

Total No. of Questions : 8]

SEAT No. :

PC2798

[Total No. of Pages : 3

[6352]-22

S.E. (E. & TC)

CONTROL SYSTEMS

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

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Solve 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.

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 unity feedback system has open loop transfer function

$G(S) = \frac{k}{s(s+2)(s+5)(s+10)}$. Determine the range of 'k' for the system stability, value of 'k' and frequency of oscillation at marginal stability. [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. $G(S) = \frac{10}{S+2}$ [8]

OR

Q4) a) For 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) 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]

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

OR

- Q6)** a) Explain advantages and disadvantages of Conventional Control Theory. [9]
b) Determine the State transition matrix of state equation [9]

$$x(t) = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

- Q7)** a) What do you mean by On-Off control? Explain with suitable example. [9]
b) Write comparison of P,I and D control action. [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) Draw and explain the block diagram of digital control system. [8]

