Part-A

1. for the signal shown in fig.1 find $x(2t+3)$

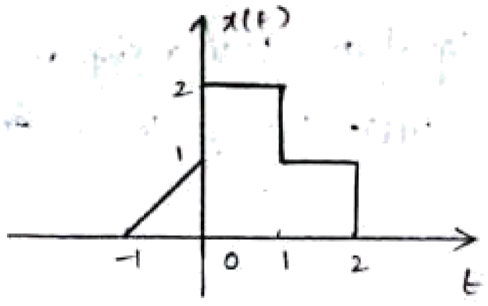


Fig.1

2. what is the classification of systems.
3. Define unit impulse and unit step signals
4. when is a system said to be memoryless? give an example
5. State the sampling theorem
6. Define the shifting property of the discrete time unit Impulse function
7. Define signal
8. what is meant by stability of a system
9. state the condition for the LTI system to be casual and stable
10. Define stability in LTI system.
11. give the mathematical and graphical representation of continuous time and discrete time unit impulse function
12. what are the conditions for a system to be LTI system.
13. Verify whether the system described by the equation is linear and time invariant $y(t) = x(t^2)$
14. find the fundamental period of the given signal $x(n) = \sin\left(\frac{6\pi n}{7}+1\right)$
15. Define Nyquist state
16. Determine whether a unit step function, $u(n)$, is a power or energy sequence
17. consider the analog signal. $x_a(t) = 5\cos 100\pi t + 10\sin 200\pi t - 15\cos 300\pi t$. what is the Nyquist rate for this signal
18. If $x(t) = \cos\left(\frac{\pi}{3}t\right) + \sin\left(\frac{\pi}{4}t\right)$ is periodic, find the period of $x(t)$
19. Express the ramp sequence in terms of step sequence.

20. Clearly show that the unit step sequence is a power or energy.

21. Test whether the ramp function is energy signal or power signal.

22. Check whether the signal $x(t) = 2\cos(\frac{1}{2}t) + 3\cos(\frac{1}{3}t - \frac{1}{5}\pi)$ is periodic or n.. If periodic, what is the period

23. Distinguish between Energy signal and power signal

24. Determine whether the signal $x(t) = t \cdot u(t)$ is an energy signal, power signal or neither.

Part-B

1. Write about elementary continuous-time signals in detail

2. Determine the power and RMS value of the following signals

$$x_1(t) = 5\cdot\cos(50t + \pi/3)$$
$$x_2(t) = 10\cos 5t \cdot \cos 10t$$

3. Determine whether the following systems are linear or not

$$\frac{dy}{dt} + 3t\,y(t) = t^2 x(t)$$
$$y(n) = 2x(n) + \frac{1}{x(n-1)}$$

4. Determine whether the following systems are time-invariant or not

$$y(t) = t \cdot x(t)$$
$$y(n) = x(2n)$$

5. Distinguish b/w the following

i) continuous time signal and discrete time signal
ii) unit step and unit ramp functions
iii) periodic and Aperiodic signals
iv) Deterministic and Random signals

6. Find whether the signal $x(t) = 2\cos(10t+1) - \sin(4t-1)$ is periodic or not.

7. find the summation $\sum_{n=-\infty}^{\infty} e^{2n}\,\delta(n-2)$.

8. Explain the properties of unit impulse function.

9. find the fundamental period T of a continuous time signal $x(t) = 20\cos(10\pi t + \pi/6)$

10. Define the following signals mathematically and represent graphically

i) Impulse signal

ii) Ramp signal

iii) Step signal

iv) Sinusoidal signal

v) Exponential signal with various time period

11. Give a broad classification of system and their details in brief

12. Determine whether the signal $x(t) = \sin 20\pi t + \sin 5\pi t$ is periodic and if it is periodic find the fundamental period

13. Define energy and power signals. find whether the signal $x(n) = \left(\frac{1}{2}\right)^n . u(n)$ is energy or power signal and calculate their energy or power

