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

Seat No.	

[4857]-1047

S.E. (E & TC/Electronics) (II Sem.) EXAMINATION, 2015
CONTROL SYSTEMS
(2012 PATTERN)

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

N.B. :—   (i)   Attempt Q. No. **1** or Q. No. **2**, Q. No. **3** or Q. No. **4**, Q. No. **5** or Q. No. **6**, Q. No. **7** or Q. No. **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)   Consider the R-L-C network shown in Fig. 1 :

(i)   Obtain transfer function if V_i and V_o are input and output voltage respectively.

(ii) Find the location of poles in terms of R, L and C.

(iii) If R = 1 MΩ, C = 1 μF, L = 1 mH. Is the location of poles of transfer function given in (i) are real ? If yes, find the location.   [6]
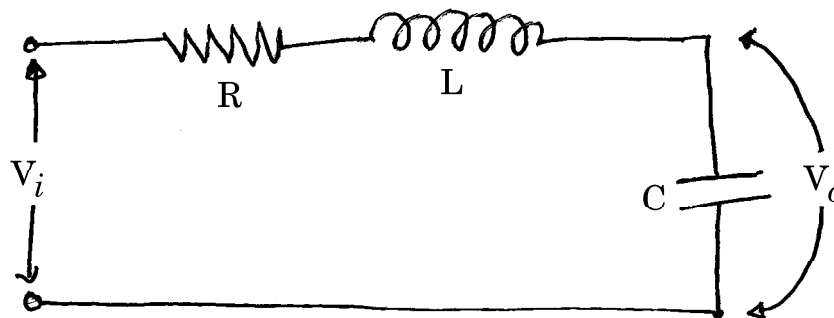

Fig. 1

P.T.O.

(b) If $G(s) = \dfrac{K}{s(s+64)}$ with $H(s) = 1$, determine value of K so that damping factor is 0.5. For this value of 'K' determine :

(i) Rise time, and

(ii) Settling time.

Assume unit step input. [6]

Or

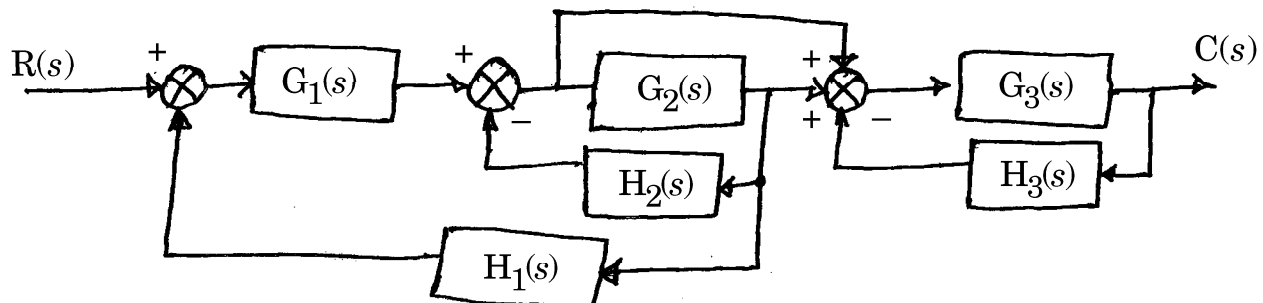2. (a) Find $\dfrac{C(s)}{R(s)}$ for the system shown in Fig. 2 using Block diagram rules. [6]

Fig. 2

(b) The open loop transfer function of unity feedback system is :

$$G(s) = \dfrac{K}{s(\tau s + 1)}, \quad K, \tau > 0$$

with a given value of K, the peak overshoot was found to be 80%. Suppose peak overshoot is decreased to 20% by decreasing gain K. Find the new value of K (say K_2) in terms of the old value. [6]

3. (*a*) Comment on stability of a system using Routh's criteria, if characteristic equation is $D(s) = s^4 + 5s^3 + s^2 + 10s + 1$. How many poles lies in Right of s-plane ? [4]

(*b*) Construct Bode Plot and calculate GM, PM, W_{gc} and W_{pc} if

$$G(s) = \frac{200(s + 20)}{s(2s + 1)(s + 40)} \text{ and } H(s) = 1.$$ [8]

Or

4. (*a*) Open loop transfer function of unity feedback system is

$$G(s) = \frac{K}{s(s + 2)(s + 10)}.$$ Sketch the complete root locus and comment on stability of system. [8]

(*b*) For unity feedback system with $G(s) = \dfrac{100}{s(s + 5)}$.

