FIRST SEMESTER 2016-2017

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

Course Handout

Date: July 27, 2016

Course No: **EEE F434**
Course Title: **Digital Signal Processing**
Instructor-in-Charge: **Pawan K. Ajmera** (Chamber no: 2146-K)
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1. **Course Description:**

The course deals with a set of fundamental signal processing concepts that are of prime interests in various related applications. It is mainly divided into four modules, wherein, the first module deals with the discrete-time Fourier transform, discrete Fourier Transform and fast Fourier transform. These transforms are very essential for estimating some of the important features of the signal and also lay the basic foundations for other advanced signal processing transforms. The second module will cover the underlying concepts and design of the continuous and discrete (or digital) filters. As filtering operations are required in most of the signal-processing related applications, it is utmost important to learn and understand these techniques and put them into practice. This module ends with a brief introduction of the adaptive filtering. The third module will introduce the topic of multirate signal processing. Using these techniques, the signal processors can alter the sampling frequency of the signal, as per their requirements. Finally, the fourth module will include lectures on Digital signal processing applications.

2. **Scope and Objective:**

To provide underlying concepts behind the fundamental transforms of signal processing, different methods of filtering operations and their application, multirate signal processing and biomedical signal processing. Lab components involve MATLAB exercises and project, which will provide students to gain hands-on experience along with the concepts gained in the class.

3. **Prerequisites:** Signals and Systems (EEE F 243/INSTR F 243) is mandatory.

4. **Text Books:**

T1: S. K. Mitra, *Digital Signal Processing (3rd edition)*, McGraw Hill Higher Education, New York City, USA, 2005. ISBN-10: 0073048372.

T2: A. V. Oppenheim and R. W. Schafer, *Discrete-Time Signal Processing (3rd edition)*, Pearson, New Delhi, India, 2013. ISBN: 978-93-325-0574-2.

Other Reference Books

R1: J. G. Proakis and D. G. Manolakis, *Digital Signal Processing (4th edition)*, Prentice Hall, Englewood Cliffs, New Jersey, USA, 2006. ISBN: 978-0131873742.

R2: L. B. Jackson, *Digital Filters and Signal Processing (3rd edition)*, Kluwer Academic publishers, Norwell, MA, 1996. ISBN 978-1-4419-5153-3.

R3: A. V. Oppenheim, A. S. Willsky and S. Hamid, *Signals and Systems (2nd edition)*, Prentice Hall, Englewood Cliffs, New Jersey, USA, 1996. ISBN: 978-0138147570.

R4: MATLAB Online Tutorials.

R5: P. P. Vaidyanathan, *Multirate Systems and Filter Banks*, Prentice Hall, Englewood Cliffs, New Jersey, USA, 1993. ISBN: 007-6092032502.

R6: R. M. Rangayyan, *Biomedical Signal Analysis: A Case-Study Approach,* Wiley-IEEE Press, New York, USA, 2001. ISBN: 978-0-471-20811-2.

Class lectures will be derived either from the text books or reference books and additional materials may be provided whenever necessary.

5. Course Plan:

Module	Lecture No.	Topics to be covered
Introduction	1	Overview of the course.
Continuous-to-Discrete signals	2-4	Continuous time signals, Sampling theorem, Aliasing, Discrete time signals and systems, Convolution.
Fundamental Transforms	5-12	Discrete Time Fourier Transform, Discrete Fourier Transform: properties, windowing effect, zero padding and FFT computation.
Filter Concepts	13-25	Overview of z-transform, Filter Characteristics, Filter types, Continuous Filters (IIR): Butterworth, Chebyshev, Elliptic. IIR Continuous-to-Discrete Filter conversion, FIR filters using windowing, Optimum approximation of FIR filter, advantages and disadvantages of using the FIR and IIR filters.
Realization of Digital Filters	26-30	FIR and IIR Filters Structures.
Adaptive Filters	31-34	Introduction and concepts of adaptive filtering, Wiener filters.
Multirate Signal Processing	35-37	Decimation and Interpolation.
Digital Signal Processing Applications	38-40	Introduction, Event detection: ECG and EEG, Speech signal processing.

6. Evaluation Scheme:

Evaluation Component	Durations (Mins)	Weightage (%)	Date, Time and Venue	Remarks
Mid Semester Test	90	30%	08/10/2016 (14:00 – 15:30)	Close Book
Labs (MATLAB)	Regular	20%		
MATLAB Project	To be announced in the class	20%		Project presentation. Report and MATLAB code submission in PDF
Comprehensive	180	30%	14/12/2016 FN	Open Book

7. Office Hours: Will be announced in the class.

8. Notices: Notices regarding the course will be displayed only on the notice board of EEE (FDII).

9. Malpractice Regulations:

The following regulations are supplementary to BITS-wide policies regarding malpractices:

- A mal-practice will include but not limited to:

  - Submitting some other student's solution as one's own.
  - Copying some other student's MATLAB code or other forms of solution.
  - Permitting some other student to see or copy or submits one's own solution.
  - Or other equivalent forms of plagiarism wherein the student does not work out the solution and use some other solution or part thereof (such as downloading it from the LAN or the Web).

10. Make-up Policy: Makeup will be granted to ***extremely genuine*** cases only, *provided the IC has been informed.*

Instructor-in-Charge

EEE F 434