Code No:A109210402 | R09 | SET-1

B.Tech II Year - I Semester Examinations, December 2011
SIGNALS AND SYSTEMS
(COMMON TO ECE, EIE, BME, ETM, ICE)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

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1.a) Derive the expression for component vector of approximating the function $f_1(t)$ over $f_2(t)$ and also prove that the component vector becomes zero if the $f_1(t)$ and $f_2(t)$ are orthogonal.

b) A rectangular function 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 *sin*t over the interval (o, 2π) such that the mean square error is minimum. [15]

2.a) List out all the properties of Fourier Series

b) Obtain the trigonometric Fourier series for the half wave rectified sine wave shown in Figure.1. [15]

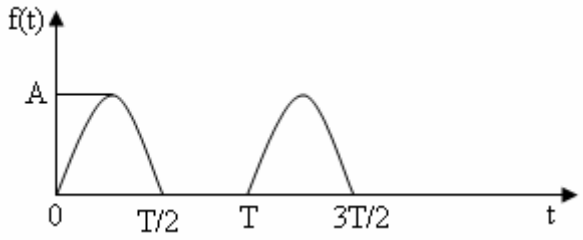

Figure.1

3. Determine the Fourier transform for the double exponential pulse shown in Figure.2. [15]

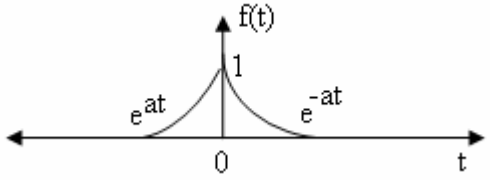

Figure.2

4.a) Define Linearity and Time-Invariant properties of a system.

b) Show that the output of an LTI system is given by the linear convolution of input signal and impulse response of the system. [15]

5.a) State and prove Parseval's Theorem.

b) Find the convolution of two signals x(n) = { 1, 1, 0, 1, 1} and h(n) = { 1, -2, -3, 4} and represent them graphically. [15]

6.a) State and Prove the sampling theorem for Band limited signals.

b) Discuss the effect of aliasing due to under sampling. [15]

7.a) Define Laplace Transform and Its inverse.

b) Define Region of convergence and state its properties.

c) Find the Laplace transform of f(t) = *sin* at *cos* bt and f(t) = t *sin* at [15]

8.a) Find the two sided Z-transform of the signal $x(n) = (1/3)^n \quad n \geq 0$
$= (-2)^n \quad n \leq -1$

b) Determine the inverse Z-Transform of $X(z) = z/(3z^2 - 4z + 1)$, if the region of convergence are i) $z > 1$ ii) $z < 1/3$ iii) $1/3 < z < 1$ [15]

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SIGNALS AND SYSTEMS
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Time: 3 hours **Max. Marks: 75**

Answer any five questions
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1.a) Define a complete set and hence show that the error can be minimized when the function f(t) is approximated using n set of orthogonal functions.

b) A rectangular function 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 *sin*t, two terms *sin*t and sin3t, three terms *sin*t, sin3t and sin5t over the interval (o, 2π) and show that the mean square error is minimum when the function is approximated by three terms rather than single term. [15]

2.a) Derive the necessary expression to represent the function f(t) using Trigonometric Fourier Series.

b) Bring out the relationship between Trigonometric and Exponential Fourier series. [15]

3.a) Prove that the time shift in time domain is equal to phase shift in frequency domain.

b) Find the Fourier transform of the function

i) $f(t) = e^{-a|t|}\ sin(t)$ ii) $f(t) = cos\ at^2$ iii) $f(t) = sin\ at^2$ [15]

4.a) What are the requirements to be satisfied by an LTI system to provide distortionless transmission of a signal?

b) Bring out the relation between bandwidth and rise time? [15]

5.a) Show that autocorrelation and power spectral density form a Fourier Transform Pair.

b) Discuss the process of extraction of a signal from noise in frequency domain. [15]

6. Define Sampling Theorem and discuss the way of performing sampling using impulse sampling technique. [15]

7.a) State and Prove Initial value and Final value theorem w.r.to Laplace transform.

b) Find the Laplace transform of the periodic rectangular wave shown in Figure.1. [15]

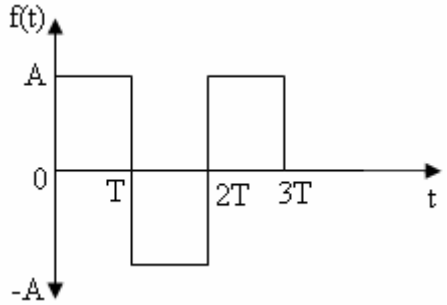

Figure.1

8.a) Determine the impulse and unit step response of the systems described by the difference equation y(n) = 0.6y(n-1)-0.08y(n-2)+x(n)

b) Define Region of Convergence and state its properties w.r.to Z- Transform. [15]