Determine :
(*i*) Resonance peak
(*ii*) Resonance frequency. [4]

5. (*a*) Enlist any *two* advantages of state space approach over transfer function. Obtain a state space representation in controllable and observable canonical form for the system

$$G(s) = \frac{s + 3}{s^2 + 3s + 2}.$$ [6]

(*b*) Obtain the state space representation of system whose differential equation is :

$$\frac{d^3y}{dt^3} + 2\frac{d^2y}{dt^2} + 3\frac{dy}{dt} + 6y = \frac{d^2u}{dt^2} - \frac{du}{dt} + 2u.$$

Also find controllability and observability of the system. Assume zero initial conditions. [7]

Or

6. (*a*) Obtain state transition matrix if :

(*i*) $\dfrac{dx}{dt} = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix} x$

(*ii*) $\dfrac{dx}{dt} = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix} x$

using Laplace transformation. [6]

(*b*) Write a short note on 'state transition matrix and its properties'. [7]

7. Write short notes on :

(1) Advantages of digital control systems over analog control systems. [4]

(2) Application of PLC (Programmable Logic Controller) in Elevator/List. [4]

(3) PID controllers and its operational characteristics. [5]

Or

8. (*a*) Obtain pulse transfer function of the system shown in Fig. 3 with $a = 1$. [6]
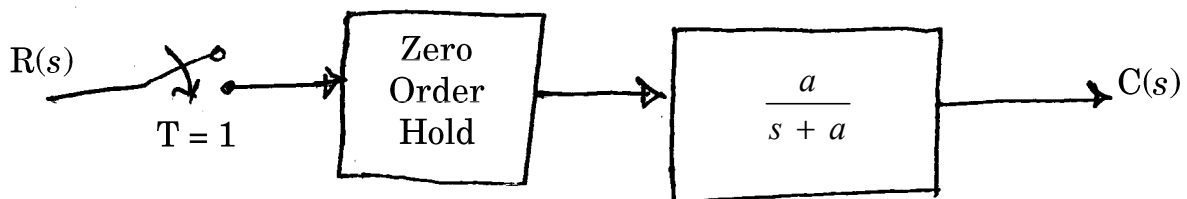

Fig. 3

(*b*)   Obtain pulse transfer function of system shown in Fig. 4.   [7]
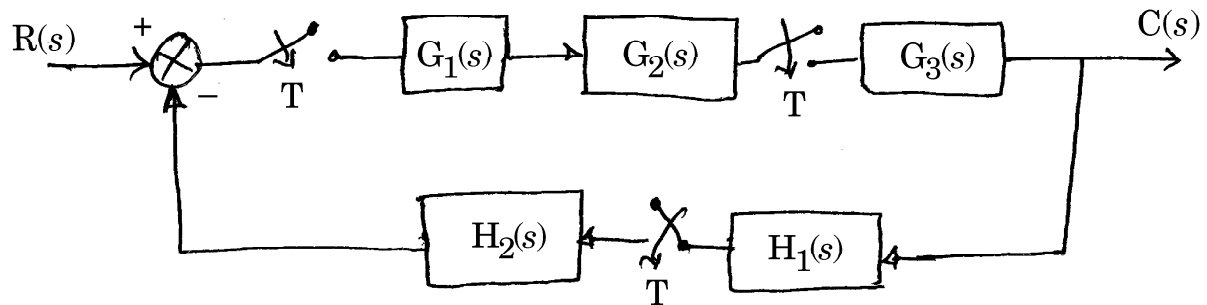

Fig. 4