14. Discuss various forms of real and complex exponential signals with graphical representation.

15. Determine whether the discrete time system $y(n) = x(n)\cos(\omega n)$ is

i) Memoryless

ii) stable

iii) casual

iv) Linear

v) Time invariant

16. Determine whether the systems described by the following input-output equations are Linear, dynamic, casual and time variant

i) $y_1(t) = x(t-3) + (3-t)$

ii) $y_2(t) = \frac{dx(t)}{dt}$

iii) $y_1(n) = n\,x(n) + b x^2(n)$

iv) $\text{Even}\{x(n-1)\}$

17. Write short notes on sampling theorem

UNIT-2

Part-A

1. what are the Dirichlet's conditions of fourier series
2. State convolution property of Fourier transform
3. state any two properties of continuous time fourier transform
4. find the fourier series coefficients of the signal $x(t) = \sin \omega t$
5. Give the equation for trigonometric fourier series
6. Determine the fourier series coefficients for the signal $\cos \pi t$
7. Prove the time shifting property of discrete time fourier transform
8. prove that the fourier series of a periodic signal with rotation symmetry contains only odd harmonics
9. Give the relation between exponential and trigonometric fourier series coefficients
10. what is the fourier transform of unit step signal
11. The signal $f(t) = 3t$ for $0 < t < 4$ and is periodic ~~for~~ with period 4. what are the harmonics present.
12. If the fourier transform of $f(t)$ is $F(\omega)$. what is the fourier transform of $f(at)$.
13. Define Bandwidth of a signal
14. what is the FT of a unit step function
15. Determine whether the signal $x(t) = A\cos(\omega_0 t + \theta)$ is a energy signal, power signal or neither
16. Find the orthogonality of the signals $\sin \omega t$ and $\sin 2\omega t$ over the time interval $(0, T)$
17. obtain the complex exponential fourier series representation for the signal $x(t) = \sin^2 t$
18. find the fourier transform of the signal $x(t) = 1$
19. State and prove parseval's theorem for fourier transform
20. Test whether the signal $\sin(1/t)$ has fourier transform or not
21. find the fourier transform of the signal $x(t) = e^{-j\omega_0 t}$
22. State and prove the time differentiation property of fourier transform

23. Check the orthogonality of the signals $e^{-jn\omega t}$ and $e^{jn\omega t}$ over the time interval $(0, T)$

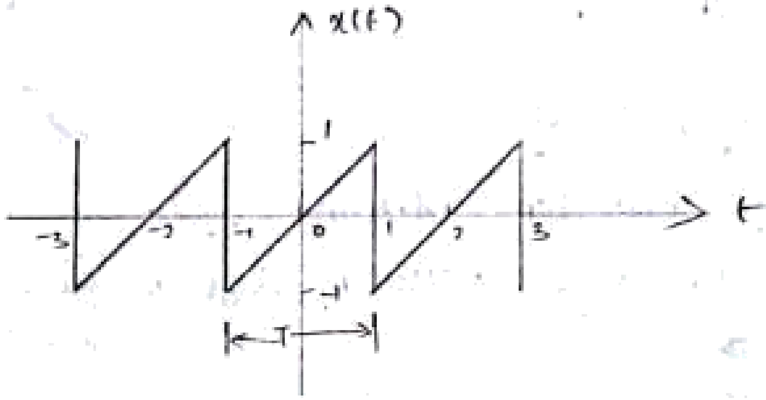
24. Determine the complex exponential Fourier series representation for the signal
$$x(t) = \cos 4t + \sin 6t$$

25. Match the following:

Time signal	Its spectrum
a) continuous and periodic	i) continuous and aperiodic
b) continuous and aperiodic	ii) continuous and periodic
	iii) Discrete and periodic
	iv) Discrete and aperiodic.

Part-B

1. Find the trigonometric Fourier series for the periodic signal $x(t)$ shown in Fig.



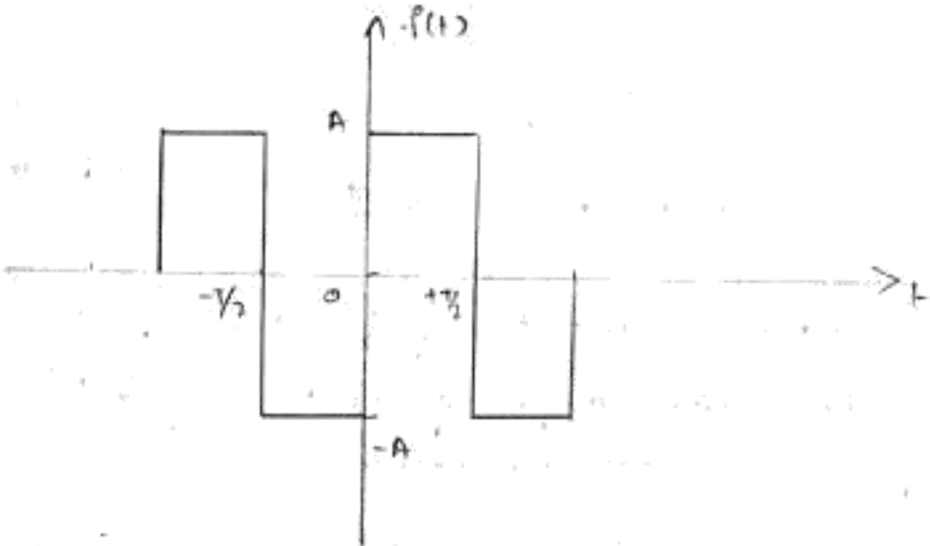
2. Find the Fourier transform of rectangular pulse. Sketch the signal and its Fourier transform

