Total No. of Questions—**8**] [Total No. of Printed Pages—**4+1**

Seat No.	

[4657]-547

S.E. (Electronics/E&TC) (Second Semester) EXAMINATION, 2014

CONTROL SYSTEMS

(2012 PATTERN)

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

N.B. **:—** (*i*) Answer Q. **1** *or* Q. **2**, Q. **3** *or* Q. **4**, Q. **5** *or* Q. **6** and Q. **7** *or* Q. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

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

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

(*v*) Assume suitable data, if necessary.

1. (*a*) Explain open loop and closed loop systems with real time example. [6]

(*b*) A unity feedback system has open loop transfer function :

$$G(s) = \frac{K}{s(s+10)}.$$

P.T.O.

Determine 'K' so that damping factor is 0.5. For this value of 'K' determine :

(1) Location of closed loop poles,

(2) Peak overshoot, and

(3) Peak time.

Assume input is unit step. [6]

Or

2. (*a*) Find closed loop transfer function $\frac{y(s)}{x(s)}$ if

$$G_1 = G_2 = \frac{1}{s+1} \quad \text{and} \quad G_3 = G_4 = s + 1,\ H_1 = 1$$

for system shown in Fig. Q. 2(*a*) using block diagram reduction technique. [6]

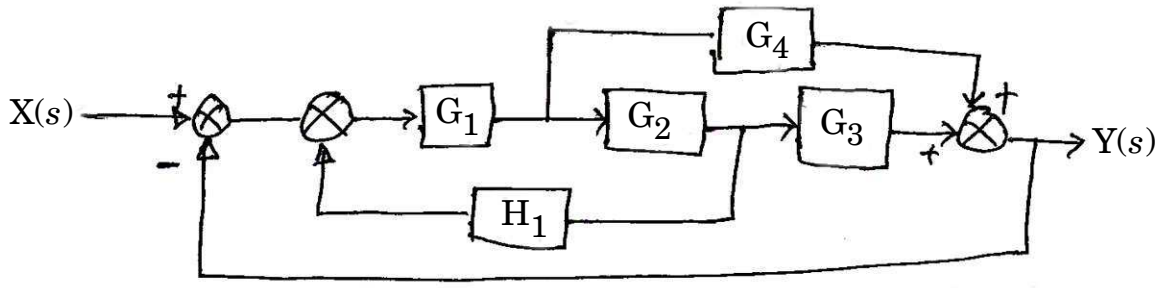

Fig. Q. 2(*a*)

(*b*) If open loop transfer function is $G(s) = \frac{1}{s+1}$, obtain unit step response. Also find output at time t = 0, 1, 2, 3, 4, 5. Assume unity feedback and G(*s*) is in closed loop. [6]

3. (*a*) Comment on stability using Routh criteria if characteristic equation is :

$$Q(s) = s^5 + 2s^4 + 3s^3 + 4s^2 + 5s + 6 = 0 .$$

How many poles lie in right half of *s*-plane ? [4]

(*b*) Construct Nyquist plot and find phase crossover frequency and gain margin if :

$$G(s) \,.\, H(s) = \frac{1}{s(s+1)(s+2)} .$$

Also comment on stability. [8]

Or

4. (*a*) If

$$G(s)\, H(s) = \frac{k(s+2)}{s(s+1)(s+3)},$$

construct root locus and comment on stability of system. [8]

(*b*) Obtain resonance peak and resonance frequency if :

$$G(s) \,.\, H(s) = \frac{21}{s(s+5)},$$

with $H(s) = 1$. [4]

5. (*a*) Obtain controllable and observable canonical state model if :

$$G(s) = \frac{y(s)}{u(s)} = \frac{s^3 + 2s^2 + 5s + 1}{s^4 + 4s^3 + 4s^2 + 7s + 2}. \quad [6]$$

(*b*) Find controllability and observability if :

$$A = \begin{bmatrix} -2 & 1 & 0 \\ 1 & -3 & 2 \\ 10 & 0 & -8 \end{bmatrix}, \quad B = \begin{bmatrix} 0 \\ 0.1 \\ 1 \end{bmatrix},$$

$$C = \begin{bmatrix} 1 & 0 & 1 \end{bmatrix}, \quad D = \begin{bmatrix} 0 \end{bmatrix}. \quad [7]$$

Or

6. (*a*) List advantages of state space over transfer function. [6]

(*b*) Obtain state transition matrix if :

$$\dot{x} = \begin{bmatrix} 0 & -3 \\ 1 & -4 \end{bmatrix} x(t). \quad [7]$$

7. (*a*) Explain Ladder concept in PLC. Draw and explain different symbols used to construct ladder. [6]

(*b*) Find pulse transfer function and impulse response for the system shown in Fig. Q. 7(*b*). [7]

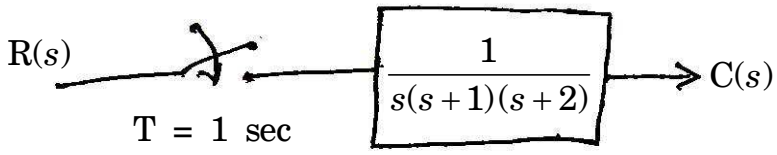

Fig. Q. 7(*b*)

Or

8. (*a*) Write PID equation. For unit step input sketch the response of P, I, D action of PID. [6]

(*b*) Write a note on digital control system with help of suitable block diagram. [7]