Course title & Code	Credits	Credit-distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Integral Transforms: Applications to Digital Signal Processing, DSE 3, V. 5.9	**4**	**1**	**0**	**3**	**12th Pass with Maths**	**Calculus, Linear Algebra, Differential equations**

Learning Objectives

Signal processing is, in a sense, application of various mathematical tools that primarily consist of Fourier Transforms, Laplace Transforms and z – Transforms. This is a practical-based course and students will :

- learn to utilize integral transformations to solve and analyze problems in digital signal processing
- comprehend and deploy signal processing techniques in an applied environment
- be able to design different types of filters

Learning outcomes

- Identification, understanding and differentiation between discrete time system and continuous time system
- Be able to apply mathematical tools – Laplace transform, Z transform and Fourier transform to various signals
- Implementation different signal types on matrix based numerical based software
- Designing different low pass, band pass and high pass filters
- Reconstruction of signal from its samples using natural sampling

Syllabus

Theory – (15 Hours)

LTI system; Convolution; Impulse response representation of LTI system; Fourier Series and Fourier coefficients; Complex exponential function; Fourier Transforms and their basic properties; Some Fourier transform pairs, Nyquist Sampling theorem

Practicals – (105 Hours)

- Representation of elementary signals (periodic and non-periodic)
- Basic operations on signals
- MATLAB implementation of different signal types
- Output of convolution of two signals
- Impulse response of an LTI system
- Simulations of difference equations
- Frequency response of LTI system from impulse response

- Representation of DTFS and FS of a signal
- Frequency response of LTI system described by a differential or difference equation
- Relating DTFS to DTFT
- Transform analysis of LTI system
- Computational structures for implementing discrete time LTI systems
- FIR & IIR Filter Implementation using the DSP Processors.
- Sampling theorem and reconstruction of signal from its samples using natural sampling

Essential/ Recommended readings:

- C. L. Byrne, "Signal Processing: A Mathematical Approach", 2 Ed., CRC Press, 2015.
- Haykin, S. and Van Been, B., "Signals and Systems" 2 Ed., John Wiley & Sons, 2003.
- Sundararajan, D., "A Practical Approach to Signals and Systems", Wiley, 2008.
- Padmanabhan, K., Ananthi, S. and Vijayarajeswaran, R., "A Practical Approach to Digital Signal Processing", New Ag International, 2003.