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

Seat No.	

S.E. (Electronics & Telecommunication/Electronics Engg.)

(II Sem.) EXAMINATION, 2014

CONTROL SYSTEMS

(2012 PATTERN)

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

***N.B.* :—** (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6** and Q. No. **7** *or* Q. No. **8** or as per instructions.

(*ii*) Use semi-log/graph papers whenever required.

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

(*iv*) Figures to the right side indicate full marks.

(*v*) Use of calculator is allowed.

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

1. (*a*) Explain the rules of block diagram reduction techniques. [6]

(*b*) If peak overshoot is 16.3% and peak time is 0.3023 seconds. Determine :

(1) damping factor,

(2) undamped natural frequency and

(3) settling time (for 2% tolerance) of the system. [6]

Or

2. (*a*) Find the closed loop transfer function $\frac{C(s)}{R(s)}$ of system shown in Fig. 1 using block diagram reduction technique. [6]

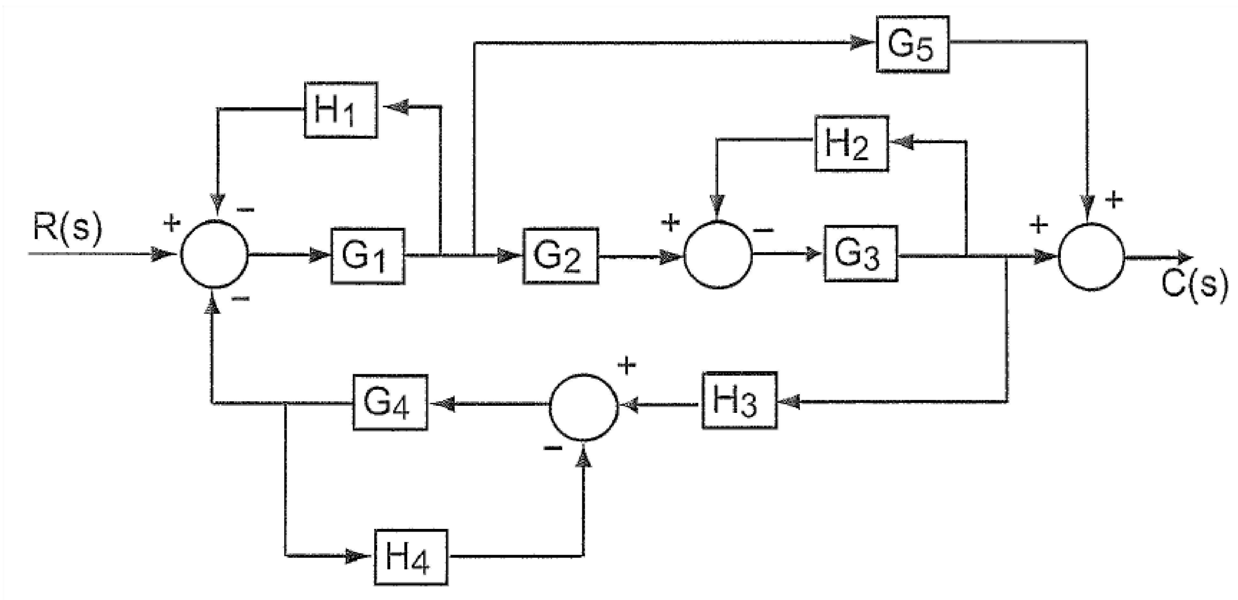

Fig. 1

(*b*) If $G(s)\,H(s) = \frac{25}{s(s+5)}$, obtain damping factor, un-damped and damped natural frequency, rise time, peak time, and settling time. [6]

3. (*a*) Comment on the stability of a system using Routh's stability criteria whose characteristic equation is :

$$s^4 + 2s^3 + 4s^2 + 6s + 8 = 0.$$

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

(*b*) If $G(s)\,H(s) = \dfrac{24}{s(s+2)(s+12)}$, construct the Bode plot and calculate gain crossover frequency, phase crossover frequency, gain margin, phase margin and comment on stability. [8]

Or

4. (*a*) Open loop transfer function of unity feedback system is $G(s) = \dfrac{K}{s(s+3)(s+5)}$. Sketch the complete root locus and find marginal gain. [8]

(*b*) If $G(s)\,H(s) = \dfrac{1}{s(s+1)}$, determine the value of :

(1) Resonance Peak and

(2) Resonance frequency. [4]

5. (*a*) State any three advantages of state space approach over classical approach. Derive an expression to obtain transfer function from state model. [7]

(*b*) Find Controllability and Observability of the system given by state model : [6]

$$A = \begin{bmatrix} 1 & 1 & 5 \\ 1 & -2 & 2 \\ 5 & 2 & -8 \end{bmatrix}, \; B = \begin{bmatrix} 5 \\ 1 \\ 10 \end{bmatrix}, \; C = \begin{bmatrix} 10 & 15 & 11 \end{bmatrix}, \; D = [0].$$

Or

6. (*a*) Explain canonical controllable and observable state model with any example/transfer function. [6]

(*b*) Obtain the state transition matrix for the system with state equation :

$$[\dot{x}] = \begin{bmatrix} 0 & 1 \\ -8 & -9 \end{bmatrix} [x]$$

using Laplace transformation. [7]

7. (*a*) Explain application of programmable logic controller for elevator system with ladder diagram. [6]

(*b*) Find the pulse transfer function and impulse response of the system shown in Fig. 2. [7]

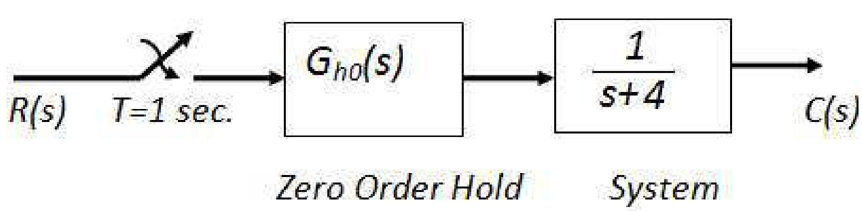

Fig. 2

Or

8. (*a*) Write the equation of PID controller and explain role of each action in short. [6]

(*b*) Obtain pulse transfer function of the system shown in Fig. 3 using first (Starred Laplace) principle. [7]

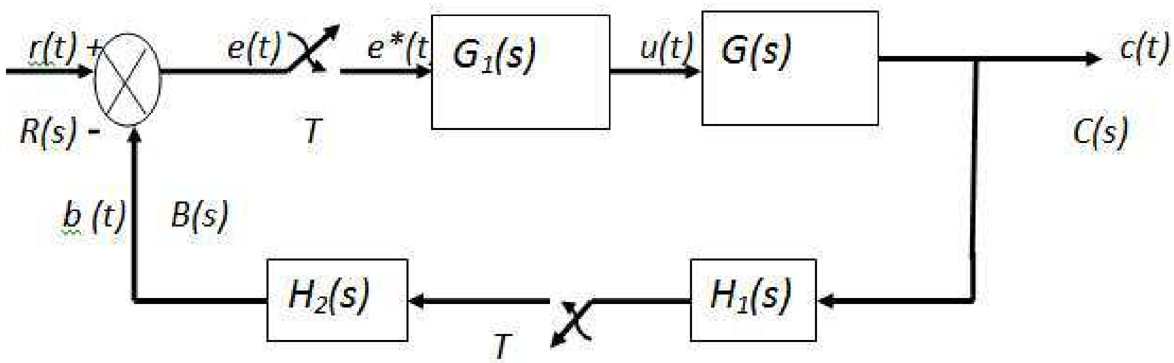

Fig. 3