3. Explain the Fourier spectrum of periodic signal $x(t)$.

4. Find the Fourier transform of
$$x(t) = e^{-|t|} \text{ for } -1 \le t \le 1$$
$$= 0 \quad \text{otherwise}$$

13. A stable LTI system is characterised by the differential equation $\frac{d^2y(t)}{dt^2} + 4\cdot\frac{dy(t)}{dt} + 3y(t) = \frac{dx(t)}{dt} + 2x(t)$. find the frequency response and impulse response using fourier transform

14. find the exponential fourier series of the waveform



15. State and prove the fourier transform of the following signal in terms of $X(j\omega)$; $x(t-t_0)$, $x(t)\cdot e^{j\omega_0 t}$.

16. find the complex exponential fourier series coefficient of the signal $x(t) = \sin 3\pi t + 2\cos 4\pi t$

17. find the complex fourier series for the signal
$x(t) = 2\cos 5t + 5\sin 15T$

18. State and prove modulation theorem for fourier transform

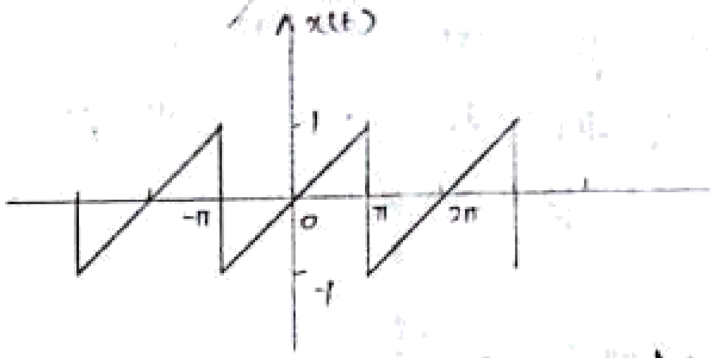
19. A signal $x(t)$ has a fourier transform given by

$$|X(\omega)| = 1 \quad -2 \le \omega \le 2$$
$$= 0 \quad \text{otherwise}$$

and $X(\omega) = \pi/2 \quad -2 \le \omega \le 0$
$= -\pi/2 \quad 0 \le \omega \le 2$

20. State and prove frequency shifting property of the fourier transform. Explain its significance

I. ~~The contin~~ Determine the fourier series representation of the signal:



6. Bringout the relationship b/w trigonometric and exponential fourier series

7. State and explain all properties of fourier transform

8. Determine the fourier transform of standard signals unit impulse function, signum function and unit step function

9. A rectangular fn. f(t) is defined by

$$f(t) = \begin{cases} 1, & 0 < t < \pi \\ -1, & \pi < t < 2\pi \end{cases}$$

Approximate this function by a waveform single term sint, two terms sint and sin 3t, three terms sint, sin 3t and sin 5t over the interval $(0, 2\pi)$ and show that the mean square error is min. when the fn is approximated by 3 terms rather than single term

10. obtain the exponential fourier series for the full wave rectified sine wave shown in fig.
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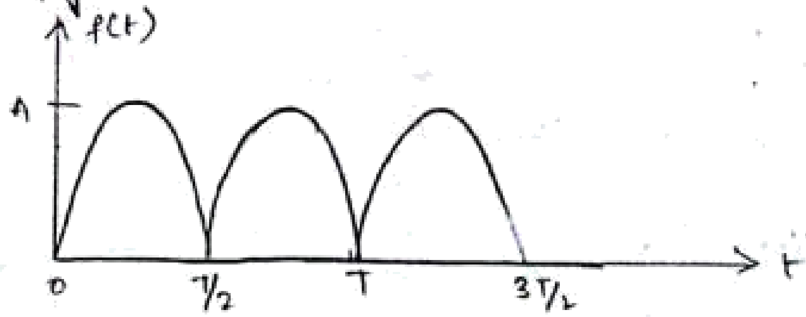
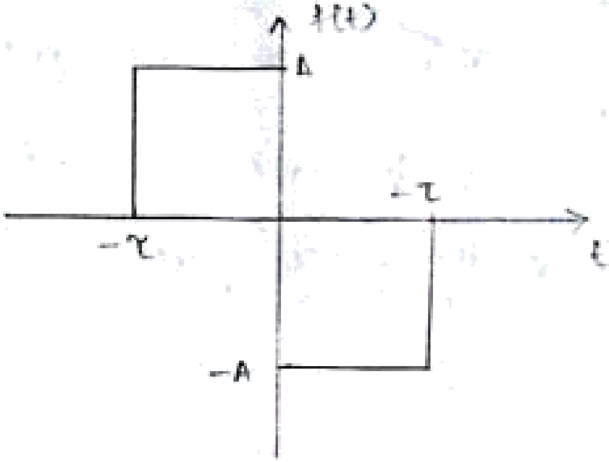


