak overshoot
- Draw block diagram of DC input module of PLC. Describe its working.
 - Draw block diagram of PLC and explain its CPU block.
 - Justify - 'Why 'D' control action is not used alone?'

4. Attempt any THREE of the following: 12

- Justify 'Modular PLC's are preferable in automation industry'.
- Explain the following terms with respect to proportional controller:
 - Offset error
 - Proportional band
- State and explain Routh's stability criteria.

- d) Derive transfer function for the system given in Figure No. 01.

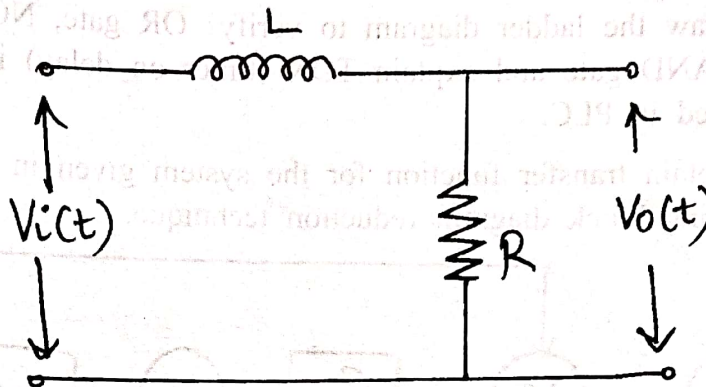


Figure No. 01.

- e) Draw AC discrete input module of PLC and describe optical isolation.

5. Attempt any TWO of the following:

12

- a) For unity feedback system having

$$G(S) = \frac{10(S + 1)}{S^2(S + 2)(S + 10)}; \text{ Find:}$$

- i) Type of system
- ii) Static error coefficients K_p , K_v , K_a
- iii) Steady state error for input

$$r(t) = 1 + 4t + \frac{t^2}{2}.$$

- b)
 - i) Explain the role of PLC in automation.
 - ii) Describe memory organization of PLC.
- c) Draw ladder diagram for two motor system with following condition:
 - i) Start push button starts motors M_1 and M_2 and
 - ii) Stop push button stops M_1 first and after 10 seconds motor M_2 .

6. Attempt any TWO of the following:

12

- Draw the ladder diagram to verify: OR gate, NOR gate and NAND gate and explain TON (timer on delay) instruction used in PLC.
- Obtain transfer function for the system given in Figure No. 02 using block diagram reduction technique.

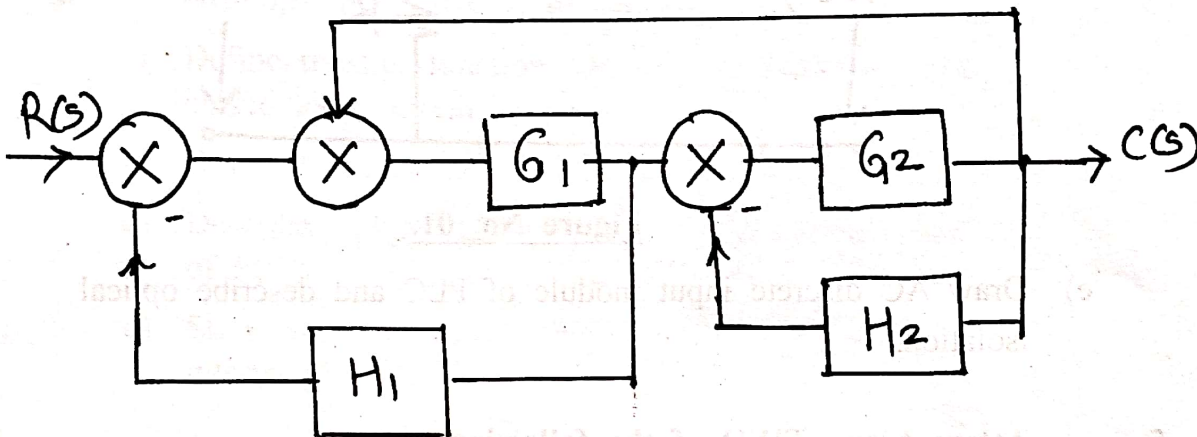


Figure No. 02.

- Explain the effect of damping on the response of second order system.