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Reg. No.													

Question Paper Code	11795

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2023

Sixth Semester

Instrumentation and Control Engineering

IC8651 - ADVANCED CONTROL SYSTEM

(Regulations 2017)

Duration: 3 Hours | Max. Marks: 100

PART-A (10 × 2 = 20 Marks)

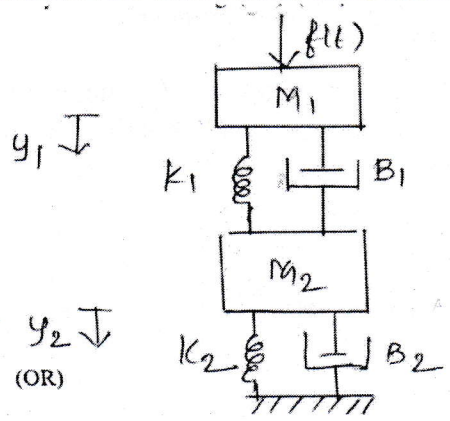
Answer ALL Questions

		Marks, K-Level,CO
1.	Define State and state variable.	*2,K1,CO1*
2.	Write the state model of n^{th} order system.	*2,K1,CO1*
3.	Identify the need for state observer in complex control problem.	*2,K2,CO2*
4.	State the condition for controllability of Gilbert's method.	*2,K1,CO2*
5.	Illustrate the stability criterion for sampled data control systems.	*2,K2,CO3*
6.	Mention the merits and demerits of sampled data control systems.	*2,K1,CO3*
7.	In describing function analysis how the stability of nonlinear systems is determined.	*2,K1,CO4*
8.	Write short notes on phase plane method.	*2,K2,CO4*
9.	Describe the role and list the application of optimal control.	*2,K2,CO5*
10.	Identify the formation of optimal control problems.	*2,K2,CO5*

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11. a) Construct the state model of mechanical system shown in fig. *13,K3,CO1*



OR

b) Explain the State model of a system to controllable and phase variable form. *13,K3,CO1*

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\\ \dot{x}_3\end{bmatrix} = \begin{bmatrix}0 & 0 & 1\\ -2 & -3 & 0\\ 0 & 2 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix} + \begin{bmatrix}0\\ 2\\ 0\end{bmatrix}[u] \;;\; y = [1\ 0\ 0]\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}$$

12. a) Consider the linear system described by the transfer function *13,K3,CO2*

$$\frac{y(s)}{U(S)} = \frac{10}{S(S+1)(S+2)}$$

Design a feedback controller with a state feedback so that the closed loop poles are placed at -2, -1 $\pm$ j.

OR

b) Consider the systems with the transfer function

$$\frac{y(s)}{U(s)} = \frac{9}{S^2-9}$$

(i) Calculate k so that the control law u=-kx. places the closed loop poles at -3 $\pm$ j3. *6,K3,CO2*

(ii) Design a full order observer such that the observer error poles are located at -6 $\pm$j6. *7,K3,CO2*

13. a) Compute the Z-transform of the given sequence

(i) $f(k) = k\,a^{(k-1)}$ *7,K3,CO3*

(ii) Compute the inverse Z-transform $F(z) = \frac{3z^2+2z+1}{z^2+3Z+2}$ *6,K3,CO3*

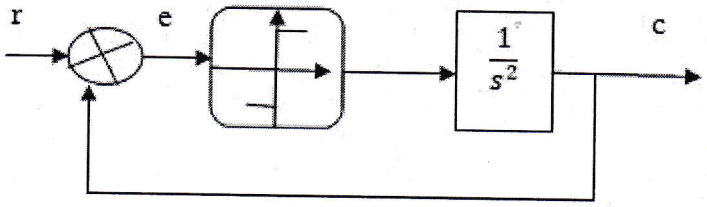
OR

b) Estimate the stability of the sampled data control systems represented by the given characteristics equations(Jury's stability Test)$F(z) = z^4 - 1.7z^3+1.04z^2-0.268z+0.024=0$ *13,K3,CO3*

14. a) Employ the describing function of Saturation Nonlinearity. *13,K2,CO4*

OR

b) Consider a system with an ideal relay as shown in fig. determine the singular points.Construct phase trajectory, corresponding to initial conditions c(0) =2, C(0) =1. Take r = 2 volts, and M = 1.2 volts. *13,K3,CO4*



15. a) Explain about optimal state regulator design. *13,K2,CO5*

OR

b) Describe about Lyapunov equation with Lyapunov stability theorem. *13,K2,CO5*

PART - C (1 × 15 = 15 Marks)

16. a) Explain about Matrix Ricatti equations of optimal control design. *15,K2,CO4*

OR

b) Apply the design optimal controller with any one example. *15,K2,CO5*