SIDDARTHA INSTITUTE OF SCIENCE AND TECHNOLOGY: PUTTUR

QUESTION BANK (DESCRIPTIVE)

Subject with Code : Signals and Systems -18EC0403 **Course & Branch**: B.Tech -ECE

Year & Sem: II-B.Tech & I-Sem **Regulation:** R18

UNIT –I INTRODUCTION OF SIGNALS AND SYSTEMS

1. Explain the classification of signals in detail. [L2][CO1]10M
2. Examine whether the following signals are periodic or not? If periodic, determine the fundamental time period. [L3][CO1]10M
   a) $X(t) = \sin 12\pi t$
   b) $x(t) = cos2t + sin\sqrt{3}t$
   c) $x(t) = 2cos50\pi t + 3sin25t$
   d) $x(n) = sin\frac{4\pi n}{3} + cos\frac{2n}{3}$
   e) $x(n) = \sin\left(\frac{n}{2}\right)\sin(\frac{n\pi}{2})$
   f) $x(n) = e^{j(\pi/2)n}$
3. Determine whether the following signals are energy signals or power signals and calculate their energy or power. [L3][CO1]10M
   a) $x(t) = rect(\frac{t}{\tau})$
   b) $x(t) = tu(t)$
   c) $x(t) = (2 + e^{-2t})u(t)$
   d) $x(n) = u(n) - u(n-1)$
   e) $x(n) = e^{j[(\pi/2)n + \pi/2]}$
   f) $x(t) = r(t-2) - r(t-3)$
4. Find which of the following signals are causal or non causal . [L3][CO1]10M
   a) $x(t) = sin2t\, u(t)$
   b) $x(t) = \cos 2t$
   c) $x(n) = u(n+3) - u(n+1)$
   d) $x(t) = sin3t\, u(t-1)$
   e) $x(n) = e^{3n}$
5. Find the even and odd components of the following signals. [L3][CO1]10M
   a) $x(t) = \cos(\omega_0 t + \frac{\pi}{3})$
   b) $x(t) = sin2t + \sin 2t \cos 2t + \cos 2t$
   c) $x(n) = \{5, 4, 3, 2, 1\}$
   d) $x(t) = 1 - 2t + 3t^2$
   e) $x(t) = \cos(2t + \frac{\pi}{2})$

6. Check whether the system is static or dynamic. [L3][CO1]10M
   a) $y(t) = x(t-3)$
   b) $y(t) = \frac{d^2x(t)}{dt} + 2x(t)$
   c) $y(n) = x(n-2) + x(n)$
   d) $y(t) = 2x^3(t)$
   e) $y(n) = x(n) + x(n+2)$
7. Check whether the following systems are causal or not. [L3][CO1]10M
   a) $y(t) = x(2-t) + x(t-4)$
   b) $y(t) = x(\frac{t}{2})$
   c) $y(n) = x(n) + x(n-2)$
   d) $y(t) = x^2(t) + x(t-3)$
   e) $y(n) = x(-2n)$
8. Check whether the systems are linear or not. [L3][CO1]10M
   a) $\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 3y(t) = x(t)\frac{dx(t)}{dt}$
   b) $y(t) = x(t^2)$
   c) $y(n) = 2x(n) + 4$
   d) $y(n) = 2x(n) + \frac{1}{x(n-3)}$
   e) $y(n) = n^2x(2n)$
9. Check whether the systems are time invariant or not. [L3][CO1]10M
   a) $y(t) = x(-2t)$
   b) $y(t) = e^{2x(t)}$
   c) $y(n) = x(n) + nx(n-2)$
   d) $y(n) = x^2(n-2)$
   e) $y(n) = sin[x(n)]$
10. Check whether the systems are stable or not. [L3][CO1]10M
    a) $y(t) = 5e^{-2t}u(t)$
    b) $y(t) = (t+5)u(t)$
    c) $y(n) = x(n) + \frac{1}{2}x(n-1) + \frac{1}{4}x(n-2)$
    d) $y(n) = 8x(n-2)$
    e) $y(n) = ax(n-7)$
11. Check whether the following systems are [L3][CO1]10M

i) Static or dynamic ii) Linear or non linear iii) Causal or non causal iv) Time invariant or time variant

   a) $\frac{d^3y(t)}{dt^3} + 5\frac{d^2y(t)}{dt^2} + 6\frac{dy(t)}{dt} + 2y(t) = x^2(t)$
   b) $y(t) = at^2x(t) + btx(t-4)$
   c) $y(n) = 2x(n-2) - x(n-2)$
   d) $y(n) = x^2(n) + \frac{1}{x^2(n-1)}$
   e) $y(n) = x(n) - x(-n-1) + x(n-1)$
12. Define various elementary signals of CT and DT signals. Indicate them graphically . [L2][CO1]10M
13. What are the basic operations on signals? Illustrate with an example. [L2][CO1]10M

2MARKS:

