Question Bank

Signal and System:IEC-402

1. Define a signal
2. Define deterministic and random signals
3. Define step
4. Define periodic and aperiodic signals
5. Define symmetric and antisymmetric signals
6. Define energy and power signals.
7. What is the period T of the signal x(t)= 2 Cos(t/4)
8. Define continuous-time, discrete-time and digital signals.
9. What is the value of the following integral?
-? ?? x(t) ? (at-b) dt
10. What are the different types of representations of DT Signals?
11. Define a system
12. Define i) CT Signals ii) DT Signals
13. What are the classifications of systems?
14. Define Linear Time Invariant (LTI) System
15. Is the system
Y(t) = y (t-1) + 2ty(t-2) time-invariant?
16. Define static and dynamic system
17. Define a causal system.
18. What is a stable system?
19. List the basic operations on signals
20. What are the classifications of signals?
21. Define Even and Odd Signals.
22. Define CT and DT Signals.
23. Define causal and non-causal signals.
24. Define Lumped-parameters and distributed-parameter system.
25. Define causal and Non-Causal System
26. Define Linear and Non-Linear Systems.
27. Define Time-invariant and Time-variant system
28. Define stable and non-stable systems.
29. Define Invertible and non-Invertible system.
30. Define BIBO stable system.
31. List the transformations in independent variables of signals.
32. Find out the energy of the given signal
X(t) = {2|t| (?=5 secs)}
= { 0, elsewhere}
33. Sketch the function x(t)= u(t)-2u(t-2) +3u(t-4) –u(t-5).
34. Find out the x(-2t-2). Given x(t)

35. Find out x(t)=2 Cos(10t+1) – Sin(4t-1) is periodic
36. Find out the energy of the given signal x(t)m = {5. |t| < ? (?=2 secs)}
37. Sketch the function x(t) = r(-0.5t +2).
38. Find out x(-2t-2). Given x(t)

39. Find out x(t)=3 Cos(15t+1) – Sin(6t-1) is periodic.
40. Find out x(n)= 3 Cos [2n/3] is periodic
41. Define impulse function and state its properties.
42. Given y(t)= x(t-1) Find out whether the system is causal.
43. Classify the following signal as a) periodic or non periodic, energy or power signal
i. e?t , ? > 1
ii. e-j2?ft
44. Is a diode linear device? Give your reason.
45. A Signal x(t)= cos2?t is passed through a device whose input output is related by y(t)= x2(t), what are the frequency components in the output.
46. Draw the waveform x(-t) & x(2-t) of the signal
i. X(t)= { t 0 < = t <=3
1 t > 3
47. What is the total energy of DT signal x[n] which takes the values of unity at n=-1 , 0 & 1?
48. Is the following system invertible y(t)=x2(t)
49. Check whether the following system is linear or causal y(t) =x(t2)
50. Determine the energy and power of the signal A ej?o n
51. When a discrete time system is BIBO stable.

Part-B

1.List the classifications of signals. Explain them.
2.List the classifications of systems. Explain them.
3.List the basic operations on signals. Explain them.
4.Sketch the following signals
(i) r (t) - 2r (t-1) + r (t-2)
(ii) ? (t- ½)
5. Sketch the following signals
(i) r (t) u (2-t)
(ii) ? (t-1)/2 + ? (t-1)
6. Sketch the following signals
(i) r (-0.5t+2)

(ii) u (t)-u (t-2)

7. Find the even and odd components of the following signals.

(i) x (t) = sin t + 2sin t +2 sin2t cos t

(ii) x(t) = { 1,0,-1,2,3 }

8. Find which of the following signals are energy signals or power signals

(i) x(t) = e -3t u (t)

(ii) x(n) = cos (?/4)n

9. Explain how CT signals are represented using impulses.

10. Explain how DT signals are represented using impulses.

11.Check whether the given system is stable or dynamic,
linear or non-linear,
causal or non-casual,
time-invarient or time –varient
y(t) d2y(t)/dt2 + 3tdy(t)/dt+y(t) = x(t)

