APJ ABDULKALAM TECHNOLOGICAL UNIVERSITY
08 PALAKKAD CLUSTER

6221_D16_1 **(Pages: 3)** **Name:.....**

Reg No: .....

FIRST SEMESTER M.TECH. DEGREE EXAMINATION DEC 2016

Branch: Electrical &Electronics Engineering Specialization:Power Electronics

08EE6221 SYSTEM DYNAMICS

Time:3 hours **Max. marks: 60**

Answer all six questions. Part 'a' of each question is compulsory.

Answer either part 'b' or part 'c' of each question

Q.no.	Module 1	Marks
1.a	Explain eigen values and eigen vectors	3
	Answer b or c	
b	Obtain the state variable representation of the system represented by transfer function $\frac{C(s)}{R(s)}=\frac{s^2+4s+3}{s^2+9s+20}$ using parallel decomposition method	6
c	Obtain the time response of the system given by state equation for u(t)=1 for t $\geq$0 $\dot{x} = \begin{bmatrix} 0 & 1 \\ -0.16 & -1 \end{bmatrix}x + \begin{bmatrix} 1 \\ 1 \end{bmatrix}u$,$x(0) = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$ $y = [1\ 0]x$	6

Q.no	Module 2	Marks
2a	Obtain a state space representation of the system described by $y(k+2)+5y(k+1)+6y(k) = u(k)$ $y(0)= y(1) = 0$	3
	Answer b or c	
b	Obtain an expression for the discretized form of continuous time state space representation	6

c	Derive an expression for the solution of discrete time state space representation of linear time invariant systems	

Q.no.	Module 3	Marks
3.a	Write and explain the mathematical definition of Lyapunov stability for continuous time nonlinear systems	3
	Answer b or c	
B	State and explain Lyapunov's stability theorem for linear time invariant continuous time systems	6
c	A non-linear system is described by the equations $\dot{x}_1 = -x_1 - x_2^2$ $\dot{x}_2 = -x_2$ By using variable gradient method, investigate the stability of the system.	6

Q.no.	Module 4	Marks
4.a	Explain the concept of controllability and observability for discrete time systems	3
	Answer b or c	
B	State and prove controllability tests for continuous time systems	6
c	Explain the determination of observability condition from observable canonical form and diagonal canonical form	6

Q.no	Module 5	Marks
5.a	Discuss the effect of state feedback on controllability	4
	Answer b or c	
B	Explain the method of designing full order observer for continuous time systems	8
c	Derive Ackerman's formula for the pole placement using state feedback for continuous time systems	8

Q.no.	Module 6	Marks
6.a	Illustrate the method of optimal control using quadratic performance measure? What is its significance?.	4
	Answer b or c	
B	A system is represented by $\dot{X}(t) = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$. If the cost function is $\int_0^\infty (x^2 + u^2)dt$ form the Riccati equation and solve to get the optimal control law.	8
c	Explain the design method of a robust PID controller for a temperature control system with plant having the transfer function of $G(s) = \frac{1}{(s+1)^2}$ and with settling time less than 0.8sec .Assume damping ratio=0.8.Use suitable prefilter in the design.	8