PRATHYUSHA ENGINEERING COLLEGE

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

EC8352- SIGNALS AND SYSTEMS

QUESTION BANK

UNIT I

CLASSIFICATION OF SIGNALS AND SYSTEMS

PART A

1. State the two properties of unit impulse function.
2. List the classification of Systems.
3. Show that $[n]=u[n]-u[n-1]$.
4. Draw the following signals

   (a) $(t)-u(t-5)$

   (b) $(1/3)=u[n-1]$

5. Define the periodicity of cos $(0.01\pi n)$.
6. Write the conditions for a system to be LTI Systems.
7. Explain when the system said to be memory less with an example
8. Compare deterministic and random Signals.
9. Estimate whether the given signal is energy or power signal and calculate its energy or power: $(t)=e2tu(t)$.
10. Outline the following system is static or dynamic and also causal or non-causal system: $[n]=x[2n]$.

Part-B(13 Marks)

1. (i) Write about elementary Continuous time Signals in detail. (7)

(ii) Find whether the following signal is periodic. If periodic determine the fundamental period:

$(t)=3cost+4\cos(3t)$. (3)

(iii) Give the equation and draw the waveforms of discrete time real and complex exponential signals. (3)

2. (i) Identify whether the following system are linear or not. (8)

(a) $dydt+3(t)=t2x(t)$

(b) y[n]=$2x[n]+1x[n-1]$

(ii) Cite the odd and even components of the following signals. (5)

(a) $(t)=\cos(t)+\sin(t)+\cos(t)\sin(t)$

(b) $[n]$={−2,1,2,−1,3}

3. (i) Tell whether the following system are time invariant or not. (7)

(a) $(t)=tx(t)$ (b) $y[n]=x[2n]$

(ii) Recognize the power and RMS value of the signal. (6)

(a) $(t)=Acos(\Omega0t+\theta)$ (b) $x(t)=Aej\Omega0t$

4. (i) List the difference between the following (6)

(a) Causal and Non-causal signals.

(b) Deterministic and Random Signals.

(ii) Draw the following signals (7)

(a) $x(t)$=−2$r(t)$ (b) $\pi(t$+2) (c) $u[-n$+2]

5. (i) Illustrate the power and RMS value of the following signals. (6)

(a) $(t)=5\cos\ (50t+\pi3/)$

(b) $(t)=10cos5t*cos10t$

(ii) Estimate whether the following signals are energy signals or power signals (7)

(a) $[n]=\ (12)nu[n]$

(b) (t)=$u(t)$−$u(t$−5)

6. (i) Predict whether the following signal is periodic or not. (3)

$(t)=2\cos(10t+1)-\sin\ (4t-1)$

(ii)Estimate the summation $\Sigma=(e2n)\delta[\mathrm{n}-2]\infty n=-\infty$ (3)

(iii) Research the fundamental period T of the continuous time signal. (7)

(a) $(t)=20\cos\ (10\pi t+\pi6/)$

(b) $(n)=2cos(\pi n4)+sin(\pi n8)-2cos(\pi n2+\pi6)$

7. A Discrete time System is given as y(n) = y2(n-1) + x(n). A bounded input of x(n) = 2δ(n) is applied to the system. Assume that the system is initially relaxed. Check whether the system is stable or unstable.

(13)

8. (i) Experiment the following for linearity, Time Invariance, Causality and Stability. (7)

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

9. (i)Compute whether the following system is linear, time invariant, stable and invertible. (8)

(a) y(n) = x2(n) (b) y(n) = x(-n)

(ii)Demonstrate that the signal satisfies linearity, time invariance, causality and stability conditions. (5)

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

UNIT II

ANALYSIS OF CONTINUOUS TIME SIGNALS

PART A

1. Identify the Fourier Series coefficients of the signal x(t) =1+ sin2ωt + 2cos2ωt + cos(3ωt + π4)

2. Write the synthesis and analysis equation of continuous time Fourier Transform.

3. Define ROC of the Laplace Transform.

4. State Initial and Final value Theorem of Laplace Transforms

5. Reproduce the Laplace Transform of the signal x(t) =e-2t u(t).

6. Outline Convolution property of Fourier Transform.

7. Explain the Relationship between Laplace Transform and Fourier Transform.

8. Express the Transfer functions of the following

a) An ideal integrator.

b) An ideal delay of T seconds.

