Signal Analysis

**Course Objectives:**  
To provide understanding of basic concepts in signals and systems.

1. **Signal(4 hours)**  
   Signal definition, continuous time signal, discrete time signal, basic signal types, energy signal, power signal, periodicity of continuous time signal, periodicity of discrete time signal, transformation of independent variable.

1. **Fourier series(9 hours)**  
   Continuous time Fourier series representation, properties of continuous time Fourier series (linearity, time shift, frequency shift, time reversal, time scaling, conjugation conjugate symmetry, multiplication, convolution), Parsevals relation.Discrete time Fourier series representation, Properties of discrete time Fourier series  (linearity, time shift, frequency shift, time reversal, conjugation and conjugate symmetry, multiplication, convolution), parseval’s relation.

1. **Fourier transform(12 hours)**  
   Continuous time Fourier transform representation, properties of continuous time Fourier transform (linearity, time shift, frequency shift, time reversal, time scaling, duality, conjugation and conjugate symmetry, multiplication, convolution), Parseval’s relation, Fourier transform of  square wave function, impulse function, unit step function, rectangular function, signum function,  cosine function, periodic function etc, energy spectral density, power spectral density. Discrete time Fourier transform representation, properties of discrete time Fourier transform (linearity, time shift, frequency shift, time reversal, conjugation and conjugate symmetry, multiplication, convolution), Parseval’s relation, Fourier transform of  rectangular sequence, unit sample sequence,  periodic sequence etc, discrete Fourier transform, properties of discrete Fourier transform.

1. **Sampling(2 hours)**  
   Ideal sampling, practical considerations in sampling, reconstruction of signal from its samples, aliasing.

1. **Continuous time system(9 hours)**  
   System definition, properties of system, Linear time invariant (LTI) system, convolution integral, properties of LTI system, frequency response of LTI system, bode plot,  conditions for distortion less transmission, ideal low pass filter, impulse response and step response of ideal low pass filter, impulse response and frequency response of first order system and second order system.

1. **Discrete time system(9 hours)**  
   System definition, properties of system, Linear time invariant (LTI) system, convolution sum, properties of LTI system, difference equation, transfer function, frequency response of LTI system, bode plot,  conditions for distortion less transmission, impulse response and frequency response of first order system and second order system.

**References**

1. Alan V. Oppenheim, Alan S. Willsky, S. Hamid “Signals and Systems”, Prentice Hall
2. B. P. Lathi, “Linear systems and signals”, Oxford University Press.

**Evaluation Scheme**  
Marks distribution for all the chapters in the syllabus is shown in the table below.

|  |  |  |
| --- | --- | --- |
| **Chapters** | **Hours** | **Mark Distribution\*** |
| 1 | 4 | 8 |
| 2 | 9 | 14 |
| 3 | 12 | 22 |
| 4 | 2 | 6 |
| 5 | 9 | 15 |
| 6 | 9 | 15 |
| **Total** | **45** | **80** |

**\*Note: There may be minor deviation in marks distribution.**