21415

3 Hours/100 Marks

Seat No.

Instructions: (1) *Illustrate your answers with **neat** sketches **wherever** necessary.*
(2) *Figures to the **right** indicate **full** marks.*
(3) *Assume **suitable data**, if necessary.*
(4) ***Use** of Non-programmable Electronic Pocket Calculator is **permissible**.*
(5) *Mobile Phone, Pager and any other Electronic Communication devices are **not** permissible in **Examination Hall**.*

MARKS

1. A) Attempt **any three** :   **12**
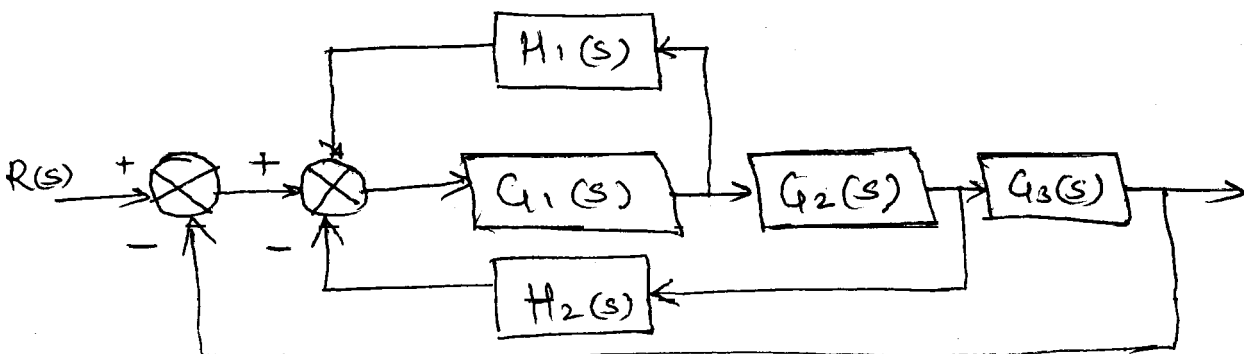
   a) Define stability and locate stable and unstable system poles on s-plane.

   b) List various input/output modules of PLC .

   c) Differentiate between open loop and close loop system.

   d) Compare between PI and PD controllers (any four points).

B) Attempt **any one** :   **6**

   a) Explain the need and benefits of PLC in automation.

   b) Derive the transfer function of the following block diagram :

2. Attempt **any two** : **16**

   a) For a unity feedback system, the open loop T.F. $G(s) = \dfrac{25}{s\,(s+6)}$. Find out :

      i) Rise time

      ii) Peak time

      iii) Max-overshoot

      iv) Settling time.

   b) For unity feedback system having $G(s) = \dfrac{5\,(s+1)}{s^2\,(s+3)\,(s+10)}$ determine type

   of system, error coefficient and the steady state error for I/P

   $r(t) = 1 + 3t + \dfrac{t^2}{2}$.

   c) Draw ladder diagram for 3 motor operation for following condition :

      1) Start push button, start motor M_1.

      2) When motor M_1 is ON after 5 min M_2 is ON and M_1 is OFF ?

      3) When M_2 is ON after 10 min M_3 is ON and M_2 is OFF ?

      4) When stop push button is pressed M_3 is OFF ?

3. Attempt **any four** : **16**

   a) Derive the transfer function of RLC network.

   b) Define scan cycle. Explain its significance in PLC.

   c) Differentiate between AC and DC servo system (four points).

d) Find out the range of K for the given system to be stable with

$$G(s)\,H(s) = \frac{K}{s\,(s+4)\,(s^2+2s+2)}\,.$$

e) Define the term scanning cycle, speed of execution in PLC.

4. A) Attempt **any three** :   **12**

   a) Explain why derivative action is not used alone. State its one advantage and disadvantage.

   b) Explain memory function and organization of ROM and RAM in PLC.

   c) Explain with diagram sinking and sourcing concept in DC I/P modules.

   d) Define pole and zero. Give its s-plane representation.

B) Attempt **any one** :   **6**

   a) Describe the wiring details of AC output modules of PLC.

   b) Describe PID control action w.r.t. equation and response to error. State one advantage and one disadvantage of it.

5. Attempt **any two** :   **16**

   a) List and explain the timer instructions of PLC.

   b) Explain with laplace representation standard test inputs. State its need and significance.

   c) Consider the system with characteristic equation
$s^5 + 2s^4 + 3s^3 + 6s^2 + 2s + 1 = 0$. Determine stability of the system using Routh's criteria.

6. Attempt **any four** : **16**

   a) Draw and explain the block diagram of process control system.

   b) State Rouths stability criteria. Describe different cases to find stability of a system.

   c) Draw the ladder diagram for to verify :

      1) AND gate

      2) NAND Gate logic.

   d) List type of control action. Give one advantage and disadvantage.

   e) List any two rules of block diagram reduction technique.

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