Total No. of Questions : 8]

SEAT No. :

P-1490

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S.E. (E & TC)

CONTROL SYSTEM

(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 the 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) 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) 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) 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]**

P.T.O.

Q3) a) For a 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) The open loop transfer function of a unity feedback system is given by $G(s)=\frac{1}{s(s+1)(s+2)}$ Sketch the polar plot and determine the gain margin. Also comment on the stability. **[8]**

OR

Q4) a) Draw Bode plot of the system with open loop transfer function : $G(s)=\frac{10}{s(s+2)(s+5)}$ and determine gain margin, Phase margin. Gain crossover frequency, Phase crossover frequency. Also comment on Stability. **[9]**

b) Derive the expression for resonant peak (M_r) and resonant frequency (W_r). **[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. **[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 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 **[9]**

$$X=\begin{bmatrix}0 & -3\\ 1 & -4\end{bmatrix}x(t)$$

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 a PID controller. **[9]**

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

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