11. find the fourier transform of the signal $x(t) = e^{-a|t|}$

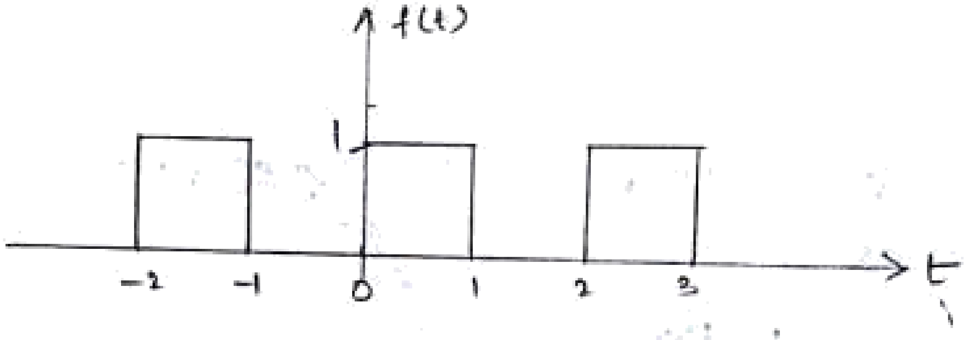
12. Find the inverse fourier transform of the rectangular spectrum given by

$$X(j\omega) = \begin{cases} 1 & -W < \omega < W \\ 0 & |\omega| > W \end{cases}$$

21. find the fourier transform of the function shown in fig.



22. find the trigonometric fourier series of the following periodic function shown in fig.1



23. State and prove the parseval's power theorem applicable to periodic signals

24. prove that the half wave symmetric signal contains only odd harmonics in fourier series

25. If $x(t) = 1 \quad |t| < a$

$\quad\quad = 0$ otherwise, obtain the fourier transform of $x(t)$

26. If $X(\omega) = j \dfrac{d}{d\omega}\left\{ \dfrac{e^{j2\omega}}{1 + \frac{j\omega}{3}} \right\}$ is the fourier transform of a signal $x(t)$, then find the signal $x(t)$

27. Derive the expressions for the fourier series coefficients

28. find the fourier transform of the signum fn. sgn(t) which is defined as $\text{sgn}(t) = \begin{cases} 1 & t>0 \\ -1 & t<0 \end{cases}$

29. find the FT of the signal $f(t) = te^{-at}u(t)$

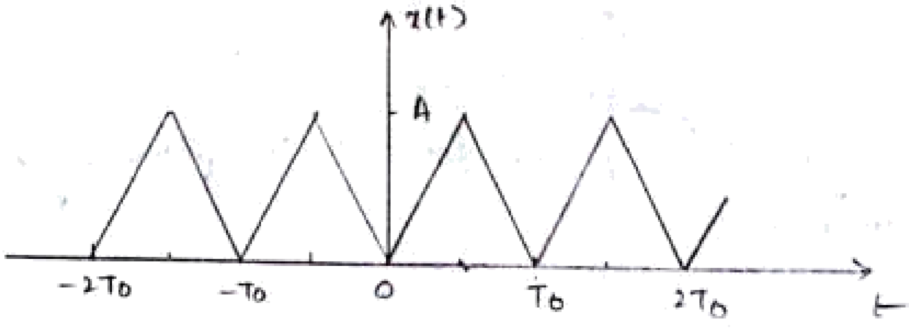
30. Using time convolution theorem, find the inverse fourier transform of

