Register Number:…………….

M.E DEGREE EXAMINATIONS: JAN 2015

(Regulation 2014)

First Semester

POWER ELECTRONICS AND DRIVES

P14PET101 : Advanced Control Theory

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

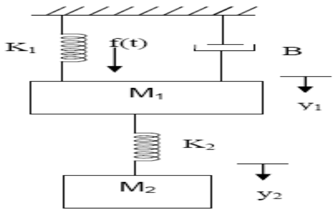
Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Assertion(A) : Sampling frequency must be at least twice the highest frequency of signal. [K_1]
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. A device of ____bit resolution has 2^n quantization level. [K_2]
   a) N+1
   b) N-1
   c) N
   d) 2N

3. The output matrix of the given system is [K_2]



   a) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$
   b) $\begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}$
   c) $\begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$
   d) $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$

4. If the system equation is y(k+2)+5y(k+1)+6y(k)=u(k) then the system transfer function is [K_3]
   a) 1/(Z+1)(Z+2)
   b) 1/(Z+2)(Z+2)
   c) 1/(Z+3)(Z+2)
   d) 1/(Z+3)(Z+1)

5. Arrange the given operation in correct sequence for 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 [K_2]
   a) D –B-A-C
   b) D-A-B-C
   c) B-D-A-C
   d) D-B-C-A

6. Gilbert'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 [K_1]

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

7. Match the following [K_1]

1.Saturation : A. Two different path for same input
2.Deadzone : B. output constant for large value of input
3.Hysteresis : C. Output response only after some time.

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

8. For the system to be stable ($-1/K_N$) locus is ________ of G(jω) locus. [K_1]

a) Enclosure   b) Non Enclosure

c) equal   d) not equal

9. For the autonomous system, system is stable in the sense of Lyapuov if $\dot{V}$ (x)is _____along trajectory. [K_1]

a) greater   b) lesser

c) zero   d) stay

10. The phase plane analysis applies primarily to [K_1]

a) linear system   b) non lineat system

c) second order system   d) both a and c

PART B (10 x 2 = 20 Marks)

11. Name the basic discrete time signals? [K_1]

12. What is Anti-aliasing filter? [K_1]

13. List the advantages of phase variable form of state space representation? [K_1]

14. Draw the signal flow graph representation of state model. [K_2]

15. Determine the system matrix for the system $G(s) = (s+3)/(s^3+4s^2+3s)$. [$K_2$]

16. Determine the modal matrix for the system with $A=\begin{bmatrix} 0 & 3 \\ -2 & -5 \end{bmatrix}$ [K_2]

17. List the methods of analysis of Non linear system? [K_1]

18. Draw the output for relay with deadzone and hysteresis nonlinearity with sinusoidal input. [K_2]

19. State Lyapunov stability theorem. [K_1]

20. State the advantages of Lyapunov's method compared to other stability analysis? [K_1]

PART C (6 x 5 = 30 Marks)

21. Test the stability using jury stability criterion. [K_3]
$Z^5+0.2Z^4+Z^3+0.5Z^2-0.1=0$.

22. For the system with A=$\begin{pmatrix} 0 & 1 \\ 0 & -1 \end{pmatrix}$ B=$\begin{pmatrix} 0 \\ 1 \end{pmatrix}$ C=(1 0) find the system Transfer function. [K_2]

23. Test the controllability of the system with A= $\begin{bmatrix} 0 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & 2 & -3 \end{bmatrix}$ and [K_3]
C=[1 0 0] using Kalman's Test.

24. Derive the value ∞ (alpha) and β (Beta) for the system with saturation+dead zone. [K_3]

25. Explain the Model Reference adaptive system. [K_1]

26. Design the state regulator of the system A=$\begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$ and B = $\begin{bmatrix} 0 \\ 1 \end{bmatrix}$ with closed loop poles are placed at -4$\pm$j4. [K_3]

PART D (4 x 10 = 40 Marks)

27. Construct state space representation of the given system using [K_3]
i)Phase variable form ii)canonical variable form

$$\frac{Y(s)}{U(s)} = \frac{10(s+4)}{s(s+1)(s+3)}$$

28. For a system with G(z)=Y(z)/R(z)=1/(z-0.5)(z+0.3) [K_2]
r(k)=1,k even
= 0,k odd
Find y(k).

29. Test the Observability of the given system using Gilberts test and Kalman's test . [K_2]

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

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

30. Derive the describing function of Dead zone Nonlinearity [K_2]

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