University of Mumbai			
CLASS: T.E. (Electronics Engineering)		**Semester - V**	
SUBJECT: Continuous Time signals and systems			
Periods per week (each of 60 min.)	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical examination		
	Oral Examination	-	25
	Term Work	-	25
	Total		150

Objective	1. To introduce the student to the idea of signals and systems analysis and characterization in continuous domain. 2. To provide a foundation to numerous other courses that deal with signal and system concepts directly or indirectly: viz: communication, control, statistical signal processing etc	
Pre-requisite	Basic knowledge of Fourier analysis ,Laplace Transform and sampling theorem	
Module	**contents**	**Hours**
1	**Introduction to signals & Systems** Definition of Signal Elementary Continuous Time (CT) signals like unit step, Impulse, ramp, exponential, sinusoidal etc. Operations on signal like shifting, flipping, scaling, addition, multiplication Breaking of a CT signal in different basic components Concept of system Classification of system on the basis of linearity, time variance, causality, memory ,stability, invertibilty etc System representation by a differential equation	10
2	**Convolution and correlation** Concept of Impulse Response Convolution integral and system response in CT domain Properties, Autocorrelation and its property. Relation of autocorrelation to signal energy, power, ESD, and PSD. Cross correlation and its property**.**	6
3	**Fourier Series (FS) & Fourier Transform (FT) for CT systems** Review of Trigonometric series, Exponential series properties and uses Amplitude & phase spectra Power Spectral Density	12

	Parseval's relation, Relation between Trigonometric and Exponential Fourier series, Gibbs Phenomenon The Fourier Transform (FT) FT of basic signals Properties of FT and derivations FT of periodic signals Conceptual introduction to C.T. short time Fourier Transform (STFT) Energy Spectral Density Analog to Digital conversion & its Reconstruction	
4.	**Fundamentals of Random processes** Introduction, concept of random variable, PDF of uniform, Gaussian and exponential random variable. Properties of Mean, variance and moments. Two or more random variables , Random processes	6
5.	**Laplace transform analysis of signals and systems** Definition & properties of Two-sided & one-sided Laplace Transform. Region of Convergence (ROC) inverse Laplace transform Relationship with Fourier Transform & mapping BIBO stability and ROC Pole-zero diagram Impulse response of a system, and impulse response of cascade and parallel systems Time domain analysis for first and second order systems Solution to differential equations and system behavior. Zero state & zero input responses System response to complex exponential inputs.	08
6.	**State -Variable Techniques** State –Variable concepts and state variable model , TF from state variable model and vice versa. Digonalization State equations & their time domain and frequency domain solutions State transition matrix System state equations	6

Text- Books:

1. S. Haykin, Signals and Systems , Wiley Eastern Publication
2. M J. Roberts, Fundamentals of Signals and Systems, second reprint, Tata McGraw-Hill, 2008
3. J.G. Proakis, D. G. Manolakis, Digital Signal Processing: Principles, Algorithms and applications, Prentice Hall of India, 1995
4. Ashok Ambardar, Analog and Digital Signal Processing, Thomson Learning, second edition, 2001

5. B.P.Lathi, linear systems and signals Oxford University Press second Indian Impression, 2007
6. D.D. Shah & A.C. Bhagali, Signals and systems, MPH publication.

Additional Reading:

1. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998
2. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prenice Hall, 1983.
3. R.A.Gabel,Signals and linear systems,John wiley and Sons.
4. chen,Signals and Systems Oxford University Press Third Indian Impression, **2007**
5. I J Nagrath, S N Sharma, R Ranjan, and S Kumar , “Signals and Systms”, Tata Mcgraw Hill

Suggested list of simulations

1. Generation and transformations of basic C.T. signals(2 simulations)
2. Verification of sampling theorem
3. Impulse and step response of a C.T. system
4. Demonstration of Fourier series coefficients
5. Demonstration of Fourier transform of signals
6. Demonstration of Laplace transform of signals
7. Finding Mean, variance and standard deviation of random data
8. State space to TF and TF to state space conversion

T.W. / Oral Examination:

Term work:

The term work shall consists of at least four assignments and six MATLAB or C simulations covering the whole of syllabus, duly recorded and graded. This will carry a weightage of fifteen marks. A test shall be conducted and will carry a weightage of ten marks.

The distribution of marks for term work shall be as follows:

Laboratory work (Experiments and Journal) : 10 marks.

Test (at least one) : 10 marks.

Attendance (Practical and Theory) : 05 marks.

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and minimum passing in the term-work.

Theory Examination:

1. Question paper will be comprise of total 7 questions, each of 20 marks.

2. Only 5 questions need to be solved.

3. Question number 1 will be compulsory and will cover all modules.

4. Remaining questions will be mixed in nature. (e.g.- suppose Q.2 has part (a) from, module 3 then part (b) will be from any module other than module 3.)

5. In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

6. No question should be asked from pre-requisite module