Total No. of Questions : 8]

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S.E. (Electronics/ET&C/Electronics (VLSI Design & Tech.)/E.C (A.C.T.))

CONTROL SYSTEMS

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

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7or Q8.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume suitable data, if necessary.***

Q1) a) Investigate the stability of the system using Routh Hurwitz criterion

$$G(s) = \frac{100}{s^4 + 6s^3 + 30s^2 + 60s + 100}$$ **[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 oscillation.

OR

Q2) a) For the given unity feedback system find the value of 'k' and 'q' such that the system will oscillates with frequency 2 rad/sec **[8]**

$$G(s) = \frac{k(s+1)}{s^3 + qs^2 + 2s + 1}$$

b) Sketch the root locus of the system with open loop transfer function

$$G(s)H(s) = \frac{k}{s(s^2+6s+25)}$$ **[10]**

P.T.O.

Q3) a) For an unity feedback system with open loop transfer function $G(s)=\frac{100}{s(s+9)}$. 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 $G(s)=\frac{12}{s(s+1)(s+2)}$. Sketch the polar plot and determine the gain and phase margin. Also comment on the stability. **[9]**

OR

Q4) a) Investigate the stability closed loop system whose open loop transfer function is $G(s)H(s)=\frac{10}{s(10s+1)}$ using Nyquist stability criteria. **[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]**

$$A=\begin{bmatrix}-2 & 1 & 0\\ 1 & -3 & 2\\ 10 & 0 & -8\end{bmatrix} \quad B=\begin{bmatrix}0\\ 0.1\\ 1\end{bmatrix} \quad C = [\,1\ 0\ 1\,] \quad D = [0]$$

OR

Q6) a) Explain advantages and disadvantages of Conventional Control Theory. **[9]**

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

Q7) a) What do you mean by On-Off control? Explain with suitable example. **[8]**

b) What do you mean dead zone? Explain with suitable example. **[8]**

OR

Q8) a) How IoT helps in Industrial Automation? What are the essentials of an Industrial IoT solution? Give two examples of Industrial IoT. **[8]**

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