28 DEC 2022

Reg. No.												

Question Paper Code	11519

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV/DEC 2022

Sixth Semester

Instrumentation and Control Engineering

IC8651 - ADVANCED CONTROL SYSTEM

(Regulations 2017)

Duration: 3 Hours | Max. Marks: 100

Answer ALL Questions

PART - A (10 × 2 = 20 Marks)

		Marks, K-Level, CO
1.	How state space approach is best suited for designing controllers?	*2,K1,CO1*
2.	Define diagonalization.	*2,K1,CO1*
3.	What is the necessary and sufficient condition for arbitrary pole placement?	*2,K1,CO2*
4.	Mention about pole placement methods.	*2,K1,CO2*
5.	Define Sampler.	*2,K1,CO3*
6.	Write the transfer function of Zero Order Hold.	*2,K1,CO3*
7.	Mention common physical nonlinearities.	*2,K1,CO4*
8.	Define singular point in nonlinear system.	*2,K1,CO4*
9.	What is quadratic performance index?	*2,K1,CO5*
10.	Compare parameter optimization and optimal control problems.	*2,K2,CO5*

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11. a) Consider the system $\dot{x} = \begin{bmatrix} 0 & 0 & -2 \\ 0 & 1 & 0 \\ 1 & 0 & 3 \end{bmatrix} x;\ x(0) = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$. Evaluate the solution of the state equation. *13, K3,CO1*

OR

b) Is the following system completely state controllable and completely observable? *13,K3,CO1*

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$$

$$y = [20 \quad 9 \quad 1] \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

12. a) Design full-order state observer. *13,K3,CO2*

OR

b) Explain state feedback with integral Control. *13,K2,CO2*

13. a) Explain in detail the sampled data control system. *13,K2,CO3*

OR

b) Discuss in detail the stability analysis and compensation techniques in Z-transform. *13,K2,CO3*

14. a) Discuss the stability of a system by describing function method. *13,K2,CO4*

OR

b) Describe the phase plane method. *13,K2,CO4*

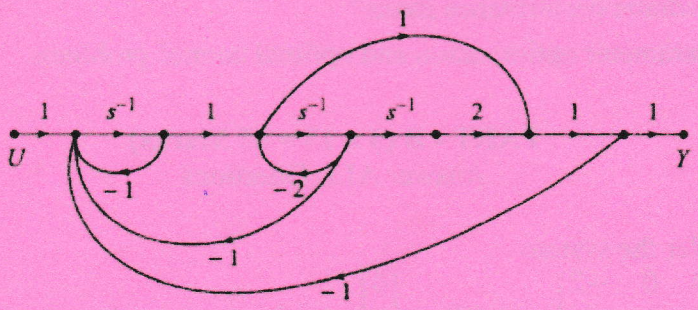
15. a) Design a state regulator through the Lyapunov function. *13,K2,CO5*

OR

b) Design an optimal state regulator through the matrix Riccati equation. *13,K2,CO5*

PART - C (1 × 15 = 15 Marks)

16. a) Construct State model for the following linear system. *15,K3,CO1*



OR

b) Obtain the response y(t) of the following system *15,K3,CO1*

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}-1 & -0.5\\ 1 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}0.5\\ 0\end{bmatrix}u,\begin{bmatrix}x_1(0)\\ x_2(0)\end{bmatrix}=\begin{bmatrix}0\\ 0\end{bmatrix}$$

$y=[1 \quad 0]\begin{bmatrix}x_1\\ x_2\end{bmatrix}$ where u(t) is the unit-step input occurring at t=0.