Non Linear Digital Control system

Multiple Choice Questions

1. Asymptotic stability is concerned with…

a) A system not under the influence of

b) A system under influence of input

c) A system under influence of the output

d) A system not under influence of input

2. The output signal is fed back from…

a) Differential

b) Take-off

c) Summing

d) All of these

3. The term backlash is…

a) Gear trains

b) Tacho generator

c) Servomotors

d) Induction relays

4. Which of the following option applies to linear mathematical model?

a) Unstable systems

b) Linear systems

c) Stable systems

5. Which of the following nodes are true to represent a signal flow graph?

a. Pointers

b. Squares

c. Circles

d. Arrows

6. Asymptotic stability is…

a) a system under influence of output

b) a system not under influence of output

c) a system under influence of input

d) a system not under influence of input

7. Nodes that comprises incoming as well as outgoing branches…

a) Main node

b) Source node

c) Sink node

d) Chain node

8. _____ is reduce with feedback…

a) System stability and gain

b) Damping

c) System Gain

d) System stability

9. Logic switching is…

a) Hang out

b) Hang on

c) Bang on

d) Bang-bang

10. Roots with higher multiplicity make the system…

a) Unstable

b) Linear

c) Absolutely stable

d) none of these

11. Which one is condition is used to verify the existence of a particular point on the root locus?

a) Angle

b) Frequency

c) Amplitude

d) Magnitude

12. Transportation lag is…

a) The inefficiency of the process

b) Errors

c) Amount to be transferred in large

d) Time take to transfer is large

13. System transformation on function H(z) for a discrete time LTI system expressed in state variable form with zero initial condition

a)$C(zI-A)^{-1}B+D$

b)$C(zI-A)^{-1}$

c)$(zI-A)^{-1}z$

d)$(zI-A)^{-1}$

14. State space analysis is applicable for non-linear systems and for multiple input and output systems.

a)True

b) False

Long answer type Questions

1. Define the term aliasing?
2. What is state transition matrix? Why is it so called?
3. What is limit cycle?
4. What is meant by singular point? Mention their importance.
5. Define Describing function and state the limitations of describing function analysis.
6. What is the use of zero order hold sampler?
7. Differentiate between incidental and intentional non linearity?

8. Define initial value and final value theorem of z-transform.

9. State advantages of digital control system.

10. What is the condition for completely observable system?

11. Check the controllability of the following system

$$\begin{bmatrix} X1 & (k+1) \\ X2 & (k+1) \end{bmatrix} = \begin{bmatrix} -1 & 1 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} X1 & (k) \\ X2 & (k) \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} \text{U (k)}$$

12. Determine the stability of a sampled data control system having following characteristic polynomial by using Jury's Stability criteria

$2Z^4+8Z^3+12Z^2+5Z+1=0$

13. Discuss the design of Discrete PID controller.

14. Explain direct method of Lyapunov's to check the stability of non-linear systems.

15. Define phase portrait. Enumerate methods used for obtaining phase portrait of a non –linear system of second order.

16. What do you mean by stability of discrete time system? Discuss the application of Routh –Hurwitz criteria to discrete time system .Why Routh's criteria is to be modified before it is applied to check the stability of discrete system?

17. Obtain the State Transition Matrix and y (k) for k≥ 1 for the system given below

$$\begin{bmatrix} x_1 & (k+1) \\ x_2 & (k+1) \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 & (k) \\ x_2 & (k) \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(k)$$

Where x_1 (0) = x_2 (0) =1, u (k) = $(-1)^k$

y (k)= x_1 (k)

18. Write short notes on the following

Krasovsikii's Method

Variable gradient Method

19. Investigate the controllability and observability of the system defined by the following equation:--

$$x(k+1)=[\,1\ \ -2;1\ \ -1]x(k)+[1\ \ -1;0\ \ \ 0]u(k)$$

$$\boldsymbol{y(k)=[1\ \ \ 0;0\ \ \ 1]x(k)}$$

20. List and explain some commonly found non linearities in the system.

21. Find the state transition matrix for a system for which matrix F is given by the following matrix

F=[0 1;-2 -3]

22. What are the positive and negative definite functions? Explain and give examples.

23. What are singular points? Explain.

24. What is delta method? Explain.

25. Consider the following system-

$$\dot{x_1} = -x_1+2x_1^{\,2}x_2$$

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

Choosing suitable Lyapunov function, investigate the stability of equilibrium.

26. Examine the stability of equilibrium of the following system using Krasovskii's method

$$\dot{x_1} = -x_1$$

$$\dot{x_2} = 4x_1-2x_2+x_2^{\,3}$$

27. Discuss the variable gradient method of generating Lyapunov function

28. Explain the phase plane method used to analyze response of a non-linear system.

29. Explain statble node and seddle point phase plane portrait

30. Differentiate between phase plane and describing function for the analysis of non linear system.

31. Define phase portraint odf second order system

32. How stability is determined by limit cycles

33. Explain direct method of Lyapunov.

34. Calculate the describing function of backlash type of non linearity.
35. Write down the significance of Zero order hold .
36. Write advantages and disadvantages of digital control system.
37. What are sample and hold circuits.
38. Obtain the transfer function of zero order hold
39. Differentiate between zero order and first order hold circuit
40. How reconstruction of sampled signal is done.
41. List the limitations of z transform.
42. Explain Jury's stability test.
43. State and Prove sampling Theorem.
44. Show how S-plane can be mapped into Z-plane.
45. What is Nyquist Rate?
46. Differentiate between Linear and Non linear system.
47. What is ideal Sampling?
48. Differentiate between practical and ideal sampling
49. State and Prove convolution Theorem.
50. Name two methods which can be used to generate Lyapunov function?