9. Give the Laplace transform of x(t) + 3e-2tu(t)-2e-tu(t) with ROC.

10. Explain the Dirichlet's conditions of Fourier series.

11. Predict the Laplace transform of the function x(t) =u(t)-u(t-2)

Part-B (13 Marks)

1. (i) Identify the difference between Fourier series analysis and Fourier transforms. (3)

(ii) Cite the trigonometric Fourier series of half wave Rectified Sine wave with a period of T=2π. (10)

2. (i) State and prove the Fourier transform of the following signal in terms of X(jω): x(t)=x(1-t) + x(-1-t) and x(t)=e-at u(t) (6)

(ii) Cite the complex exponential Fourier series coefficient of the signal x(t)=2sin(2πt-3)+sin(6πt) (7)

3. Recall the Fourier transform of x(t) = $e-|t|$ and plot the Fourier spectrum. (13)

4. (i) Write the properties of Fourier Transform. (6)

(ii) Outline the Trigonometric Fourier series for the full wave rectified sine wave. (7)

5. (i)Illustrate the Laplace transform of the following signal (7)

x(t) = sin(πt)u(t), 0 ≤ t ≤ 2

= 0 , otherwise

(ii) Summarize the properties of Laplace Transforms. (6)

6. (i) Express the Laplace Transform of the following.

a) x(t) = u(t− 2) (3)

b) x(t) = t2e−2tu(t) (3)

(ii) Restate the Fourier Transform of Rectangular pulse. Sketch the signal. (7)

7. (i) Estimate the Fourier Transform of x(t) = 1-e-|t|cosωot . (7)

(ii)Summarize with inverse Laplace Transform of the function. ROC: -2 < Re{s} < -1 (6)

8. (i)Compute the Laplace Transform and ROC of the signal x(t)=e−3tu(t)+e−2tu(t) (7)

(ii)Demonstrate Convolution property and Parseval's relation of Fourier series. (6)

9. (i)Solve the inverse Laplace transform of x(s)=(s+3)/[(s+1)(s+2)2] (7)

10. (i)Detect the inverse Laplace Transform of x(s) = 3s2(s+1) (7) (ii)Examine the initial and final value of a signal x(t)=sin4tu(t). (6)

UNIT III

LINEAR TIME INVARIANT- CONTINUOUS TIME SYSTEMS

PART A

1. State the condition for LTI system to be stable and causal.

2. Given the differential equation representation of the system d2y(t)/dt2 +2dy(t)/dt -3y(t)=2x(t). Find the frequency response.

3. Draw the block diagram of the LTI system described by dy(t)/dt + y(t) = 0.1x(t).

4. Define block diagram representation of the system.

5. Write the properties for convolution integral.

6. Describe impulse response of an LTI system.

7. Express and Illustrate the basic elements of block diagram representation of the continuous time system.

8. Given H(s) = $1s2+2s+1$ .Express the differential equation representation of the system.

9. Explain the block diagram representing the system H(s)= s/s+1

10. Predict the step response of a CT LTI system for the given h(t).

11. Apply the causality of the system with impulse response h(t)=e-t u(t).

12. Compute the unit step response of the system given by h(t)=1/RC e-t/RC u(t).

PART B (13 Marks)

1. Find the Convolution of following signals. x(t)= e-3t u(t) and h(t)= u(t-1) (13)

2. i) Define convolution Integral and describe its equation. (6)

ii) A stable LTI system is characterized by the differential equation

$d^2y(t)/dt^2 + 4dy(t)/dt + 3y(t) = dx(t)/dt + 2x(t)$. Locate the frequency response & impulse response using Fourier transform. (7)

3. (i) Identify the impulse response h(t) of the system given by the differential equation

$d^2y(t)/dt^2 + 3dy(t)/dt + 2y(t) = x(t)$ with all initial conditions to be zero. (7)

(ii) Draw the Direct Form-I realization of, $d^2y(t)/dt^2 + 5dy(t)/dt + 4y(t) = dx(t)/dt$. (6)

4. Cite the output response of the system described by the differential equation $d^2y(t)/dt^2 + 6dy(t)/dt + 8y(t) = dx(t)/dt + x(t)$, when the input signal x(t) =u(t) and the initial conditions are y(0+)=1, dy(0+)/dt=1 (13)

5. The system produces the output y(t) = e^{-t}u(t) for an input x(t) =e^{-2t}u(t). Predict

i) frequency response ii) the impulse response. (13)

6. (i) Draw the parallel form realization of te system H(s) = $s(s+1)/[(s+2)(s+3)(s+4)]$ (6)

(ii) Using Laplace transform, observe the impulse response of an LTI sysem described by the differential equation. d2y(t)/dt2 - dy(t)/dt - 2y(t) = x(t). (7)

7.(i) Express the transfer function of the system for the impulse response h(t)= δ(t) + e-3tu(t) +2e-tu(t) (6)

(ii) Predict the impulse response for the differential equation RCdy(t)/dt + y(t) =x(t). (7)

8. Compute & illustrate the convolution y(t) of the given signals.

(i) x(t)=cost u(t) ,h(t)=u(t) (7)

(ii) x(t)=u(t), h(t)= $RLe-tR/L$u(t) (6)

9. (i) Draw the following in Direct form-II

d3y(t)/dt3 + 2d2y(t)/dt2 + 4dy(t)/dt + 6y(t) = 3d2x(t)/dt2 + 5dx(t)/dt + 7x(t). (7)

(ii) Calculate the step response of the system h(t) = e-4t u(t). (6)

UNIT IV

ANALYSIS OF DISCRETE TIME SIGNALS

PART A

1. Define convolution integral of continuous time system.
2. State the need for sampling.
3. Give the condition for existence of DTFT.
4. List the properties of DTFT.
5. Write the circularly folded sequences.
6. Prove the time folding property of Z-transform.
7. Observe the sufficient condition for the existence of DTFT for an aperiodic sequence.
8. Express one sided Z-transform and two sided Z transform.
9. Illustrate the main condition to avoid aliasing.
10. Summarize the methods of obtaining inverse Z transform.
11. Solve the inverse z transform of x(z)=1/z-a,|z|>|a|.
12. Discover the system function for the given difference equation

y(n) = 0.5 y(n-1)+ x(n).

