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

PA-1195 **[Total No. of Pages : 2**

[5925]-217
S.E. (E & TC)
CONTROL SYSTEMS
(2019 Pattern) (Semester - IV) (204192)

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

Instructions to the candidates:

1) ***Solve questions Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Figures to the right side indicate full marks.***
3) ***Assume the suitable data, if necessary.***

Q1) a) Using Routh's & Hurwitz's criteria, comment on the stability if characteristic equation is: $S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16$. **[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) The open loop transfer function of the unity feedback system is $G(S) = \frac{200}{s(s^3 + 6s^2 + 11S + 6)}$ Using Routh criterion determine stability of the system. **[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, reason peak, resonant frequency. **[9]**

b) Explain Nyquist Stability Criterion. **[8]**

OR

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Q4) a) If $G(S)H(S)=\frac{1}{s(s+1)}$. Find Resonance peak and resonance frequency. **[9]**

b) Explain Advantages of frequency Domain Analysis. **[8]**

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

b) Find Controllability and Observability of the system given by state model.

$$A=\begin{bmatrix}1 & 1 & 5\\ 1 & -2 & 2\\ 5 & 2 & -8\end{bmatrix}, B=\begin{bmatrix}5\\ 1\\ 10\end{bmatrix}, C=\begin{bmatrix}10 & 15 & 11\end{bmatrix}, D=[0]$$ **[9]**

OR

Q6) a) Obtain the state model for the system with transfer function $\frac{Y(s)}{U(s)}=\frac{3S+4}{s^2+5S+6}$. **[9]**

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

Q7) a) Explain Proportional mode, Integral Mode and Derivative Mode. **[9]**

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 tuning a PID controller. **[9]**

b) $\frac{C(s)}{R(s)}=\frac{1}{S^2+S+1}$ Compute the T_r, T_p, T_s and $\%M_p$ for the same. Compare the time domain for proportion gain $K_p = 20$. **[8]**