12.Check whether the given system is stable or dynamic,
linear or non-linear,
causal or non-casual,
time-invarient or time –varient
d3y(t)/dt3+4d2y(t)/dt2 + 5dy(t)/dt+2y2(t) = x(t)

13.Check whether the given system is stable or dynamic,
linear or non-linear,
causal or non-casual,
time-invarient or time –varient
y(n)=x(n) x(n-1)

14. Verify the linearity , causality and time invariance of the system
y(n+2) = ax(n+1) + bx(n+3)

15. What is the periodicity of the signal x(t) = sin 100 ? t + cos 150 ? t

16. Given y[n] = x[n] +1/8 x[n-1]+1/3 x[n-2]
find whether the system is stable or not.

17. Test whether the following system of equation represent LTI system.

(i) y(t)=t[x(t)]2

(ii) y(t)= a[x(t)] 2 +b x(t)

Unit- II

PART – A

1. Define Fourier Series.

2. What are the Dirichlet Conditions.

3. If the periodic signal x(t) having even symmetry then the Fourier expansion contain ___________ terms only.

4. The Fourier Series expansion of an odd periodic function contains ________ terms only.

5. When a periodic signal is said to have a half-wave symmetry?
6. What is the relationship between cosine and Trigonometric representation?
7. Explain time shifting property of CT Fourier Series.
8. State Parseval's Theorem for CT Fourier Series
9. The Fourier expansion of a half-wave symmetry periodic signal contains __________ harmonics.
10. List the property of CT Fourier Series.
11. How will you represent power using Fourier Series?
12. What is a single-sided spectra?
13. What is a two-sided spectra?
14. What is a line Spectrum?
15. What is a Gibb's Phenomenon?
16. Define Fourier Transform of a Signal x(t).
17. Define Inverse Fourier Transform
18. What is the condition for existence of Fourier transform of a signal x(t).
19. State Duality property of Fourier Transform.
20. State Parseval's Theorem for CT aperiodic Signal.
21. State Modulation property of Fourier Transform.
22. State Time differentiation property of Fourier Transform.
23. State Time Shifting property of Fourier Transform.
24. State Frequency Shifting property of Fourier Transform.
25. State Time Convolution property of Fourier Transform.
26. F[?(t/?)] = ----------------------
27. F[? (t/?)] = -----------------------
28. State Linearity Property of Fourier Transform.
29. State Time Reversal Property of Fourier Transform.
30. State Time Scaling Property of Fourier Transform.
31. State Frequency differentiation Property of Fourier Transform.
32. State Time Integration Property of Fourier Transform.
33. State Conjugation Property of Fourier Transform.
34. State Auto Correlation Property of Fourier Transform.
35. State Multiplication Property of Fourier Transform.
36. x(t)= Sin (4 /3t) . Find the Fourier series coefficient .
37. A Loud Speaker is driven with 10Hz – Square wave& Sine Wave which signal is audible?
38. Find out F[cos?0t]
39. Write a note on Hilbert Transform.

PART-B

1. List the properties of continuous time Fourier series and explain them.
2. List the properties of Fourier Transform and explain them.
3. Write a note on Fourier Spectrum.
4. Find the Fourier Series coefficients for the CT periodic signal.
5. Find the Fourier series for the periodic signal x(t)=t 0<t
second.

6. Find the exponential series of the following signal.

6. Find the Fourier coefficients for the CT periodic signal x(t)= 1.5 for 0<t
=-1.5 for 1<t<2
with fundamental frequency ?.

7. Find the Fourier Transform of the following and sketch the magnitude and phase spectrum.
(i) x(t)=?(t)
(ii) x(t)=e-at u(t)

8. Find the inverse Fourier Transform of the following
(i) ?(?)
(ii) ?(?-?o)

9. Find the Fourier Transform of the following
(i) x(t)=cos ?ot
(ii) x(t)=sin ?ot

10. Find the Fourier Transform of the following
(i) e at u(-t)
(ii) te-at u(t)

11. Find the Fourier Transform of the following
(i) e j?o t u(-t)
(ii)cos ?ot u(t)

12. Prove F[Sin(?o t) u(t)] = {?o /(?o 2 - ?2)}+ (?j/2)[?(?+?o)- ?(?-?o)]
13. Find the Fourier Transform of x(t)=1-e-?t? cos ?ot
14. Find the inverse Fourier Transform of the following
(i) j?/(3+j?)2
(ii)e -???

