28

Exam. Code: 0935
Sub. Code: 6985

1128

B.E. (Electrical and Electronics Engineering)
Fifth Semester
EE-509: Control Engineering – II

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Part.

x-x-x

Note: Q.1 is compulsory. Attempt any four selecting at least two from each part.

Q.1 i) Define state variables and state model.

(ii) How transfer function can be obtained from state model?

(iii) Draw circuit of phase lead compensator.

(iv) How does PI controller affect system dynamics?

(v) Differentiate between feedback and feed forward control.

(5 x 2)

Part A

Q.2 (i) Draw state block diagram and obtain state equations using parallel decomposition:

$$\frac{C(s)}{U(s)} = \frac{s+5}{s^2+10s+9}$$

(5)

(ii) Explain the significance of controllability and observability of a state model using one physical example. Test the following system for these two characteristics:

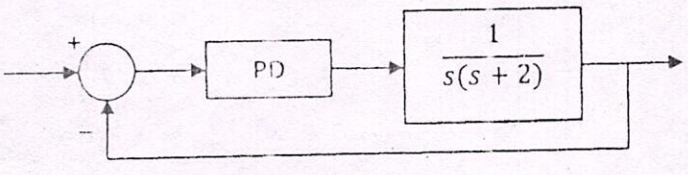
$$\dot{x}(t) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 0 \\ 2 \end{bmatrix} u(t)$$

$$y(t) = [1 \quad 0 \quad 0]x(t)$$

(5)

Q.3 (i) What is meant by tuning of PID controller? Why is it important? Explain one empirical method used for tuning the parameters. (5)

(ii) Find parameters of PD controller such that the following system exhibits peak overshoot of 2.5% and settling time of 0.5s.



(5)

P.T.O.

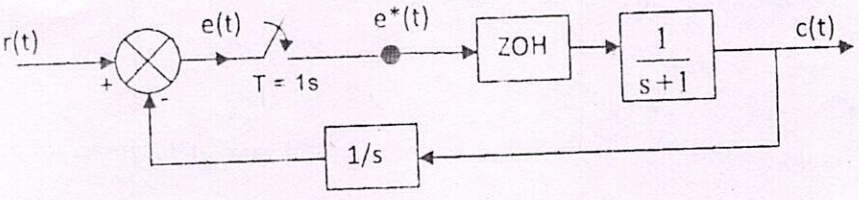
Q.4. (i) List various factors for selection of compensators in control system and hence justify the need for compensation. (2)

(ii) Design a phase lag compensator using Bode plot and root locus. Compare the two designs. (8)

Part B

Q.5 (i) Find z-transform of $e^{at}\cos\omega t$. (3)

(ii) Obtain pulse transfer function for the following system:



(7)

Q. 6 (i) Explain digital temperature control system with the help of block diagram. (5)

(ii) Explain the working of stepper motor with a neat diagram. How it is operated in a controlled way? (5)

Q. 7 (i) Discuss common incidental non-linearities in control systems. (3)

(ii) State model of a system is: $\dot{x} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} x$. Find suitable Liapunov's function V(x). Find upper bound on time that takes the system to get from initial condition $\dot{x} = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$ to within the area $x_1^2 + x_2^2 = 0.1$ (7)

x-x-x