Total No. of Questions: 8]

PA-1195

SEAT No. :	
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[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.
 - 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

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.

$$A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & -2 & 2 \\ 5 & 2 & -8 \end{bmatrix}, B = \begin{bmatrix} 5 \\ 1 \\ 10 \end{bmatrix}, C = \begin{bmatrix} 10 & 15 & 11 \end{bmatrix}, D = \begin{bmatrix} 0 \end{bmatrix}$$

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]