U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

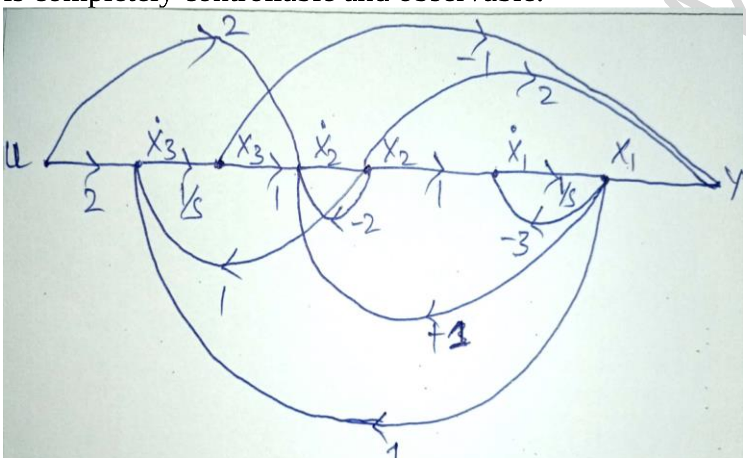
September / October 2024 Supplementary Examinations

Programme: B.E. **Semester: VI**
Branch: Electrical and Electronics Engineering **Duration: 3 hrs.**
Course Code: 19EE6PCMCT **Max Marks: 100**
Course: Modern Control Theory

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	***CO***	***PO***	**Marks**
1	a)	For the given transfer function, obtain state model using Phase variable method. $$T(s) = \frac{(S+2)\,(S+3)}{S(S+1)(s^2+9S+20)}$$	C01	PO2	**10**
	b)	Construct the state model using phase variables. If the system is described by the differential equation: - $$\frac{d^3y(t)}{dt^3}+4\frac{d^2y(t)}{dt^2}+7\frac{dy(t)}{dt}+2y(t)=5U(t)$$	CO1	PO2	**10**
		UNIT - II			
2	a)	With an example, explain Eigen Values, Eigen Vectors, Modal matrix(m) and Vander Monde matrix (V).	CO1	PO3	**10**
	b)	Derive an expression of transfer function from state model and also derive state transaction matrix.	CO1	PO3	**10**
		UNIT - III			
3	a)	Define Observability. Explain with an example both Kalman's test for Observability and also Gilbert's test for Observability.	CO2	PO3	**10**
	b)	A system represented by following state model is controllable but not observable. Show that non-observability is due to pole-zero cancellation.	CO2	PO3	**10**

			$\dot{x}(t) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(t)$ $y(t) = \begin{bmatrix} 1 & 1 & 0 \end{bmatrix} x(t)$			
			OR			
	4	a)	Define Controllability. Explain with an example both Kalman's test for Controllability and also Gilberts test for controllability.	CO2	PO3	**10**
		b)	Use Controllability and Observability matrices to determine whether the system represented by the signal flow graph in Fig.4.b is completely controllable and observable.  Fig. 4.b.	CO2	PO3	**10**
			UNIT - IV			
	5	a)	It is desired to place the closed loop poles of the following system at S=-3 and S=-4 by a state feedback controller with the control u=-kx. Determine the state feedback gain matrix using all the methods. $\dot{x} = \begin{bmatrix} 0 & 1 \\ -1 & -3 \end{bmatrix} x + \begin{bmatrix} 0 \\ 2 \end{bmatrix} u$ $y = \begin{bmatrix} 1 & 0 \end{bmatrix} x$	CO2	PO3	**12**
		b)	Explain State Observer and also explain the methods to find Ke.	CO2	PO3	**08**

			UNIT - V			
	6	a)	Explain the following (i) Deadzone (ii) Saturation (iii) Limit Cycle (iv)Relay (v) Backlash	CO2	PO3	**10**
		b)	Determine the kind of singularity for each of the following for each of the differential equations (i) $\ddot{y} + 3\dot{y}$ +2y =0 (ii) $\ddot{x} + 0.5\dot{x}$ + 2x =0	CO2	PO3	**10**
			OR			
	7	a)	Describe in detail Isocline method for construction of Phase Trajectory with an example.	CO3	PO3	**10**
		b)	Determine the kind of singularity for each of the following for each of the differential equations (i) $\ddot{y} + 3\dot{y}$ + 2y =0 (ii) $\ddot{y} + 3\dot{y}$ -10y=0	CO3	PO3	**10**

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