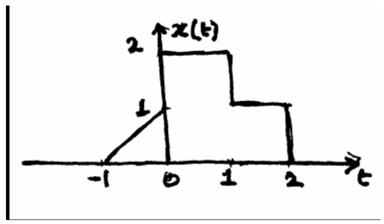
QUESTION BANK SIGNALS AND SYSTEMS
(4th SEM ECE)

1. For the signal shown in Fig. 1, find $x(2t+3)$.



i. Fig. 1

2. What is the classification of the systems?
3. What are the Dirichlet's conditions of Fourier series?
4. State convolution property of Fourier transform.
5. What is the Laplace transform of the function $x(t) = u(t) - u(t-2)$?
6. What are the transfer functions of the following?
   (a) An ideal integrator
   (b) An ideal delay of T seconds.
7. What is an anti–aliasing filter?
8. State Parseval's relation for discrete–time aperiodic signals.
9. What is the z-transform of the sequence $x(n) = a^n u(n)$?.
10. Define system function.
11. State Parseval's power theorem.
12. Define Fourier Transform.
13. Define transform function.
14. Define Laplace transform.
15. What is Region of convergence (ROC)?
16. Define transform function.
17. Define Laplace transform
18. Find the Fourier transform of function x(t)=d(t)
19. write the major classification of signals.
20. Define periodic and non-periodic signals.
21. Explain even and odd signals with help of examples.
22. Define energy and power signals.
23. Define following terms:

(a) Unit ramp

(b) Unit step

(c) Unit impulse

24. Properties of even and odd signals.
25. PROPERTIES OF LINEAR TIME-INVARIANT SYSTEMS
26. Define poles and zeros of a transfer function.
27. Define (i)steady state response(ii)Transient response.
28. What are the transfer functions of the following?
29. What is the condition for stability of a system?
30. What are the different types of realizations?
31. Write about elementary continuous–time signals in detail.
32. State and prove parseval's theorem.
33. State condition for periodicity of a signal.
34. Continuous real and complex exponential signal.
35. Discrete time real and complex exponential signal.
36. Give the following signals.

    (i) 2cos3_t + 3sin _t

    (ii) e5t u(t)

    (iii) 2sin2t + 2cos _ (t)

    (iv) et u(t)
37. Identify energy signal and power signal and calculate their energies and their average power.
38. *Draw the waveforms represented by following step functions.*

    (i) $f_1(t) = 2\,u(t-1)$

    (ii) $f_2(t) = -2\,u(t-2)$

    (iii) $f(t) = f_1(t) + f_2(t)$

    (iv) $f(t) = f_1(t) - f_2(t)$
39. *Draw the waveforms represented by following step functions.*

    (i) $f_1(t) = (t-1)\,u(t-1)$

    (ii) $f_2(t) = -(t-2)\,u(t-2)$

    (iii) $f_3(t) = -u(t-2)$

    (iv) $f_4(t) = f_1(t) + f_2(t)$

40. (v) $f_5(t) = f_4(t) + f_3(t)$

e 1.4.4: *Prove the following*

(i) $\delta(n) = u(n) - u(n-1)$

(ii) $u(n) = \sum_{k=-\infty}^{n} \delta(k)$

(iii) $u(n) = \sum_{k=0}^{\infty} \delta(n-k)$

41. *1. Determine whether the following signals are energy signals or power signals and why ?*

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

ii) $x(t) = A(1+t) \quad$ *for* $-1 < t < 0$

$\quad = A(1-t) \quad$ *for* $0 < t < 1$

iii) $x(t) = \sin \omega_1 t + \cos \omega_2 t$

2. A rectangular pulse is determined as $A \operatorname{rect}\left(\frac{t}{\tau}\right)$ *i.e.,*

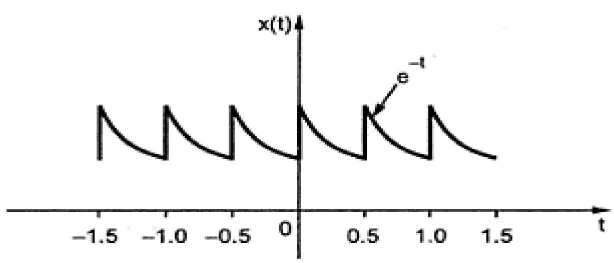
$$x(t) = A \quad \text{for } |t| \leq \frac{\tau}{2}$$

$$= 0 \quad \text{elsewhere}$$

42. *Find out energy of this pulse and state whether it is energy or power signal.*

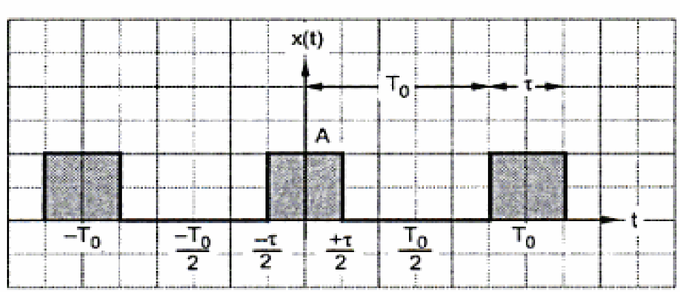
43.

