**DIGITAL SIGNAL PROCESSING**

1. Given a continuous time signal x(t)=2cos500πt. Evaluate the Nyquist rate and fundamental frequency of the signal?
2. Consider the analog signal x(t)=3 cos 50πt + 10 sin 300 πt - cos 100 πt. Determine the Nyquist rate sampling rate.
3. Analyze the system described by the equation y(n) = nx(n) is linear or not.
4. A discrete system is characterized by the difference equation

y(n)=x(n)-0.5y(n-1)+0.25x(n-1) Check the system for (i) Linearity (ii) Causality (iii) Time Invariant (iv) Static and (v) Stability.

1. Demonstrate which of the following systems are stable
2. y(n)=cos x(n)
3. y(n)=ax(n)
4. y(n)=x(n)
5. y(n)=
6. A discrete time systems can be
   1. Static or dynamic
   2. Linear or non Linear
   3. Time invariant or time varying
   4. Stable or unstable
   5. Causal or noncausal
7. Analyze the following systems with respect to the properties above
   * 1. y(n)=x()
     2. y(n)= (n)
     3. y(n)= cos(x(n))
8. Determine whether or not each of the following signals is periodic. If the signal is periodic, specify its fundamental period.
   * 1. x(n)=cos((5πn/9)+1)
     2. x(n)=
     3. x(n)=sin(π/8)
9. Consider the analog signal x(t)=3 cos(200πt) (i) Determine the maximum sampling rate required to avoid aliasing (ii) Let the signal sampled rate Fs=400 Hz. Find the discrete time after sampling (iii) Fs=150 Hz. Find the discrete sampling. Find the discrete time after sampling and also obtain sinusoidal yield frequency 0<F<Fs/2.For each of these cases, explain if you can recover the signal x (t) from the samples signal.
10. State and prove the sampling theorem
11. Check for following systems are static and stability
    * 1. y(n)=n x(n)
      2. y(n)=x(n2)
      3. y(n)=x(n)+3u(n+1)
12. Check the time invariant and stability of the given system y(n)=cos x(n).
13. Determine the function is stable or not. (1) y(n)= sin x(n) (2) y(n)=ax(n) (3) y(n)= cos x(n)
14. Analyze the types of signals with its mathematical expression and neat diagram.
15. A signal X(t) = sin C(50t)) is sample at rate of 20Hz, 50Hz and 75Hz. For each of these case, explain if you can recover the signal x(t) from the sample
16. Determine whether the following signals are energy or power or neither energy nor power signals.
17. = u(n)
18. = Sin(n)
19. =
20. =u(n)
21. Consider the analog signal x(t) = 3Cos 100t.
22. Determine the minimum sampling rate requires to avoid aliasing
23. If the signal is sampled at the rate of = 200Hz, what is the discrete time signal obtained after sampling?
24. Determine whether the following systems are static, linear, time invariant, causal and stable with proper justifications. (4+4+5)

i) y(n) = x(n) + nx(n + 1)

ii) y(n) = x( – n)

iii) y(n) = sign (x(n))

1. Determine which of the following signals are periodic and determine the fundamental period also.
2. X(t) = 20 Sin25πt
3. X(t) = 20 Sint
4. X(t) = 10Cos10πt
5. X(t) = 3Cos(5t+)
6. Consider the signal (t) = 10 Cos2 (1000) t + 5Cos2 (5000) t is to be sampled. Determine the Nyquist rate for this signal if the signal is sampled at 4KHz, will the signal be recovered from its sampled
7. Determine whether the folowing discrete time signal are periodic or not? If periodic, determine the fundamental period.
8. X(n) = Cos (0.05n)
9. X(n) = Sin(5n)
10. X(n) = Cos (7)
11. X(n) = Cos(n/8)Cos()
12. Explain in detail about analog to digital conversion with suitable block diagram and to reconstruct the analog signal

**Z- TRANSFORM**

1. Determine the pole-zero plot for the system described by the difference equation

y(n)-(3/4)y(n-1)+(1/8)y(n-2) = x(n)-x(n-1)

(ii) State and prove convolution and Parseval’s theorem using Z transform.

