COURSE TITLE	**SIGNALS AND SYSTEMS**
COURSE CODE	**01EE1502**
COURSE CREDITS	**5**

Objective:

1 The objective of this course is to introduce learners to the basics of signals, systems, and their application in electrical engineering.

Course Outcomes: After completion of this course, student will be able to:

1 Classify signals and systems using their mathematical function.

2 Obtain the output from impulse response of given system.

3 Analyze system response using various transforms.

4 Determine the sampling frequency and reconstruction method for correct representation of signal.

5 Assess a system performance based on given set of input signals and desired response.

Pre-requisite of course: None

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
4	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Introduction to Signals and Systems** Introduction to signals and their applications, Representation of signals, Classification of signals, special signals – Unit impulse function, Unit step function, Unit ramp function, Sinusoidal signals, exponential signal in continuous time and discrete time, classification of systems	10
2	**Mathematical operation of Signals and Systems** Impulse response characterization and convolution integral for CT-LTI system, system, signal responses to CT-LTI system, properties of convolution, LTI system response properties from impulse response, Impulse response characterization and convolution sum, Properties of convolution summation, Impulse response of DT-LTI system, Difference equation, solution of difference equation, system analysis from difference equation model	10
3	**Fourier Transform of CT-LTI systems** Representation of periodic functions, Fourier series, Frequency spectrum of aperiodic signals, Fourier Transform, Relation between Laplace Transform and Fourier Transform and its properties, Discrete Time Fourier Transform	8

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Contents : Unit	Topics	Contact Hours
4	**Laplace Transform for CT-LTI systems** Review of the Laplace Transform for continuous time signals and systems, Region of convergence of Laplace Transform, system functions, poles and zeros of system functions and signals, Properties of Laplace Transform, Analysis and characterization of LTI system using Laplace Transforms	6
5	**z-Transform and application to DT-LTI systems** The z-Transform for discrete time signals and systems, Properties of z-Transform, Region of Convergence, Analysis and characterization of LTI system using z- Transform, Inverse z-Transform, Method of Inverse z-Transform, Application to Systems	12
6	**Filtering** Introduction to Ideal Filter, Butterworth lowpass filter, Chebyshev filter, Digital filter – FIR and IIR filters, Design of FIR filter, Design of IIR filter	4
7	**Sampling & reconstruction** The Sampling Theorem and its implications, Spectra of sampled signals. Reconstruction, ideal interpolator, zero-order hold, first-order hold, Aliasing and its effects, Relation between continuous and discrete time systems	6
Total Hours		**56**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Experiment No. 01** Generation and Capturing of standard Continuous Time (CT) signals	2
2	**Experiment No. 02** Generation and Capturing of standard Discrete Time (DT) signals	2
3	**Experiment No. 03** Simulate the response of Continuous Time System	2
4	**Experiment No. 04** Simulate the response of Discrete Time System	2
5	**Experiment No. 05** Compute Fourier Transform of Continuous time signal	2
6	**Experiment No. 06** Apply Laplace Transform to Continuous time system	2
7	**Experiment No. 07** Apply z-Transform to assess performance of Discrete time signals and systems	2
8	**Experiment No. 08** Discretization of continuous time signal and verification of Nyquist criteria	2

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
9	**Experiment No. 09** Verify the performance of Analog filter	2
10	**Experiment No. 10** Design and simulate the FIR filter for an electrical signal	2
11	**Experiment No. 11** Design and simulate the IIR filter for an electrical signal	2
12	**Experiment No. 12** Verify the aliasing effect in a discretized signal	2
Total Hours		**24**

Textbook :

1 Signals and Systems, Alan V. Oppenheim, Alan S. Wilsky and Nawab, Prentice Hall, 1997

2 Digital Signal Processing, John G. Proakis Dimitris K. Manolakis,, Pearson Education,, 2014

3 Linear Systems and Signals, B.P.Lathi, Oxford University Press, 2006

4 Signal and Systems, Anand Kumar, Prentice Hall India Learning Private Limited, 2013

References:

1 Signals and System – MATLAB Integrated Approach, Signals and System – MATLAB Integrated Approach, Oktay Alkin, CRC Press, 2014

2 Signals and Systems, Signals and Systems, Simon Haykin and Bary Van Veen, Wiley-India Publications, 2010

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
10.00	20.00	20.00	25.00	15.00	10.00

Instructional Method:

1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, case studies etc.

2 The internal evaluation will be done on the basis of continuous evaluation of students in the class-room.

3 Practical examination will be conducted at the end of semester for evaluation of performance of students in classroom

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Instructional Method:

4 Students will use supplementary resources such as online videos

Supplementary Resources:

1 https://nptel.ac.in/courses/108/104/108104100/

2 https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/video-lectures/

3 https://www.youtube.com/playlist?list=PLBlnK6fEyqRhG6s3jYIU48CqsT5cyiDTO

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