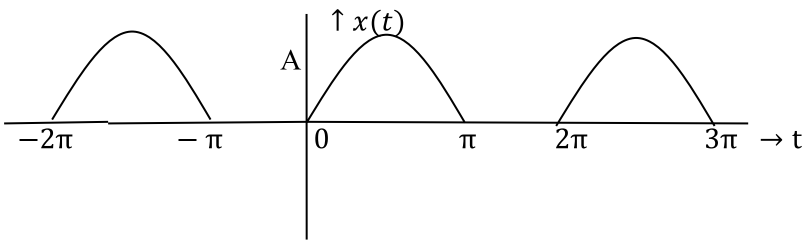
1. Define signal & system.
2. Define unit step function
3. Define unit ramp function
4. Define sinusoidal signal
5. Define real exponential signal
6. What are the basic operations on signals?
7. How the signals are classified?
8. Distinguish between continuous and discrete time signals?
9. Define causal and non-causal signals?
10. Define periodic and aperiodic signals?
11. Distinguish between deterministic and random signals.
12. Define a linear system with an example.
13. Define a time in variant system with an example.
14. Define BIBO with an example.

UNIT –II FOURIER SERIES AND FOURIER TRANSFORM

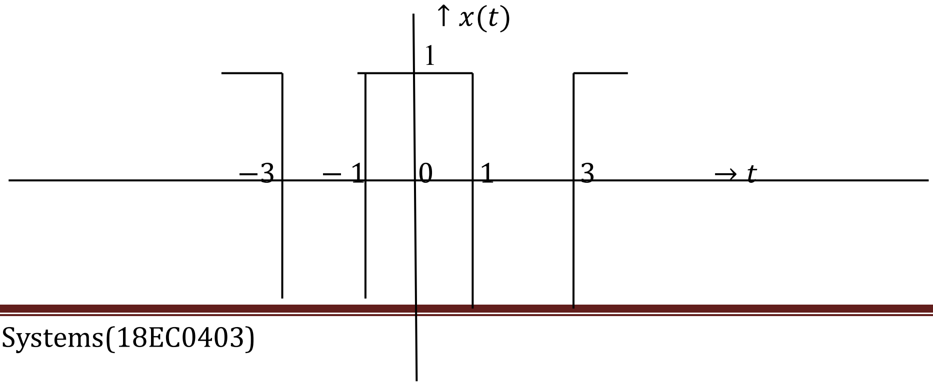
1.What is meant by Fourier Series? Explain the conditions under which any periodic waveform can be expressed using Fourier series. [L2][CO2]10M

2. Derive the expression for the Trigonometric Fourier Series coefficients. [L2][CO2]10M

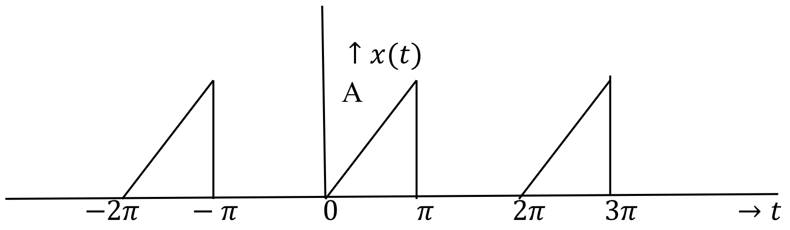
3. Find the trigonometric Fourier series expansion of the half wave rectified sine wave shown below. [L3][CO2]10M



4. Find the trigonometric Fourier series for the periodic signal $x(t)$ shown in below [L3][CO2]10M



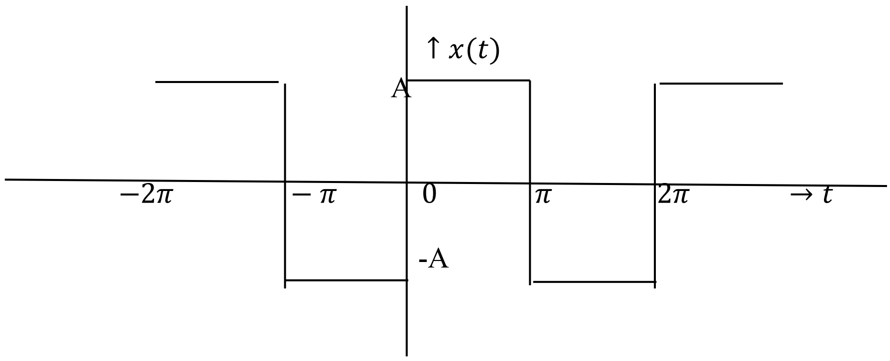
5. Find the trigonometric Fourier series for the periodic signal $x(t)$ shown in below [L3][CO2]10M



