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]

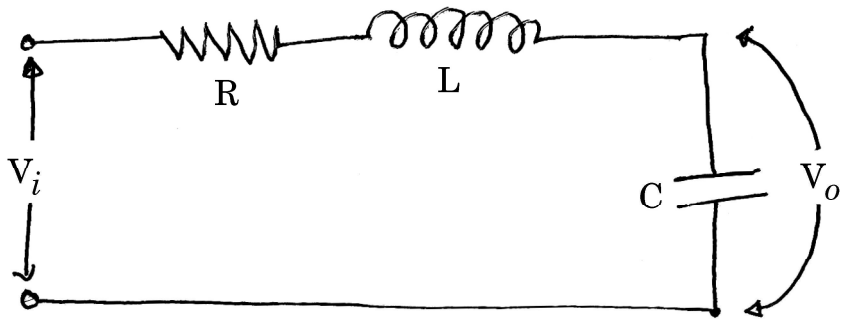

Fig. 1

P.T.O.

(*b*) If $G(s) = \frac{K}{s(s+64)}$ 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 $\frac{C(s)}{R(s)}$ for the system shown in Fig. 2 using Block diagram rules. [6]

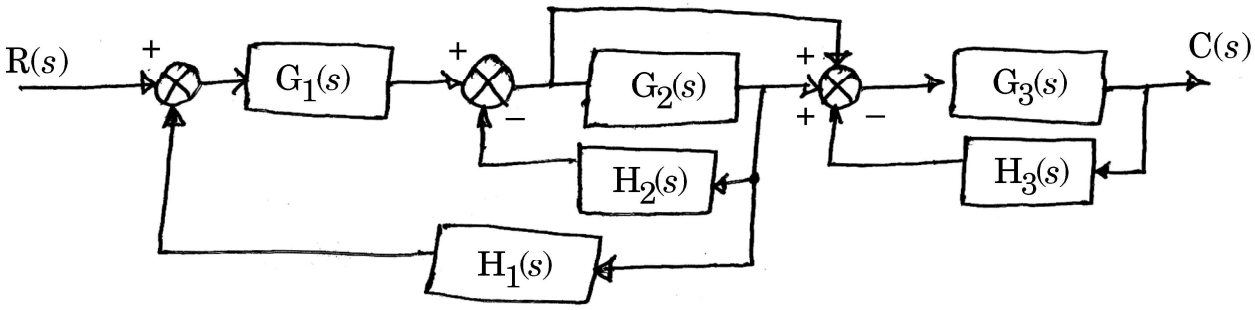

Fig. 2

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

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

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

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

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 $G(s) = \frac{100}{s(s + 5)}$.

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

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

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

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

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]

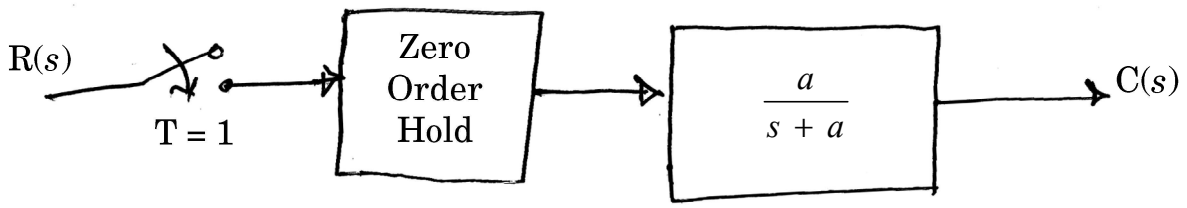

Fig. 3

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

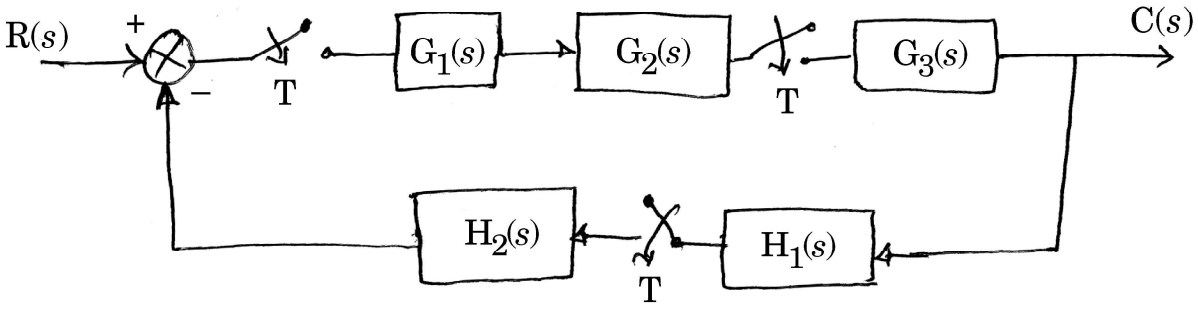

Fig. 4