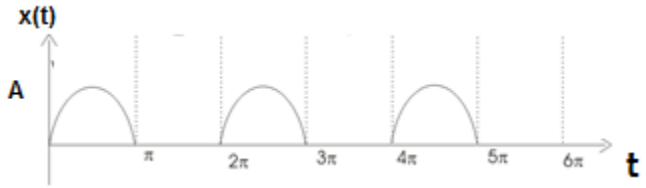
SIDDHARTH INSTITUTE OF ENGINEERING AND TECHNOLOGY
AUTONOMOUS

SIGNALS AND SYSTEMS

UNIT-I

1 Define various elementary signals in continuous time and discrete time and indicate them Graphically?
2 What are the basic operations on signals? Illustrate with an example.
3 How are signals classified? Differentiate between them.
4 Write short notes on the following signals.
a). Unit step b). Unit impulse c).Unit ramp d). Signum
5 Find whether the following signals periodic or not? if periodic determine the fundamental Periodic
a).sine 12π b).3sine $200\pi t$+4 cos100t c).sine$10\pi t$+cos$20\pi t$
d).sin (10t+1)- 2cos (5t-2) e).$e^{j4\pi t}$
6 Find the Fourier series expansion of the half wave rectified sine wave shown in figure.



7 Check whether the following system is
(a) static or dynamic (b) linear or non- linear (c) causal or non- causal
1(d) Time-invariant or time –variant

i) $d^3y(t)/dt^3+2d^2y(t)/dt^2+4\ dy(t)/dt+3y^2(t)=x(t+1)$

8 Check whether the following system is
(a) static or dynamic (b) linear or non- linear (c) causal or non- causal
(d) Time-invariant or time –variant
i) $d^2y(t)/dt^2+2y(t)\ dy(t)/dt+3ty(t)=x(t)$
9 a) Sketch the following signals
(i) u(-t+2) (ii) -4r(t) (iii) r(-t+3)
(b) Define the following signals in functional form
(i) unit step (ii) unit ramp (iii) sinc function
(c) Define causal and non-causal signals?
(d) Define periodic and non-periodic signals?
(e) Define time-variant and time –invariant systems?
10 Check whether the following systems are causal or not?
(i) $y(t)=x^2(t)+x(t-3)$ (ii) y(t)=x(t+2) (iii) y(t)=x(-2n)
11 State the properties of continuous time Fourier series?
12 a). Determine the power and rms value of the signal $x(t)= A\sin(w_0t+\emptyset)$.
b). Determine whether the following signals are energy signals or power signals and calculate their energy or power?
(i) x(t)= rect(t/T) (ii) x(t)=u(t) (iii) $x(t)=\sin^2 w_0t$

UNIT-II

1. State and prove the time shifting and frequency shifting properties of Continuous time Fourier transform?
2. State and prove the time reversal and time scaling properties of Continuous time Fourier transform?
3. State and prove the differentiation in time domain and differentiation in frequency domain properties of Continuous time Fourier transform?
4. State and prove the convolution and multiplication properties of Continuous time Fourier transform?
5. Find the Fourier transform of the following signals
   (i) impulse function (ii) $x(t)=e^{-at}u(t)$ (iii) $x(t)=e^{-jwot}$ (iv) $x(t)=u(t)$
6. Find the Fourier transform of the following signals
   (i) $x(t)=e^{-3t}u(t)$ (ii) $x(t)=te^{-at}u(t)$ (iii) $x(t)=e^{-t}\sin 5t\,u(t)$ (iv) $x(t)=e^{-t}\cos 5t\,u(t)$
7. Find the inverse Fourier transform of the signals
   (i) $X(w)=\frac{4(jw)+6}{(jw)2+6(jw)+8}$ (ii) $X(W)=\frac{1+3(jw)}{(jw+3)2}$
8. State and prove the time shifting and frequency shifting properties of discrete time Fourier transform?
9. State and prove the time reversal and time scaling properties of Discrete time Fourier transform?
10. a).Find the inverse Fourier transform of $X(w)=\frac{jw}{(a+jw)2}$
    b) Find the inverse Fourier transform of $X(w)=e^{-2w}u(w)$
11. State and prove the convolution and multiplication properties of Discrete time Fourier transform?

