22531

23124

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) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1.   **Attempt any <u>FIVE</u> of the following:**   **10**

a) List any four input devices connected to PLC.

b) Define :–
   i)   Transient Response
   ii) Steady state error.

c) For a certain system c(t) is the output and r(t) is the input. If the differential equation is

$$\frac{5.dc(t)}{dt} + 8.c(t) = \frac{2\,dr(t)}{dt} + r(t)$$

find transfer function

d) Define scanning cycle and speed of execution w.r.t. PLC.

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

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

f) Draw the block diagram of DC servo system.

g) Give the reason why derivative controller cannot be used alone?

P.T.O.

Marks

2.   Attempt any THREE of the following: 12

a) Compare open loop and closed loop control system (any four points).

b) Define dead band and proportional band w.r.t. controller.

c) Draw the block diagram of DC input module and describe the function of optical isolation.

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

3.   Attempt any THREE of the following: 12

a) For the given characteristic equation of a control system. Find stability using Routh's criteria.

$$s^4 + 6s^3 + 21s^2 + 36s + 20 = 0$$

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

c) Draw the block diagram of PLC and list the functions of input and output module.

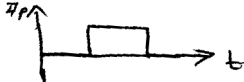d) Compare P, I and D controller (any four points).

4.   Attempt any THREE of the following: 12

a) Describe the memory organisation in PLC w.r.t.

   i)   Program files

   ii)   Data files.

b) Draw the output of –

   i)   (1) P

        (2) I

        (3) PID Controller

        For the input

   ii)   Write the output equation, y(s) for PID controller.

c) Give graphical and mathematical representation of the standard test signals with Laplace transform.

Marks

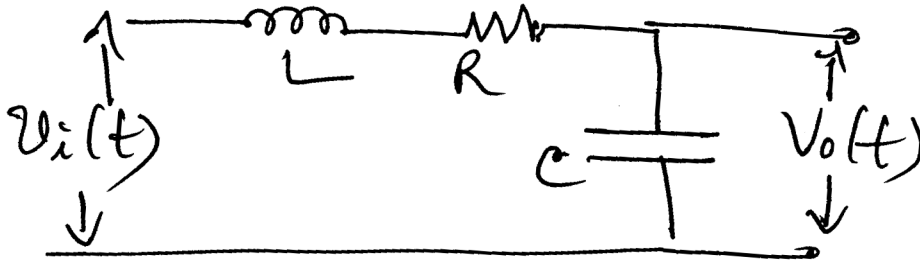d) Find the Transfer Function of the given electrical circuit reference Figure No. 1

Fig. No. 1

e) Draw the ladder diagram for the basic gates.

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

a) A second order system is given by

$$\frac{C(s)}{C(s)} = \frac{8}{s^2 + 4s + 8}$$

Find –

i) Rise time

ii) Peak overshoot

iii) Settling time

b) Draw the block diagram of power supply used in PLC and explain the function of each block.

c) For two motor system draw the ladder diagram –

i) Start switch starts Motor 1 10 seconds later Motor 2 starts.

ii) Stop switch stops Motor 1 and Motor 2 simultaneously.

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

   a) List all the comparison instructions used in PLC and explain
       LES and LIM.

   b) Derive the transfer function of the given system using block
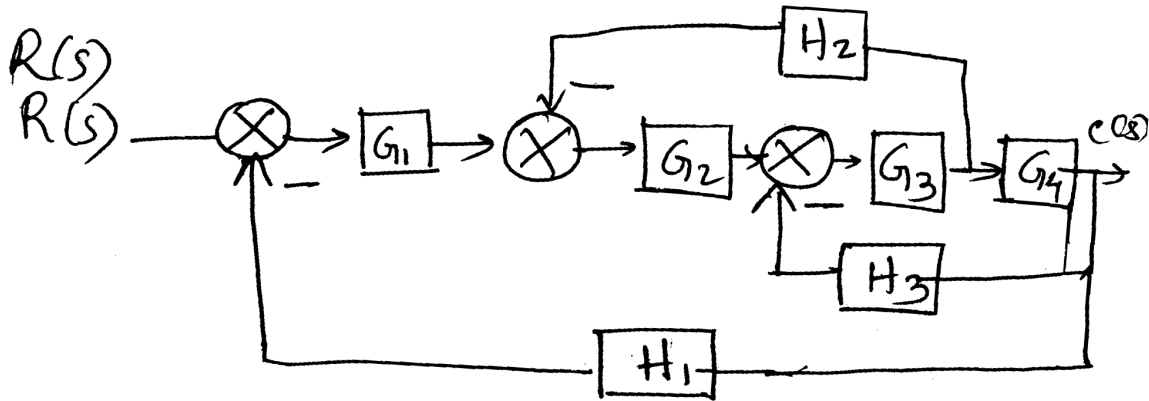   diagram reduction technique reference Figure No. 2

Fig. No. 2

   c) A second order unity feedback system is given by

   $$\frac{C(s)}{R(s)} = \frac{16}{s^2 + 5s + 16}$$

   i)   Peak time Tp

   ii)   Peak Overshoot % Mp

   iii) Settling time Ts.

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