22531

12526

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 answer 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) State two types of PLC Timer instruction.

b) Define :–

i) Time response

ii) Steady state response.

c) Derive transfer function of the given electrical circuit Figure No. 1

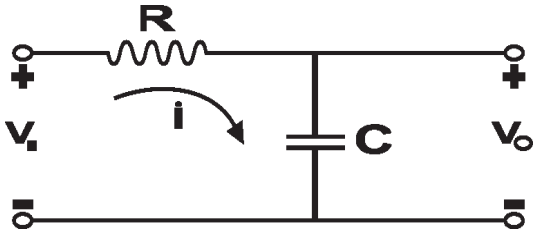

Fig. No. 1

P.T.O.

Marks

d) List any four input devices connected to PLC.

e) Find poles and order of the system representated by :–

$$\frac{e(s)}{R(s)} = \frac{s + 2}{s\,(s^2 + 7s + 12)}$$

f) Give any two applications of Servo System.

g) State the mathematical expression and principle of proportional control action.

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

a) Define transfer function. Derive an expression for transfer function of closed loop system.

b) Illustrate proportional - Integral - Derivative control (PID) action with output equation and nature of output response.

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

d) Compare fixed and modular PLC. (Any four points)

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) Explain TON (Timer On Delay) instruction used in PLC.

c) Give importance of PLC in automation.

d) Draw and describe Neutral zone in ON-OFF controller mode.

Marks

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

a) Identity the name of the block diagram in Figure No. 2 and name the components labelled as 1, 2, 3, 4 Redraw labelled diagram.

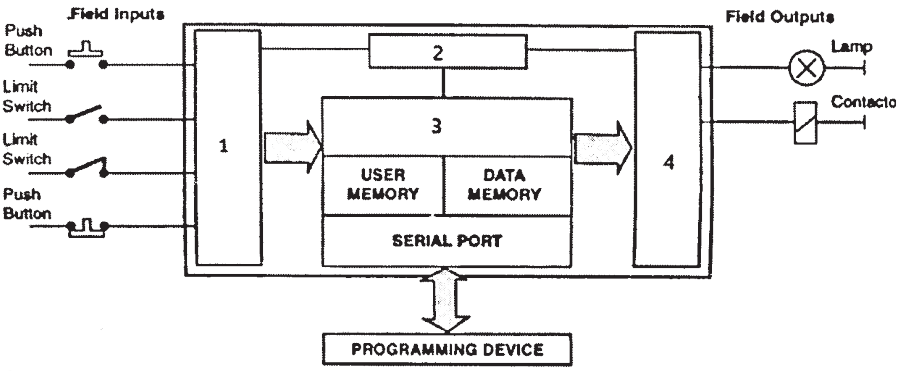

Fig. No. 2

b) Describe Pl 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 system.

e) Draw ladder diagram for the following output Y1 and Y2.

Table No. 1

Input		Output	
A	B	Y1	Y2
0	0	0	0
0	1	0	1
1	0	0	1
1	1	1	0

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 and Kp, Kv, Ka

ii) Steady state error for i/p = $3 + t + t^2/2$.

Marks

b) Describe the following terms of PLC in detail :–

i) Scanning Cycle

ii) Speed of Execution.

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 20 second M2 is ON.

iii) When M2 is ON after 50 seconds M3 is ON and when stop push button is pressed all motors are OFF.

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

a) Draw the ladder diagram for the following Boolean expressions.

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

ii) $Y2 = A + B + C$

iii) $Y3 = AB + \overline{A}\ \overline{B}$.

b) Derive the transfer function of the given system using block diagram reduction technique reference Figure No. 3.

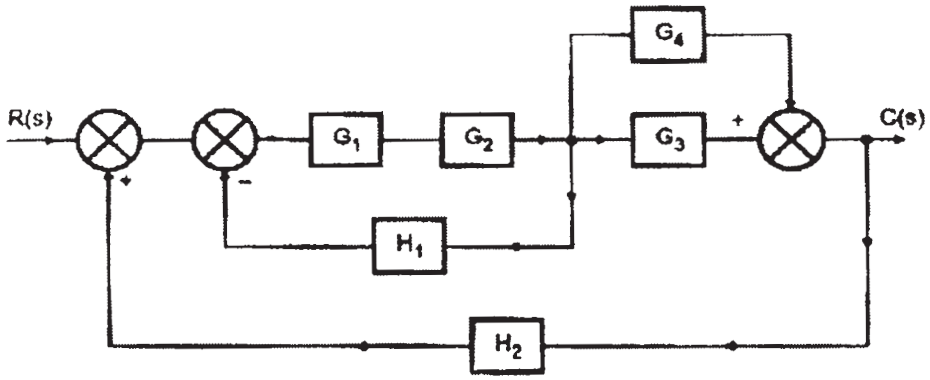

Fig. No. 3

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