

# Online Short Term Course on "Multirate Signal Processing and Applications"



2 Nov – 27 Dec, 2020

Centre for Continuing Education (CCE)

Indian Institute of Science, Bangalore, India - 560012

## Module wise coverage:

- Module#1

Sampling theorem proof and its significance; Basics of multirate systems; Frequency representation of expanders and decimators; Decimation and interpolation filters.

- Module#2

Fractional sampling rate alterations; Digital filter banks; DFT as filter bank; Noble Identities; Polyphase representation; Efficient architectures for interpolation and decimation filters.

- Module#3

Efficient architecture for fractional decimator; Multistage filter design; Two-channel filter banks; Amplitude and phase distortion in signals.

- Module#4

Polyphase representation of 2-channel filter banks, signal flow graphs and perfect reconstruction; M-channel filter banks; Polyphase representation of M-channel filter bank; Perfect reconstruction of signals.

- Module#5

Nyquist and half band filters; Special filter banks for perfect reconstruction Demonstration of sub-band coding of signals. Implementations of speech and image compression. Discussions and Applications Introduction to wavelets (Physics approach and Solitons).

This is expected to be an online 30 hour crash course on Multirate Signal Processing and its Applications. The subject of multirate signal processing stems from the need of sampling rate conversions done digitally without requiring to go back and forth from digital to analog converters (DACs) and resampling them. From signal compression engines, sampling rate converters to communication systems, multirate signal processing techniques are extensively used. In this course, we provide the necessary knowledge on theory and practice of such systems.

Online course materials will be provided.

### **Target Audience:**

- Students who have done a B.E or M.Sc in Physics or mathematics with familiarity in undergraduate DSP wanting to learn advanced concepts in this field.
- College teachers who want to learn advanced DSP techniques to hone their teaching and research skills benefiting from this course.
- Industry professionals who work in signal processing and communications systems, building circuits and systems based on the domain knowledge in this field.
- The course requires a minimum of 200 students to start the course. The maximum number is capped at 250.

### **Grading Policy:**

- A final exam – 50%
- A project completion along with a report – 50%

### **Resources:**

- P. P. Vaidyanathan. Multirate Systems and Filter Banks. Prentice Hall. Book, 1993. ISSN 1050- 2769. ISBN 0136057187, 9780136057185
- S.S. Garani. Mathematical Methods and Techniques in Signal Processing. NPTEL, 2018.

### **Minimum Qualification Required:**

Bachelors in EE/ECE/Instrumentation Engineering or M.Sc Physics/Mathematics and Allied Areas

### **Prerequisites:**

Familiarity with signals and systems Undergraduate DSP level.

**Course Coordinator:**

Prof. Shayan Srinivasa Garani, Dept. of Electronic System Engineering, Indian Institute of Science, Bangalore – 560012

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**Registration:** This course can be attended only by registration. The number of participants is limited to 250. The registration will be accepted on a first-come first-served basis.

**Apply online at:** <http://cce.iisc.ac.in/ssp-stc.html>

**The registration fee is INR 15000 +18% GST**

**Duration:** 2 November – 27 December, 2020 (4 hrs a week)

**Last Date to Apply:** 30/09/2020

**Note:** Classes will be conducted via Microsoft Teams/Google meet.