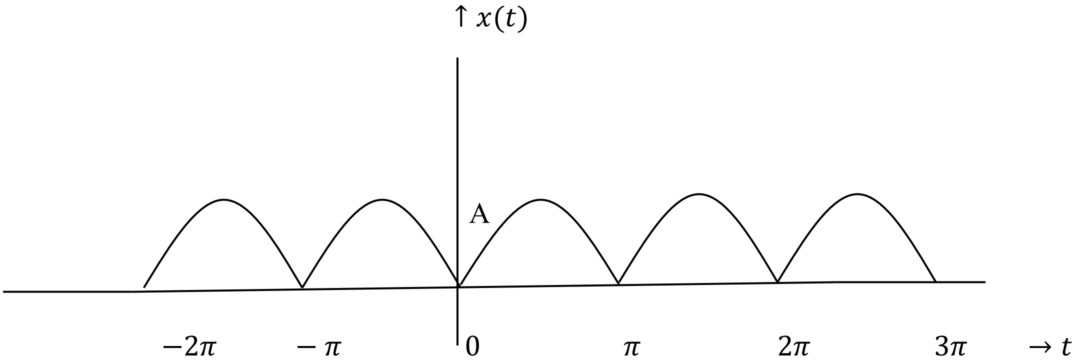
6.a) Obtain trigonometric Fourier series from exponential Fourier series. [L2][CO2]10M

b) Obtain exponential Fourier series from trigonometric Fourier series.

7.Obtain the exponential Fourier series for the periodic signal $x(t)$ shown in below [L3][CO2]10M



8. Obtain the exponential Fourier series for the periodic signal $x(t)$ shown in below [L3][CO2]10M



9. State and explain the properties of the Continuous time Fourier series. [L2][CO2]10M

10. State and explain the properties of the Discrete time Fourier series. [L2][CO2]10M

11.a)Derive the Continuous Fourier transform of a non periodic signal from Continuous Fourier series of periodic signal [L2][CO2]10M

b) State the merits and limitation of Fourier transform.

12.Find the Fourier transform of the following (Standard) signals. [L2][CO2]10M

a)$x(t) = e^{-at}\ u(t)$ b)$x(t) = e^{j\omega_0 t}$ c) $x(t) = rect(\frac{t}{\tau})$ d) $x(t) = sgn(t)$ e) $x(t) = u(t)$

13. State and prove the properties of continuous time Fourier transform. [L2][CO2]10M

14.Find the Fourier transform of the following Signals. [L3][CO2]10M

a) $x(t) = e^{-5t} \sin 5t\ u(t)$

b) $x(t) = e^{at}u(-t)$

c) $x(t) = cos\omega_0 t\ u(t)$

d) $x(t) = e^{5t}u(t)$

e) $x(t) = te^{-2t}u(t)$

15. Using properties of Fourier transform ,find the Fourier transform of the following signals.

a) $x(t) = e^{-3t}u(t-2)$ [L3][CO2]10M

b) $x(t) = te^{-2t}u(t)$

c) $x(t) = \delta(t+2) + \delta(t+1) + \delta(t-1) + \delta(t-2)$

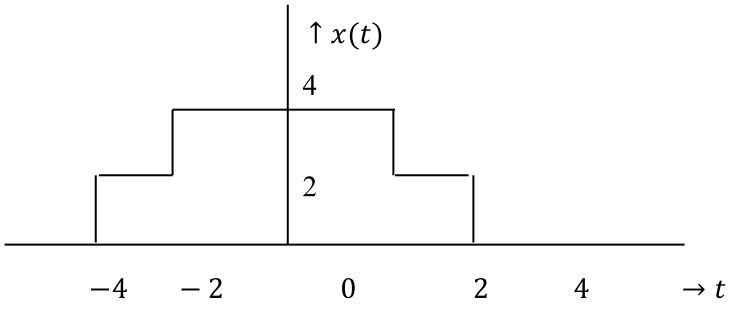
d) $x(t) = e^{j4t}u(t)$

e)$x(t) = e^{-4t}u(t-3)$

16. a) Find the Fourier transform of the signal $x(t) = e^{-a|t|}sgn(t)$ [L3][CO2]10M

b) Compute the Fourier transform of the signal $x(t) = \begin{cases} 1 + cos\pi t & |t| < 1 \\ 0 & |t| > 1 \end{cases}$

17. a) Determine the Fourier transform of the signal shown below. [L3][CO2]10M



18. By using partial fraction method, find the inverse Fourier transform of the following

a) $X(\omega) = \frac{4(j\omega)+6}{(j\omega)^2+6(j\omega)+8}$ b) $X(\omega) = \frac{1+3(j\omega)}{(j\omega+3)^2}$ c)$X(\omega) = \frac{j\omega}{(3+j\omega)^2}$ [L3][CO2]10M

19.Using Fourier transform , find the convolution of the signals. [L3][CO2]10M

a) $x_1(t) = e^{-2t}u(t)$; $x_2(t) = e^{-3t}u(t)$

b) $x_1(t) = te^{-t}u(t)$; $x_2(t) = te^{-2t}u(t)$

c) $x_1(t) = e^{-t}u(t)$; $x_2(t) = e^{-3t}u(t)$

d) $x_1(t) = te^{-t}u(t)$; $x_2(t) = e^{-2t}u(t)$

20. Consider a causal LTI system with impulse response $h(t) = e^{-3t}u(t)$.Find the output of the system for an input $x(t) = e^{-4t}u(t)$ [L3][CO2]10M

