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

P9097 **[Total No. of Pages : 3**

[6179]-222
S.E. (Electronics/E & TC)
CONTROL SYSTEMS
(2019 Pattern) (Semester - IV) (204192)

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

Instructions to the candidates:

1) ***Solve question 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 indicate full marks.***
3) ***Assume suitable data, if necessary.***
4) ***Neat diagrams must be drawn wherever necessary.***

Q1) a) Investigate the stability of the system using Routh Hurwitz criterion **[8]**

$$G(s) = \frac{100}{S^4+6S^3+30S^2+60S+100}$$

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) The closed loop transfer function of the system is given as

$G(S) = \frac{s+2}{s^3-3s^2+4s-2}$, Determine the stability of system. **[8]**

b) A unity feedback transfer function has forward path gain

$G(S) = \frac{k}{s(s+2)}$ Plot a root locus. **[10]**

P.T.O.

Q3) a) If G(S)H(S) = $\frac{24}{s(S+2)(S+12)}$, Construct the Bode plot and Calculate gain crossover frequency, Phase Crossover frequency. **[9]**

b) Draw the Polar plot for given transfer function. G(S)H(S) = $\frac{5}{s(s+2)}$. **[8]**

OR

Q4) a) For unity feedback system with open loop transfer G(S) = $\frac{100}{S(S+9)}$. Determine damping factor, undamped natural frequency, resonant peak, and resonant frequency. **[9]**

b) Define and explain **[8]**

i) Bandwidth

ii) Gain margin

iii) Phase margin

iv) Gain cross-over frequency

v) Phase cross over frequency.

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

$$X=\begin{bmatrix}0 & 1\\ -1 & 0\end{bmatrix}x(t).$$ **[9]**

Q7) a) What do you mean by On-Off control? Explain with suitable example. **[9]**

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 . **[9]**

b) Write short note on digital control system over analog control system. **[8]**

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