SCHEME OF COURSE WORK

COURSE DETAILS:

Course Title	**Introduction to Signals and Systems**
Course Code	**13EE1107**
Program	B.Tech
Branch	Electrical & Electronics Engineering
Semester	IV
Prerequisites	Mathematics-I, II & III
Course to which it is prerequisite	All Advanced Courses In Electrical Engineering

COURSE OUTCOMES: At the end of the course, a student will be able to

CO1	Classify various types of signals and systems, represent and manipulate signals
CO2	Apply Fourier series and Fourier Transform for signal analysis
CO3	Apply sampling theorem to sample and reconstruct an analog signal
CO4	Illustrate what happens when signals pass through linear systems
CO5	Analyze LTI systems using Z-transforms.

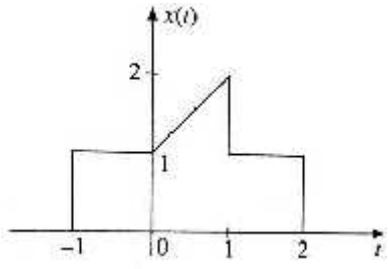
COURSE OUTCOME/PROGRAM OUTCOMES:

CO'S	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO-1	M	M		S	M	M	M		M			M
CO-2	M	M		S	M	M	M		M			M
CO-3	M	M		S	M	M	M		M			M
CO-4	M	M		S	M	M	M		M			M
C0-5	M	M		S	M	M	M		M			M

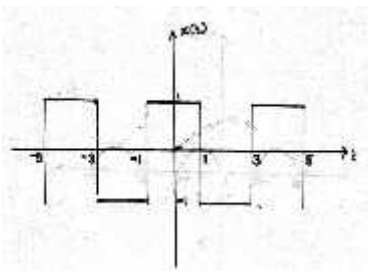
Assessment Methods	Assignments/Quiz/Mid Exam/Seminar/Viva-Voce/End Exam

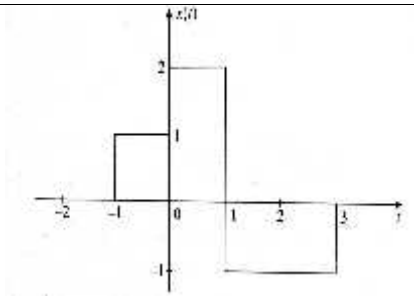
TEACHING LEARNING AND EVALUATION

Week	Topic/content	Course outcomes	Sample questions	Teaching-learning stategy	Assesment method & schedule

1	**Unit-I** **SIGNALS**: Introduction, Signals, Basic continuous time signals & Discrete time signals, Basic Operations on signals	CO-1	1. Define Signal. 2. What are the major classifications of the signal? 3. Define discrete time signals and classify them. 4. Define continuous time signals and classify them. 5. Define discrete time unit step &unit impulse. 6. Define continuous time unit step and unit impulse. 7. Define unit ramp signal. 8. Define unit pulse function. 9. 1. For the signal x(t) shown in figure find and sketch the following signals 	Lecture/ Discussion/ problem solving/Power Point Presentation	Assignment-1 & quiz- 1
Week-2	Continuous time systems and Discrete time systems, properties of systems	CO-1	2. Find which of the following signal energy is or power signals a). $x(t)=e^{-3t}\,u(t)$ b) $x(n) = e^{j(2n+\pi/4)}$ 3. Examine whether the following signals are periodic or not? If periodic determine the fundamental period. $x(t) = \sin(10t + 1) - 2\cos(5t - 2)$ b). $x(t) = e^{j[4t+(\Pi/3)]} + 8e^{j[3\Pi t+(\Pi/4)]}$	Lecture/ Discussion/ problem solving/Power Point Presentation	Assignment-1 & quiz- 1
We	The representation of		1. Obtain the convolution of		

ek-3	Signals in terms of Impulses, Continuous Time – LTI systems, Convolution integral, Discrete Time LTI systems, Convolution Sum, Properties of LTI systems,	CO-1	following two functions a) $x(t) = \begin{cases} 1 & for -3 \le t \le 3 \\ 0 & elsewhere \end{cases}$ $h(t) = \begin{cases} 2 & for 0 \le t \le 3 \\ 0 & elsewhere \end{cases}$ b) $x_1(t) = \cos t\, u(t)$ $h_1(t) = u(t)$ 2. Test whether the following system is Linear, time invariant, dynamic and causal $y(t) = \frac{d(e^{-2t}x(t))}{dt}$ 3. Test whether the following system is Linear, time invariant, dynamic and causal i) y(n)=x(n)+nx(n-1) 2. Find the convolution of x(n) = cos(nπ)u(n), h(n) = $(1/2)^n$ u(n)	Lecture/ Discussion/ problem solving/ Power Point Presentation	Assignment-1 & quiz- 1
Week-4	Systems described by Differential and Difference Equations, Block Diagram Representation of LTI systems described differential	CO-1	1). Find the output y(n) of a linear time invariant discrete time system specified by the equation. y(n)-3/2y(n-1) +1/2 y(n-2) = 2x(n) +3/2 x(n-1) when initial conditions are y(-1) =0,y(-2) = 1 and input x(n)=(1/4)n u(n) 2.) Determine the complete response of the system described by $\frac{d^2y(t)}{dt^2} + 7\frac{dy(t)}{dt} + 6y(t) = \frac{dx(t)}{dt}$; **y(0)=0 ;** $\left.\frac{dy(t)}{dt}\right\|_{t=0} = 1$ for the input $x(t) = e^{-2t}u(t)$.	Lecture/ Discussion/ problem solving/Power Point Presentation	Assignment-1 & quiz- 1
Week-5	**UNIT-II FOURIER SERIES & FOURIER TRANSFORM**	CO-2	1). For the Continuous time periodic signal $x(t) = 2 + \cos 2t + \sin 4t$,	Lecture/ Discussion/ problem solving/Power Point Presentation	Assignment-1 & quiz-1

