Total No. of Questions—**8**] [Total No. of Printed Pages—**5**

Seat No.	

[5057]-247

S.E. (Electronics/E & TC) (II Sem.) EXAMINATION, 2016

CONTROL SYSTEM

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Neat diagrams must be drawn wherever necessary.

(*ii*) Figures to the right indicate full marks.

(*iii*) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*iv*) Assume suitable data if necessary.

1. (*a*) Explain open loop and closed loop systems with suitable examples. [6]

(*b*) For a system with closed loop transfer function : [6]

$$G(s) = \frac{9}{(s^2 + 4s + 9)}$$

Determine rise time, peak time, peak overshoot, setting time with 2% criterion.

Or

2. (*a*) Determine $\frac{C(s)}{D(s)}$ for the block diagram shown in Fig. 1 using block diagram reduction : [6]

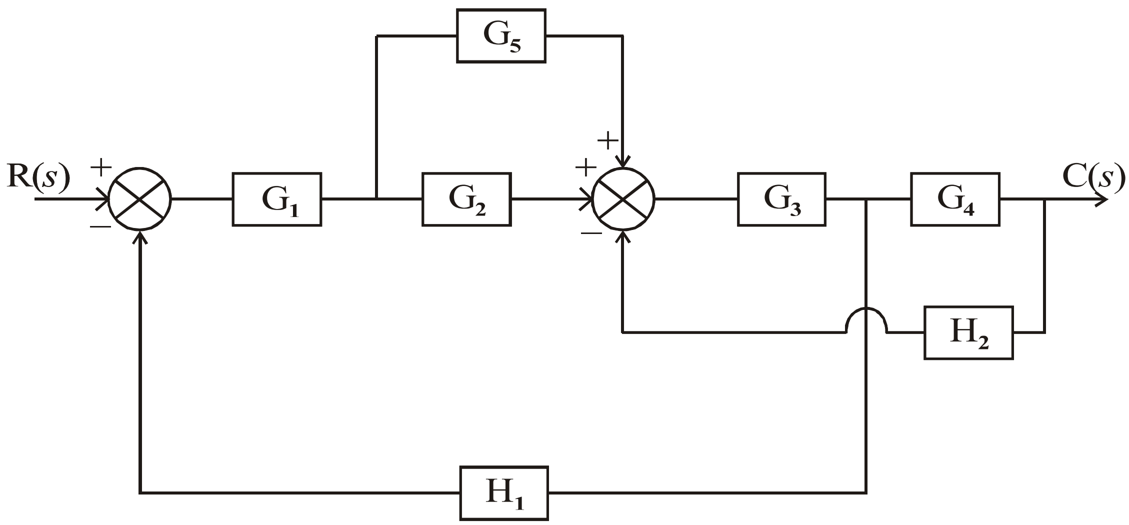

Fig. 1

(*b*) For unity feedback system with open loop transfer function $G(s) = \frac{k}{s(s+5)}$ determine k, peak overshoot, rise time, settling time with 2% criterion if damping factor is $\xi = 0.5$. [6]

3. (*a*) Investigate the stability of system with characteristic equation : [4]

$$Q(s) = s^4 + 3s^3 + 4s^2 + 3s + 2 = 0.$$

(*b*) Draw Bode plot of a system with open loop transfer function $G(s) = \frac{100}{s(s+2)(s+5)}$. Determine gain margin, phase margin, gain cross over frequency, phase cross over frequency and comment on stability. [8]

Or

4. (*a*) For an unity feedback system with open loop transfer function $G(s) = \dfrac{4}{s(s+2)}$ determine damping factor, undamped natural frequency, resonant peak, resonant frequency. [4]

(*b*) Sketch root locus of unity feedback system with open loop trnasfer function : [8]

$$G(s) = \frac{k}{s(s+2)(s+6)}.$$

5. (*a*) For a system with transfer function :

$$G(s) = \frac{2s^2 + 3s + 1}{s^3 + 5s^2 + 7s + 4}.$$

Determine state model in controllable canonical and observable canonical form. [6]

(*b*) Derive the expression for state transition matrix by Laplace transform method and state properties of state transition matrix. [7]

Or

6. (*a*) Determine the state transition matrix of : [7]

$$A = \begin{bmatrix} 0 & 1 \\ -4 & -5 \end{bmatrix}$$

and obtain solution $x(t)$ of state equation

$\dot{x} = Ax$ if initial state is $x(0) = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$.

(*b*) Investigate state controllability and state observability if : [6]

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -4 & -6 & -8 \end{bmatrix}, \ B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}, \ C = [1 \ \ 2 \ \ 1].$$

7. (*a*) Explain PID controller with the help of its block diagram, equation and transfer function. [6]

(*b*) Determine the pulse transfer function of the system shown in Fig. 2 using first principles : [7]

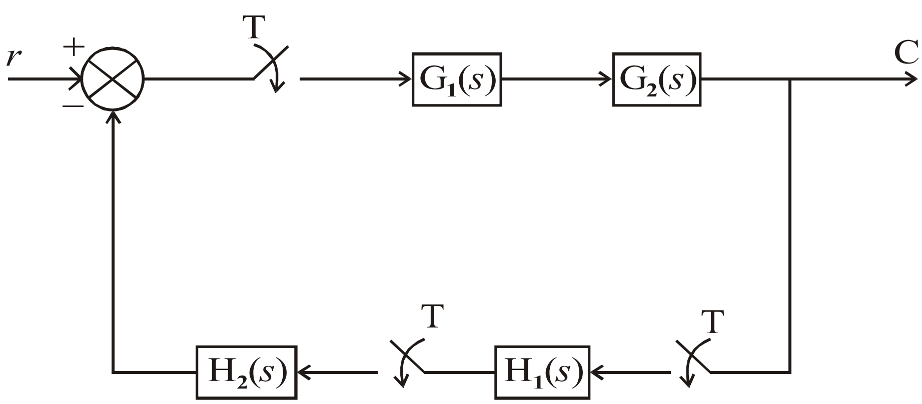

Fig. 2

Or

8. (*a*) Sketch and explain block diagram of programmable logic controller (PLC). [6]

(*b*) Determine the closed loop pulse transfer function $\frac{C(z)}{R(z)}$ for the systme shown in Fig. 3 : [7]

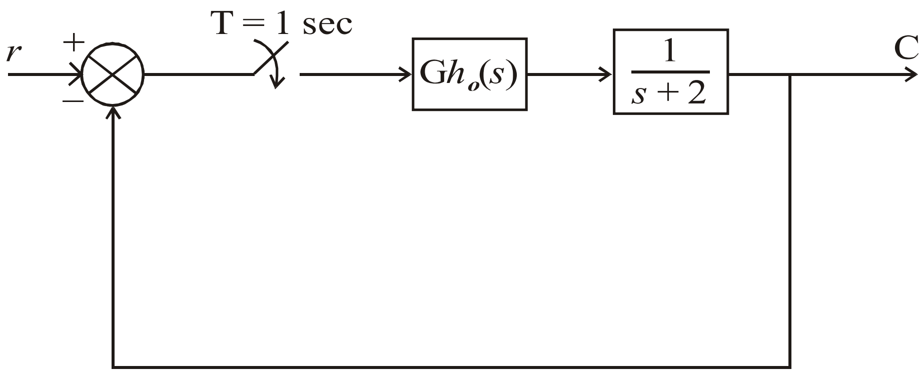

Fig. 3