21. Consider a causal LTI system with frequency response $H(\omega) = \frac{1}{j\omega+4}$ .For a particular input $x(t)$ this system is observed to produce the output $y(t) = e^{-3t}u(t) - e^{-5t}u(t)$ [L3][CO2]10M

22.Derive the Discrete Fourier transform of a non periodic signal from discrete Fourier series of periodic signal. [L2][CO2]10M

23.Find the DTFT of the following sequences. [L3][CO2]10M

a) $x(n) = \{1, -2, 2, 3\}$

b) $x(n) = (\frac{1}{4})^n u(n+1)$

c) $x(n) = (0.2)^n u(n) - 2^n u(-n-1)$

d) $x(n) = a^n u(n)$

e) $x(n) = a^n \cos \omega_0 n$

24. State and prove the properties of Discrete time Fourier transform. [L2][CO2]10M

25. Find the DTFT of the rectangular pulse Sequences. [L3][CO2]10M

$$x(n) = \begin{cases} A & |n| \leq N \\ 0 & |n| > N \end{cases}$$

26. Using Properties of DTFT, Find the FT of the following. [L3][CO2]10M

a) $x(n) = n2^n u(n)$

b)$x(n) = (\frac{1}{2})^{n-4} u(n-4)$

c) $x(n) = e^{j2n} u(n)$

d) $x(n) = u(n+1) - u(n+2)$

e) $x(n) = \delta(n-2) - \delta(n+2)$.

27. a)The impulse response of an LTI system is $h(n) = \{1, 2, 1, -1\}$. Find the response of the system for the input $x(n) = \{1, 3, 2, 1\}$ [L3][CO2]10M

b) The impulse response of an LTI system is $h(n) = \{1, 2, 1, -2\}$. Find the response of the system for the input $x(n) = \{1, 3, 2, 1\}$

28. a) Find the convolution of the signals given below using Fourier transform. [L3][CO2]10M

$x_1(n) = (\frac{1}{2})^n u(n)$; $x_2(n) = (\frac{1}{3})^n u(n)$

b) Find the convolution of the sequences given below using Fourier transform

$$x_1(n) = x_2(n) = \{ 1 , 1 ,1\}$$

TWO MARKS QUESTIONS

1. What are the conditions for existence of FT?
2. Give the expressions of CTFT?
3. Define sinc function?
4. State duality property of FT?
5. What is the use of FT?
6. What are limitations of Fourier Transform?
7. State the sampling theorem?
8. State the convolution property?
9. State parsvel's theorem ?
10. What is the difference between Fourier series and Fourier transform?
11. What are the merits of FT?
12. FT of sgn(t)?
13. FT of impulse function?
14. FT of unit step function?
15. Define time shifting property?
16. State conjugation property?
17. Define frequency shifting property?
18. State autocorrelation property?
19. State multiplication property?
20. FT of a periodic signal?
21. Define Fourier series?
22. What are the types of Fourier series?
23. Write the formula of trigonometric Fourier series?
24. Write the formula for Exponential Fourier series?

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UNIT – III SIGNAL TRANSMISSION THROUGH LINEAR SYSTEMS

1. Explain the properties of LTI system in detail. [L2][CO3]10M
2. Explain the transfer function of LTI systems and explain the filter characteristics of linear system. [L2][CO3]10M
3. a)Consider the causal LTI system with frequency response H(w) = $1/(4+jw)$. For a particular 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). [L3][CO3]05M

   b) Consider the causal LTI system with frequency response H(w) = $1/(3+jw)$. For a particular input x(t), the system is observed to produce the output y(t) = $e^{-t}\ u(t)-e^{-3t}\ u(t)$ find the input x(t). [L3][CO3]05M
4. a)The impulse response of a continuous time system is expressed as $h(t)=\frac{1}{RC}\ e^{-\frac{t}{RC}}\ u(t)$ Find the Magnitude and frequency response of the system. [L3][CO3]05M

   b)The impulse response of a continuous time system is expressed as $h(t)=\ e^{-2t}\ u(t)$ Find the Magnitude and frequency response of the system. [L3][CO3]05M
5. a)A system produces an output $y(t)=e^{-t}\,u(t)$ for an input of $x(t)=e^{-2t}\,u(t)$. Determine the impulse response and frequency response of the system. [L3][CO3]05M

   b)A system produces an output $y(t)=e^{-3t}\,u(t)$ for an input of $x(t)=e^{-5t}\,u(t)$. Determine the impulse response and frequency response of the system. [L3][CO3]05M
6. a) For a system excited by $x(t)=e^{-3t}u(t)$, the impulse response is $h(t)=\ e^{-2t}\ u(t)+\ e^{2t}\ u(-t)$, Find the output of the system. [L3][CO3]05M

