Program : **Diploma in Electronics and Communication/ Biomedical Engineering**	
Course Code :	Course Title: **Signals and Systems**
Semester : **5/6**	Credits: **4**
Course Category: **Program Core/ Elective**	
Periods per week: **4 (L:3, T:1, P:0)**	Periods per semester: **60**

Course Objectives:

- To introduce students to the idea of signals and systems, their characteristics in time and frequency domain.
- To provide basic knowledge on Fourier representation and Laplace transform and its applications on signals and systems

Course Prerequisites:

Topic	Course code	Course name	Semester
Differentiation, Integration	1002 2002	Mathematics I & II	1 & 2

Course Outcomes:

On completion of the course, the student will be able to:

COn	Description	Duration (Hours)	Cognitive level
CO1	Summarize the basic concepts, classifications and mathematical properties of signals	14	Understanding
CO2	Classify and compare continuous time and discrete time systems	12	Understanding
CO3	Explain Fourier representation of signals	16	Understanding
CO4	Apply Laplace transform to demonstrate the concepts of signals and systems	16	Applying
	Series Test	2	

CO – PO Mapping:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2						
CO2	2						
CO3	2						
CO4	3						

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

Course Outline:

Module Outcomes	Description	Duration (Hours)	Cognitive Level
CO1	**Summarize the basic concepts, classifications and mathematical properties of signals**		
M1.01	Define signals and its importance.	3	Understanding
M1.02	Explain the basic elementary signals used in communication.	4	Understanding
M1.03	Select various types of signals.	4	Apply
M1.04	Explain the basic operation on signals.	3	Understanding
Contents: • **Define signals:** state the importance of signals and systems in the field of science and engineering. • **Basic elementary signals:** Unit step function, unit impulse function, ramp, parabolic, signum, exponential, rectangular, triangular, and sinusoidal. • **Classification of signals:** continuous time and discrete time, deterministic and non-deterministic, even and odd, periodic and aperiodic, energy and power, real and imaginary. • **Mathematical operations on signals:** amplitude scaling, time scaling, time shifting, time reversal, addition, subtraction, multiplication and convolution.			
CO2	**Classify and compare continuous time and discrete time systems**		
M2.01	Show time domain representation of a system.	3	Understanding
M2.02	Compare continuous time and discrete time systems	3	Understanding

M2.03	Interpret impulse response of a continuous time and discrete time system.	3	Understanding
M2.04	Identify various properties of systems.	3	Apply
	Series Test – I	1	

Contents:

- **Representation of systems:** Differential equation representation, Difference equation representation
- **Continuous time and discrete time systems –** Impulse response, examples
- **Properties of systems –** linearity, time invariant system, invertible, casual and non-casual, stable and unstable.

CO3	**Explain Fourier representation of signals**		
M3.01	Apply Fourier series and discrete time Fourier series	5	Apply
M3.02	Summarize the properties of Fourier series	3	Understanding
M3.03	Explain sampling theorem, aliasing, reconstruction	4	Understanding
M3.04	Apply Fourier transform, discrete time Fourier transform	4	Apply

Contents:

- Fourier representation of four class of signals
  - Continuous time periodic signal : Fourier series (FS)
  - Discrete time periodic signal : Discrete time Fourier series (DTFS)
  - Continuous time non-periodic signal : Fourier transform (FT)
  - Discrete time non-periodic signal : Discrete time Fourier transform (DTFT)
- Properties of Fourier representation – linearity, symmetry, time shift, frequency shift, scaling, differentiation and integration, convolution and modulation
- Sampling theorem, aliasing, reconstruction

CO4	**Apply Laplace transform to demonstrate the concepts of signals and systems**		
M4.01	Interpret the frequency domain parameters of a signal using Laplace transform	5	Understanding
M4.02	Illustrate the region of convergence	2	Understanding
M4.03	Outline Properties of Laplace transform	4	Understanding

M4.04	Apply Inverse Laplace transform to Signals	5	Applying
	Series Test – II	1	

Contents:

- **Need of Laplace transform**
- **Region of Convergence (ROC)**
- Advantages and limitation of Laplace transform
- **Laplace transform of some commonly used signals** - impulse, step, ramp, parabolic, exponential, sine and cosine functions
- **Properties of Laplace transform:** Linearity, time shifting, time scaling, time reversal, transform of derivatives and integrals, initial value theorem, final value theorem.
- **Inverse Laplace transform:** simple problems (no derivation required)

Text/Reference:

T/R	Book Title/Author
T1	Simon Haykin : Signals and System, John Wiley 2/e 2003
T2	A. Anand Kumar : Signals and System, PHI, 2/e 2012
T3	Nagoor Kani : Signals and System, Tata McGrew Hill, 3/e 2011
R1	Ramesh Babu : Signals and Systems, Scotch Publications, 4/e
R2	Alan V. Oppenhein, Alan S. Willsky : Signals and System, PHI, 2/e
R3	Simon Haykin : Communication Systems, John Wiley 4/e
R4	Hwei P. Hsue : Signals and System, Tata McGrew Hill 1995
R5	Rodger E. Ziemer : Signals and System – Continuous and Discrete 4/e, Pearson Education
R6	M. J. Robert : Signals and Systems, Tata McGrew Hill, 2003

Online Resources:

Sl.No	Website Link
1	https://nptel.ac.in/courses/108/104/108104100/
2	https://nptel.ac.in/courses/117/101/117101055/