Building an Online Digital Signal Processing Course

Course Title	Building an Online Digital Signal Processing Course – Workshop for TEQIP-III Institute Faculty
Course Category	Pedagogy
Relevant Discipline(s)	Electrical Engineering, Electronics Engineering, Electronics and Telecommunication, Computer Science and Engineering.
Duration of course in equivalent integer no. of days(min 3 days, 1 day = 6 hrs of lectures/hands on sessions)	3 days: On each day, online discussions on half day, solving exercises and assignments together, the other half
Proposed dates	9-11 December 2020. If need be, we may repeat this in a subsequent week.

Brief Course Description and Course Contents

Digital Signal Processing is a fundamental course, taught either as a core subject or a preferred elective in many disciplines, particularly the disciplines of Electrical Engineering, Electronics Engineering, Electronics and Telecommunication, Computer Science and Engineering.

The advent of modern computers has implied a dramatic increase in computational power and computational resources. This has enormous implications for signal processing: which is the science by which we extract information from signals and modify them. The current scenario has led to the development of certain signal processing tools which were unheard of, when processing was purely analog. Further, such tools are easily amenable to modification and upgradation. In all this development, however, it has been necessary to adopt one fundamental change in the modus operandi of processing signals, which is as follows. Analog processing inherently works with a continuum of values for the independent variable. On the other hand, for the best possible use of computational resources available today, the independent variable must be discretized. If the independent variable is time, for example, one needs to deal with a series of data indexed by discrete points in time.

Over the last quarter of the twentieth century, this subject of dealing with discrete data has evolved tremendously. It is formally termed “Digital Signal Processing” (DSP). Tremendous research has gone into building the subject up to its current status. It has myriad applications. The areas of application include, but are not limited to: data communication, audio and video compression, instrumentation, active noise control, geophysical system analysis and design, biomedical signal and system analysis, wireless communication systems…in fact, the domain of application of Digital Signal Processing is growing day by day. Research and development in this field continues even to date.

The aim of this course is to introduce the basic principles and developments that have taken place in this rich and evergreen subject, while providing some expertise in DSP

system design.

During this workshop, we plan to build a pedagogical approach to achieving as many of the following learning outcomes for a student of the course, as we find we can reasonably do. If need be, we shall plan a follow up workshop for the remaining and further objectives:

1. Design Infinite Impulse Response (IIR) Filters with given realizable specifications, taking assistance of programming and numerical tools, using the bilinear transformation and frequency transformations, based on the Butterworth and Chebyschev approximations for IIR Filter Design.
2. Design Finite Impulse Reponse (FIR) Filters with given realizable specifications, taking assistance of programming and numerical tools, using the window method.
3. Realize discrete systems using, at least, Direct Form – I, II and Cascade-Parallel Forms.
4. Use the Discrete Fourier Transform (DFT) at an elementary level, to analyze discrete time systems, when admissible.
5. Write out a radix-2 Fast Fourier Transform (FFT) algorithm using decimation in time and decimation in frequency and evaluate it for computational complexity.
6. Describe and explain in reasonable detail, at an elementary level, at least one practical application of Digital Signal Processing, with sound technical details.

Instructor Details

S. No.	**Name of the Instructor**	**Department**	**Email**
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