Total No. of Questions : 8]

SEAT No. : ____

PF-4734

[Total No. of Pages : 3

[6625]-27

S.E. (Elecronics/E&TC/E.Eng.-VLSI D&T/E.C-ACT)

CONTROL SYSTEMS

(2019 Pattern) (Semester - IV) (204192)

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

Instructions to the candidates:

1) ***Solve question Q1 or Q2, Q3 or Q4, Q5 or Q6 and Q7 or Q8.***
2) ***Figures to the right side indicate full marks.***
3) ***Assume suitable data, if 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) The O.L.T.F. of unity gain negative feedback system given. **[10]**

$$G(s) = \frac{k}{s(s+4)(s^2+s+1)}$$

i) Calculate the range of k for system to be in stable state when stability of closed loop system is concerned.

ii) Calculate the value of k for system to become marginally stable, also calculate the frequency of natural oscillation.

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) Sketch the root locus of the system with open loop transfer function **[10]**

$$G(s)H(s) = \frac{k}{s(s^2+6s+25)}$$

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]**

P.T.O.

b) The open loop transfer function of a unity feedback system is given by $G(s) = \frac{12}{s(s+1)(s+2)}$. Sketch the polar plot and determine the gain and phase margin. Also comment on the stability. **[9]**

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 $G(s) = \frac{40}{s(s+5)(s+8)}$ Sketch the bode plot. Determine gain crossover frequency, phase crossover frequency, gain margin and phase margin. Also investigate the stability. **[9]**

Q5) a) A feedback system with transfer function $G(s) = \frac{s^2+3s+3}{s^3+2s^2+3s+1}$. Construct a state model for the system. **[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 stae 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. **[9]**

$$\dot{X} = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix} x(t)$$

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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) Draw and explain the block diagram of digital control system and write advantages of DCS. **[8]**

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