Register Number:…………….

M.E DEGREE EXAMINATIONS: JUNE 2017

(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. Assertion(A) : Sampling frequency must be at least twice the highest frequency of signal. CO1 [K_2]

   Reason(R): A corollary to aliasing problem is sampling theorem.

   a) A and R are true but not related b) A and R are true and related

   c) A is true and R is false d) R is false and A is false

2. Arrange the following in the operation of Analog to digital converter 1) Quantization 2) Encoding 3) Sampling 4) Digital words CO1 [K_2]

   a) 3, 1, 4 , 2 b) 3, 1, 2, 4

   c) 4, 2, 1, 3 d) 4, 2, 3, 1

3. Match the following CO2 [K_2]

   1.Transfer function model : A. Getting solution of equation with higher order is not difficult.

   2. State variable model : B. Even for system with initial values

   3.Advantage with state variable model : C.Only for relaxed system

   a) 1-B,2-C,3-A b) 1-A,2-C,3-B

   c) 1-C,2-A,3-B d) 1-B,2-A,3-C

4. Match the following CO2 [K_2]

State variable representation	Purpose
A. Phase variable representation	i. System matrix is the diagonal matrix

B. Physical variable representation	ii. Not available for Measurement and control purpose
C. Canonical variable representation	iii. Available for Measurement and control purpose

	A	B	C
a)	ii	iii	i
b)	ii	i	iii
c)	iii	ii	i
d)	iii	i	ii

5. Kalman's method used for A) finding which state variable is uncontrollable B) finding overall controllability C) finding which state variable is unobservable D) finding overall system observability. CO2 [K_2]

a) Both A and B are true b) Both C and D are true
c) Both B and D are true d) All are true

6. Arrange the given operation in the design of state feedback. A)finding actual characteristic equation B) finding the gain matrix C)Finding the desired characteristic equation D) Finding complete controllability of the system. CO2 [K_3]

a) D)B)A)C) b) D)A)B)C)
c) B)D)A)C) d) D)B)C)A)

7. Assertion : Nyquist stability criterion used for stability analysis of Non linear system. Reason : System exhibits sustained oscillations or limit cycle when K_N G(jω) = -1. CO3 [K_3]

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

8. -1/K_N locus enters in to stable region to unstable region then A) unstable limit cycle occurs B) stable limit cycle occurs system C) limit cycle occurs D) system is unstable CO3 [K_3]

a) Both A and B are true b) Both C and D are true
c) Both B and D are true d) Both A and C are true

9. The phase plane analysis primarily is applied to CO1 [K_2]

a) linear system b) non linear system
c) second order system d) both a and c

10. For asymptotic stability ____ is required CO1 [K_2]

a) Negative definite b) Negative indefinite
c) Positive definite d) Positive indefinite

PART B (10 x 2 = 20 Marks)

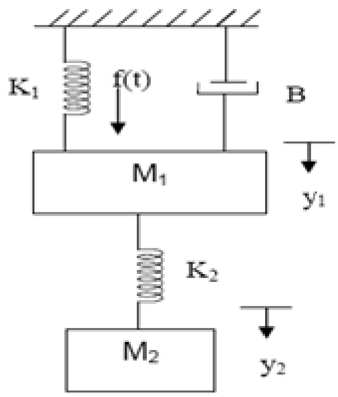
11.	Define unit impulse sequence and delayed unit impulse sequence for discrete system.	CO1	[K_2]
12.	Derive the transfer function model of unit delayer.	CO1	[K_2]
13.	Write the system matrix for the system $G(s) = (s+3)/(s^3+4s^2+3s)$.	CO2	[K_3]
14.	Find Eigen values for the matrix A= $\begin{bmatrix} 1 & 0 \\ 3 & 2 \end{bmatrix}$.	CO2	[K_3]
15.	State Cayley Hamilton Theorem.	CO2	[K_2]
16.	Write the desired characteristic equation of closed loop poles at -5,-5 in the state regulator design.	CO2	[K_3]
17.	What is meant by full order observer?	CO2	[K_2]
18.	Draw the output for relay with deadzone and hysteresis nonlinearity with sinusoidal input.	CO3	[K_2]
19.	What is limit cycle in non linear system?	CO3	[K_2]
20.	State Lyapunov stability theorem.	CO1	[K_2]

PART C (6 x 5 = 30 Marks)

21. Test the stability using jury stability criterion. CO1 [K_3]

$Z^5+0.2Z^4+Z^2+0.5Z-0.1=0$.

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



23. Verify the controllability on the system with A= $\begin{bmatrix} 0 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & 2 & -3 \end{bmatrix}$ and B= $\begin{bmatrix} 0 \\ 2 \\ 0 \end{bmatrix}$. CO2 [$K_3$]

24. Design a state regulator using Ackermann's formulae for the given model CO2 [K_2]

$\dot{X} = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix} X + \begin{bmatrix} 0 \\ 1 \end{bmatrix} U$ for given closed loop poles are placed at $-4 \pm j4$.

25. How to find the stability of non linear system using Nyquist stability criterion? CO3 [K_2]

26. What is Modal Reference Adaptive system? Explain. CO3 [K_2]

Answer any FOUR Questions

PART D (4 x 10 = 40 Marks)

27. $y(k+2) - 1.3679y(k+1) + 0.3679y(k) = 0.3679r(k+1) + 0.2642r(k)$ CO1 [K_4]

    y(k)=0 for k≤0 and r(k)=0 for k<0,

    r(0)=1,r(1)=0.2142,r(2)=-0.2142,

    r(k)=0,k=3,4,5….

    Find y(k).

28. Construct Jordon canonical form of the system G(s) = 5 / $(s+1)^2(s+2)$. CO2 [K_3]

29. Compute the solution of homogeneous equation assuming initial state vector $X_0=\begin{bmatrix}0\\1\end{bmatrix}$ and state equation $\begin{bmatrix}\dot{x}_1\\\dot{x}_2\end{bmatrix} = \begin{bmatrix}1 & 0\\1 & 1\end{bmatrix}\begin{bmatrix}x_1\\x_2\end{bmatrix}$ CO2 [K_4]

30. Convert the given model to canonical state model. CO2 [K_3]

$$\begin{bmatrix}\dot{x}_1\\\dot{x}_2\\\dot{x}_3\end{bmatrix}=\begin{bmatrix}1 & 0 & 2\\-1 & 1 & 1\\0 & 3 & -1\end{bmatrix}\begin{bmatrix}x_1\\x_2\\x_3\end{bmatrix}+\begin{bmatrix}1\\1\\0\end{bmatrix}u$$

$$y=\begin{bmatrix}1 & 0 & 1\end{bmatrix}\begin{bmatrix}x_1\\x_2\\x_3\end{bmatrix}$$

31. Derive the describing function for Dead zone non linearity. CO3 [K_3]

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