BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
Pilani Campus
AUGS/ AGSR Division

SECOND SEMESTER 2020-2021

COURSE HANDOUT

Date: 18-01-2021

In addition to part I (General Handout for all courses appended to the Time table) this portion gives further specific details regarding the course.

Course No	**:** EEE F243 / INSTR F243
Course Title	**:** SIGNALS AND SYSTEMS
Instructor-in-Charge	**:** Dr. Anantha Krishna Chintanpalli
Instructor(s)	**:** Dr. Anantha Krishna Chintanpalli, Dr. Pawan K. Ajmera
Tutorial/Practical Instructors	**:** Dr. Anantha Krishna Chintanpalli, Dr. Pawan K. Ajmera, Dr. Praveen Kumar A V, Dr. Sainath Bitragunta, Dr. Sujan Yenuganti, Dr. Shishir Maheshwari

1. Course Description: This course is intended to provide a comprehensive coverage of Signals and Systems, a fundamental subject of Electrical Engineering. The topics covered are: Continuous-time and discrete-time signals and systems, convolution, properties of linear time-invariant (LTI) systems, Fourier series, Fourier transform, Laplace transform, z-transform, system analysis, frequency response, analog filters, sampling and reconstruction.

2. Scope and Objective of the Course: This course is a fundamental course in which the basics of signals and systems are covered. It deals with the basic transforms, that are essential for signal processing related applications. Apart from the regular lecture series, the weekly tutorial session will assist the students for a better understanding of the concepts. The evaluation components include quizzes (conducted during the tutorial hours) and exams. The students are required to review the following mathematical topics: Calculus, vector analysis, coordinate systems, arithmetic and geometric progression, probability and complex variables.

3. Text Books:
T1: B. P. Lathi, *"Signal Processing & Linear Systems",* Oxford University Press, 2nd edition, 2009.
T2: I. J. Nagrath and S. N. Sharan, "Signals and Systems," TMH, 2nd edition, 2009.

4. Reference Books:

R1: A. V. Oppenheim, A. S. Willsky with S. H. Nawab, Signals and Systems, Pearson India Education Services, Second Edition, 2015.

R2: M. J. Roberts, Signals and Systems: Analysis using Transform Methods and MATLAB, Tata McGraw-Hill Publishing Company Limited, Second Edition, 2003.

5. Course Plan:

Module No.	Lecture Session	Reference	Learning outcomes
1. (1)	Introduction		
2. (2-5)	Classifications; Mathematical Representation; Elementary signals: Unit Impulse, Unit Step, Unit Ramp, and Exponential; Transformations of the Independent Variable.	T1-1.1 to 1.5 T1- 8.1 to 8.4 R1 -1.1 to 1.4	Understand the fundamental signals used in continuous-time (CT) and discrete-time (DT) representations.
3. (6-8)	Basic System Properties (Causality, Stability, Time-Invariance, Linearity, Invertibility, systems with and without memory); Interconnections of systems.	T1-1.6 to 1.8 T1- 8.5 R1-1.5 to 1.6	Understand the various properties associated with CT and DT systems.

4. (9-13)	Unit Impulse Response; Convolution Sum and Convolution Integral Representation; Properties of LTI systems.	T1- ch2, ch9 R1- 2.1 to 2.4	Understand the concepts of convolution in CT and DT domains.
5. (14-17)	Fourier Series Representation for periodic signals and its convergence; Properties of Fourier Series.	T1- ch3, ch10 R1- 3.1 to 3.8	Understand the concepts of Fourier series for periodic signals in CT and DT domains.
6. (18-21)	CT Fourier Transform and its Properties; continuous-time LTI System characterizations using the differential equations.	T1- ch4, R1- ch4	Understand the concepts of Fourier Transform for CT signals.
7. (22-25)	Laplace Transform and it properties, Region of Convergence; LTI System characterizations.	T1- ch6 R1- ch9	Understand the concepts of stability with respect to ROC for CT LTI systems.
8. (26-29)	Conversion from CT signals to DT signals using the sampling theorem; Aliasing, Reconstruction of Signals; Effect of Under Sampling.	T1- ch5 R1- 7.1 to 7.3	Understand the concept of Sampling.
9. (30-33)	DT Fourier Transform and its Properties; discrete-time LTI System characterization using the difference equations.	T1- ch10 R1- ch5	Understand the concepts of Fourier Transform for DT signals.
10. (34-37)	z-transform and it properties, Region of Convergence; LTI System characterization; Hardware implementations (Direct form-I and II)	T1- ch11 R1 - ch10	Understand the concepts of stability with respect to ROC for DT LTI systems.
11. (38-40)	Random Signals and Systems	Notes	

6. Evaluation Scheme:

Component	**Duration**	**Weightage (200 marks)**	**Date & Time**	**Nature of component (Close Book/ Open Book)**
Mid-Semester Test	90 Mins	30%	TBA	Open Book
Comprehensive Examination	2 Hours	40%	01/05 FN	Open/closed Book
Quizzes (Total = 3) Best of 2 Quizzes	20 Mins	20%	TBA	Open Book
MATLAB Assignment		10%	TBA	Open Book

7. Chamber Consultation Hour:

8. Notices: Notices regarding the course will be displayed only on NALANDA.

9. Make-up Policy: No make-up will be given for Quizzes, however for other components; make-up will be given ONLY in ***extremely genuine*** cases. In such cases, the student must produce the sufficient proof or must have taken the prior permission from the IC.

10. Note (if any):

Instructor-in-charge
Course No. EEE/INSTR F243