Unit – III
Part – A

1. Define region of convergence of a Laplace transform.

2. What is the conditions for existence of Laplace transform?
3. How to obtain Fourier transform from its Laplace transform?
4. Find the Laplace transform of e-at u(t).
5. State bilateral and unilateral Laplace transform.
6. State the conditions for a region of convergence of a i) Causal signal b) non-causal.
7. State initial value theorem of Laplace transform.
8. State final value theorem of Laplace transform.
9. State frequency convolution.
10. Find initial value, if they exists using Laplace transform for S + 5/S2 + 3S + 2.
11. State time shifting properly of Laplace transform.
12. State inverse Laplace transform.
13. Define total response of a system.
14. Define steady state and transients response.
15. What is the laplace transform of a zero state response?
16. Derive the transfer function of a ideal differentiator using laplace transform
17. Define poles and zeros of a transfer function.
18. What is the condition for the stability of a system?
19. What is the relation between Fourier transform and laplace transform.
20. Define state of a system.
21. Define convolution integral of 2 signals.
22. Define step response of an LTI – CT system using convolution integral.

23. Say whether the following system with impulse response h(t) is stable or not
i) h(t) = t e-t u (t) ii) h(t) = e-2t u (t-1)
24. Find the step response of the system. Whose impulse response is given by h(t) = t u (t).
25. How can an arbitrary signal out can be represented as a linear combination of a scaled and shifted impulse functions.
26. What is the condition for a LTI CT system to be causal?
27. State duality property of Fourier transform.
28. State modulation property of Fourier transform.
29. Find the frequency response of an LTI-CT system described by
30. If and LTI-CT systems frequency response is H (j ?) = a-j ? / a+j?. Find |h(j?)|, H(j?) and impulse response.
31. State time convolution property of Fourier transform.
32. Given the transform pair L [x (t)] = 2s/s2 –2. Determine the Laplace transform of x (2t).
33. Find the impulse response of H (s) = s+2/s2 + 5s + 4.
34. Find the transfer function of a ideal integrator.
35. State frequency shifting property of laplace transform.
36. Plot pole – zero diagram of the following transfer functions.
1) s+2 / s2 +2s +2 2) S + 3 / s (s2+4) (s+2) (s+1)
37. What is meant by state of a system?
38. What is need of transforms in signal analysis?
39. Represent an inductor in s-domain with zero initial conditions.
40. What is the laplace transform of t n e-at.

Part – B

1. The input and output of an LTI-CT causal system is
d2y(t)/dt2 + 6 dy(t)/dt + 8 y(t) = 2x(t)
i) What is the impulse response of the system.
ii) What is response of the system if x (t) = t-2t u(t)

2. Use convolution theorem of laplace transform find y (t) when
a) x1 (t) = e – 3t u (t) x2 (t) = u (t-2) b) x1 (t) = Cos 4t u(t) x2 (t) = sin2t u(t).

3. An LTI – CT system is described by
d2y(t)/dt2 + 5 dy(t)/dt + 6 y(t) = dx(t)/dt + 4x(t)
The input is x (t) = e –t u(t)
Find
1) Natural response for initial conditions y (0) = 3; dy (o)/ dt = 0
2) Forced Response 3) Total Response.

4 a) Find whether the system is stable or not.
a) h (t) = sin wot u (t).
b) Find step response of h (t) = (t) – (t-1)
c) Find convolution for x1 (t) = sin u (t) ; x2 (t) = u (t)

5. Using graphical procedure fine the convolution of the following signals
x1 (t)= = e- 2t u (t); x2 (t) = u (t+2)

6. For a transfer function H (s) = S+10/ s2 + 3s + 2.
Find the response due to input x (t) = Sin2(t) u (t).

7. Find the frequency response of the RC circuit shown

Plot the phase response for RC =1 (use Fourier transform.)

