Principles of Signals and Systems

Electronics & Communication Engineering

Instructor Name: Prof. Aditya K. Jagannatham
Institute: IIT Kanpur
Department: Electrical Engineering

About Instructor: Prof. Aditya K. Jagannatham (http://home.iitk.ac.in/~adityaj/index.html) received his Bachelors degree from the Indian Institute of Technology, Bombay and M.S. and Ph.D. degrees from the University of California, San Diego, U.S.A.. From April 07 to May 09 he was employed as a senior wireless systems engineer at Qualcomm Inc., San Diego, California, where he worked on developing 3G UMTS/WCDMA/HSDPA mobile chipsets as part of the Qualcomm CDMA technologies division. His research interests are in the area of next-generation wireless communications and networking, sensor and ad-hoc networks, digital video processing for wireless systems, wireless 3G/4G cellular standards and CDMA/OFDM/MIMO wireless technologies. He has contributed to the 802.11n high throughput wireless LAN standard and has published extensively in leading international journals and conferences. He was awarded the CAL(IT)2 fellowship for pursuing graduate studies at the University of California San Diego and in 2009 he received the Upendra Patel Achievement Award for his efforts towards developing HSDPA/HSUPA/HSPA+ WCDMA technologies at Qualcomm. Since 2009 he has been a faculty member in the Electrical Engineering department at IIT Kanpur, where he is currently an Associate Professor, and is also associated with the BSNL-IITK Telecom Center of Excellence (BITCOE). At IIT Kanpur he has been awarded the P.K. Kelkar Young Faculty Research Fellowship (June 2012 to May 2015) for excellence in research. His popular video lectures for the NPTEL (National Programme on Technology Enhanced Learning) course on Advanced 3G and 4G Wireless Mobile Communications can found at the following YouTube link (NPTEL 3G/4G).

Pre Requisites: : Basic knowledge of - Integration, Differentiation, Complex Numbers
Core/Elective: : Core_Elective
UG/PG: : Both
Industry Support : Most companies in Electronics, Communication and Signal Processing. Examples are Qualcomm, Broadcom, Intel, Sasken etc.

Course Intro: : This course is introduces the fundamental principles of signals and system analysis. These concepts form the building blocks of modern digital signal processing, communication and control systems. Hence, a sound understanding of these principles is necessary for all students of Electronics and Communication engineering (ECE), Electrical and Electronics Engineering (EEE), and Instrumentation Engineering (IE). The course will cover various basic tools of signal and system analysis such as signal classification, LTI systems, Properties of LTI Systems, Frequency Response, Laplace Transform, Z-Transform, Fourier Transform, Fourier Series, Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT), Cascade/ Parallel structures and their various practical applications. Various concepts such as convolution, impulse/ frequency response, causality, stability of systems will be especially emphasized. Other additional topics such as state space techniques and solutions to state space equations will also be covered. This course is suitable for all UG/PG students and practicing engineers/ managers who are looking to build a solid grasp of the fundamental concepts of signals and systems as well as students/ professionals preparing for their college/ university/ competitive exams.

COURSE PLAN

SL.NO	Week	Module Name

1	1	Introduction to Signals, Signal Classification, Continuous Discrete Time Signals
2	2	Definition and Classification of Systems, Linear Time Invariant (LTI) Systems
3	3	Properties of LTI Systems, Impulse Response, Convolution, Causality, Stability
4	4	Impulse Response of Discrete Time Systems, Discrete Time Convolution, Difference Equations and Analysis
5	5	Laplace Transform, Properties of Laplace Transform, Inverse Laplace Transform
6	6	Introduction to z-Transform, Properties of z-Transform, Region of Convergence, Inverse z-Transform
7	7	Introduction to Fourier Analysis, Fourier Series for Periodic Signals, Properties of Fourier Series
8	8	Introduction to Fourier Transform, Properties of Fourier Transform, Frequency Response of Continuous Time Systems, Examples of Frequency Response
9	9	Fourier Analysis of Discrete Signals, Discrete Time Fourier Transform (DTFT), Properties of DTFT, Examples of DTFT
10	10	Frequency Response of Discrete Time Systems, Discrete Fourier Transform (DFT), Properties of DFT, Examples of DFT
11	11	- IIR FIR Filters, Direct Form Realization, Cascade and Parallel Form Realization, Problem Solving
12	12	Concept of State, State Space Analysis, State Space Representation of Continuous Time Systems, Solution of State Equations for Continuous Systems