Code No: R1621043 **R16** SET - 1

II B. Tech I Semester Regular/Supplementary Examinations, October/November - 2019
SIGNALS & SYSTEMS
(Com to ECE, EIE and ECC)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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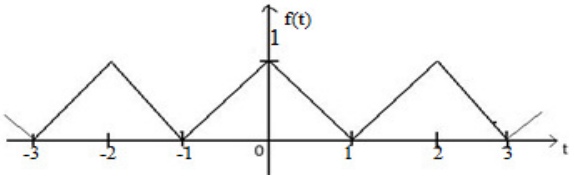
PART –A

1. a) What is an orthonormal vector space? (2M)
   b) State the sufficient condition for existence of Fourier transform. (2M)
   c) What is aliasing? (2M)
   d) What is the response for an input f(t) of a distortion less transmission system. (2M)
   e) Find the ROC of a function $e^{-at}u(t) + e^{-bt}u(-t)$ for i)a<b ii) a>b (3M)
   f) What is z transform of sequence $X(n)=a^n u(n)$ (3M)

PART -B

2. a) Define the error function while approximating signals and hence derive the expression for condition for orthogonality between two waveforms $f_1(t)$ and $f_2(t)$ (7M)
   b) Determine whether the systems described the i/p o/p equations are linear, time invariant, dynamic and stable. (7M)
      i) $y_1(t) = x(t-3) + (3-t)$
      ii) $y_2(t) = \frac{dx(t)}{dt}$
      iii) $y_2(n) = nx[n] + bx^2[n]$

3. a) Find the exponential Fourier series for the following periodic function. (7M)



   b) Prove that the set of exponentials 1, $e^{\pm jwot}$, $e^{\pm j2wot}$, $e^{\pm j3wot}$ ... is orthogonal over interval T_o. (7M)

4. a) The signal x(t) = 6 cos 10πt is sampled by an impulse train with sampling frequency 7 Hz and 14 Hz. Draw the spectra of original and sampled signals. (8M)
   b) Explain the different types of Sampling techniques. (6M)

5. a) Find the impulse response of the discrete time system described by the difference equation (8M)
   y(n-2)-3y(n-1)+2y(n)=x(n-1)
   b) Obtain the relationship between bandwidth and rise time. (6M)
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6. a) Determine the initial value and final value of signal x(t) whose Laplace Transform is, (7M)

$$X(s) = \frac{2s+5}{s(s+3)}$$

b) Briefly explain the Constraints on ROC for various classes of signals (7M)

7. a) State and prove the following two properties of Z- transform: (6M)
   (i) Time convolution
   (ii) Differentiation in Z-domain

b) Determine the transfer function and impulse response for the causal LTI system described by the equation using Z transform (8M)
Y(n) – 1/4y(n-1)-3/8y(n-2) = -x(n) + 2x(n-1)

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PART –A

1. a) Is y(t) = x (-t), a causal or non-causal system (2M)
   b) Find The Fourier Transform of Signum function (2M)
   c) Give the poly wiener criterion. (2M)
   d) List out the properties of Auto Correlation function (2M)
   e) Determine the Laplace transform of the signal X(t)=u(t-2)-u(t-3) (3M)
   f) Derive the relation between Fourier and Z transforms (3M)

PART -B

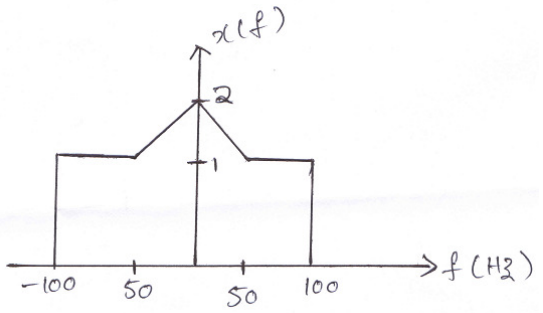
2. a) Discuss the Orthogonal Signal Space and obtain the expression for mean signal error. (6M)
   b) Check whether the following are periodic. (8M)

$$x[n] = \sin\left(\left(\frac{6\pi n}{7} + 1\right)\right)$$

$$x(n) = e^{\int 3\pi/5(n+\frac{1}{5})}$$

3. a) State and prove, time differentiation and integration property of Fourier Transform. (7M)
   b) Obtain the fourier transform of x (t) = A cos $2\pi f_c t$ and also plot the amplitude spectrum. (7M)

4. a) State and prove sampling theorem for band limited signals. How the recovered signal will differ in amplitude if samples are taken by natural and flat top sampling. (7M)
   b) A signal x(t), whose spectrum shown in figure is sampled at a rate of 300 samples/second. What is the spectrum of the sampled discrete time signal? (7M)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5. a) What is linear time invariant system? Discuss the impulse response of LTI system and show that for LTI output y(t) = h(t) $\otimes$ x(t), where x(t) is input and h(t) is the system response (7M)

   b) What is meant by distortionless transmission? What are the different types of distortions in linear systems? Explain each one in brief. (7M)

