22531

23242

3 Hours / 70 Marks Seat No. | | | | | | | | |

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) Draw ladder diagram of AND gate and NOT gate for PLC.

b) List standard test inputs with their Laplace transform.

c) Derive the transfer function of the given electrical circuit below **(Fig. No. 1)**:

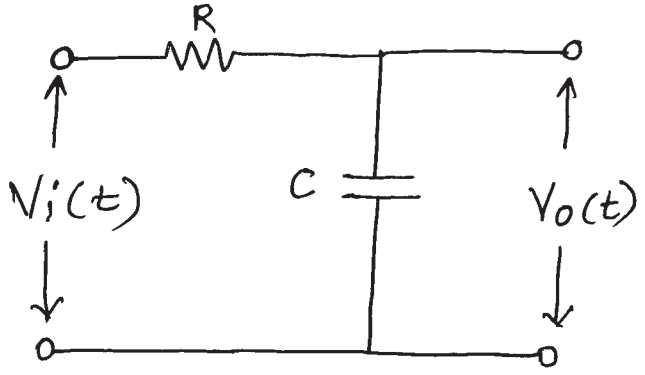


Fig. No. 1

P.T.O.

Marks

d) State need and benefits of PLC in automation. (any four)

e) Find the poles and zeros of the following function

$$G(S) = \frac{(S+2)(S+3)}{(S+4)(S+1+j)(S+1-j)}$$

f) Compare Open loop and Closed loop control system. (any four points.)

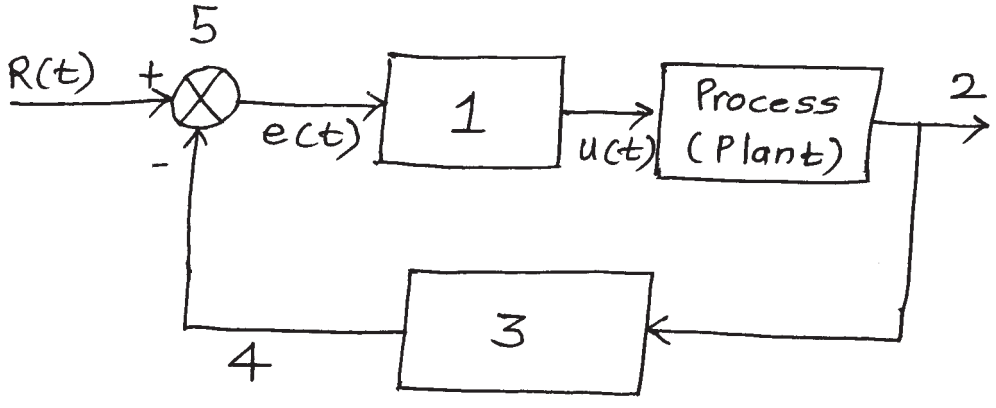
g) Identify control system is faster or sluggish (slow) with respect to the

i) Wide proportional band

ii) Narrow proportional band

2. Attempt any <u>THREE</u> of the following: **12**

a) Name the components labelled as 1, 2, 3, 4, 5. Redraw labelled diagram and identity the name of the block diagram. **(Fig. No. 2)**



<u>Fig. No. 2</u>

b) State mathematical equations of controller output for

i) ON-OFF Controller

ii) Proportional Controller

iii) PID Controller

c) Describe different COMPARISON instructions with syntax used in ladder diagram.

Marks

d) Identify the names of the components labelled as 1 and 2. State functions of component 1, 2 and 3 **(Fig. No. 3)**