   b) For a system excited by $x(t)=e^{-t}u(t)$, the impulse response is $h(t)=\ e^{-3t}\ u(t)+\ e^{t}\ u(-t)$, Find the output of the system. [L3][CO3]05M
7. a) The input voltage to an RC circuit is given as $x(t)=te^{-3t}u(t)$ and the impulse response of this circuit is given as $2e^{-4t}u(t)$.Determine the output $y(t)$ [L3][CO3]05M

   b) The input voltage to an RC circuit is given as $x(t)=te^{-3t}u(t)$ and the impulse response of this circuit is given as $2e^{-3t}u(t)$.Determine the output $y(t)$ [L3][CO3]05M
8. What is meant by Sampling? Explain the sampling theorem with derivation in detail. [L1][CO3]10M
9. Explain the impulse sampling techniques in detail. [L1][CO3]05M
10. Explain the Data reconstruction and ideal reconstruction filter in detail. [L1][CO3]05M

11.Determine the Nyquist rate corresponding to each of the following signals. [L3][CO3]10M

a) $x(t) = 1 + \cos 2000\pi t + \sin 4000\pi t$

b) $x(t) = \frac{\sin(4000\pi t)}{\pi t}$

c) $x(t) = -10\cos 300\pi t \ \sin 40\pi t$

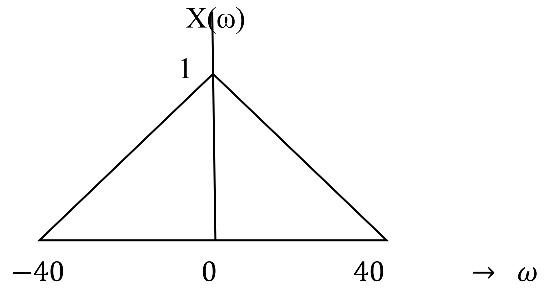
d) $x(t) = \frac{1}{2}\ sinc(100\pi t) + \frac{1}{2} sinc(50\pi t)$

e) $x(t) = sinc^2(300\pi t)$

f) $x(t) = sinc(100\pi t) + 5sinc^2(200\pi t)$.

12.A signal $x(t) = 2\cos 400\pi t + 6\cos 640\pi t$ is ideally sampled at f_s= 500 Hz . If the sampled signal is passed through an ideal LPF with a cut off frequency of 400Hz, what frequency components will appear in the output? Find the output signal. [L3][CO3]10M

13. Consider a continuous time signal $x(t)$ with frequency spectrum shown in figure. Find the frequency spectrum of its sampled sequences if the sampling frequency (a) ω_s= 40 rad/sec (b)) ω_s= 80 rad/sec (c) ω_s= 120 rad/sec. Also find in which cases the signal $x(t)$ can be recovered from its samples.



[L3][CO3]10M

14 a) Define impulse response of a system and write the importance of impulse response? [L1][CO3]10M

b) Define Transfer function of a system.

c) What is meant by sampling theorem?

d) What is meant by Nyquist rate and Nyquist interval?

e) What is meant by Aliasing ? How it occurs and how to avoid it?

2 MARKS QUESTIONS

1. What is the importance of impulse response?
2. Define stability?
3. Define transfer function of a system?
4. Define impulse response of a system?
5. What is the relation between impulse response and transfer function of a system?
6. What is a filter?
7. How filters are classified?
8. What is low pass filter?

