Total No. of Questions : 8] **SEAT No. :** [ ]

PB-3617 **[Total No. of Pages : 2**

[6261]-22
S.E.(Electronics & Telecommunication)
CONTROL SYSTEMS
(2019 Pattern) (Semester - IV) (204192)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right side indicate full marks.***
3) ***Assume suitable data, if necessary.***
4) ***Neat diagrams must be drawn wherever necessary.***

Q1) a) Using Routh's & Hurwitz's criteria, comment on the stability if characteristic equation is: $S^6 + 3S^5 + 4S^4 + 6S^3 + 5S^2 + 3S + 2$. **[8]**

b) Sketch root locus of the unity feedback system with open loop transfer function $G(s)=\frac{K}{s(s+1)(s+4)}$. **[10]**

OR

Q2) a) A feedback control system has open loop gain $G(s)H(s)=\frac{k(s+2)}{s(s+1)(s^2+2s+5)}$. Determine the value of 'k' for which the system is stable as well as critically stable. **[8]**

b) A unity feedback system has the loop transfer function, $G(s)=\frac{k}{s(s+1)(s+3)(s+4)}$ Determine: Breakaway points, intersection with imaginary axis. Plot root locus. **[10]**

Q3) a) For an unity feedback system with open loop transfer function $G(s)=\frac{4}{s(s+2)}$. Determine Damping factor, Undamped natural frequency, resonant peak, and resonant frequency. **[9]**

b) The open loop transfer function of a unity feedback system is given by $G(s)=\frac{1}{s(s+1)(s+2)}$ Sketch the polar plot and determine the gain margin. Also comment on the stability. **[9]**

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OR

Q4) a) The open loop transfer function of the system $G(s)H(s)=\frac{10}{(s+2)(s+4)}$

Determine the system stability using Nyquist plot. **[9]**

b) For the unity feedback system with open loop transfer function $G(s)=\frac{12}{s(s+2)(s+6)}$ sketch the bode plot. Determine gain crossover frequency, phase crossover frequency, gain margin and phase margin. Also investigate the stability. **[9]**

Q5) a) Obtain the expression for state transition matrix and state any four properties of state transition matrix. **[9]**

b) Find Controllability and Observability of the system given by state model. **[9]**

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

OR

Q6) a) Obtain the state model for the system with transfer function $\frac{Y(s)}{U(s)}=\frac{3S+4}{S2+5S+6}$. **[9]**

b) Determine the transition matrix of state equation $\dot{X}=\begin{bmatrix}0 & -3\\ 1 & -4\end{bmatrix}x(t)$. **[9]**

Q7) a) Explain Proportional mode, Integral Mode and Derivative Mode. **[8]**

b) What do you mean by Industrial Automation? What are its types? Explain the architecture of an automation. **[8]**

OR

Q8) a) Explain the Ziegler–Nichols tuning method of a PID controller. **[8]**

b) Explain what do you mean by Offset in controller. Which method is used to eliminate this problem? **[8]**

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