8. Find the time domain signal x (t) given X(s) =2s+1/ (s+1) (s2+2s+2).
9. Using laplace transform solve the following differential equation
D3y(t)/dt3 + 6 d2y(t)/dt2 + 16 dy(t)/dt +12y(t) = x(t)

10. Using graphical convolution procedure find the output of the system. Given
x (t) = u (t-3) – u (t-5);

h(t) = e- 3 t u (t)

UNIT-IV

Part - A

1. Define DTFT
2. State the condition for existence of DTFT
3. State the time shift property of DTFT.
4. State the scaling property of DTFT.
5. What is convolution in DTFT?
6. State Parsavel’s theorem.
7. Find the fourier transform of the unit sample x[n] = d[n].
8. Write any two properties of DFT.
9. What is linear convolution?
10. what is circular convolution?
11. Define a unilateral Z transform
12. Mention the four different methods used to obtain inverse Z transform.
13. What is a region of convergence?
14. State the convolution property of Z transform.
15. What is the Z transform of A d[n-m]?
16. State modulation theorem.
17. State correlation theorem.

Part – B

1. Write the properties of DTFT.
2. Find the fourier transform of x[n] = an u[n] for -1<a<1.
3. Determine the fourier transform of the discrete time rectangular pulse of amplitude A and length L i.e x[n] = A for 0= n=L-1

0 otherwise

4. Determine the discrete time sequence where DTFT is given as

X(w) = 1 for –wc = w = wc

0 for wc < | w | < ?

5. Determine the fourier transform of unit step sequence x[n] = u[n].
6. Compute the DFT of the following sequence x[n] = { 0,1,2,3}
7. Compute the 8 point DFT of the following signal x[n] = { 1,1,1,1 }
8. Compute the N-point DFT of x[n] = an for 0<n<n-1
9. Write the properties of DFT
10. State and prove convolution theorem of Z transform
11. Find the inverse Z transform of

2Z

F(Z) = ---

Z2+ 2Z +1
12. What is the inverse Z transform of 1/(1-az-1)
13. State and prove the time delay theorem of z transform.
14. Find the z transform of the following and determine ROC x[n] = {8,3,-2,0,4,-6}

15. Find the DTFT of the following
(i) x[n] = {1,-1,2,2 }
(ii) x[n] = 2n u[n]
(iii) x[n] = (0.5) n + 2 –n u[-n-1)
16. Find the frequency response of the following causal system
y[n] = ½ x[n] +x[n-1] + ½ x[n-2]
17. Find the IDFT of the following
X[k] = { 1,-1,-j2,-1,1+j2 }
X[k] = { 1,0,1,0}
18. Find the circular convolution of the following sequence
X1 [n] = { 1,-1,2,3}
X2[n] = {0,1,2,3}
19. Find the Z transform of the following sequence
x[n] = u[n] – u[n-3]
x[n] = {1,2,-1,2,3}

UNIT-V

PART-A

1. Why FFT is needed?
2. What is the main advantage of FFT?
3. What is meant by radix-2 FFT?
4. How many multiplications and additions are required to compute N-point DFT using radix-2 FFT?
5. What is a twiddle factor?
6. What is DIT algorithm?
7. What is DIF algorithm?
8. How we calculate IDFT using FFT algorithm?
9. What are the applications of FFT algorithm?
10. Find the system function and impulse response of the system described by the difference equation y(n)=1/5y(n-1) + x(n).
11. Define System function.
12. Find the convolution of the following using z-transform
a. x(n) = {1,2,1 } h(n)= {1,1,1}
13. What are the different types of structures for realization of IIR systems?
14. What is the main advantage of direct-form II realization when compared to direct-form I realization?
15. Distinguish between recursive realization and non-recursive realization.
16. Draw the parallel form structure of IIR filter.
17. Define the terms i) natural response ii) forced response.

18. Define the impulse response and step response of a system.
19. What are the properties of convolution?
20. Find the convolution of x(n)= { 1,-2,3,1} and h(n) = {2, -3 ,2}.
21. How do you represent a discrete –time signal in terms of impulses.
22. Represent the sequence x(n) = {3,2,-1,2,4,1} as sum of shifted unit impulses.
23. what is meant by zero input response and zero state response?
24. Define convolution sum.
25. Test if the following system are stable or not.
Y(n) = cos x(n)
26. How can you find the step response of a system if the impulse response h(n) is known?
27. Find the step response if the impulse response is given by (-a)nu(n).
28. Define frequency response of a discrete –time system.
29. What are the properties of frequency response H (ej?) of an LTI system?
30. Define FIR and IIR system.