9. What is high pass filter?
10. What is band pass filter?
11. What is stop band?

UNIT - IV CONVOLUTION AND CORRELATION OF SIGNALS

1. Explain the concept of Convolution and list the properties of Convolution in detail. [L1][CO4]10M
2. Find the Convolution of the following signals. [L3][CO4]10M
   a) $x_1(t) = e^{-2t}u(t)$; $x_2(t) = e^{-4t}u(t)$
   b) $x_1(t) = tu(t)$; $x_2(t) = tu(t)$
   c) $x_1(t) = sint\ u(t)$; $x_2(t) = u(t)$
   d) $x_1(t) = e^{-3t}u(t)$; $x_2(t) = u(t+3)$
   e) $x_1(t) = e^{-t}u(t)$; $x_2(t) = u(t)$
3. Explain the convolution theorem in detail. [L1][CO4]10M
4. Find the convolution of the following signals using fourier transform . [L3][CO4]10M
   a) $x_1(t) = e^{-at}u(t)$; $x_2(t) = e^{-bt}u(t)$
   b) $x_1(t) = 2e^{-2t}u(t)$; $x_2(t) = u(t)$
   c) $x_1(t) = 2e^{-2t}u(t)$; $x_2(t) = e^{-4t}u(t)$
   d) $x_1(t) = e^{-t}u(t)$; $x_2(t) = e^{-t}u(t)$
5. List the graphical procedure to perform convolution. [L2][CO4]10M
6. Find the convolution of the following signals by graphical method . [L3][CO4]10M
   a) $x(t) = e^{-3t}u(t)$; $h(t) = u(t+3)$
   b) $x(t) = e^{-t}u(t)$; $h(t) = e^{-3t}[u(t) - u(t-2)]$
   c) $x(t) = u(t+1)$; $h(t) = u(t-2)$
   d) $x(t) = \begin{cases} 1 & for\ -3 \le t \le 3 \\ 0 & else\ where \end{cases}$; $h(t) = \begin{cases} 2 & for\ 0 \le t \le 3 \\ 0 & else\ where \end{cases}$
   e) $x(t) = \begin{cases} 1 & for\ 0 \le t \le 2 \\ 0 & else\ where \end{cases}$; $h(t) = \begin{cases} 1 & for\ 0 \le t \le 3 \\ 0 & else\ where \end{cases}$
7. Explain the cross correlation and their properties in energy signals and power signals. [L2][CO4]10M
8. Explain the auto correlation and their properties in energy signals and power signals. [L2][CO4]10M
9. Explain the energy density spectrum in detail. [L2][CO4]10M
10. Explain the power density spectrum in detail. [L2][CO4]10M
11. Explain the detection of periodic signal in the presence of noise by correlation. [L2][CO4]10M
12. a) What is meant by correlation? [L2][CO4]10M
    b) What is the relationship between correlation and convolution and write the expression.
    c) Define Spectral density.

d) State Parseval's theorem of energy and power signal.

e) Comparison between energy spectral density and power spectral density.

13. a)Find the autocorrelation of the signal $x(t) = A\cos(\omega_0 t + \theta)$. [L3][CO4]10M

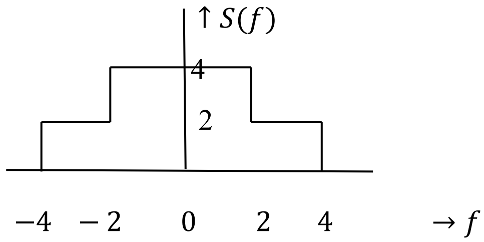
b) Find the autocorrelation of the signal $x(t) = A\sin(\omega_0 t + \theta)$. [L3][CO4]10M

14. A filter has an input $x(t) = e^{-t}u(t)$ and its impulse response $h(t) = e^{-3t}u(t)$.Find the energy spectral density of the output. [L3][CO4]10M

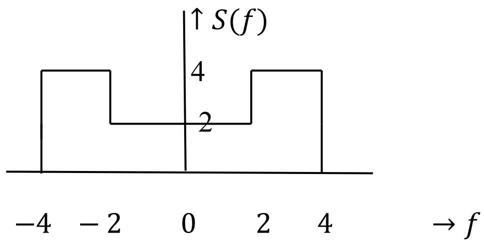
15. a) Verify Parseval's theorem for the energy signal $x(t) = e^{-t}u(t)$ [L3][CO4]10M

b) Verify Parseval's theorem for the energy signal $x(t) = e^{-3t}u(t)$ [L3][CO4]10M

16. a) Figure shows the PSD of the signal $x(t)$.Find out its average power. [L3][CO4]10M



b) Figure shows the PSD of the signal $x(t)$.Find out its average power. [L3][CO4]10M



Two Marks

1. What is convolution?
2. What are the properties of Convolution?
3. State time convolution theorem.
4. State frequency Convolution theorem.
5. What is correlation?
6. Write the properties of autocorrelation of energy signals.
7. Write the properties of autocorrelation of power signals
8. Define energy spectral and power spectral density.
9. Write the properties of ESD and PSD.
10. State Parseval's power and energy theorem.

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UNIT- V LAPLACE TRANSFORM AND Z TRANSFORM