$$X(\omega) = \frac{1}{(a+j\omega)^2}$$

31. consider the triangular wave $x(t)$ shown in fig. find

a) the complex exponential fourier series of $x(t)$. and

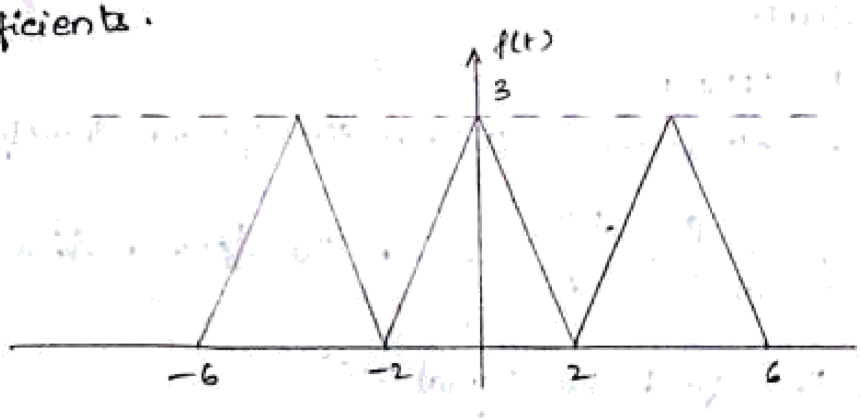
b) the trigonometric fourier series of $x(t)$.



32. find the fourier transform of the signum function, sgn (t) which is defined as

$$sgn(t) = \begin{cases} 1 & t>0 \\ -1 & t<0 \end{cases}$$

33. for the periodic waveform shown in fig(1). determine the fourier series coefficients.



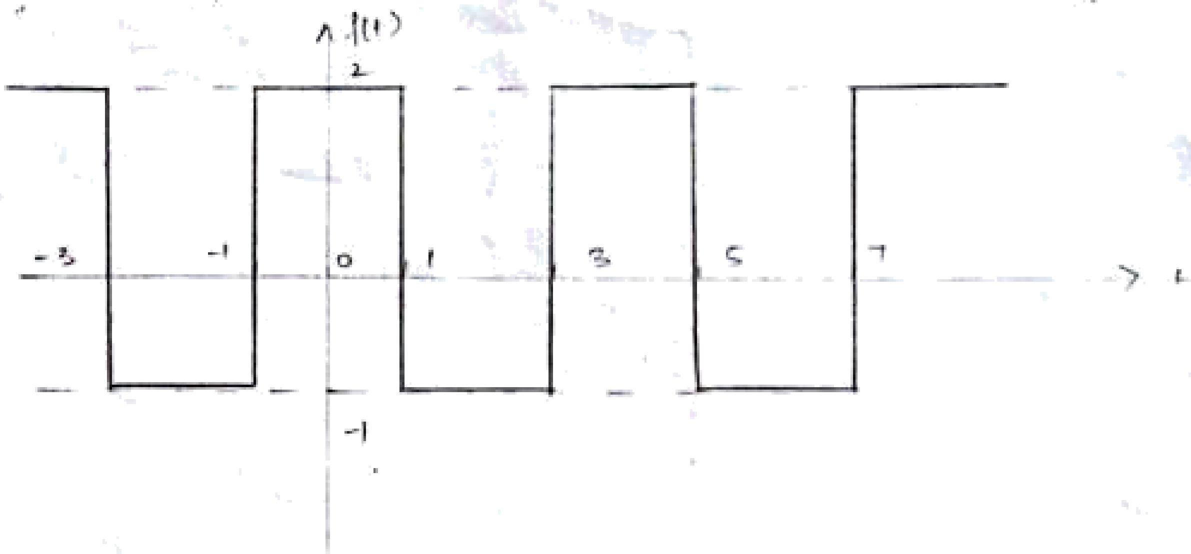
34. State and prove the Modulation property of fourier transform

35. A signal $f(t) = \cos 50t + \cos 70t$ modulates the carrier $f_c(t) = \cos 500t$. find the spectrum of the Modulated signal using fourier transforms

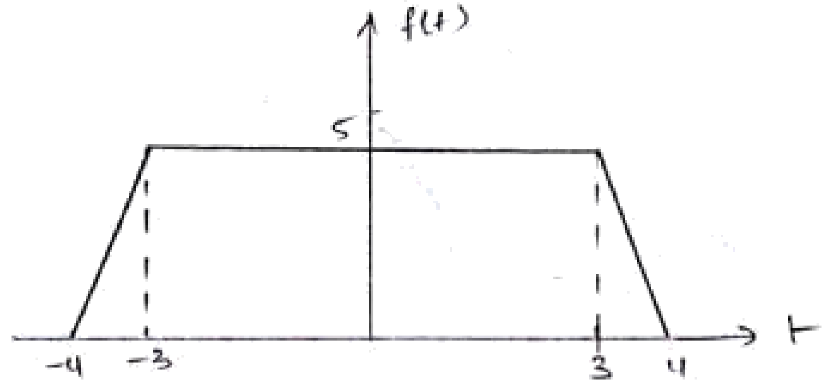
36. Explain the symmetry properties of fourier series