	Fourier series representation of continuous time periodic signals		determine the fundamental frequency and exponential Fourier series coefficients and draw frequency spectra 2.) Obtain Trigonometric Fourier series for the given signal 		
Week-6	. Properties of Fourier series. Representation of periodic signals: CT Fourier transform Fourier transform of periodic signals	CO-2	1). State and prove properties of Fourier series 2). Find the Fourier transform of following signals a) $x(t)$ $e^{at}u(-t)$ b) $x(t)$ $te^{-at}u(t)$ 3. Find the inverse Fourier transform of following signals i) $\frac{3j\omega+2}{(j\omega)^2+5(j\omega)+6}$ ii) $\frac{1+2j\omega}{(j\omega+2)^2}$	Lecture/ Discussion/ problem solving/Power Point Presentation	Assignment-1 & quiz- 1
Week-7	Properties of continuous time Fourier transform	CO-2	3. Compute the Fourier transform for the signal shown in figure	Lecture/ Discussion/ problem solving/Power Point Presentation	Assignment-1 & quiz-1

			 2). State and prove the properties of CT Fourier transform 3. Find Fourier transform by using properties of Fourier transform		
Week-8	**UNIT-III SAMPLING** : Introduction, representation of continuous time signals by its samples	CO-3	Explain the process of representation of continuous time signals by its samples	Lecture/ Discussion/ problem solving/Power Point Presentation	Assignment-2 & quiz- 2
Week-9	MID TEST-1	CO-1,CO-2,			
Week-10	Sampling theorem	CO-3	1). State and prove the sampling theorem. Also explain how reconstruction of original signal is done from sampled signal in detail 2). Determine the Nyquist sampling rate and Nyquist sampling intervals for $x(t) = \text{sinc}(200\pi t) + 3\text{sinc}^2(120\pi t)$	Lecture/ Discussion/ problem solving/Power Point Presentation	Assignment-2 & quiz- 2
Week-11	The effect of under sampling : aliasing	CO-3	Explain the effect of under sampling i.e aliasing in detail	Lecture/ Discussion/ problem solving/Power Point Presentation	Assignment-2 & quiz-2
We	**UNIT-IV**	CO-4	1). for a system excited by $x(t) = e^{-3t}$	Lecture/ Discussion/ problem solving	

ek-12	**SIGNAL TRANSMISSION THROUGH LINEAR SYSTEMS:** Linear systems, Impulse response, response of a linear system, LTI system, Transfer function of LTI system,		u(t), the impulse response is h(t) = e^{-2t} u(t) + e^{2t} u(-t) find the Output of the system 2. A system produces an output of y(t) = e^{-t} u(t) for an input of x(t) = e^{-2t} u(t). Determine the impulse Response and frequency of the system		Assignment-2 & quiz-2
Week-13	Filter characteristics of linear systems, Distortionless transmission through a system, signal band width	CO-4	1). Explain filter characteristics of linear systems 2. Explain concept of Distortionless transmission through a system	Lecture/ Discussion/ problem solving	Assignment-2 & quiz-2
Week-14	Ideal LPF, BPF, and HPF characteristics, Causality and Poly – wiener criterion for physical realisation	CO-4	1). Explain Ideal LPF, BPF, and HPF characteristics 2). Explain Poly –wiener criterion for physical realisation	Lecture/ Discussion/ problem solving	Assignment-2 & quiz-2
Week-15	**UNIT-V THE Z-TRANSFORM & PROPERTIES** Introduction, The Z-transform Region of Convergence for the Z-transform	CO-5	1). Define Z transform. What are the two types of Z transform? Define unilateral Z transform. What is region of Convergence. What are the Properties of ROC. 2. Find the Z-transform and ROC of $x(n) = 3\left(\frac{5}{7}\right)^n u(n) + 2\left(\frac{-1}{3}\right)^n u(n)$ Prove that the sequences $x(n) = a^n u(n)$ and $x_2^1(n) = -a_n u(-n-1)$ have same X (z) but differ only in ROC.	Lecture/ Discussion/ problem solving/Power Point Presentation	Assignment-2 & quiz-2

			Also plot their ROC		
Week-16	Properties of Z-transform, Inverse Z-transform	C0-5	1). State and prove properties of Z-transform 2.) Find the inverse Z-transform of $X(z) = \frac{z^{-1}}{z^{-2} - 4z^{-1} + 3}, \ldots for, ROC \vdots$ using partial fraction method	Lecture/ Discussion/ problem solving/Power Point Presentation	Assignment-2 & quiz- 2
Week-17	Analysis and characterization of linear time invariant systems using Z-transforms	CO-5	1). Plot the pole-zero pattern and determine which of the following systems are stable a) y(n)=y(n-1)-0.8y(n-2)+x(n)+x(n-2) b) y(n)=2y(n-1)-0.8y(n-2)+x(n)+ 0.8x(n-1) 2). Determine the Impulse response and step response of the causal system and discuss on system stability Y(n)+y(n-1)-y(n-2)=x(n-1)+2x(n-2) 3. A LTI system is described by the difference equation Y(n)-3/4y(n-1)+1/8y(n-2)=x(n)+x(n-1) Y(-1)=0, y(-2)=-1 Find the total response of the system and also frequency response	Lecture/ Discussion/ problem solving/Power Point Presentation	Assignment-2 & quiz- 2
Week-18	MID Exam-2	CO-3,CO-4,CO-5			
Week-19, 20	End Exam	All co's			External exam