Hall Ticket No | | | | | | | | | | | Question Paper Code: AECB14

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER-I

B.Tech IV Semester End Examinations, May - 2019
Regulation: IARE-R18
SIGNALS AND SYSTEMS
(Electronics and Communication Engineering)

Time: 3 Hours **Max Marks: 70**

Answer any ONE question from each Module
All questions carry equal marks
All parts of the question must be answered in one place only

MODULE – I

1 a) Discuss orthogonality in complex functions. [7M]

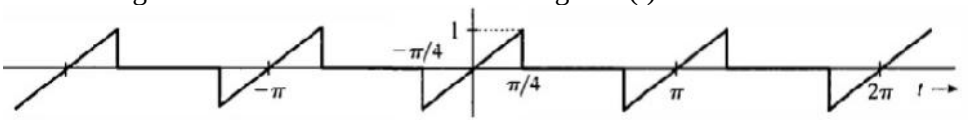
b) Derive the expression for component vector of approximating the function $f_1(t)$ over $f_2(t)$ and also prove that the component vector becomes zero if the $f_1(t)$ and $f_2(t)$ are orthogonal. [7M]

2 a) sketch the following signals
$(i) f(t) = r(t+2) - r(t+1) - r(t-1) + r(t-2)$ $(ii) f(t) = r(t) - r(t-1) - u(t-1)$

b) Find the even and odd components of the signal x(t) = $\cos(\omega_o t + \pi/3)$. [7M]

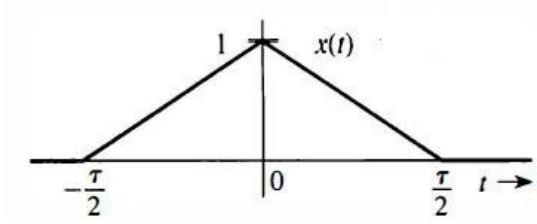
MODULE – II

3 a) Find the trigonometric Fourier series for the signal x(t) shown below. [7M]



b) Derive the necessary expression to represent the function f(t) using Trigonometric Fourier Series. [7M]

4 a) Compute the Fourier transform of the signal x(t) applying differentiation in time property of Fourier transform. [7M]



b) Define Hilbert Transform. What is its significance with signals. Obtain the Fourier transform of impulse signal. [7M]

MODULE – III

5 a) Obtain the impulse response of an LTI system defined by dy(t)/dt + 2y(t) = x(t). Also obtain the response of this system when excited by $e^{-2t}u(t)$. [7M]

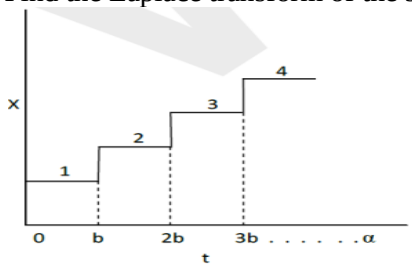
b) Find the impulse response of the RC high pass filter shown in figure. Also find the transfer function. What would be its frequency response? [7M]

6 a) Check the following systems with respect to the properties i) linearity (ii) invariant (iii) Causality (iv) stability. $(a)\ y(t) = \sin x(t)\quad (b)\ y(t) = \int_{-\infty}^{t} x(\tau)\, d\tau$. [7M]

b) Consider two functions $x(t) = u(t+1) and\ h(t) = u(t-2)$. Find convolution of $x(t) and\ h(t)$ using graphical method. [7M]

MODULE – IV

7 a) Find the Laplace transform of the stair case wave form shown in fig [7M]



b) Find the Laplace transform following signals and its ROC [7M]

(i) $x(t) = \delta(t) - \frac{4}{3}e^{-t}\,u(t) + \frac{1}{3}\,e^{2t}\,u(t)\quad (ii)\ x(t) = e^{-|a|t}$

8 a) If $X(z) = 1+2z^{-1}+4z^{-2}$. Find the initial and final values of the corresponding sequence x (n). [7M]

b) Determine Z Transform of the following [7M]

i)$(1/4)^n\,u(n) - \cos(n\pi/4)\,u(n)$ ii)$2^n\,u(n-2)$

MODULE – V

9 a) What are the disadvantages of under-sampling? For a signal x(t), calculate Nyquist rate and Nyquist interval. x (t) = 3cos 25πt - 10 sin200πt + cos300πt. [7M]

b) A continuous time signal is given as $x(t) = 8\cos 200\pi t$ .Determine [7M]

i) Minimum sampling rate

ii) If f_s=400Hz, what is discrete time signal obtained after sampling. iii) If f_s=150Hz, what is discrete time signal obtained after sampling.