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Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

1.a) Discuss the concept of orthogonality in complex functions and derive the expression for component vector of approximating the function $f_1(t)$ over $f_2(t)$ in case of complex functions.
b) Derive the expression for Mean square Error in approximating a function f(t) by a set of n orthogonal functions. [15]

2.a) State the necessary and sufficient conditions for the existence of Fourier series representation of a Periodic Signal.
b) Obtain the trigonometric Fourier series for the signal shown in Figure.1. [15]

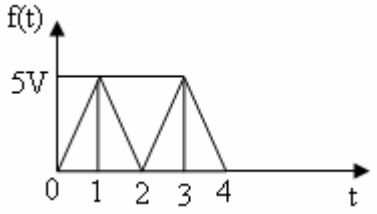

Figure.1

3.a) State and prove any Four Properties of Fourier Transform.
b) Find the Fourier Transform of
i) $f(t) = e^{-at} \cos(bt)$ ii) $f(t) = t \cos at$. [15]

4.a) Define the terms:
i) Signal Bandwidth ii) System bandwidth
iii) Linear time Variant system iv)Paley-wiener criteria for physical realizability.
b) Test the linearity, causality, time-variance, stability of the system governed by the equation
i) $y(n) = ax(n) + b$ ii) $y(n) = n \cos[x(n)]$ [15]

5.a) Explain the process of detection of periodic signals by the process of correlation.
b) Define autocorrelation and state its properties. [15]

6. Define Sampling Theorem and discuss the way of performing sampling using Natural sampling technique and compare it with impulse sampling. [15]

7.a) State any four properties of Laplace transform.
b) Find the Laplace transform of the wave form shown in Figure.2.

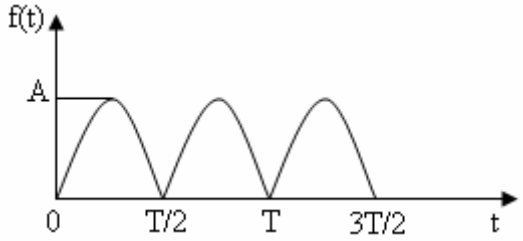

Figure.2

c) Find the inverse Laplace transform of (S-1) / (S) (S+1). [15]

8.a) Using scaling property determine the Z-transform of $a^n \cos\omega n$ and find its ROC.
b) Using differentiation property find the Z-transform of $x(n) = n^2 u(n)$.
c) Obtain the Z-transform of $x(n) = -a^n u(-n-1)$ and find its ROC. [15]

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Code No:A109210402 | R09 | SET-4

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SIGNALS AND SYSTEMS
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Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

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1.a) Approximate the function f(t) by a set of Legendre polynomials and derive the expression for component vector.
b) Define the following basic signals with graphical representation
i) Unit Sample Signal ii) Unit Step Signal
iii) Ramp Signal iv) Sinusoidal signal. [15]

2.a) Expand the following function over the interval (-4, 4) by a complex Fourier Series
$f(t) = 1 ; -2 \leq t \leq 2$
$= 0 ;$ else where
b) Justify the following with respect to Fourier series
i) Odd functions have only sine terms
ii) Even functions have only cosine terms. [15]

3.a) Compute the Fourier Transform of
i) f(t) = (1/2)-n u(-n-1) ii) f(t) = sin(nπ/2)+cos(n)
b) State all the properties of Fourier Transform. [15]

4.a) Draw the ideal characteristics of Lowpass, Highpass, Bandpass and Bandstop filters.
b) Test the linearity, causality, time-variance of the system governed by the equation
i) $y(n) = x(n-n_0)$ ii) $y(n) = \cos(n\omega_0)\, x(n)$ iii) $y(n) = a[x(n)]^2+b$ [15]

5.a) Explain the process of detection of periodic signals by the process of correlation.
b) Determine the cross correlation between the two sequences x(n) = [1,0,01) and h(n) = { 4,3,2,1} [15]

6.a) Define Nyquist rate. Compare the merits and demerits of performing sampling using impulse, Natural and Flat-top sampling techniques.
b) Discuss the process of reconstructing the signal from its samples. [15]

7.a) Bring out the relationship between Laplace and Fourier Transform.
b) Determine the Laplace transform of
i) $f(t) = e^{-at} \sin \omega t$ ii) $f(t) = e^{-at} \cosh \omega t$
c) Find the final value of the function F(s) given by $(S-1) / S(S^2-1)$ [15]

8.a) State and prove Time-reversal, Time-Shifting and scaling properties w.r.to Z-transform
b) A system has an impulse response h(n) = {1,2,3} and output response y(n) = {1,1,2,-1,3}. Determine the input sequence x(n). [15]

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