16172

3 Hours / 100 Marks Seat No. | | | | | | | | |

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. (A) Attempt any THREE of the following : **12**

(a) Define stability. Sketch the root locations in S-plane for stable & unstable system.

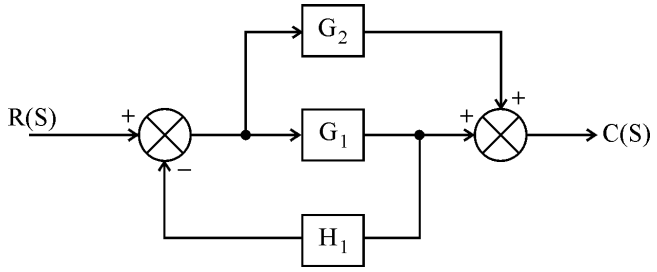
(b) Give the classification of PLC. Explain modular PLC in brief.

(c) Define servo system. Draw the block diagram of DC servo system.

(d) Draw electronic PID controller and state its equation.

(B) Attempt any ONE of the following : **6**

(a) Using block diagram reduction technique, obtain T.F. of the block diagram.



(b) State with respect to PLC :

(i) Scanning Cycle &

(ii) Speed of execution

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

(a) Find K_p, K_v, K_a & steady state error for a system with open loop transfer function as

$$G(S)\,H(S) = \frac{10(S+2)(S+3)}{S(S+1)(S+4)(S+5)}$$

Where input $r(t) = 3 + t + \frac{t^2}{2}$

(b) A unity feedback system has

$$G(S) = \frac{16}{S(S+5)}$$

If a step input is given, calculate (i) rise time, (ii) peak time, (iii) maximum overshoot, (iv) settling time.

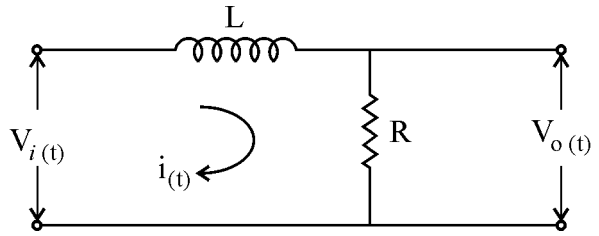
(c) Draw ladder diagram for ON & OFF of lamps for following conditions :

(i) START push button switch ON Green & Red lamp &

(ii) STOP push button switch OFF Green lamp first & after 20 seconds Red lamp.

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

(a) Derive the transfer function of given network.



(b) List any four input & four output devices used with PLC.

(c) Explain the significance of Laplace transform in control system.

(d) For a system with the characteristic equation :

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

Find the stability of the system with Routh's stability criterion.

(e) Describe in brief memory organization of PLC.

4. (A) Attempt any THREE of the following : **12**

(a) State the principle of ON-OFF control action. Write its standard equation & define neutral zone.

(b) Draw the typical wiring details & four specifications of AC output module of PLC.

(c) Explain the need of PLC in automation.

(d) What are the different standard test inputs ? Draw them & give their Laplace representation.

(B) Attempt any ONE of the following : **6**

(a) Draw the block diagram of discrete input module & explain each block.

(b) Draw the labelled block diagram of process control system & explain each block.

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

(a) List & explain the timer instructions of PLC. Draw the Ladder diagram to verify

(i) OR gate &

(ii) NOR gate logic

(b) Define the terms : (i) Poles, (ii) Zeros, (iii) Order of system & (iv) Characteristic equation. Also for a given transfer function.

$$\frac{C(S)}{R(S)} = \frac{10\,(S + 8)}{S\,(S + 4)\,(S^2 + 5S + 6)}$$

Find, (i) Poles (ii) Zeros & (iii) Plot them on S-Plane.

(c) A unity feedback system has

$$G(S)\,H(S) = \frac{K}{S(S + 2)\,(S + 4)\,(S + 8)}$$

Where 'K' is positive. Determine range of values of K for the system to be stable.

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

(a) Why 'D' control action is not used alone ? Justify.

(b) Define :

(i) Linear & Non-linear system.

(ii) Time varying & Time in-varying system.

(c) List two instructions each of the following :

(i) Relay instructions.

(ii) Data handling instructions.

(iii) Logical instructions.

(iv) Comparision instructions.

(d) Draw electronic PD-controller. State its equation. Explain PD controller in brief.

(e) Draw neat sketch of unit step response of a second order system with neat labeling.

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