

Seat No.	
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[5057]-247**S.E. (Electronics/E & TC) (II Sem.) EXAMINATION, 2016****CONTROL SYSTEM****(2012 PATTERN)****Time : Two Hours****Maximum Marks : 50****N.B. :—** (i) Neat diagrams must be drawn wherever necessary.

(ii) Figures to the right indicate full marks.

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

(iv) Assume suitable data if necessary.

1. (a) Explain open loop and closed loop systems with suitable examples. [6]

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

$$G(s) = \frac{9}{(s^2 + 4s + 9)}$$

Determine rise time, peak time, peak overshoot, setting time with 2% criterion.

P.T.O.

Or

2. (a) Determine $\frac{C(s)}{D(s)}$ for the block diagram shown in Fig. 1 using block diagram reduction : [6]

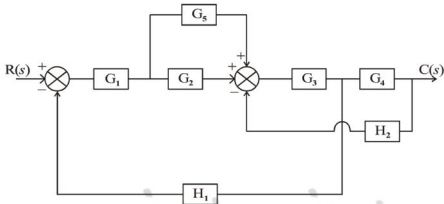


Fig. 1

- (b) For unity feedback system with open loop transfer function $G(s) = \frac{k}{s(s+5)}$ determine k , peak overshoot, rise time, settling time with 2% criterion if damping factor is $\zeta = 0.5$. [6]
3. (a) Investigate the stability of system with characteristic equation : [4]

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

- (b) Draw Bode plot of a system with open loop transfer function $G(s) = \frac{100}{s(s+2)(s+5)}$. Determine gain margin, phase margin, gain cross over frequency, phase cross over frequency and comment on stability. [8]

Or

4. (a) For an unity feedback system with open loop transfer function

$$G(s) = \frac{4}{s(s+2)} \text{ determine damping factor, undamped natural frequency, resonant peak, resonant frequency.} \quad [4]$$

- (b) Sketch root locus of unity feedback system with open loop transfer function : [8]

$$G(s) = \frac{k}{s(s+2)(s+6)}.$$

5. (a) For a system with transfer function :

$$G(s) = \frac{2s^2 + 3s + 1}{s^3 + 5s^2 + 7s + 4}.$$

Determine state model in controllable canonical and observable canonical form. [6]

- (b) Derive the expression for state transition matrix by Laplace transform method and state properties of state transition matrix. [7]

Or

6. (a) Determine the state transition matrix of : [7]

$$A = \begin{bmatrix} 0 & 1 \\ -4 & -5 \end{bmatrix}$$

and obtain solution $x(t)$ of state equation

$$\dot{x} = Ax \text{ if initial state is } x(0) = \begin{bmatrix} 1 \\ 0 \end{bmatrix}.$$

- (b) Investigate state controllability and state observability if : [6]

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -4 & -6 & -8 \end{bmatrix}, B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}, C = [1 \ 2 \ 1].$$

7. (a) Explain PID controller with the help of its block diagram, equation and transfer function. [6]
- (b) Determine the pulse transfer function of the system shown in Fig. 2 using first principles : [7]

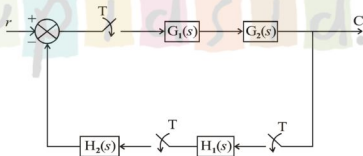


Fig. 2

Or

8. (a) Sketch and explain block diagram of programmable logic controller (PLC). [6]

- (b) Determine the closed loop pulse transfer function $\frac{C(z)}{R(z)}$ for the system shown in Fig. 3 : [7]

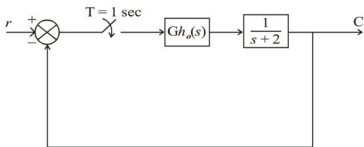


Fig. 3

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