**BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI-Hyderabad Campus**
**SECOND SEMESTER 2019 - 2020**
<u>**COURSE HANDOUT (PART II)**</u>

**Dt:** 06-01-2020

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

*Course No*              : **EEE / ECE / INSTR F243**
*Course Title*           : **Signals & Systems**
*Instructor-in-charge*   : BVVSN Prabhakar Rao
Instructors              : BVVSN Prabhakar Rao, Ramakant, Rajesh Kumar
                           Tripathy, R.Venkateswaran

**1. 1: Scope and Objective:**

This course is a preparatory course in which the basics of signal processing are covered. It deals with the basic transforms used in signal processing & introduces the analog filters. For practical exposure **Matlab based assignments** are included.
The students are required to review following mathematical topics: **Fourier Series, Fourier Transforms, Laplace Transform, Calculus, Complex variables and Statistic**s.

**1.2: Learning outcomes:**

On completion of this course, student should be able to:

(1)  **Represent** both continuous-time and discrete-time signals as a Fourier series.
(2) **Use** the Fourier transform and the Laplace transform to analyze continuous-time signals and systems
(3) **Explain** the importance of superposition and convolution in the analysis of linear time invariant systems.
(4) **Demonstrate** an understanding of the relationship between the stability and causality of systems and the region of convergence of their Laplace transforms
(5) **Use** the discrete-time Fourier transform and the z-transform to analyze discrete-time signals and systems
(6) **Use** FFT algorithm

**2. Text Book :**

**T1:** Lathi B P, Principles of *Signal Processing & Linear Systems* Oxford University Press, 2009.

**3. Reference Books :**

**R1:** A V Oppenheim, A S Willsky, Nawab S N, *"Signals & Systems"*, PHI, Second Edition, 2006
**R2:** Nagrath I J, Sharan S N, Ranjan Rakesh & Kumar S, S*ignals & Systems*, Second Edition TMH, 2001.

**4. Course Plan:**

| Lecture No. | Learning Objectives | Topics to be covered | Chapter in the Text Book |
|---|---|---|---|
| 1 | Importance of the signals & Systems course | Introduction to course | ------- |
| 2 - 4 | Introduction about function, understanding different types of continuous time signals and performing different time signal operations | Classification of Signals & Signal operations | Class notes and T1: 1.1 - 1.5 |
| 5 - 6 | Signal representation using basis signals | Orthogonal Signal set & Fourier series | Class notes and T1 :3.3 T1: 3.4 - 3.5 (self-study) |
| 7 - 9 | Synthesize and analysis of various continuous time signals | Aperiodic Signal Representation, Fourier Transforms & its properties | Class notes and T1: 4.1-4.3 (exclude : 4.3-6) |
| 10 | Defining various systems | Classification of Systems | Class notes and T1: 1.6 & 1.7 |
| 11 - 12 | Obtaining of LTI system output for any arbitrary input signal using impulse response | Linear convolution (LC) & LC using Fourier Transform | Class notes and T1: 2.4 & 4.3-6 |
| 13 - 14 | Studying exponentially growing signals and analyzing stable systems | Laplace transform & its properties | Class notes and T1: 6.1 - 6.2 |
| 15 | Analyzing stable systems | Solution of LTI continuous time systems using Laplace transforms | Class notes and T1: 6.3 |
| 16 - 18 | Sampling of continuous time signals and their recovery | Sampling & reconstruction | Class notes and T1: 5.1 |
| 19 - 20 | Understanding different types of discrete time signals and performing different time signal operations | Discrete-time signals & Signal operations | Class notes and T1: 8.1 - 8.4 |
| 21 - 22 | Synthesize and analysis of various discrete time signals | Discrete Time Fourier Transform & its properties | Class notes and T1: 10.2 - 10.5 |
| 23 – 24 | Analysis of discrete time systems | Z-transforms & its properties | Class notes and T1 : 11.1 – 11.2 |
| 25 – 26 | z-transform solution of Linear difference equation | Z-transforms converting difference equations into algebraic equations | Class notes and T1 : 11.3 |
| 27 -28 | Numerical computation of Discrete Fourier transform | DFT & its Properties | Class notes and T1: 5.2 |
| 29- 30 | Obtaining output for discrete time systems for any arbitrary discrete input signal | Discrete time systems, Discrete time convolution (graphical procedure) | Class notes and T1 : 9.4-1 |
| 31 - 33 | DFT method using FFT algorithms | Fast Fourier Transform, DIT FFT & DIF FFT algorithms | Class notes and T1: 5.3 |
| 34 - 37 | DFT & IDFT using FFT algorithms | DFT using FFT & Inverse DFT, Discrete-time convolution using FFT | Class notes and T1 : 10.6 |

| | 38- 42 | Study of frequency response of different systems | Introduction to analog filters | Class notes and T1: 7.1, 7.4 & 7.5 |
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**\*The primary reference for the coverage (breadth and depth)/nomenclature/notations for a particular topic would be as per the lecturers/tutorials. Students are advised to take class notes during the lectures.**

**5. Evaluation Scheme (CB-Closed book and OB-Open Book)**

| EC No. | Evaluation Component | Time Duration (min) | Weightage (%) | Marks | Date & Time | Nature of Component |
|---|---|---|---|---|---|---|
| 1 | Midsem Test | 90 | 30 | 90 | | CB |
| 2 | Quizzes | | 35 | 105 | To be announced in Class | CB |
| 3 | Comprehensive | 180 | 35 | 105 | 12/05 AN | CB+OB (15% +20%) |

**6. Make-up Policy:**

**No Make-up for the quizzes.**
Make-up for the midterm will be granted as per ID rules and regulations (in case of sickness it should be supported by a medical certificate endorsed by Hostel warden as per ID rules). In all cases prior intimation must be given to IC.

7. **Notices**: Displayed only on CMS

**8. Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in–charge