1. Find x(n) if X(Z)=(1+[1/2])/ (1-[1/2])
2. Determine the Z-transform and ROC of the signal x(n) = [3-4()]u(n)
3. Determine the Z-transform of ;
4. X(n) = Cos
5. X(n) = Sin
6. Determine the unit step response of the system described by the difference equation y(n) =0.9y(n-1) -0.81y(n-2) +x(n) under the following conditions:
7. Y(-1) =y(-2) =0
8. Y(-1) =y(-2) =1
9. The total response of the system, which inculdes the response of arbitrary initial conditions is the sim of the equation. Using Z-transform determine the response y(n) for n o if y(n) = 1/2y(n-1)+ x(n) ; x(n) = u(n), y(-1) =1
10. Find the Z- transform of the following signals and plot its ROC
11. = u(n)
12. = - u(-n-1)
13. = u(n) = ,
14. State and prove the following properties of Z-transform
15. Time shifting
16. Scaling in Z transform
17. Differentiation
18. Determine the one side Z transform of y(n)+ 1/2y(n-1) – 1/4y(n-2) = 0; y(-1) = y(-2) =1
19. Find the response of the casual system y(n) –y(n-1) = x(n) + x(n-1) to the input x(n) = u(n) Test its stability
20. Find the inverse z-transform of X (Z) =for all possible ROCs also analyzed about the relationship between ROC and Z-transform.
21. Find the z-transform and ROC of the sequence x(n) = u(n-1)
22. Evaluate the following:
    1. Inverse Z-Transform for X(z)=1/(z-1.5)4; ROC : |z| > ¼.
    2. The ROC of a finite duration signal x(n)={2, -1, -2, -3, 0, -1}

(iii) The ROC of a infinite duration signal x(n)=u(n)

1. A Linear time-invariant system is characterized by the system function H(z)=
2. Specify the ROC of H(z) and Estimate the value of h(n) for the following conditions
   * 1. The system is stable
     2. The system is causal
     3. The system is anticausal
3. ii) Examine the value of x(n ) for the given x(Z) with ROC
   * 1. |z|>2
     2. |z| <2

X(Z) =

1. Calculate the causal signal x(n) whose z-transform is given by
   1. (Z) =
   2. Solve and obtain the z-transform of the signal x(n)= (cosnϴ)u(n).
2. A system is described by the difference equation y(n-()y(n-1)=5x(n). Illustrate and Determine the solution, when the x(n) = u(n )and the initial condition is given by y(-1)=1, using z transform.
3. Find the impulse response, frequency response, magnitude response and phase response of the second order system y(n)-y(n-1) +y(n-2) =x(n) -x(n-1)
4. Analyze the impulse response of the system described by the difference equation y(n) = y(n-1)-1/2 y(n-2) +x(n)+x(n-1)using Z transform and discuss its stability.
5. Find the response of the causal system y(n) – y(n-1) = x(n) + x(n-1) to the input x(n)=u(n).

Test its stability.

1. Find the inverse Z transform of X (z) = {+}/ {(z-1) (z-3)} ROC |z|>3.
2. Find the circular convolution of the two sequences x1(n)={1,3,5,7} and x2(n)={2,4,6,8}
3. Describe how direct form –I is being realized hence solve for second order digital filter y(n) = 5rcos ()y(n-1) - 4 y(n-2) + x(n)- 3r cos()x(n-1)
4. Describe how direct form –II being realized hence solve for the system having a difference equation y(n) = - 0.85y(n-1) + 0.67y(n-2) +0.934x(n) -0.525x(n-1)
5. Distinguish between recursive and non- recursive
6. Compare IIR and FIR digital filters and explain why FIR are always stable
7. Realize the system with difference equation y(n) = y(n-1) - y(n-2) + x(n) + x(n-1) in cascade form
8. What is mean by FIR filter?
9. Write the steps involved in FIR filter design
10. What are advantages of FIR filter?
11. What are the disadvantages of FIR FILTER?
12. What is the reason that FIR filter is always stable?
13. What are the features of FIR filter?
14. How can you design a digital filter from analog filter?
15. Distinguish IIR and FIR filters
16. Distinguish analog and digital filters
17. Define IIR Hence Mention the features of IIR filters