10 a) Find the auto correlation function of a signal $R(z) = e^{-2\alpha|\tau|}$ and also determine the spectral density of the process. [7M]

b) Find the energy spectral density of the signal x(t) = 10 Sinc 10t. Also find its total energy. [7M]

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COURSE OBJECTIVES:

The course should enable the students to:	
I	Classify signals and systems and their analysis in time and frequency domains.
II	Study the concept of distortion less transmission through LTI systems, convolution and correlation properties.
III	Understand Laplace and Z-Transforms their properties for analysis of signals and systems.
IV	Identify the need for sampling of CT signals, types and merits and demerits of each type.

COURSE OUTCOMES (COs):

CO 1	Apply the knowledge of linear algebra to represent any arbitrary signals in terms of complete sets of orthogonal functions and classify the signals and systems based on their properties.
CO 2	Analyze the spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis.
CO 3	Understand the properties of linear time invariant system, ideal filter characteristics through distortion less transmission and its bandwidth, causality with convolution and correlation.
CO 4	Apply the Laplace transform and Z- transform and their Region of convergence (ROC) properties for analysis of continuous-time and discrete-time signals and systems respectively.
CO 5	Understand the process of sampling to convert an analog signal into discrete signal and the effects of under sampling and study correlation, spectral densities.

COURSE LEARNING OUTCOMES (CLOs):

AECB14.01	Apply the knowledge of vectors to find an analogy with signals.
AECB14.02	Understand Orthogonal signal space and orthogonal functions.
AECB14.03	Introduce the basic classification of signals in both continuous and discrete domain, exponential and sinusoidal signals, standard test signals
AECB14.04	Introduce the basic classification of systems in both continuous and discrete domain
AECB14.05	Representation of Fourier series for a periodic signal.
AECB14.06	Deduce Fourier Transform from Fourier series
AECB14.07	Compute Fourier Transform of Periodic Signal
AECB14.08	Introduce the special transform-Hilbert transform
AECB14.09	Analyze time variance for linear systems.
AECB14.10	Understand the concept of distortion less transmission through a system
AECB14.11	Analyze Causality and Paley-Wiener criterion for physical realization.
AECB14.12	Understand the concept of convolution through graphical representation
AECB14.13	Introduce the concepts of Laplace transform for conversion to S-domain.
AECB14.14	Represent Region of Convergence for Laplace transforms and properties of Laplace Transforms.
AECB14.15	Understand the Z-Transform for discrete signals with issues of Region of Convergence
AECB14.16	Analyze the properties of Z-Transforms.
AECB14.17	Categorical analysis of sampling into different types.
AECB14.18	Understand how to reconstruct signals after sampling
AECB14.19	Understand cross correlation and auto correlation concepts.
AECB14.20	Analyze Power Spectral and Energy Spectral Characteristics

MAPPING OF SEMESTER END EXAMINATION - COURSE OUTCOMES

SEE Question No		Course Learning Outcomes		Course Outcomes	Blooms Taxonomy Level
1	a	AECB14.02	Understand Orthogonal signal space and orthogonal functions.	CO 1	Remember
	b	AECB14.02	Understand Orthogonal signal space and orthogonal functions.	CO 1	Understand
2	a	AECB14.02	Introduce the basic classification of signals in both continuous and discrete domain	CO 1	Remember
	b	AECB14.03	Introduce the basic classification of signals in both continuous and discrete domain	CO 1	Understand
3	a	AECB14.05	Representation of Fourier series for a periodic signal.	CO 2	Understand
	b	AECB14.05	Representation of Fourier series for a periodic signal.	CO 2	Remember
4	a	AECB14.06	Deduce Fourier Transform from Fourier series	CO 2	Understand
	b	AECB14.08	Introduce the special transform-Hilbert transform	CO 2	Remember
5	a	AECB14.09	Analyze time variance for linear systems.	CO 3	Understand
	b	AECB14.09	Analyze time variance for linear systems.	CO 3	Understand
6	a	AECB14.11	Analyze Causality and Paley-Wiener criterion for physical realization.	CO 3	Understand
	b	AECB14.12	Understand the concept of convolution through graphical representation.	CO 3	Understand
7	a	AECB14.14	Introduce the concepts of Laplace transform for conversion to S-domain.	CO 4	Understand
	b	AECB14.14	Introduce the concepts of Laplace transform for conversion to S-domain.	CO 4	Understand
8	a	AECB14.15	Understand the Z-Transform for discrete signals with issues of Region of Convergence	CO 4	Understand
	b	AECB14.16	Analyze the properties of Z-Transforms.	CO 4	Understand
9	a	AECB14.17	Categorical analysis of sampling into different types.	CO 5	Remember
	b	AECB14.17	Categorical analysis of sampling into different types.	CO 5	Understand
10	a	AECB14.19	Understand cross correlation and auto correlation concepts.	CO 5	Understand
	b	AECB14.20	Analyze Power Spectral and Energy Spectral Characteristics	CO 5	Understand

Signature of Course Coordinator **HOD, ECE**