17536

**21718**

**3 Hours / 100 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) 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 :** **12**

(a) Compare open loop and closed loop control system based on block diagram, transfer function, examples and stability.

(b) Describe role of PLC in automation.

(c) Draw labelled block diagram of Process Control System. Give classification of control actions.

(d) List standard test input signals. Give their laplace representation.

**(B) Attempt any ONE :** **6**

(a) Draw block diagram of AC input module of PLC. Describe function of each block.

(b) Derive the transfer function of block diagram using block diagram reduction rules.

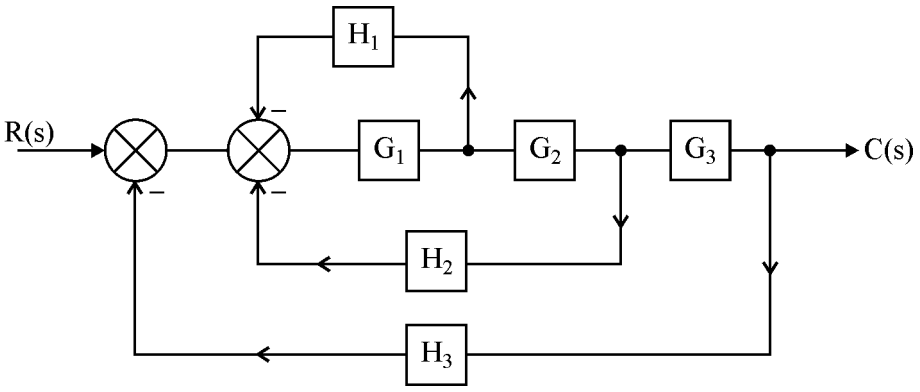


**Fig. No. – 1**

**2. Attempt any TWO :** **16**

(a) Determine the range of values of K for system to be stable whose characteristic equation is

$$s^4 + 22s^3 + 10s^2 + s + K = 0$$

(b) For a system having closed loop transfer function $\frac{C(s)}{R(s)} = \frac{18}{s^2 + 4s + 18}$

Determine :

(i) $W_d$ – damped frequency of oscillations.

(ii) Peak time

(iii) % Peak overshoot

(iv) Settling time

(c) Draw ladder diagram for following logical equations :

(i) $Y = \bar{A}\bar{B} + AB$

(ii) $Y = (\bar{A} + \bar{B})(A + B)$

**3. Attempt any FOUR :** **16**

(a) Compare fixed and modular PLC. (any 4 points)

(b) Draw response of 2nd order system for step input for given values of zeta ($\zeta$) (i) $\zeta = 0$ (ii) $\zeta = 0.5$ (iii) $\zeta = 1$ (iv) $\zeta = 5$

(c) Define transfer function. Obtain transfer function of RC network.

(d) Draw and explain memory organization in PLC.

(e) Define 'ON-OFF' controller. Describe it's working principle using one example.

**4. (A) Attempt any THREE :** **12**

(a) Draw labelled block diagram of PLC. List any two output devices.

(b) Draw ON-Delay instruction format of PLC. Give significance of EN and DN bits.

(c) Draw electronic circuit diagram for PD controller. Describe why derivative controller not used alone.

(d) Define Servo-System. Draw block diagram of DC Servo-System.

**(B) Attempt any ONE :** **6**

(a) For system whose open loop transfer function is

$$G(s)\,H(s) = \frac{100}{s^2(1 + 0.5s)\,(s + 2)}$$

Determine :

(i) Type of system

(ii) Error constants $K_p$, $K_v$, $K_a$

(iii) Steady state error for unit parabolic input.

(b) Draw ladder diagram to blink LED continuously for 60 times. LED should be ON for one second and OFF for one second.

**5. Attempt any FOUR :** **16**

(a) Obtain stability of system whose characteristic equation is

$s^5 + s^4 + 3s^3 + 9s^2 + 16s + 10 = 0$

use Routh's criterion.

**P.T.O.**

(b) Describe with neat diagram concept of sinking and sourcing in discrete input module.

(c) Define following terms :

(i) Poles

(ii) Zero's

(iii) Order of system

(iv) Characteristic equation

(d) State Routh's stability criterion. Explain with example.

(e) State and explain any four block diagram reduction rules.

(f) List data handling instructions of PLC. Describe any one in details.

**6. Attempt any FOUR :** **16**

(a) Define following terms related to PLC (i) Scanning cycle (ii) Speed of execution.

(b) Compare Proportional and Integral control action on basis of (i) Response to error (ii) Output equation (iii) applications (iv) limitations.

(c) Derive unit step response of $1^{st}$ order system.

(d) List comparison instruction of PLC. Describe any two with diagram.

(e) Define : (i) Relative Stability (ii) Marginally Stable System.

(f) Draw block diagram of power supply used in PLC. Describe function of each block.

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