COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC202	**SIGNALS & SYSTEMS**	**3-1-0-4**	**2016**

Prerequisite: Nil

Course objectives:

1. To train students for an intermediate level of fluency with signals and systems in both continuous time and discrete time, in preparation for more advanced subjects in digital signal processing, image processing, communication theory and control systems.
2. To study continuous and discrete-time signals and systems, their properties and representations and methods those are necessary for the analysis of continuous and discrete-time signals and systems.
3. To familiarize with techniques suitable for analyzing and synthesizing both continuous-time and discrete time systems.
4. To gain knowledge of time-domain representation and analysis concepts as they relate to differential equations, difference equations, impulse response and convolution, etc.
5. To study frequency-domain representation and analysis concepts using Fourier analysis tools, Laplace Transform and Z-transform.
6. To study concepts of the sampling process, reconstruction of signals and interpolation.

Syllabus:

Elementary Signals, Continuous time and Discrete time signals and systems, Signal operations, Differential equation representation , difference equation representation, continuous time LTI systems, Discrete Time LTI systems, Correlation between signals, orthogonality of signals. Frequency domain representation, Continuous time Fourier Series ,Continuous Time Fourier Transform, Laplace Transform, Inverse transform, unilateral Laplace Transform, transfer function, Frequency response, sampling , aliasing, Z transform ,Inverse transform , unilateral Z transform, Frequency domain representation of Discrete Time Signals, Discrete Time Fourier Series and Discrete Time Fourier Transform (DTFT), Analysis of Discrete Time LTI systems using all transforms

Expected outcome:

1.Define, represent, classify and characterize basic properties of continuous and discrete time signals and systems.
2.Represent the CT signals in Fourier series and interpret the properties of Fourier transform, Laplace transform
3.Outline the relation between convolutions, correlation and to describe the orthoganality of signals.
4.Illustrate the concept of transfer function and determine the Magnitude and phase response of systems.
5.Explain sampling theorem and techniques for sampling and reconstruction.
6.Determine z transforms, inverse z transforms signals and analyze systems using z transforms.

Text Books:

1. Alan V. Oppenheim and Alan Willsky, Signals and Systems, PHI, 2/e, 2009
2. Simon Haykin Signals & Systems, John Wiley, 2/e, 2003

References:

1. Anand Kumar, Signals and Systems, PHI, 3/e, 2013.
2. Mahmood Nahvi, Signals and System, Mc Graw Hill (India), 2015.
3. P Ramakrishna Rao, Shankar Prakriya, Signals and System, MC Graw Hill Edn 2013.
4. B P. Lathi, Priciples of Signal Processing & Linear systems, Oxford University Press.
5. Gurung, Signals and System , PHI.
6. Rodger E. Ziemer Signals & Systems - Continuous and Discrete, Pearson, 4/e, 2013

Course Plan			
Module	**Course content (48 hrs)**	**Hours**	**Sem. Exam Marks**
I	Elementary Signals, Classification and Representation of Continuous time and Discrete time signals, Signal operations	4	**15**
	Continuous Time and Discrete Time Systems - Classification, Properties.	3	
	Representation of systems: Differential Equation representation of Continuous Time Systems. Difference Equation Representation of Discrete Systems.	2	
II	Continuous Time LTI systems and Convolution Integral.	3	**15**
	Discrete Time LTI systems and linear convolution.	2	
	Stability and causality of LTI systems.	2	
	Correlation between signals, orthoganality of signals.	2	
FIRST INTERNAL EXAM			
III	Frequency Domain Representation of Continuous Time Signals- Continuous Time Fourier Series and its properties.	3	**15**
	Convergence,Continuous Time Fourier Transform: Properties.	2	
	Laplace Transform, ROC, Inverse transform, properties, unilateral Laplace Transform.	3	
	Relation between Fourier and Laplace Transforms.	1	
IV	Analysis of LTI systems using Laplace and Fourier Transforms. Concept of transfer function, Frequency response, Magnitude and phase response.	3	**15**
	Sampling of continuous time signals, Sampling theorem for lowpass signals, aliasing.	3	
SECOND INTERNAL EXAM			
V	Z transform, ROC , Inverse transform, properties, unilateral Z transform.	3	**20**
	Frequency Domain Representation of Discrete Time Signals, Discrete Time Fourier Series and its properties.	3	
	Discrete Time Fourier Transform (DTFT) and its properties	3	
VI	Relation between DTFT and Z-Transform, Analysis of Discrete Time LTI systems using Z transforms and DTFT, Transfer function, Magnitude and phase response.	6	**20**
END SEMESTER EXAM			

Assignment: Convolution by graphical methods, Solution of differential equations.
Project: Use of Matlab in finding various transforms, magnitude and phase responses.

Question Paper Pattern

The question paper consists of three parts. Part A covers modules I and II, Part B covers modules III and IV and Part C covers modules V and VI. Each part has three questions. Each question can have a maximum of four subparts. Among the three questions one will be a compulsory question covering both the modules and the remaining two questions will be as one question from each module, of which one is to be answered. Mark pattern is according to the syllabus with maximum 30 % for theory and 70% for logical/numerical problems, derivation and proof.