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

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER-II

B.Tech IV Semester End Examinations, May - 2020
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

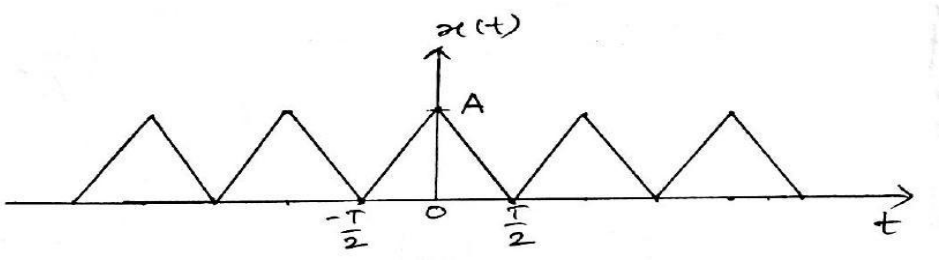
1 a) Test the orthogonality of the signals sin wt cos2 wt over the interval (t_0 , t_0+T). [7M]
b) Define and derive the expression for evaluating mean square errors and its types. [7M]

2 a) Define and sketch the following signals [7M]y
i) Truncated Exponential signal
ii) Delayed Unit impulse function
iii) Unit parabolic function
iv) Sinc function
b) Determine whether the following systems are linear, memoryless, time invariant, causal and stable or not . [7M]

$$(i)\ y(n) = 4\,x(n) + 5\ (ii)\ y(t) = x^2(t-2) + x(t+2)$$

MODULE – II

3 a) Determine the exponential form of the Fourier series representation of the signalshown below. [7M]



b) Bring out the relationship between Trigonometric and Exponential Fourier series. [7M]

4 a) If x (t) has Fourier transform pair X (w). Deduce the Fourier Transform of X (at-t_0). [7M]
b) Find the Fourier transform of x(t) =e^{-at} u (t). [7M]

MODULE – III

5 a) Obtain the relationship between the bandwidth and rise time of ideal low pass filter. [7M]

b) find the convolution of $x(t) = e^{-t}\, u(t)$ and $y(t) = \text{rect}(t/2)$ Using graphical method. [7M]

6 a) What is poly-wiener criterion and explain how it is related to physical reliability of a system? [7M]

b) Present the relation between convolution and correlation. [7M]

MODULE – IV

7 a) Define Laplace Transform and explain the properties of Laplace Transform [7M]

b) Find the Laplace transform of $x(t) = -t^2 e^{-at} u(-t)$ and indicate its ROC. [7M]

8 a) Find the Z transform of $x[n] = a^{n+1}\, u[n+1]$ [7M]

b) State and prove initial and final value theorems of z-transform. [7M]

MODULE – V

9 a) The signal $x(t)=\cos 5\pi t+0.3 \cos 10\pi t$ is instantaneously sampled. Determine the maximum interval of the sample. [7M]

b) Show that a band limited signal of finite energy which has no frequency components higher than f_m Hz is completely described by specifying values of the signals at instants of time separated by $1/2\ f_m$ seconds. Also show that if the instantaneous values of the signal are separated at intervals larger than $1/2f_m$ seconds, they fail to describe the signal. A band pass signal has spectral range extending from 20kHz to 80kHz; find the acceptable range of sampling frequency f_s. [7M]

10 a) a) compute the auto correlation function for each of the two signals $x_1(t)$ and $x_2(t)$ as shown in fig-a [7M]

b) let x(t) be a given signal, and assume that x(t) is of finite duration—i.e., that $x(t)=0$ for $t<0$ and $t>T$. Find the impulse response of an LTI system so that $\emptyset_{xx}(t-T)$ is the output if x(t) is the input

c) The system determined in fig-b is a matched filter for the signal x(t). Let x(t) be as in fig-b, and let y(t) denote the response to x(t) of an LTI system with real impulse response h(t). Assume that $h(t)=0$ for $t<0$ and for $t>T$. show that the choice for h(t) that maximizes y(T), subject to the constraint that

$$\int_0^T h^2(t)dt = M;\ a\ fixed\ positive\ number$$

b) What is an energy density spectrum and power density spectrum? Derive the relation between autocorrelation and power spectral density. [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**