KUMARAGURU college of technology
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Register Number:…………..….

M.E DEGREE EXAMINATIONS: MAY 2016

(Regulation 2015)

Second Semester

POWER ELECTRONICS AND DRIVES

P15PET203:Advanced Control Theory

COURSE OUTCOMES

CO1: Develop transfer function model for discrete time system, find the stability of the discrete time systems.

CO2: Exposed to analyze the system and find the state space model of any given systems.

CO3: Analyze the stability of non – linear systems.

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Sequence the operations in discrete time system A) plant with controlled output B)Digital to analog operation with control element C)Analog to digital operation with processing of signals D) sensor low frequency signals CO1 [K_2]

   a) B)A)C)D) b) C)A)D)B)

   c) D)C)B)A) d) D)C)A)B)

2. Main aim of feedback design is to A)stabilize the system B) improve transient stability C)find transfer function CO2 [K_2]

   a) Both A and C are true b) Both A and B are true

   c) Both B and C are true d) All are true

3. Describing function analysis is used for finding CO3 [K_2]

   a) Stability of non linear system b) Transfer function of the system

   c) Block diagram of the system d) Stability of linear system

4. Match the following CO1 [K_2]

Circuit	Purpose
A. Analog to digital converter	i. storage element for past value
B. Digital to analog converter	ii. Encoder
C. Unit delayer	iii. Zero order hold

   a) A)-i) ,B) –iii),C)-ii) b) A)-ii) ,B) –iii),C)-i)

c) A)-ii) ,B) –i),C)-iii) d) A)-iii) ,B) –ii),C)-i)

5. Arrange the operation analysis of nonlinear system.A)Finding the $-1/K_N$ locus B)draw the locus of G(jw) and $-1/K_N$ locus in complex plane C)use nyquist stability theorem D)finding G(jw) locus CO3 [K_2]

a) D)A)C)B) b) D)A)B)C)

c) A)B)D)C) d) D)C)A)B)

6. Match the following CO2 [K_2]

Form of system	**Purpose**
A. Observable phase variable form	i. For system with complete controllability
B. Controllable phase variable form	ii. only for state variables less than total variables available
C. Reduced order observer	iii. For system with complete observability

a) A)-i) ,B) –iii),C)-ii) b) A)-ii) ,B) –iii),C)-i)

c) A)-iii) ,B) –i),C)-ii) d) A)-iii) ,B) –ii),C)-i)

7. Assertion (A): Mostly physical variables are taken as state variables CO2 [K_2]
Reason (R):In physical variable representation state variables can be utilized for state feed back

a) Both A and R are true related b) A is true and R is false

c) Both A and R are true but not related d) A is false and R is true

8. For asymptotic stability ____ condition is required CO3 [K_2]

a) Negative definite b) Negative indefinite

c) Positive definite d) Positive indefinite

9. State equation can be obtained from A)transfer function B)differential equation C) signal flow graph CO2 [K_2]

a) Both A and B are true b) Both B and A are true

c) Both A and C are true d) All are true

10. In a simple scalar equation ,constant is zero and all the solutions are constant then system is CO1 [K_2]

a) unstable b) Stable

c) asymptotically stable d) Conditionally stable

PART B (10 x 2 = 20 Marks)

11.	State sampling theorem.	CO1	[K_2]
12.	Describe unit impulse sequence and delayed unit step sequence for discrete system.	CO1	[K_2]
13.	Find the system transfer function if the system equation is y(k+2)+5y(k+1)+6y(k)=u(k) .	CO2	[K_3]
14.	Find the output matrix of the system equation $\dddot{y} + y = 10u$	CO2	[K_3]
15.	Verify the controllability of the system with A=$\begin{bmatrix} 1 & -3 \\ 2 & 4 \end{bmatrix}$ and B=$\begin{bmatrix} 1 \\ 1 \end{bmatrix}$	CO2	[K_3]
16.	State Cayley Hamilton Theorem.	CO2	[K_2]
17.	Draw the output for hysteresis nonlinearity with sinusoidal input.	CO3	[K_1]
18.	What is meant by full order observer?	CO3	[K_2]
19.	State Lyapunov functions for linear systems.	CO2	[K_2]
20.	What are the types of non linearities?	CO3	[K_2]

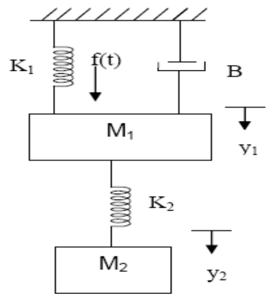
PART C (6 x 5 = 30 Marks)

21.	Test the stability using Jury's stability criterion. $Z^5+2.6Z^4-0.56Z^3-2.05Z^2+0.0775Z+0.35=0$	CO1	[K_3]
22.	A linear time invariant system is characterized by homogenous state equation $\begin{bmatrix} \dot{x_1} \\ \dot{x_2} \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$ compute the solution of the equation assuming initial state vector $x_0=\begin{bmatrix} 1 \\ 1 \end{bmatrix}$.	CO2	[K_2]
23.	Find the impulse response y(k) for the system transfer function $G(Z) = \frac{0.05Z}{(Z-0.95)}$	CO1	[K_3]
24.	Check the observability of the system with A=$\begin{bmatrix} 0 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & 2 & -3 \end{bmatrix}$ and C=[1 0 0] using Kalman's Test.	CO2	[K_3]
25.	Explain the concept of Non – linear system with dead zone and hysteresis.	CO3	[K_3]

26. What is limit cycle? How to find the stability of limit cycle? CO3 [K_2]

Answer any FOUR Questions
PART D (4 x 10 = 40 Marks)

27. Construct the state model of the given system . CO2 [K_3]



28. Construct Jordon canonical form of the system CO2 [K_4]

$G(s) = (s+3) / (s+2)^2(s+5)$

29. Design a state feedback controller for the system CO2 [K_4]

$A=\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix}$, $B=\begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}$ and C=[1 0 0] for the desired eigen values of -2+j3.464, -2-j3.464 , -5.

30. Derive the describing function of saturation. CO3 [K_3]

31. What is Model Reference adaptive system? Explain with neat diagram. CO1 [K_2]

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