1. List the comparison of Laplace transform and Fourier transform. [L2][CO5]10M
2. Find the Laplace transform of the following signals and find their ROCs. [L3][CO5]10M
   a) $x(t) = e^{-t}u(t) + e^{-4t}u(t)$
   b) $x(t) = e^{-2t}u(t) + e^{3t}u(t)$
   c) $x(t) = e^{-at}u(t) - e^{-bt}u(-t)$
   d) $x(t) = e^{-2t}u(-t) + e^{-3t}u(-t)$
   e) $x(t) = e^{-a|t|}$
3. Find the Laplace transform of the following signals and find their ROCs. [L3][CO5]10M
   a) $x(t) = e^{t} sin2t \; for \; t \leq 0$
   b) $x(t) = te^{-2|t|}$
4. Find the Laplace transform of the following signals. [L3][CO5]10M
   a) $x(t) = sin^2 3t \, u(t)$
   b) $x(t) = [1 + \sin 2t \, cos2t] \, u(t)$
   c) $x(t) = \cos(\omega t + \theta) \, u(t)$
5. Explain the properties and theorems of Laplace transform. [L2][CO5]10M
6. Using Properties of Laplace transform , find the Laplace transform of the following signals.
   a) $x(t) = te^{-3t}u(t)$ [L3][CO5]10M
   b) $x(t) = tu(t-2)$
   c) $x(t) = te^{-2t}u(t-3)$
   d) $x(t) = 2e^{-6t}u(t) - 10e^{4t}u(-t)$
   e) $x(t) = te^{-2t} \sin 2t \, u(t)$
7. Find the initial value $x(0^+)$ for the following Laplace transform. [L3][CO5]10M
   a) $X(s) = \frac{4}{s^2+3s-5}$ b) $X(s) = \frac{3s+2}{s(s^2+3s+2)}$ c) $X(s) = \frac{s+3}{s^2+5s+4}$
8. Find the final value $x(\infty)$ for the following Laplace transform. [L3][CO5]10M
   a) $X(s) = \frac{s-2}{s(s+4)}$ b) $X(s) = \frac{2}{s^2+4s-2}$ c) $X(s) = \frac{10}{s^3+3s^2+5s}$
9. Draw the pole – zero plot and determine the magnitude of the Fourier transform of the signal whose Laplace transform is $x(s) = \frac{s^2-s+1}{s^2+s+1}$ [L3][CO5]10M
10. Find the inverse Laplace transform for the following [L3][CO5]10M
    a) $X(s) = \frac{1}{(s+1)^2}$
    b) $X(s) = \frac{s}{(s+2)^2+1}$

c) $X(s) = \frac{s^3+1}{s(s+1)(s+2)}$

d) $X(s) = \frac{s^2+2s+1}{s^2+3s+2}$

e) $X(s) = \frac{2s-1}{s^2+2s+1}$

11. Find the inverse Laplace transform of the following [L3][CO5]10M

a) $X(s) = \frac{s^2+6s+7}{s^2+3s+2}$; Re(s) > -1

b) $X(s) = \frac{s^3+2s^2+6}{s^2+3s}$; Re(s) > 0

12. Using the convolution theorem of Laplace transform find $y(t)$ [L3][CO5]10M

a) $x_1(t) = e^{-2t}u(t)$; $x_2(t) = u(t-3)$

b) $x_1(t) = tu(t)$; $x_2(t) = tu(t)$

c) $x_1(t) = cos4t\, u(t)$; $x_2(t) = \sin 2t\, u(t)$

d) $x_1(t) = e^{-2t}u(t)$; $x_2(t) = e^{-4t}u(t)$

e) $x_1(t) = e^{-t}u(t)$; $x_2(t) = e^{-3t}u(t)$

13.a) Find the inverse Laplace transform of $X(s) = \frac{1}{(s+4)(s-2)}$ if the ROC is [L3][CO5]10M

i) $-4 < Re(s) < 2$ ii) $Re(s) > 2$ iii) $Re(s) < -4$ iv) $2 < Re(s) < -4$

b) Find the inverse Laplace transform of $X(s) = \frac{1}{(s+1)(s+2)(s+3)}$ if the ROC is [L3][CO5]10M

i) $Re(s) > -1$ ii) $Re(s) < -3$ iii) $-3 < Re(s) < -2$ iv) $2 < Re(s) < -1$

14. Using Laplace transform , solve the following differential equations. [L3][CO5]10M

(find the response of the system $y(t)$)

a) $\frac{d^2y(t)}{dt^2} + y(t) = x(t)\ if\ \frac{dy(0^-)}{dt} = 2, y(0^-) = 1\ for\ input\ x(t) = cos2t$

b) $\frac{d^2y(t)}{dt^2} + 6\frac{dy(t)}{dt} + 5y(t) = \frac{dx(t)}{dt}\ if\ \frac{dy(0^-)}{dt} = 2, y(0^-) = 1\ for\ input\ x(t) = e^{-2t}u(t)$

c) $\frac{d^2y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2y(t) = x(t)\ if\ \frac{dy(0^-)}{dt} = 1, y(0^-) = 2\ for\ input\ x(t) = e^{-t}u(t)$

d) $\frac{d^2y(t)}{dt^2} + 7\frac{dy(t)}{dt} + 12y(t) = x(t) if\ \frac{dy(0^-)}{dt} = 0, y(0^-) = -2\ for\ input\ x(t) = u(t)$

15. a)What is meant by ROC? List the properties of ROC in Laplace transform. [L2][CO5]10M

b) List the Advantages and limitation of Laplace transform.

16. List the comparison of Laplace transform and Z transform. [L2][CO5]10M

17. a)What is meant by ROC? List the properties of ROC in Z transform. [L2][CO5]10M

b) List the Advantages and limitation of Z transform.