PART-B

1. Find the natural response of the system described by difference equation
Y(n) – 1.5y(n-1) + 0.5 y(n-2) = x(n) , y(-1) = 1 ; y(-2) = 0
2. Find the forced response of the system described by the difference equation
Y(n) – 1.5y(n-1) + 0.5 y(n-2) = x(n), for input x(n) = 2n u(n).
3. Determine the impulse response h(n) for the system described by the second-order difference equation
y(n) = 0.6 y(n-1) -0.08 y(n-2) + x(n)

4. Determine the impulse response h(n) for the system described by difference equation
y(n) + y(n-1) -2 y(n-2) = x(n-1) + 2x(n-2)

5. Determine the step response of the system described by difference equation
Y(n) +4y(n-1) + 4y(n-2) = x(n)

6. Determine the response y(n),n = 0 , of the system described by the second order difference equation
y(n) -3y(n-1) -4y(n-2) = x(n) +2x(n-1) to the input x(n)= 4nu(n).

7. Find the solution of a linear constant coefficient difference equation
Y(n) – 3/2 y(n-1) +1/2 y(n-2) = (1/4)n for n=0
With initial conditions y(-1) =4 and y(-2) =10.

8. Determine the convolution sum of two sequences
X(n)= (1,4,3,2) h(n) = (1, 3, 2,1)

9. Determine the output response of the following sequence
X(n) = 2d(n+1) – d(n) + d(n-1) + 3 d(n-2)
H(n) = 3d(n-1)+4 d(n-2) +2 d(n-3)

10. Find the convolution of two infinite duration sequences
H(n) = anu(n) for all n, x(n) = bnu(n) for all n
i). when a?b ii). When a=b

11. Find the DFT of a sequence x(n)={1,2,3,4,4,3,2,1} using DIT & DIF algorithm.
12. Compute 4-point DFT of a sequence x(n)={0,1,2,3} using DIT,DIF algorithm.
13. Compute IDFT of a sequence
X(k)={7,-0.707-j0.707,-j,0.707-j0.707,1,0.707+j0.707,j,-0.707+j0.707} using DIT& DIF algorithm.
14. Find the system function and the impulse response of the system described by the difference equation
y(n) = x(n) +2x(n-1) – 4x(n-2) + x(n-3).
15. Determine the pole-zero plot for the system described by difference equation
y(n) – ¾ y(n-1) +1/8y(n-2) = x(n) –x(n-1).
16. Determine the direct form I & direct form II for the given system
y(n) = 1/2y(n-1) -1/4y(n-2) + x(n) +x(n-1).
17. Realize the system with difference equation y(n) = 3/4y(n-1) -1/8y(n-2) +x(n) +1/3x(n-1) in cascade form.
18. Realize the system given by difference equation
y(n) = -0.1y(n-1) +0.72y(n-2) + 0.7x(n) -0.252x(n-2) in parallel form.

19. Find the impulse response and step response for the following system.
y(n) -3/4 y(n-1) + 1/8 y(n-2) = x(n)
y(n) = x(n) + 2x (n-1) -4 x(n-2) +x(n-3) in z-transform.
20. Find the frequency response of a I order system described by difference equation
Y(n) = ay(n-1) +x(n) plot the magnitude and phase response of a system whose impulse response h(n) = an u(n) for a=0.5.
21. A causal system is represented by the following difference equation y(n) +1/4 y(n-1) = x(n) + ½ x(n-1) a).Find the system function H(z) and give the corresponding region of convergence. b). Find the unit sample response of the system. C). Find the frequency response H(ej?) and determine its magnitude and phase.
22.Find the output of the system whose input and output are related by y(n) = 7y(n-1) – 12 y(n-2) + 2x(n) – x(n-2) for the input x(n) = u(n).

</n<n-1
</a<1.
</t<2
</t</t