Find Quadrature Fourier series for the periodic signal $x(t)$ *of Fig.*



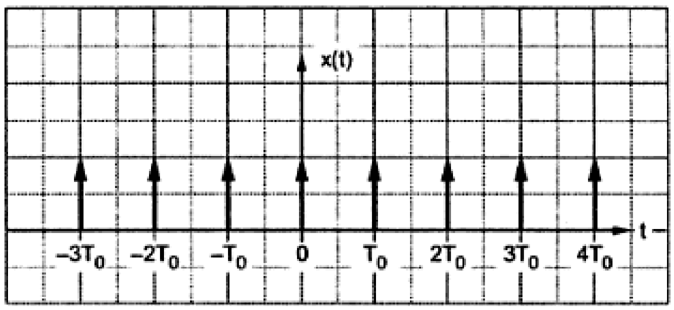
44.

Find out the exponential Fourier series and plot the magnitude and phase spectrum for the rectangular pulse train shown in Fig.



45.

Find out the exponential Fourier series for the impulse train shown in Fig. ¯ ¯ ¯ ***Also plot its magnitude and phase spectrum.***



46. Determine whether the following systems are linear or not.
47. Determine whether the following systems are time–invariant or not?
48. Find the trigonometric Fourier series for the periodic signal shown in Fig. 2.

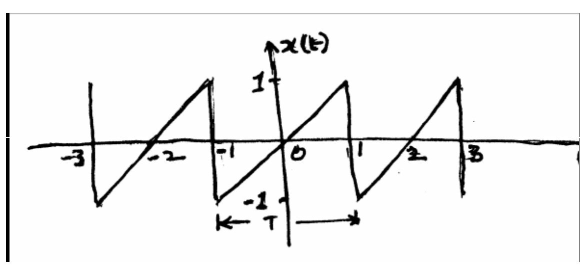
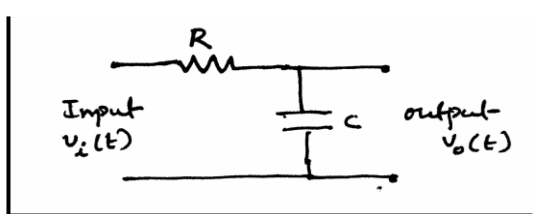


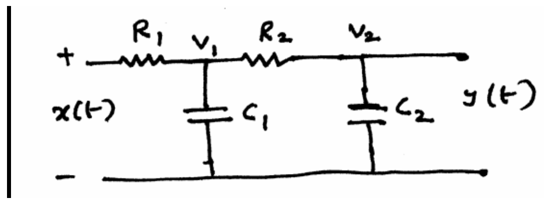
Fig. 2

49. Find the impulse response of the system shown in Fig. 3.



50. For the circuit shown in Fig. 4, obtain state variable equation. The input voltage source is $x(t)$ and

the output $y(t)$ is taken across capacitor C.



