B.E. (Electrical Engineering (Electronics & Power)) Seventh Semester (C.B.S.)

Control System - II

P. Pages : 3 **NIR/KW/18/3543**

Time : Three Hours * 1 7 9 7 * Max. Marks : 80

Notes : 1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Assume suitable data whenever necessary.
9. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) Derive the transfer function of lead compensator and the expression for maximum value of phase lead. **7**

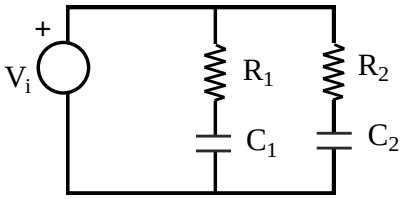
b) Briefly describe the compensation and the need for the same. **6**

OR

2. a) Explain the effect of addition of lag compensator on root locus of uncompensated system. **7**

b) Lag compensator is used to improve steady state performance of the system. Justify. **6**

3. a) Obtain the state model for the network shown in fig.3(a). **7**



b) Obtain the Jordan's canonical form for **7**

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -2 & -5 & -4 \end{bmatrix}$$

OR

4. a) For the system **7**

$$\text{If } A = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$$

Find STM using Caylay Hamilton Method.

b) The system is described by the equation **7**

$\ddot{c} + 2\dot{c} + c = \dot{u} + u;$

$x_1 = c \;\&\; x_2 = \dot{c} = u;$

Comment on controllability & observability of a system.

5. a) Define controllability and observability. Explain Kalman's & Gilbert test for controllability and observability. **7**

b) Comment on controllability & observability and also stability of the system described by the equation. **6**

$$\dot{x} = \begin{bmatrix} 2 & 1 & 0 \\ 0 & 2 & 1 \\ 0 & 0 & 0 \end{bmatrix} x + \begin{bmatrix} 4 & 2 \\ 0 & 0 \\ 3 & 0 \end{bmatrix} u$$

$$y = \begin{bmatrix} 0 & 1 & 3 \\ 0 & 2 & 4 \end{bmatrix} x$$

OR

6. a) Explain the effect of state feedback on controllability and observability. **4**

b) The system is described by **9**

$$\dot{x} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -2 & -3 \end{bmatrix} x + \begin{bmatrix} 0 & 1 \\ 0 & 0 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \end{bmatrix};$$

$$y = \begin{bmatrix} a & b & 1 \end{bmatrix} x$$

Part 1] Comment on controllability of the system.

Part 2] Comment on observability of the system when input u_1 is acting alone.

Part 3] Comment on observability of the system when input u_2 is acting alone.

Part 4] Identify the controllable states/modes,

i) When u_1 is acting alone

ii) When u_2 is acting alone

iii) When both inputs are acting together

7. a) What are different types of errors in optimal control system. **7**

b) For standard second order system find ISE using Parseval's theorem for unit step input. **7**

OR

8. a) The closed loop transfer function due to disturbance signal is given by **7**

$$\frac{C(s)}{N(s)} = \frac{s(s+a)}{s^2 + as + 10}$$

Find 'a' so that ISE due to unit step disturbance is minimized. Also find the minimum value of ISE.

b) State and prove Parseval's theorem. **7**

9. a) Explain difference between linear and non linear system. **6**

b) Explain the procedure for the construction of phase trajectories using Delta Method and Isocline method **7**

OR

10. a) Derive the describing function for ideal relay. **6**

b) Write short note on **7**
a) Jump Resource
2) Incidental & Inherent non linearity.

11. a) A sample data control system is characterised by following equations. **7**
$9(z) = 45z^3 + 117z^2 + 119z - 39$.
Comment on stability.

b) State Shannon's sampling theorem. **6**

OR

12. a) Solve the difference equation. **7**
$x(k+2) - 5x(k+1) + 6x(k) = u(k)$
Where $u(k) = 1$ for $k > 0$
$= 0$ for $k < 0$
$x(0) = 0; \quad x(1) = 1$

b) Write short note on sampler and hold circuit. **6**

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