22531

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) Use of Non-programmable Electronic Pocket Calculator is permissible.

(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) Give the specification for the PLC based on the following:

    i)   Type of PLC

    ii)   No. of inputs and outputs

b) Define:

    i)   Time response

    ii)   Steady state response

c) Derive transfer function of the given electrical circuit. (fig. 1)
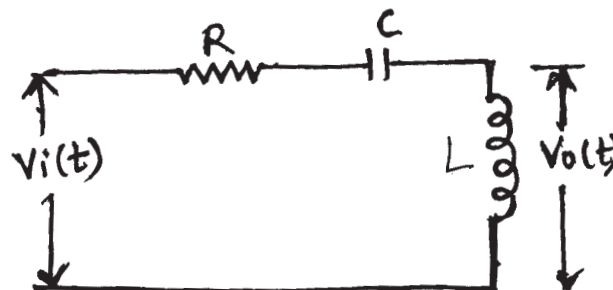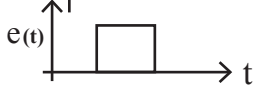

Fig. No. 1

d) Draw the block diagram of PLC.

e) Draw the response of first order control system and show the effect of time constant in it.

f) Compare open loop system and closed loop system on the basis of following points.

   i) Feedback path

   ii) Complexity

   iii) Cost

   iv) Accuracy

g) Draw the output of derivative controller mode if the error signal is

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

a) Write any four rules of block diagram reduction technique.

b) Define following terms related to control action:

   i) Controller

   ii) Error signal

   iii) Offset

   iv) Proportional Band

c) Describe the wiring details of AC i/p module of PLC.

d) Write any four input and output devices which can be interface with PLCs.

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

a) For a given T.F $= \dfrac{K \ (s + 7)}{s \ (s + 2) \ (s + 5) \ (s^2 + 7s + 12)}$ find

   i) Poles

   ii) Zero

   iii) Characteristics equation

   iv) Order of the system

Marks

b) Explain the procedure of PLC installation.

c) Define the following terms related to PLC:
   i) Scanning cycle
   ii) Scanning
   iii) Scan time
   iv) Speed of Execution

d) Incorporation of PI action may lead to instability in the closed loop performance - justify.

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

   a) 'Modular PLCs are preferable in automation industry'- Justify.

   b) Describe PI control action with respect to output equation transfer function. State two advantages.

   c) Define marginally stable system. Draw the location of poles and response of such a system.

   d) Differentiate between Linear and Nonlinear control systems.

   e) Give the functional description for following timer instructions.
      i) On delay
      ii) Off delay
      iii) Retentive
      iv) Reset

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

   a) A unity feedback system with open loop transfer function
   $$G(s) = \frac{10\ (s\ +\ 2)\ (s\ +\ 3)}{s\ (s\ +\ 1)\ (s\ +\ 4)\ (s\ +\ 7)}$$
   Find out
      i) Types of system & Kp, Kv, Kq.,
      ii) Steady state error for U/P $= 3+t+t^2$

   b) Compare Relay logic control and Programmable logic control. (min. 6 points)

c) Draw ladder diagram for 3 motor operation for following condition.

   i) Start push button, start motor M1.

   ii) When motor M1 is ON after 8 minutes M2 is ON and M1 is OFF.

   iii) When M2 is ON, after 15 minutes M3 is ON and M2 is OFF. and when stop push button is pressed M3 is OFF.

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

   a) Draw the ladder diagram to verify

      i) 'AND' Gate logic

      ii) 'NOR' Gate logic.

      iii) 'OR' Gate logic.

   b) Derive the transfer function of fig 2 using block diagram simplification method.
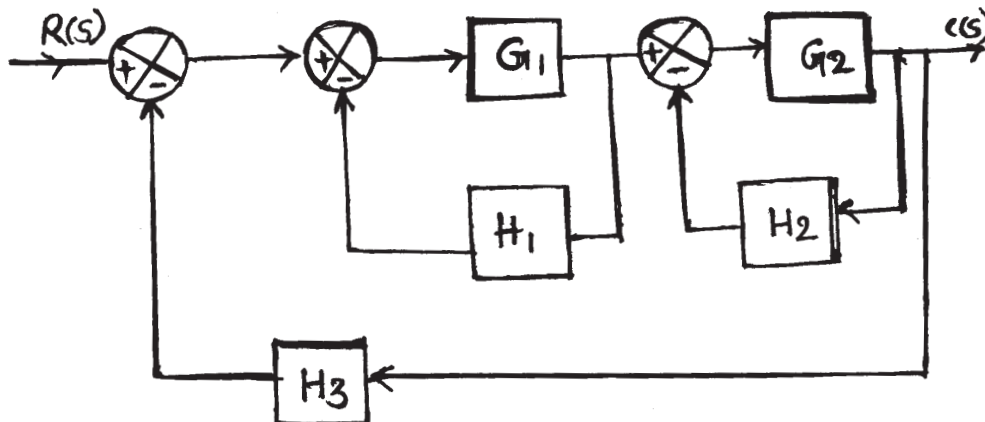

Fig. No. 2

   c) Write any three advantages and disadvantages of Routh's criterion. Also describe different cases to find stability of a system.

_____