APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

08 PALAKKAD CLUSTER

(pages: 3) **Name:**

Reg No:

FIRST SEMESTER M.TECH. DEGREE EXAMINATION DEC 2015

M.Tech- Power Electronics

08EE6221 **SYSTEM DYNAMICS**

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

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

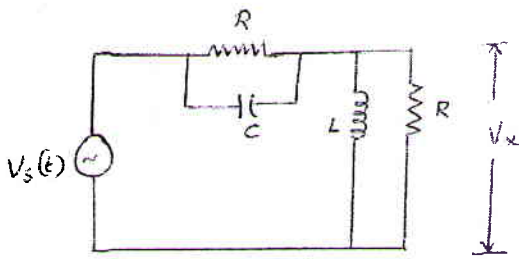
Answer either part 'b' or part 'c' of each question

Q.no.	Module 1	Marks
1.a	Explain the concept of equilibrium points.	3
	Answer b or c	
b	Obtain solution of the state equation $\begin{bmatrix} x_1' \\ x_2' \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$ Where u is a unit step function at t=0	6
c	Compute state transition matrix and hence the solution of the system where, Y'''+6y''+11y'+6y=6u	6

Q.no.	Module 2	Marks
2.a	Obtain solution of the state equation for a discrete time system.	3
	Answer b or c	
b	Obtain the state transition matrix of the discrete system $X(k+1) = = \begin{bmatrix} 0 & 1 \\ -10 & -7 \end{bmatrix} X(k)$	6
C	Obtain the discrete time state, output equations and pulse T.F of the system $G(s) = \frac{1}{s(s+2)}$	6

Q.no.	Module 3	Marks
3.a	State and prove Lyapunov stability theorem for LTI constant time system	3
	Answer b or c	
b	Obtain the Lyapunouv function for the state space system $\dot{x} = Ax$, where $A = \begin{bmatrix} -2 & 1 \\ -5 & 0 \end{bmatrix}$	6
c	Using Krasoviski's method, determine the stability of the system $\dot{x_1} = -x_1 + 2x_2$ and $\dot{x_2} = -5x_1 - 7x_2$	6

Q.no.	Module 4	Marks
4.a	Derive and explain the condition for Observablity.	3
	Answer b or c	
b	Test for controllablity and observablity of a dc motor having transfer function $\frac{10}{s^2(s+1)(s^2+2s+2)}$	6
C	For the circuit given, formulate the state model with the capacitor voltage v_c and inductor current i_L as state variables with source voltage vs as input and vx as output. Check controllability condition.	6



Q.no.	Module 5	Marks
5.a	Explain the concept of state feedback controllers .	4
	Answer b or c	
b	Design a state feedback controller to yield a percentage overshoot of 20.8 and	8

setting time of 4 seconds for a plant. $G(s) = \frac{s+4}{(s+1)(s+2)(s+5)}$.

c Consider a system described by the transfer function $\frac{s^2+2s+50}{s(s+4)(S+6)}$ Design 8

a. A full order observer for the system with poles s=-10,-10,-10
b. A reduced order observer with poles -10 and -10

Q.no.	Module 6	Marks
6.a	Obtain the optimal state regulator problem.	4

Answer b or c

b A continuous time system is given by $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 2 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u$ and y=cx. Solve matrix Riccatti equation that results in control signal that minimizes the performance index. $\int_0^5 [y^T(t)y(t) + u^T(t)u(t)]dt$. Solve for $C_1 = [0 \quad 1]$ and $C_2 = [1 \quad 0]$ and complete the results. 8

c For a second order unity feedback system with open loop transfer function G(s)= $\frac{10}{s(s+a)}$, determine 'a' that will minimise the performance measure J= $\int_0^a [x^T Q x]dt$ when the input is a unit step. 8