APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

08 PALAKKAD CLUSTER

6221-17Dec-1 **(pages: 2)** **Name:**

Reg No:

FIRST SEMESTER M.TECH. DEGREE EXAMINATION DEC 2017

(POWER ELECTRONICS)

Subject ID: 08EE6221 **SUBJECT NAME: 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	Mention the properties of state transition matrices	3
	Answer b or c	
b	Obtain two different state model of the system represented by transfer functioni $\frac{C(s)}{R(s)} = \frac{10(s+4)}{s(s+1)(s+3)}$	6
c	Obtain the time response of the system represented by state equation for unit step input $\dot{x} = Ax(t) + Bu(t)$ y(t) = Cx(t) where A = $\begin{bmatrix} -8 & 6 \\ -6 & 4 \end{bmatrix}$, B = $\begin{bmatrix} 4 \\ -6 \end{bmatrix}$, C = [1 -1] and x(0)= $\begin{bmatrix} -1 \\ 0 \end{bmatrix}$	6

Q.no.	Module 2	Marks
2.a	Obtain a state space representation of the following pulse transfer function in diagonal canonical form $\frac{Y(z)}{U(z)} = \frac{1+6z^{-1}+8z^{-2}}{1+4z^{-1}+3z^{-2}}$	3
	Answer b or c	
b	Explain discretization of continuous time system	6
c	Obtain the state transition matrix of the discrete system represented by state equation X(k+1) = Gx(k), where G = $\begin{bmatrix} 0 & 1 \\ -12 & 7 \end{bmatrix}$,	6

Q.no.	Module 3	Marks
3.a	Write and explain mathematical definition for stability	3
	Answer b or c	
b	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
c	State and explain Lyapunov stability theorem for continuous time linear systems	6

Q.no.	Module 4	Marks
4.a	State and explain the concept of Controllability and Observability mentioning its physical significance	3
	Answer b or c	
b	State and prove Controllability and Observability test for continuous time systems	6
c	Explain controllability concept based on canonical forms of state model	6

Module 5

Q.no.		Marks
5.a	Explain the effect of state feedback on controllability	4
	Answer b or c	
b	Explain the design of full order Observer for Continuous time systems	8
c	Derive Ackerman's formula for the pole placement using state feedback	8

Q.no.	Module 6	Marks
6.a	Explain the formulation of state regulator problem	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	Illustrate with an example the design of Robust PID Controller system	8