Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY M. E. - SEMESTER – I • EXAMINATION – WINTER • 2013

Subj	Date: 23-12-2013		
Subj Tim	otal Marks: 70		
Inst	ruct 1. 2. 3.	tions: Attempt all questions. Make suitable assumptions wherever necessary. Figures to the right indicate full marks.	
Q.1	(a) (b)	How pole placement is decided in state feedback? Enumerate and discuss the design factors of an optimu controller	07 im 07
Q.2	(a)	\dot{x} (t)= Ax(t)+Bu(t) y (t)= Cx(t)+Du(t). Prove that this state model is Bour Input Bounded Output stable if and only if H(t) = C.e	07 Ided ^{at} .B
	(b)	State and prove the sufficient condition of stability for autonomous system, $\dot{x}(t) = f(x)$; $f(0) = 0$ using Liapun Stability Theorem.	the 07 ov's
	(b)	A linear autonomous system is described by the state equation $\dot{x} = Ax$ where, $A = \begin{bmatrix} -4K & 4K \\ 2K & 6K \end{bmatrix}$	07
		Find restrictions on the parameter K to guarantee the stability of the system.	
Q.3	(a) (b)	Write a short note on Full Order Observers. Discuss any three physical problems with the selection their performance index. State boundary value conditi for Case-I to Case-IV.	07 n of 07 ons
Q.3	(a)	OR Why eigenvalues of matrix A have negative real parts make linear system stable? Give your answer with	to 07
	(b)	Define equilibrium point and discuss about stability at equilibrium point for linear time varying system.	07
Q.4	(a)	$\vec{x_1} = -\vec{x_1} + \vec{x_2}$ $\vec{x_2} = -2x_2$. Check the stability of system by using varian gradient method.	08 able

	(b)	Find the curve with minimum arc length between the point $x(0)=0$ and the curve, $\Theta(t) = t^2 - 10t + 24$.			
		OR	14		
Q.4	(a)	Show that the external for the functional,	07		
		$J(x) = \int_0^{\pi/2} (x^2 - x^2) dt$. Which satisfies the boundary			
		conditions $x(0) = 0$; $x(\pi/2) = 1$ is $x^{*}(t) = \sin t$.			
	(b) Single input state equation is as under		07		
		$\dot{x} = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -2 & 0 \\ 1 & 1 & 2 \end{bmatrix} x + \begin{bmatrix} 8 \\ 2 \\ 1 \end{bmatrix} u$			
		Design state feedback controller so that system has poles at			
		-1, -2, -4.			
Q-5	(a)	Derive the equations of Optimal control law, feedback gain	08		
		algorithm and Optimal performance index for Discrete-			
		time Linear State Regulator problem.			
	(b)	What are the characteristics of Stochastic process? Give the	06		
		response of linear discrete time system to white noise.			
		OR			
Q-5	(a)	Derive the equation of boundary condition for Case IV	08		
	having terminal time t_1 and $x(t_1)$ free, such that $J(x) =$				
		$\int_{t_0}^{t_0} g(x, x, t) dt \text{ is optimal.}$			
	(b)	Write a short note on Optimal estimation for linear continuous time system.	06		
