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

Seat No.	

[5352]-137

S.E. (Electronics/E&TC) (II Sem.) EXAMINATION, 2018

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**, 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*) Determine the transfer function $V_0(s)/V_{in}(s)$ for the system shown in Fig. 1. [6]

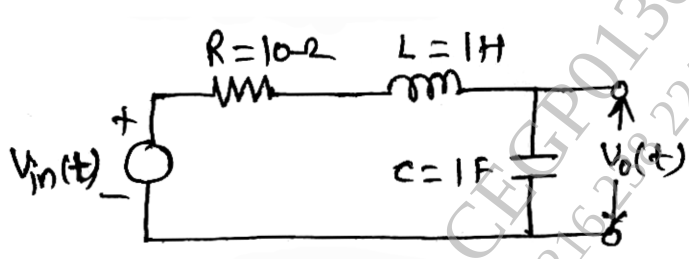

Fig. 1

P.T.O.

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

$$G_{CL}(s) = \frac{100}{s^2 + 12s + 100}.$$

Determine ξ, ω_n, t_p, t_r, m_p and t_s for 2% setting.

Or

2. (*a*) Explain the open loop and closed loop control system with the help of neat block diagram and real life examples. [6]

(*b*) For the unity feedback system with open loop transfer function : [6]

$$G(s) = \frac{100(s+5)}{s(s^2 + 7s + 20)(s+10)},$$

determine order, type of the system k_p, k_v, k_a and steady state error for unit ramp input.

3. (*a*) For the system with closed loop characteristic equation : [4]

$$Q(s) = s^4 + 7s^3 + 9s^2 + 12s + 2 = 0,$$

investigate the stability using Routh stability criterion.

(*b*) Sketch the Bode plot of the system with open loop transfer function : [8]

$$G(s) = \frac{20}{s(s+2)(s+10)}$$

and determine gain crossover frequency, phase crossover frequency, gain margin and phase margin. Also comment on stability.

Or

4. (*a*) For the system with closed loop tranfer function : [4]

$$G_{CL}(s) = \frac{9}{s^2 + 3s + 9},$$

determine ξ, ω_n, resonant peak and resonant frequency.

(*b*) Sketch the root locus for the system with open loop transfer function : [8]

$$G(s) = \frac{k}{s(s+1)(s+4)}.$$

5. (*a*) Obtain the controllable canonical and observable canonical state models for the system with transfer function : [6]

$$G(s) = \frac{s^2 + 5s + 2}{s^3 + 4s^2 + 11s + 3}.$$

(*b*) Investigate the controllability and observability of the system with state model : [7]

$$\dot{x} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -4 & -7 & -2 \end{bmatrix} x + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$$

$$y = \begin{bmatrix} 2 & 1 & 0 \end{bmatrix} x$$

Or

6. (*a*) Obtain the state transition matrix for the system with state model : [6]

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ 0 & -2 \end{bmatrix} x$$

(*b*) Derive the formula for the conversion of state model to transfer function and obtain the transfer function of the system with state model : [7]

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ -3 & -8 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

$$y = \begin{bmatrix} 3 & 4 \end{bmatrix} x$$

7. (*a*) Explain the architecture of PLC with the help of neat block diagram. [6]

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

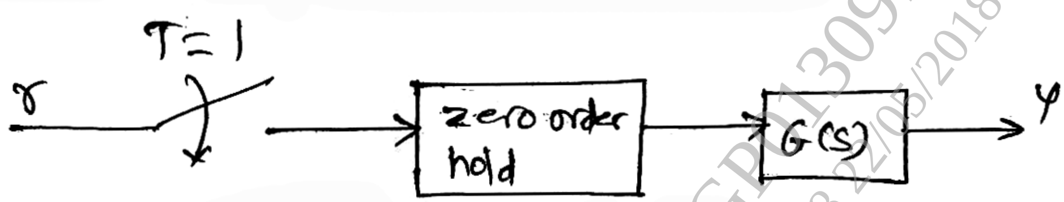

Fig. 2

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

Or

8. (*a*) Write a short note on PID controller. [6]

(*b*) Obtain the pulse transfer function of the system shown in Fig. 3 using first principle (starred Laplace and *z*-transform method). [7]

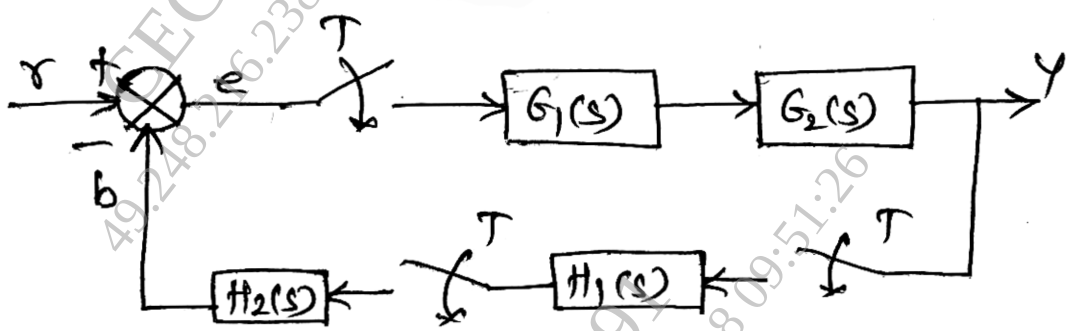

Fig. 3