13. Calculate Z transform of x(n)={1,2,3,4}.

PART –B (13 Marks)

1. (i) State and explain sampling theorem both in time and frequency domains with necessary quantitative analysis and illustrations. (8)

(ii)Describe the effects of under sampling and the steps to eliminate aliasing. (5)

2. (i) List any four properties of DTFT. (8)

(ii) Write the transfer function of a zero order hold. (5)

3. (i) Prove the sampling theorem and explain how the original signal can be reconstructed from the sampled version. (8)

(ii) Sort the initial and final value theorem. (5)

4. (i) Identify and explain the following properties of Z transform

(a) Time and frequency convolution property. (3)

5. (i) Express the properties of ROC. (7)

(ii) Explain the contour integration method with an example. (6)

6. (i) Use convolution theorem,estimate the inverse Z-transform of y(z)= z / (z-1)3. (7)

(ii)Estimate the inverse Z-transform for the following sequences.

(a) x(z)= $Z(Z-0.5)(Z+0.7)$ (3)

(b) x(z)= $Z(Z+1.2)(Z+0.7)$ (3)

7. (i) Predict the convolution of two signals using DTFT. x1(n) =(1/2)nu(n) and x2(n) = (1/4)nu(n). (7)

(ii) Find the DTFT of x(n)= 3nu(n) and x(n)=(3)nu(-n). (6)

8. (i) Solve the Z transform and ROC of the sequence x(n)=u(n)-u(n-3). (7)

(ii) Prepare the relationship between DTFT and Z transform. (6)

9. (i) Compute the DTFT of (1/2) n u (n). Draw its spectrum. (7)

(ii) Discover the Z transform of x(n) = rn(sinω0n)u(n). (6)

UNIT V

LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS

PART A

1. Define natural response and forced response.
2. Describe the non-recursive and recursive systems.
3. In terms of ROC state the condition for an LTI discrete time system to be causal and stable.
4. Write the difference equation for recursive systems.
5. Write the convolution sum with its equation x1(n) & x2(n) are two input sequence.
6. Predict the relationship between impulse response and transfer function of a DT-LTI system.
7. Give the impulse response of a linear time invariant system as
h(n)=sin πn. Research whether the system is stable or not.
8. If u (n) is the impulse response of the system, Predict step response.
9. Confirm that the range of values of the parameter 'a' for which the linear time invariant System with impulse response h(n)=anu(n) is stable.
10. Compute the convolution of given two sequences x(n)={1,1,1,1} and h(n)={2,2}.
11. If x(w) is the DTFT of x(n), compute the DTFT of x*(-n).

PART –B (13 Marks)

1. (i) Describe the block diagram representation for LTI discrete time systems. (10)

(ii) Define the pole zero pattern of transfer function. (3)

2. (i) Write the properties of convolution sum. (8)

(ii) List and explain the steps of methods to compute the cnvolution sum. (5)

3. (i) Locate the discrete fourier analysis for recursive and non recursive systems. (8)

(ii) State system function and sketch the Pole locations of the corresponding impulse response. (5)

4. (i) Select the Z transform for analysis of recursive and non recursive systems. (7)

(ii) Draw the magnitude and phase response of y(n)=1/2x(n)+1/2x(n-1). (6)

5. In LTI discrete time system

y(n)=3/2y(n-1)-1/2y(n-2)+x(n)+x(n-1) is given an input x(n)=u(n)

(i) Observe the transfer function of the system. (7)

(ii) Predict the impulse response of the system. (6)

6. (i) Sort the forced response of the system described by the difference equation y(n)-1.2y(n-1)+0.5y(n-2)=x(n) for an input signal x(n)=3n u(n). (10)

(ii) Group the advantages and disadvantages of cascade realization. (3)

7. Consider a causal and stable LTI system whose input x(n) and output y(n) are related through the second order difference equation

y(n)-1/6y(n-1)-1/6y(n-2)=x(n). Illustrate

(i) Frequency response of the system. (6)

(ii) Impulse response of the system. (5)

(iii) The system output for the input (1/4)nu(n). (2)

8. (i) Compute the impulse response of the discrete time system described by the difference equation y(n-2)-3y(n-1)+2y(n)=x(n-1). (8)

(ii) Discover the autocorrelation of {1,2,1,3}. (5)