DISCIPLINE SPECIFIC ELECTIVE COURSE (DSE):

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
A mathematical approach to signal processing DSE	**4**	**3**	**1**	**0**		**Calculus, Linear Algebra, Ordinary Differential Equations**

Learning Objectives

Signal processing is, in a sense, application of various mathematical tools that primarilty consist of Fourier Transforms, Laplace Transforms and z – Transforms. Through this course a student would learn the necessary mathematical background and tools in order to comprehend and deploy signal processing techniques in an applied environment. The emphasis would be on some fundamental problems and essential tools, as well as on their applications to digital signal processing.

Learning outcomes

After completing this course, student should be able to:

- Identify, understand and differentiate between discrete time system and continuous time system
- Apply mathematical tools – Laplace transform, Z transform and Fourier transform to various signals
- Implement different signal types on matrix based numerical based software

SYLLABUS

Unit I: Fourier Series and Fourier coefficients; Complex exponential function; Fourier Transforms and their basic properties; Some Fourier transform pairs; Dirac delta; Inverse Fourier transforms (12 hour)

Unit II: Classification of Signals; LTI system; Convolution; Impulse response representation of LTI system and its properties; Differential and Difference equation representation of LTI system; Application of Fourier Series and Fourier transforms to Discrete and Continuous periodic and non-periodic signals (12 hour)

Unit III: Laplace Transform; Inverse Laplace Transform; Solving Differential equation with initial conditions using Laplace Transform, Representing signals by using continuous time complex exponentials (10 hours)

Unit IV: z-Transform; Properties of z-Transform; Inverse of z-Transform; Representing signals by using discrete time complex exponentials (9 hours)

Essential/recommended readings

1. *C. L. Byrne,* "Signal Processing: A Mathematical Approach", 2 Ed., CRC Press, 2015.
2. *Haykin, S. and Van Been, B*., "Signals and Systems" 2 Ed., John Wiley & Sons, 2003.
3. *Oppenheim, Alan, and Alan Willsky*. Signals and Systems. 2nd ed. Prentice Hall, 1996.