6. a) State and prove Differentiation and integration properties of Complex Fourier Transform. (6M)

   b) Find the Laplace Transform for the following functions (8M)

   i) $e^{-at}u(t) + e^{-bt}u(t)$ ii) S ln $(\frac{S+a}{S+b})$

7. a) State and prove the following properties of z-transform: (6M)
   (i) Time reversal (ii) Conjugation

   b) Using the power series expansion techniques, find the inverse Z – transform of the following x(z). (8M)

   (i) x(z) = $\frac{Z}{2z^2-3z+1}$ $|z| < \frac{1}{2}$

   (ii) x(z) = $\frac{Z}{2z^2-3z+1}$ $|z| > 1$

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2. Answer **ALL** the question in **Part-A**
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PART –A

1. a) Define Signal. What are the classification of Signals (2M)
   b) State Parseval's theorem of Fourier series (2M)
   c) Explain about impulse sampling (2M)
   d) Determine the convolution of the signals X(n)={2,-1,3,2} & h(n)={1,-1,1,1} (3M)
   e) What is the condition for Laplace transform to exist (2M)
   f) What is the Z-transform of sequence $x(n)=a^n u(n)$? (3M)

PART -B

2. a) Check whether the following are periodic. (8M)

$$x[n] = \sin\left(\left(\frac{6\pi n}{7} + 1\right)\right)$$

$$x(n) = e^{\int 3\pi/5(n+\frac{1}{5})}$$

   b) Explain the procedure for the approximation of the function by a set of mutually orthogonal functions and derive an expression for minimum mean square error? (6M)

3. a) Define Fourier series of signal f(t). Derive the Relationship between various types of Fourier series representations. (7M)
   b) Prove the Fourier Transform of a unit impulse train is its own transform (7M)

4. a) Discuss about effects of under sampling and oversampling (7M)
   b) State and Prove the sampling theorem for Band limited signals. (7M)

5. a) Explain the characteristics of an ideal LPF. Explain why it can't be realized. (6M)
   b) What is linear time invariant system? Discuss the impulse response of LTI system and show that for LTI output y(t) = h(t) $\otimes$ x(t), where x(t) is input and h(t) is the system response (8M)
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6. a) State and prove convolution theorem in Laplace domain. (6M)

   b) Find the Laplace transform of the periodic rectangular wave shown in Figure.1. (8M)

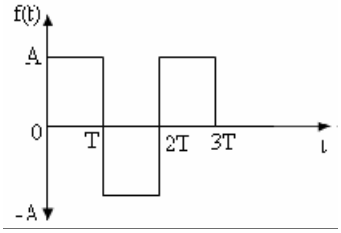

Figure 1.

7. a) List the properties of ROC for Z-transforms (6M)

   b) Find the Inverse z transform of $X(z) = \frac{\left(3+\frac{11}{2}z^{-1}+7z^{-2}\right)}{\left(1-\frac{1}{2}z^{-1}\right)(1+2z^{-1}+4z^{-2})}$ using Partial fraction expansion method. (8M)

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2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1.	a)	Give the mathematical and graphical representation of continuous time and Discrete time impulse function.	(2M)
	b)	Write the Derichlet's conditions to obtain Fourier series representation of any signal	(2M)
	c)	Explain about Band pass sampling	(2M)
	d)	Write down the convolution integral to find the output of the CT systems	(2M)
	e)	What are the Laplace transform of δ(t) and u(t)?	(3M)
	f)	Find the relationship between Laplace Transform and Z-Transform	(3M)

PART -B

2.	a)	Determine whether the following systems are time invariant or not. Check whether the systems are causal or not. $y(t) = tx(t)$ $y(n) = x(2n)$	(8M)
	b)	Explain about orthogonality in complex functions.	(6M)
3.	a)	Define Fourier series of signal f(t) .Derive the Relationship between various types of Fourier series representations	(7M)
	b)	State and derive the Fourier transform of $f(t) = e^{-\|at\|}$	(7M)
4.	a)	Explain the frequency domain description of sampler.	(7M)
	b)	Explain the differences among different sampling technique.	(7M)
5.	a)	Explain how input and output signals are related to impulse response of a LTI system.	(8M)
	b)	Explain the characteristics of an ideal HPF and BPF	(6M)
6.	a)	Determine the function of time x(t) for each of the following laplace transforms and their associated regions of convergence. i. (s+1)2 s2−s+1 Re {S} > ½ ii. s2−s+1 (s+1)2 Re {S} > −1	(8M)
	b)	State the properties of the ROC of L.T.	(6M)
7.	a)	State and Prove the initial and final value theorem of z-transform	(7M)
	b)	Find the inverse Z- transform of $x(z) = \frac{1+3z^{-1}}{1+3z^{-1}+2z^{-2}}$	(7M)
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