Code No: 183CC

R22

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year I Semester Examinations, February - 2024
SIGNALS AND SYSTEMS
(Common to ECE, EIE)

Time: 3 Hours **Max. Marks: 60**

Note: This question paper contains two parts A and B.
i) **Part- A** for 10 marks, ii) **Part - B** for 50 marks.
- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of **ten questions** (numbered from 2 to 11) **carrying 10 marks each**. From each unit, there are two questions and the student should answer one of them. Hence, the student should answer five questions from Part-B.

PART – A

(10 Marks)

1.a)	State the two properties of unit impulse function.	[1]
b)	State and explain the Dirichlet's conditions.	[1]
c)	Define exponential Fourier series.	[1]
d)	What is the practical use of the Hilbert transform?	[1]
e)	What is a convolution of signals?	[1]
f)	Final value theorem is for sequence x[n] is given by _____.	[1]
g)	Find the Laplace Transform for the signal $x(t)= -5e^{8t} u(t)$.	[1]
h)	Find the Z-transform and ROC for the signal $x(n) = a^n u(n)$.	[1]
i)	Define autocorrelation.	[1]
j)	Define Normalized energy and Energy spectral density.	[1]

PART – B

(50 Marks)

2.a) Prove the Orthogonality condition in the case of a signal represented by orthogonal signal space consisting of exponential functions, $\{ e^{jnw_0 t} \}$ for 'n' integer.

b) Find the odd and even components of the signal cost + sint + cost sint. [5+5]

OR

3.a) A function f(t) is defined rectangular pulse given by:

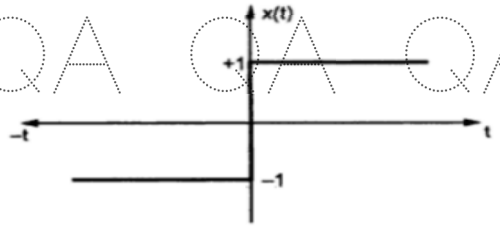
$$f(t) = \begin{cases} 1 & 0 < t < \pi \\ -1 & \pi \leq t < 2\pi \end{cases}$$

Approximate above function by a finite series of Sinusoidal functions

b) Define and derive the expression for evaluating mean square errors and its types. [5+5]

4.a) Compute the Fourier transform of each of the following signals i) $\left(\frac{sin\pi t}{\pi t}\right)$ $ii)$ $\left(\frac{sin2\pi t}{2\pi t}\right)$

b) Find the Fourier Transform of the Signum function shown in figure. [5+5]



OR

5.a) Obtain the Fourier series representation of an impulse train given by

$$x(t) = \sum_{n=-\infty}^{\infty} \delta(t - nT_0).$$

b) Derive the Fourier transform of
i) $x(t) = e^{-at} \text{Sin}(\omega t)u(t)$.
ii) $x(t) = e^{-at} \text{Cos}(\omega t)u(t)$. [5+5]

6.a) Find the convolution of following functions

x(t)= 1 -3<t<t h(t)= 2 0<t<3
0 otherwise 0 otherwise

b) The unit impulse response h[n] of a DT LTI system is $h[n]=1/5^n u[n]$. Use convolution to compute the system's response to the input $x[n]=u[-n-3]$. [5+5]

OR

7.a) Explain the characteristics of ideal LPF, HPF and BPF.

b) Compute the response of an LTI system described by its impulse response

$$h[n] = \begin{cases} \alpha^n, & 0 \le n \le 6 \\ 0, & otherwise \end{cases}$$ to the input signal $$x[n] = \begin{cases} 1, & 0 \le n \le 4 \\ 0, & otherwise \end{cases}$$

[5+5]

8.a) Derive the relationship between Laplacian transform and Fourier Transforms.

b) Determine the discrete time sequence associated with Z transform given below using power series method: $X(z) = (1-(1/2)z^{-1})/ 1+(1/2)z^{-1}$ with ROC $|z| > 1/2$. [5+5]

OR

9.a) Determine the Laplacian transform and ROC of signal $x(t) = -e^{-at} u(-t)$.

b) Find the Z transform and ROC of the sequence $x(n) = r^n \cos(n\theta)u(n)$. [5+5]

10.a) A filter with $H(\omega) = 1/1+j\omega$ is given an input $x(t) = e^{-2t} u(t)$. Find Energy density spectrum of the output.

b) Determine the convolution by graphical method for $y(t)=h(t)*f(t)$ if $h(t)=e^{-t}u(t)$ and $f(t)= e^{-2t}u(t)$. [5+5]

OR

11.a) Determine the Nyquist sampling rate and Nyquist sampling interval for the signals.
i) sinc(100πt)
ii) sinc2(100πt)
iii) sinc(100πt) + sinc(50πt)
iv) sinc(100πt) + 3 sinc2(60πt)

b) Explain Natural and flat-top sampling. [5+5]

---ooOoo---