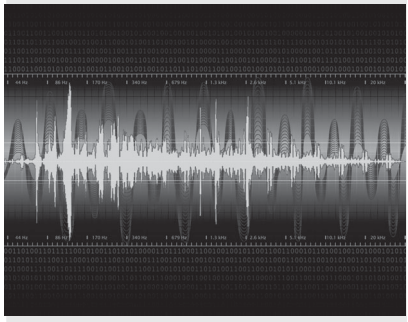
16BM205 SIGNALS AND SYSTEMS FOR BIOENGINEERS



Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P
45	-	30

WA/RA	SSH/HSH	CS	SA	S	BS
20	48	6	12	3	2

Course Description and Objectives:

This course deals with varoius signals, systems and their analysis along with their applications. The objective of this course is to enable the student to understand the continous time signals, systems and thier properties, analysis of signals using transforms, to analize and predict the behaviour of linear systems.

Course Outcomes:

The student will be able to:

- explain the importance of superposition in the analysis of linear systems.
- list and apply properties of different transforms.
- use Fourier and Laplace transforms to solve differential equations, and to determine the response of linear systems to known inputs.
- understand the relationship between the stability and causality of systems and the region of convergence of their Laplace transforms.
- demonstrate the relation among the transfer function, convolution, and the impulse response.
- understand the fundamentals of sampling including the implications of the sampling theorem.

SKILLS:

- ✓ *Design and test a stable system.*
- ✓ *Choose the various transforms and their applications in the analysis of signals and systems.*
- ✓ *Apply transformation to real-world problems involving bio-signals such as EEG, ECG and EMG.*
- ✓ *Analyze the abnormalities present in the physiological systems.*
- ✓ *Choose the desired sampling frequency for a given application.*

ACTIVITIES:

- *Recording of various signals like Speech, Noise, Audio signals and analysis using Matlab and spectrum analyzer.*

UNIT - 1 **L-9**

CLASSIFICATION OF SIGNALS AND SYSTEMS: Continuous time signals (CT signals), Discrete time signals (DT signals), Step, Ramp, Pulse, Impulse, Sinusoidal, Exponential, Classification of CT and DT signals, Periodic and A periodic signals, Deterministic and Random signals, Energy and Power signals, CT systems and DT systems Classification of systems, Static and Dynamic, Linear and Nonlinear, Time-variant and Time-invariant, Causal and Noncausal, Stable and Unstable.

UNIT - 2 **L-9**

ANALYSIS OF CONTINUOUS TIME SIGNALS: Fourier series analysis-spectrum of continuous Time (CT) signals, Fourier and Laplace Transforms in CT Signal Analysis, Properties.

UNIT - 3 **L-9**

LINEAR TIME INVARIANT- CONTINUOUS TIME SYSTEMS: Differential Equation, Block diagram representation, Impulse response, Convolution Integrals, Fourier and Laplace transforms in Analysis of CT systems.

UNIT - 4 **L-9**

ANALYSIS OF DISCRETE TIME SIGNALS: Baseband Sampling, DTFT, Properties of DTFT, Z Transform, Properties of Z Transform.

UNIT - 5 **L-9**

LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS: Difference Equations, Block Diagram Representation, Impulse response, Convolution sum, Discrete Fourier and Z Transform Analysis of Recursive and Non-Recursive systems.

LABORATORY EXPERIMENTS

Outcomes:

Students will be able to:

- explain the importance of superposition in the analysis of linear systems.
- list and apply properties of different transforms.
- use Fourier and Laplace transforms to solve differential equations, and to determine the response of linear systems to known inputs.
- understand the relationship between the stability and causality of systems and the regionof convergence of their Laplace transforms.
- demonstrate the relation among the transfer function, convolution, and the impulse response.
- understand the fundamentals of sampling including the implications of the sampling theorem.

LIST OF EXPERIMENTS: Total hours-30

1. Introduction to MATLAB.
2. Vectors and Matrices generation and operations on it.
3. Generation and plotting of Trigonometric and exponential functions.
4. Standard Signal Generation (Impulse,Step, Ramp & Sinc).
5. Operations on signals (Folding, Shifting and Scaling).
6. Periodic and Non-periodic signal generation.
7. Analysis of periodic signals.
8. Analysis of Non-periodic signals.
9. Analysis of transfer function.
10. System Analysis by using poles and zeroes.
11. Sampling theorem verification.
12. System Response.
13. Convolution of Continuous signals.
14. Correlation of Continuous signals.

Note: Any twelve of the above experiments.

TEXT BOOK:

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, “Signals and Systems”, 3rd edition,Pearson, 2007.

REFERENCE BOOKS:

1. B. P. Lathi, “Principles of Linear Systems and Signals”, 2nd edition, Oxford, 2009.
2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, “Signals and Systems - Continuous and Discrete”,4th edition, Pearson, 2007.
3. John Alan Stuller, “An Introduction to Signals and Systems”,1st edition, Thomson, 2007.
4. M.J.Roberts, “Signals & Systems Analysis using Transform Methods and MATLAB”, 2nd edition,Tata McGraw Hill, 2007.