37. state and prove time differentiation property of FT

38. find the trigonometric fourier series expansion of the signal as shown



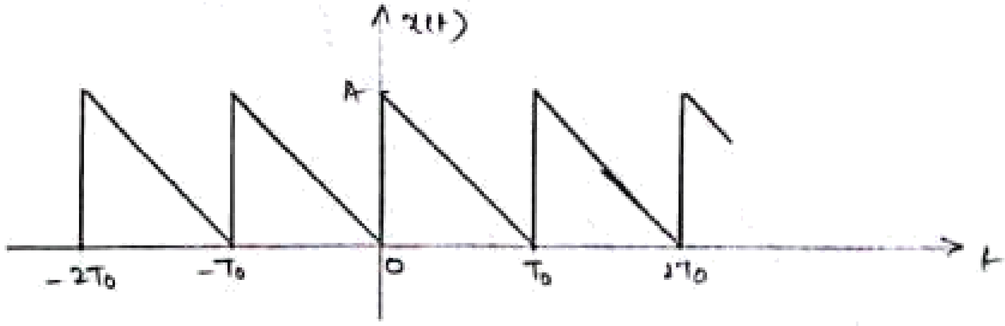
39. find the FT of the waveform shown in fig.



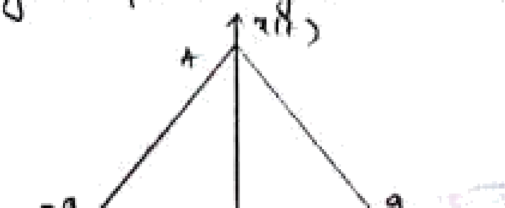
40 consider the triangular wave x(t) shown in fig. find

a) the complex exponential fourier series of x(t) and

b) the trigonometric fourier series of x(t)



41. State and prove the time differentiation property of FT. using this property, find FT of triangular pulse signal shown in fig.



Part-A

UNIT-III

1. what is the laplace transform of the function $x(t) = u(t) - u(t-2)$
2. what are the transfer functions of the following
   a) An ideal integrator
   b) An ideal delay of T seconds
3. Determine the laplace transform of following signals
   i) $x_1(t) = u(t-2)$
   ii) $x_2(t) = t^2 e^{-2t} u(t)$
   iii) $x(t) = \begin{cases} \sin \pi t, & 0<t<1 \\ 0, & \text{otherwise} \end{cases}$
4. find the laplace transform of the signal $x(t) = e^{-at} \cdot u(t)$
5. State the convolution integral for continuous time LTI system
6. what is the impulse response of two LTI systems connected in parallel
7. find the laplace transform of the signal $\delta(t-5)$ and $u(t-5)$
8. Define convolution integral
9. List the steps involved in linear convolution
10. State the relationship between Fourier transform and Laplace transform
11. Define Auto correlation and cross correlation and list out properties of each
12. check whether the causal system with transfer fn $H(s) = \frac{1}{s-2}$ is stable.
13. Define convolution sum with its equation
14. State final value theorem
15. find the convolution integral when $f_1(t) = e^{-at}$ and $f_2(t) = t$
16. find the laplace transform of the function $f(t) = t e^{-at} \cdot u(t)$
17. write properties of convolution
18. find the laplace transform of $x(t) = e^{-at} \cdot u(-t)$
19. what is the relation between convolution and correlation
20. State the condition in terms of impulse response for a system to be causal.
21. find the laplace transform and associate ROC for the signal
    $x(t) = e^{-2t}[u(t) - u(t-5)]$
22. find the inverse laplace transform for $X(s) = \frac{2s+4}{s^2+4s+3}$, $-3 < Re(s) < -1$
23. obtain the convolution of the functions $f_1(t) = e^{-2t}$ and $f_2(t) = u(t)$.

Q4. what is the significance of ROC

Q5. what is the autocorrelation of u(t)

Q6. what is the laplace transform of $f(t) = e^{-3t}[u(t) - u(t-1)]$

Q7. find the laplace transform and associated ROC for the signal $x(t) = \delta(at+b)$, where a, b are real constants.

Q8. find the inverse laplace transform for :

$$X(s) = \frac{2s+1}{s+2} \ ; \ Re(s) > -2$$

Q9. obtain the convolution of the functions $f_1(t) = e^{-5t}$ and $f_2(t) = t$

30.