51. Determine the Nyquist sampling rate and Nyquist sampling interval for the signal $x(t)=\sin c^2(200\pi t)$.
52. Determine the z-transform of the signal x(n)= sin ω0 nu(n) .
53. State and prove time shifting property of discrete–time Fourier Transform.
54. State and prove convolution property of z-transform.
55. Find the impulse and step response of the following system :
    y(n)+y(n-1)+y(n-2)=x(n)
56. Obtain the cascade and parallel form realization of the following system.
    y(n) + y(n - 1) +y(n - 2)=x(n) + 3x(n -1) + 2x(n-2)
57. State and prove properties of DTFT.
58. Find the DTFT of x(n)={1,1,1,1,1,1,0,0}.
59. Find the convolution of x1(n)={1,2,0,1} , x2(n)={2,2,1,1}
60. State and prove the sampling theorem.
61. Derive the Lowpass sampling theorem.
62. Find the z-transform of x(n)= an u(n) and for unit impulse signal.
63. Give the relationship between z-transform and Fourier transform.
64. Determine the inverse z transform of the following function
    x(z)=1/(1+z-1) (1-z-1)2 ROC : |Z>1|
65. Discuss the classification of DT and CT signals with examples.
66. Discuss the classification of DT and CT systems with examples.
67. Find whether the following signals are periodic or not
    I. x(t)=2cos(10t+1)-sin(4t-1)
    II. x(t)=3cos4t+2sint
68. For the systems represented by the following functions. Determine whether every
69. system is (1) stable (2) Causal (3) linear (4) Shift invariant
    (i) T[x(n)]= ex(n) (8)
    (ii) T[x(n)]=ax(n)+6
70. Explain about the classifications of continuous time system.
71. The input and output of a causal LTI system are related by the differentia equation,
    d2y(t)/dt2+6dy(t)/dt+8y(t)=2x(t) (8)
    i) Find the impulse response of the system.
    ii) What is the response of this system if x(t) = t e-2t u(t)
72. Explain the Classification of signals with examples
73. Define discrete time unit step &unit impulse.
74. Find the energy of the signal x(n) = (½) nu(n)
75. Find the odd and even components of the x(n)={1,2,2,3,4}.
76. Find the energy of the signal e-2tu(t).
77. Find the power and rms value of signal x(t)=20cos2πt.

78. Find the trigonometric fourier series representation of a periodic square wave

x(t) = 1, for the interval (0 , π).

= 0,for the interval (π , 2π)

79. Draw and explain the following sequences:

I. Unit sample sequence

II. Unit step sequence

III. Unit ramp sequence

IV. Sinusoidal sequence and

V. Real exponential sequence

80. Compute the convolution of the following signals

x(n) = {1,0,2,5,4} h(n) = {1,-1,1,-1}

h(n) = {1,0,1} x(n) = {1,-2,-2,3,4}

↑ ↑

81. Find the convolution of the two signals

x(n) = 3nu(-n); h(n) = (1/3)nu(n-2)

x(n) = (1/3) –nu(-n-1); h(n) = u(n-1)

x(n) = u(n) –u(n-5); h(n) = 2[u(n) – u(n-3)]

82. State initial value theorem.

83. Find the z-transform and ROC of the causal sequence.

X(n) = {1,0,3,-1,2}

84. Find the z-transform and ROC of the anticausal sequence

X(n) = {-3,-2,-1,0,1}

85. Determine the z-transform and ROC of the signal

I. x(n) = anu(n) and

II. x(n) = -bnu(-n-1)

86. Find the stability of the system whose impulse response h(n) = (2)nu(n)

87. Determine the z-transform of x(n) = cos ωn u(n)

88. State and prove the following properties of ztransform.

i) Time shifting

ii) Time reversal

iii) Differentiation

iv) Scaling in z-domain

89. Determine the inverse z-transform of

x(z) = (1+3z-1) / (1+3z-1+2z-2) for z >2

90. Compute the response of the system

y(n) = 0.7y(n-1)-0.12y(n-2)+x(n-1)+x(n-2) to input

x(n) = nu(n).Is the system is stable?

91. Find the inverse z-transform of x(z) = (z2+z) / (z-1)(z-3), ROC: z > 3. Using (i) Partial fraction method, (ii) Residue method and (iii) Convolution method.

92. Determine the unit step response of the system

93. whose difference equation is

$y(n)-0.7y(n-1)+0.12y(n-2) = x(n-1)+x(n-2)$ if $y(-1) = y(-2) = 1$

94. Find the input x(n) of the system, if the impulse response h(n) and the output y(n) as shown below.

95. $h(n) = \{1,2,3,2\}$ $y(n) = \{1,3,7,10,10,7,2\}$

96. Determine the convolution sum of two sequences $x(n) = \{3,2,1,2\}$, $h(n) = \{1,2,1,2\}$ (8)

97. Find the convolution of the signals

$x(n) = 1$ $n = -2,0,1$

$= 2$ $n = -1$

$= 0$ elsewhere

$h(n) = \delta(n)-\delta(n-1)+ \delta(n-2)- \delta(n-3)$

98. Determine the inverse z-transform of $x(z) = (1+3z-1) / (1+3z-1+2z-2)$ for $z >2$

99. Find the inverse z-transform of $x(z) = (z2+z) / (z-1)(z-3)$, ROC: $z > 3$. Using (i) Partial fraction method, (ii) Residue method and (iii) Convolution method.

100. (a) Using DIT-FFT algorithms find DFT of $x(n)=\{0,1,2,3,4,5,6,7\}$?

(b) State and prove the convolution and multiplication property of DFT?