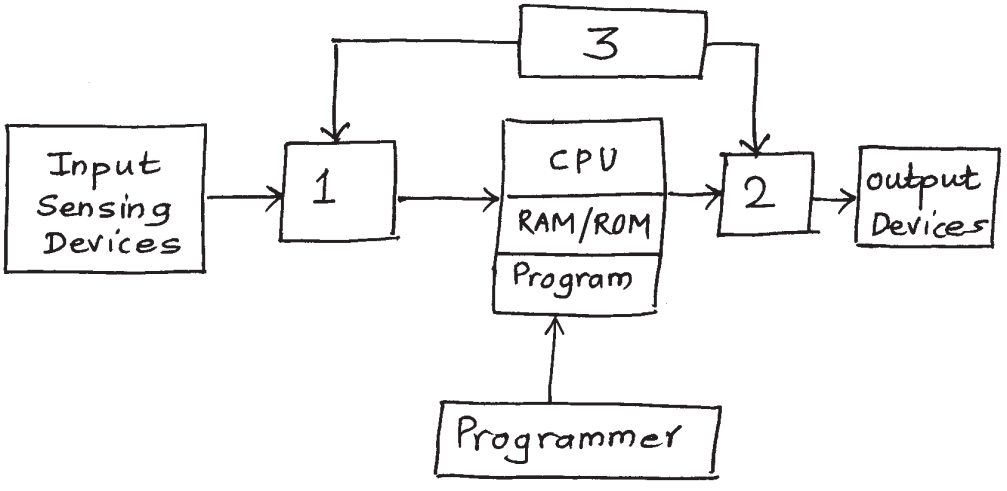


Fig. No. 3

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

a) The transfer function of the system is given by

$$T(S) = \frac{k\,(s+6)}{s(s+2)\,(s+5)\,(s^2+7s+12)}$$

Calculate

i) Poles

ii) Zeros

iii) Characteristic equation

iv) Order of the system

b) Draw neat block diagram of Discrete DC input module for PLC.

c) List input and output devices of PLC with their use. (Each four)

d) Elaborate ON - OFF controller with suitable example. State significance of neutral zone.

Marks

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

a) Illustrate Fixed and Modular PLC in details.

b) Classify various Control action modes of Controller.

c) Identify following system based on roots located on S - plane.

i) If all the roots of Characteristic equation lie on the left half of S - plane.

ii) If all the roots of Characteristic equation lie on the right half of S - plane.

iii) If non repeated poles are located on the imaginary axis of S - plane.

iv) If the poles are located far away from the imaginary axis of S - plane.

d) Describe DC Servo System using suitable diagram.

e) Describe Relay instructions with symbols used in ladder programming for PLC.

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

a) A unity feedback system has open loop function.

$$G(S) = \frac{10\,(s+1)}{s\,(s+2)\,(s+5)}$$

Calculate

i) Positional Error coefficient K_p

ii) Velocity Error coefficient K_v

iii) Acceleration Error coefficient K_a

b) Describe the following terms of PLC in detail.

i) Scanning Cycle

ii) Speed of Execution

c) Implement the following Boolean expressions using ladder programming.

i) $Y1 = ABC + D(E+F)$

ii) $Y2 = \overline{A + B}$

iii) $Y3 = \overline{AB}$

Marks

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

a) Develop ladder diagram for following condition

i) When START push button pressed, then Motor M1 and RED light turns ON.

ii) GREEN light turns ON only when all A, B and C push buttons are pressed.

iii) YELLOW light turns ON when any one of the A, B or C push button pressed.

b) Reduce the given control system using block diagram reduction techniques and obtain its transfer function. **(Fig. No. 4)**

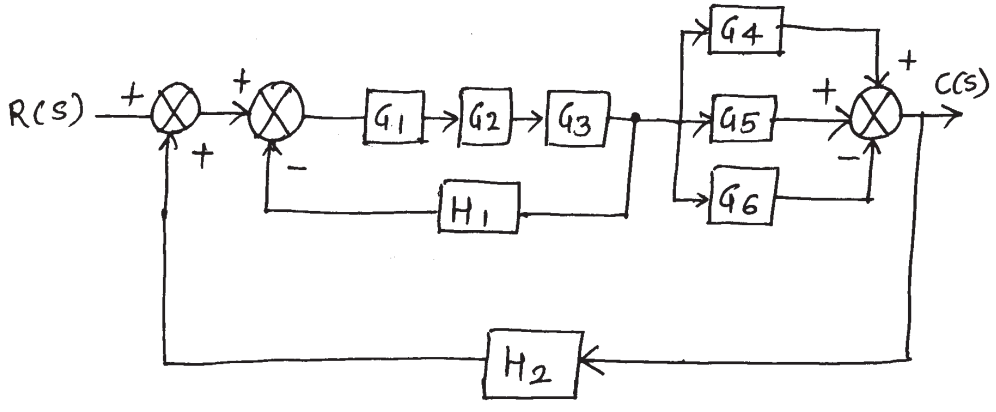


Fig. No. 4

c) Illustrate two special cases of Routh's Stability Criterion with suitable examples.