Part - B

1. State and prove the time-scaling property of laplace transform

2. Obtain the laplace transform of the signal :

$$f(t) = e^{-at} \cos \omega_0 t \cdot u(t)$$

3. How do you perform graphically convolution of two signals ? Explain with the example $x(t) = e^{-2t} \cdot u(t)$ and $y(t) = u(t)$

4. write short notes on : a) singularity functions
b) parseval's relation

5. find the inverse laplace transform of. a) $F(s) = \frac{e^{-2s}}{(s+1)(s+2)^2}$

b) $F(s) = \frac{1-e^{-3s}}{3s^3+2s^2}$

6. find the laplace transform of the functions :

a) $f(t) = 5u(t) u(3-t)$

b) $f(t) = e^{-3t}[u(t+2) - u(t-3)]$

7. find laplace transform of $x(t) = (e^{-t} \cos 2t - 5e^{-2t}) u(t) + \frac{1}{2} e^{-2t} u(-t)$

8. find the inverse laplace transform of

$$X(s) = \frac{s^2+2s+5}{(s+3)(s+5)^2} \ ; \ Re(s) > -3$$

9. compute the convolution of $h(t)$ and $x(t)$ where $h(t) = e^{-\alpha t} u(t)$,

$x(t) = e^{\alpha t} u(-t)$ and $\alpha > 0$

10. find inverse laplace transform of $X(s) = \frac{4(s+1)}{s^2+2s+2}$

11. The transfer function of the system is $H(s) = \frac{s+2}{(s+3)(s+1)^2}$. sketch the pole-zero plot and test the stability of system.

12. State and prove scaling property of L- transform

13. If the L-transform of $x(t)$ is $X(s) = \frac{4}{(s+2)^2}$. find the LT of $g(t) = x(2t-2)$

14. obtain the output signal of a system whose input signal, $x(t) = e^{-t} \cdot u(t-1)$ and the impulse response, $h(t) = 2u(t-1)$.

15. consider a continuous time linear time invariant system for which the input $x(t)$ and output $y(t)$ are related by $\frac{d^2y(t)}{dt^2} + \frac{dy(t)}{dt} - 2y(t) = x(t)$

a) find the system function

b) Determine the impulse response for each of following cases

i) the system is stable

ii) the system is causal and stable

16. How do you perform graphically convolution of two signals? Explain with example. $x(t) = e^{-at} \cdot u(t)$, $h(t) = u(t) - u(t-T)$

17. obtain the convolution of a step function with respect to itself

18. find inverse laplace transform of $F(s) = \frac{e^{-2s} - e^{-3s}}{s^2+2s+2}$

19. find the output of the system whose impulse response $h(t) = e^{-2t} \cdot u(t)$ when the excitation $x(t) = t \cdot u(t)$.

20. The LTI system is characterised by impulse response fn. given by

$H(s) = \frac{1}{s+10}$ ROC : Re > -10

Determine the output of a system when it is excite by input

$x(t) = -2e^{2t} u(-t) - 3e^{-3t} u(t)$

21. compute and plot the convolution $y(t)$ of given signals

i) $x(t) = u(t-3) - u(t-5)$, $h(t) = e^{-3t} \cdot u(t)$

ii) $x(t) = u(t)$, $h(t) = e^{-t}u(t)$

22. find laplace transform of the signal $f(t) = e^{-at}\sin\omega t\, u(t)$.

23. ~~Draw direct form, cascade form and parallel form of a system with system function.~~ $\cancel{H(s) = \frac{1}{(s+1)(s+2)}}$

24. Discuss various properties of laplace transform

25. find $y(n) = x(n) * h(n)$ using matrix method. $x(n) = \{1,2,3,4\}$; $h(n) = \{1,1,1,1\}$

26. The continuous time LTI system is described by equation

$$\frac{d^2y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2y(t) = \frac{dx(t)}{dt} + x(t).$$ Find,

i) The impulse response of the system

ii) The output response of the system for the input signal $x(t) = e^{-3t}u(t)$

27. find the laplace transform of the signal $x(t) = e^{-at}u(t) + e^{-bt}u(-t)$

28. Explain the properties of convolution integral

29. using laplace transform, find the impulse response of an LTI system described by differential equation, $\frac{d^2y(t)}{dt^2} - \frac{dy(t)}{dt} - 2y(t) = x(t)$

30. find the convolution of the following signals $x(t) = e^{-2t}u(t)$

$h(t) = u(t+2)$

31. Explain the steps to compute the convolution integral.

32. find convolution of following signals

$x_1(t) = e^{-at}u(t)$

$x_2(t) = e^{-bt}u(t)$.

