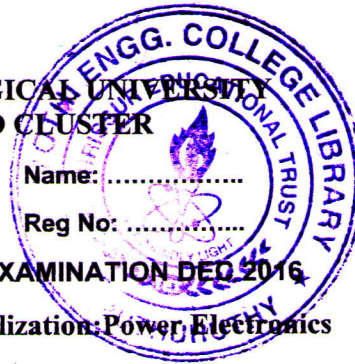


APJ ABDULKALAM TECHNOLOGICAL UNIVERSITY
08 PALAKKAD CLUSTER

6221_D16_1

(Pages: 3)



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 $t \geq 0$	6

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ -0.16 & -1 \end{bmatrix} x + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u, x(0) = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$$
$$y = [1 \ 0]x$$

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 | 6 |

$$\dot{x}_1 = -x_1 - x_2^2$$

$$\dot{x}_2 = -x_2$$

By using variable gradient method, investigate the stability of the system.

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	8
	$\dot{X}(t) = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t).$	
	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.	
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