

17536

14115

3 Hours / 100 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. a) Attempt any **THREE** of the following : **12**
- (i) Define stable and unstable system; critically stable and conditionally stable system.
 - (ii) Name any four input and output devices each used with PLC.
 - (iii) Compare open loop and closed loop system based on block diagram, transfer function, examples and stability.
 - (iv) Classify different modes of process control action.

P.T.O.

b) Attempt any ONE of the following :

6

- (i) Describe in brief memory organization of PLC.
- (ii) Derive the transfer function of the following block diagram. Refer Fig. No. 1.

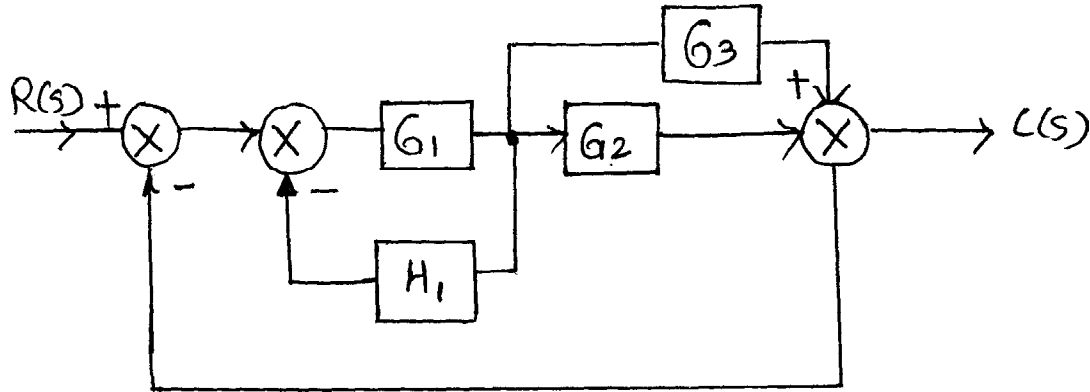


Fig. No. 1

2. Attempt any TWO of the following :

16

- a) T.F. of a second order system is given by $\frac{C(s)}{R(s)} = \frac{2s}{s^2 + 6s + 2s}$.
Find out T_r , T_p , T_s and % M_p for unit step input.

- b) A unity feedback system has $G(S) = \frac{10(s+1)}{s^2(s+2)(s+10)}$.

Find out : -

- (i) Type of system.
 - (ii) Static error coefficient K_p , K_v , K_a
 - (iii) Steady state error for input $r(t) = 1 + 4t + t^2/2$
- c) Draw ladder diagram for 2 motor operation for following conditions -
- (i) start push button starts motors M_1 and M_2 and
 - (ii) Stop push button stops motor M_1 first and after 10 seconds motor M_2 .

3. Attempt any **FOUR** of the following :

16

- a) Derive the transfer function of given network. Refer Fig. No. 2.

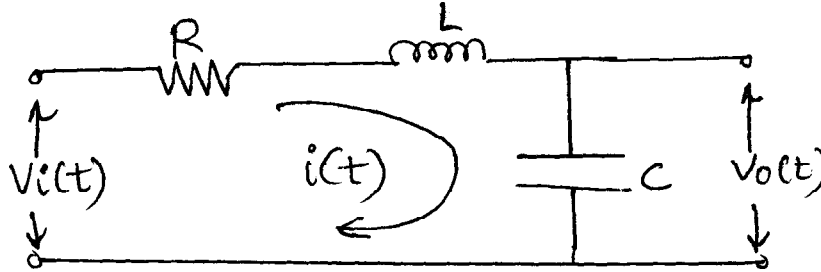


Fig. No. 2

- b) Draw block diagram of PLC and explain each blocks in brief.
 c) Define transfer function. Derive the expression of T.F. of closed loop system.
 d) For system, characteristic equation is $s^4 + 22s^3 + 10s^2 + s + k = 0$. Find k.
 e) Describe the term redundancy in PLC.

4. a) Attempt any **THREE** of the following :

12

- (i) Compare proportional and integral controller on the basis of equation, advantages, response to error and application.
 (ii) Draw the block diagram and AC input module of PLC.
 (iii) Describe the role of PLC in automation.
 (iv) Derive relation of steady state error in terms of open loop transfer function $G(S).H(s)$. Find e_{ss} for step input.

b) Attempt any **ONE** of the following :

6

- (i) Describe the wiring details of AC-output module of PLC.
 (ii) Draw the labelled block diagram and process control system and explain. Define w.r.t. controller –
 (1) Offset error
 (2) Proportional band.

5. Attempt any TWO of the following :**16**

- a) (i) Describe sinking and sourcing concept in DC input modules of PLC.
- (ii) Draw the block diagram of AC discrete input module of PLC.
- b) (i) Draw the effect of damping on the response of second order system.
- (ii) Define the time response specifications delay time T_d , rise time T_r , settling time T_s and peak overshoot M_p .
- c) By means of Routh's criteria, determine stability of system represented as

$$s^4 + 2s^3 + 8s^2 + 4s + 3 = 0$$

6. Attempt any FOUR of the following :**16**

- a) Describe ON-OFF control action. State its any one advantage and disadvantage of each.
 - b) State Routh's stability criteria and discuss different cases to find stability of a system.
 - c) Explain the TON instruction of PLC.
 - d) Draw electronic PID controller. State its equation and give its two advantages.
 - e) Define servo system. Draw its standard block diagram and explain.
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