18. UNIT-IV

Part-A

1. What is the z-transform of the sequence $x(n) = a^n u(n)$?
2. Define one-sided z-transform and two-sided z-transform
3. Define stability & why what is meant by ROC of z-transform
4. Define unilateral and bilateral z-transform
5. Check whether the system with system function $H(z) = \frac{1}{1-\frac{1}{2}z^{-1}} + \frac{1}{1-2z^{-1}}$ with ROC $|z| < 1/2$ is causal and stable
6. State final value theorem
7. If the z-transform of $x(n)$ is $X(z)$, then find the z-transform of $n \cdot x(n)$.
8. State and prove the time shifting property of z-transform
9. Realise the system with 2 delays $y(n) = 5y(n-1) + 3x(n) + 2x(n-1)$
10. for a left-sided sequence $x(n)$, draw the ROC in the z-plane
11. If the z-transform of a sequence is $X(z)$, what is the z transform of $x(-n)$
12. If $X(z) = 3z^2 + 5z - 7z^{-1} + 6z^{-2} - 4z^{-3}$, find the sequence $x(n)$
13. Obtain the z-transform and the associated ROC for the sequence $x(n) = a^n u(-n)$
14. find the inverse z-transform of $X(z) = \frac{z}{2z^2-3z+1}$, $|z| < 1/2$

Part-B

1. Using the power series expansion technique, find the inverse z-transform of $X(z) = \frac{z}{2z^2-3z+1}$, $|z| < 1/2$
2. Solve the following difference equation with given initial conditions:
$y(n) - 3y(n-1) = x(n)$ with $x(n) = 4u(n)$, $y(-1) = 1$
3. Determine the inverse z-transform of $X(z) = \frac{1}{1-1.5z^{-1}+0.5z^{-2}}$. ROC: $|z| < 0.5$ using long division method.

4. Determine the inverse z-transform for the following function

$$X(z) = \frac{(z+1)(z+5)}{(z+2)(z+3)(z+6)} \quad \text{for } |z| \le 3$$

5. Realise the system with 2 delays $y(n) = y(n-1) + 2x(n) + 8x(n-1)$

6. write short note on Relationship between s-plane and z-plane

7. find the inverse z-transform of $(1-z^{-1})^{-2}$.

8. A linear discrete time system is given by $y(n) + 0.95y(n-1) = 0.05x(n)$

i) find the impulse response of the system

ii) find the response of the system if $x(n) = 0.5^n u(n)$

9. show that convolution operation is commutative

10. find the z-transform and ROC for the sequence $x(n) = 0.8^n u(n)$

11. state and prove convolution property of z-transform

12. find the inverse z-transform of $X(z) = \dfrac{z+1}{(z+0.2)(z-0.6)}$

13. for the system given by the difference equation, draw the canonical form realisation diagram

$y(n) + 0.5y(n-1) + 2y(n-2) + 3y(n-3) + 0.8y(n-4) = 3x(n) + 5x(n-2)$

14. Determine the z-transform of $x(n) = \cos(\omega n) \cdot u(n)$

15. Using partial fraction expansion method obtain the inverse z-transform of $X(z) = \dfrac{6z^3 + 2z^2 - z}{z^3 - z^2 - z + 1}$

16. find the z-transform and sketch the ROC for following sequences.

i) $x(n) = \left(\frac{1}{2}\right)^n u(n)$

ii) $x(n) = \left(\frac{1}{2}\right)^{n-1} u(n-1)$

17. A causal LTI system is described by difference equation $y(n) = y(n-1) + y(n-2) + x(n-1)$. find unit sample response of system

18. Determine the z-transform and sketch the pole zero plot with ROC for each of the following signals

i) $x(n) = (0.5)^n u(n) - (1/3)^n u(n)$

ii) $x(n) = (1/2)^n u(n) + (1/3)^n u(n-1)$

19. find the inverse z-transform of $\frac{1}{z^2 - 1.2z + 0.2}$

20. Express the fourier transforms of the following signals in terms of $X(e^{j\omega})$

i) $x_1(n) = x(1-n)$

ii) $x_2(n) = (n+1)^2 x(n)$

21. find the z-transform and ROC of the sequence $x(n) = r^n \cos(n\theta) u(n)$

22 State and prove the following properties of z-transform

i) Linearity

ii) Time shifting

iii) Differentiation

iv) correlation

23. find the inverse z-transform of the function $X(z) = \frac{1+z^{-1}}{(1-\frac{2}{3}z^{-1})^2}$ ROC $|z| > \frac{2}{3}$

24. Determine the z transform of the following signal and plot the ROC

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

ii) $x(n) = -a^n u(-n-1)$

25 find the z-transform of the given signal $x(n)$ and find ROC.

$x(n) = \sin(\omega_0 n) \cdot u(n)$

26. find the impulse response of the Discrete time System described by difference Equation $y(n-2) - 3y(n-1) + 2y(n) = x(n-1)$

27. Discuss the block diagram representation for LTI discrete time systems