18. Find the Z transform of the following signals [L3][CO5]10M

a) $x(n) = n\delta(n)$

b) $x(n) = \{2, 4, 1, 0, 1, 3, 5\}$

↑

c) $x(n) = (\frac{1}{4})^n\, u(n) + (\frac{1}{5})^n\, u(n)$

d) $x(n) = (\frac{1}{5})^n\, u(n) + (\frac{1}{4})^n\, u(-n-1)$

e) $x(n) = n[u(n) - u(n-3)]$

19. Explain the properties and theorems of Z transform in detail. [L2][CO5]10M

20. Find the Z transform and ROC of $X(z)$ [L3][CO5]10M

a) $x(n) = 3(\frac{5}{7})^n u(n) + 2(-\frac{1}{3})^n u(n)$

b) $x(n) = (\frac{1}{2})^n u(-n) - 2^n(-\frac{1}{3})^n u(-n-1)$

c) $x(n) = 2(\frac{5}{6})^n u(-n-1) + 3(\frac{1}{2})^{2n}\, u(n)$

d) $x(n) = a^{|n|}\,; |a| < 1$

21. Using the properties of Z transform , find the Z transform of the following sequences [L3][CO5]10M

a) $x(n) = u(-n-2)$

b) $x(n) = 2^n u(n-2)$

c) $x(n) = (\frac{1}{2})^n[u(n) - u(n-8)]$

d) $x(n) = nu(n-1)$

e) $x(n) = (\frac{1}{3})^n\, u(-n)$

22. Using theorem, Find $x(0) and\ x(\infty)$ for the $X(z)$ given as [L3][CO5]10M

a) $X(z) = \frac{z+1}{(z-0.6)^2}$ b) $X(z) = \frac{z^2+2z+2}{(z+1)(z+0.5)}$ c) $X(z) = \frac{2z+3}{(z+1)(z+3)(z-1)}$

23. Determine the inverse Z transform of the following signals [L3][CO5]10M

a) $X(z) = \frac{1}{z-a}\,; ROC\ |Z| > a$

b) $X(z) = \frac{1}{1-az^{-1}}\,; ROC\ |Z| > a$

c) $X(z) = \frac{1}{(1+z^{-1})^2(1-z^{-1})}\ ;\ ROC\ |Z| > \frac{1}{2}$

24. Determine the inverse Z transform of the following signals using Power series method [L3][CO5]10M

a) $X(z) = \frac{z}{2z^2-3z+1}\,; ROC\ |z| < \frac{1}{2}$

b) $X(z) = \frac{z}{2z^2-3z+1}\,; ROC\ |z| > 1$

25. Determine the inverse Z transform of the signals using Long division method [L3][CO5]10M

$X(z) = \frac{1}{2-4z^{-1}+2z^{-2}}$ When a) $ROC\ |z| > 1$ b) $ROC\ |z| < \frac{1}{2}$

26. Determine the inverse Z transform of the following signals using Partial fraction method

[L3][CO5]10M

a) $X(z) = \frac{(1/6)z^{-1}}{[1-(1/2)z^{-1}][1-(1/3)z^{-1}]}\ ; ROC\ |z| > \frac{1}{2}$

b) $X(z) = \frac{1+2z^{-1}+z^{-2}}{1-(3/2)z^{-1}+(1/2)z^{-2}}$

c) $X(z) = \frac{4-3z^{-1}+3z^{-2}}{(z+2)(z-3)^2}$

d) $X(z) = \frac{(1/4)z^{-1}}{[1-(1/2)z^{-1}][1-(1/4)z^{-1}]}$; $i) ROC\ |z| > \frac{1}{2}$ $ii) ROC\ |z| < \frac{1}{4}$ iii) $ROC\ \frac{1}{4} < |z| < \frac{1}{2}$

27. Find the convolution for the following using Z transform. [L3][CO5]10M

a) $x_1(n) = (\frac{1}{2})^n u(n)\ ;\ x_2(n) = (\frac{1}{4})^n u(n)$

b) $x_1(n) = \{2, 1, 0, -1, 3\};\ x_2(n) = \{1, -3, 2\}$

c) $x_1(n) = (\frac{1}{2})^n u(n)\ ;\ x_2(n) = (\frac{1}{3})^{n-2} u(n-2)$

2 MARKS QUESTIONS

1. State and prove convolution property of Laplace transform ?
2. Write the of Laplace transform of $x(t) = e^{-j2t} u(t)$?
3. Name the signal which has ROC in entire z-plane and justify the answer?
4. State and prove differentiation property of Z-transform?
5. State and prove final value theorem of Z-transform?
6. Find Z-transform and ROC of $x(n)= a^n u(n)$?
7. Differentiation property of LT
8. How is LT is useful in the analysis of LTI systems?
9. What is ROC?
10. State initial value theorem of LT?
11. State final value theorem of LT?
12. Define Z-transform?
13. What are the advantages and limitations of Z-transform?
14. What is the relation between DTFT and ZT?
15. How do you get the DTFT from ZT?
16. When are the Z-transform and DTFT are same?
17. What is the condition for x(t) to be Laplace transformable?
18. What is the relation between LT and FT?
19. What is a right-sided signal? What is it's ROC?
20. What is left-sided signal? What is it's ROC?