UNIT III

1. Explain clearly about ideal filter characteristics.
2. Filter characteristics of linear systems explain with neat diagrams
3. Obtain the conditions for distortion less transmission through a system.
4. Derive the transfer function and impulse response of an LTI system.
5. a).Find the Nyquist rate and Nyquist interval for the following signals
   i) rect(300t) ii) -10 sin $40\pi t$ cos $300\pi t$
   b) What is Aliasing? Explain in detail with spectral details of a sample data.
6. Discuss the properties of linear time invariant systems.
7. Let the system function of an LTI system be $1/(j\omega+2)$.what is the output of the system for an input$(0.8)^t$ u(t)?
8. a) consider a causal LTI system with frequency response $H(\omega)=1/4+J\omega$,for a input x(t),the system is observed to produce the output $y(t)=e^{-2t}u(t)- e^{-4t}u(t)$.find the input x(t)
   b).Consider a stable LTI system with differential equation $dy(t)/dt+2y(t)=x(t)$ find its impulse response
9. State and prove sampling theorem for band limited signals.
10. Consider a stable LTI system that is characterized by the differential equation $d^2y(t)/dt^2+4dy(t)/dt+3y(t)= dx(t)/dt+2x(t)$ find the response for an input $x(t)=e^{-t}$ u(t).

UNIT IV

1 Write the properties of convolution.
2 a) State and prove the time convolution theorem with Fourier transforms.
b) State and prove the frequency convolution theorem with Fourier transforms.
3 Derive the relation between convolution and correlation.
4 State and prove the Parseval's theorem for energy signal.
5 a) Write the properties of ESD and PSD.
b) Compare ESD and PSD.
6 a) Show that R(r) and ESD form Fourier transform pair.
b) Show that R(r) and PSD form Fourier transform pair.
7 Explain the detection of periodic signals in the presence of noise by auto correlation.
8 Explain the extraction of noise by Filtering.
9 Determine the autocorrelation function and energy spectral density of $x(t)= e^{-at} u(t)$
10 Explain the detection of periodic signals in the presence of noise by cross correlation

UNIT V

1. Find the inverse Z-transform of X(z) given $X(z) = 1/(1-az^{-1})$, ROC; $z|>|a|$
2. a). Explain the methods of determining the inverse Laplace transform?
   b). State and prove initial and final value theorems of Z-transform?
3. Find the signal that corresponds to $X(s)= (3s^2+22s+27)/(s^2+3s+2)(s^2+2s+5)$
4. Prove that the final value of x(n) for $X(z) = z^2/(z-1)(z-0.2)$ is 1.25 and its final value is unity?
5. Find the inverse Z-transform of $X(z)= z^{-1}/(3-4z^{-1}+z^{-2})$, ROC: $|z|>1$
6. a). State and prove time differentiation property for one sided Laplace transform?
   b).Derive the relationship between Laplace transform and Z-transform?
7. Determine the inverse Z-Transform of $X(Z) = \log_e(1/1-az^{-1})$; ROC $|Z|>a$.
8. Find the Laplace transform of the signal $x(t)= e^{-at} u(t) -e^{-bt} u(-t)$ and also find its ROC
9. Find the inverse Laplace transform of:
   $X(s) = 1/ s(s+1) (s+2) (s+3)$
10. Find the convolution of the sequences: $x_1(n)=(1/2)^n u(n)$ and $(1/3)^{n-2} u(n-2)$
11. Find the inverse z-transform of:
    $X(z)=3z^{-1}/(1-z^{-1)} (1-2z^{-1)}$

    a) If ROC ; $|z|>2$ b). If ROC ; $|z|<1$ C). If ROC ; $1<|z|<2$