PRINCIPLES OF SIGNALS AND SYSTEMS

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PRE-REQUISITES : Basic knowledge of Integration, Differentiation, Complex Numbers

INTENDED AUDIENCE : Students in Electrical Engineering, Electronics and Communication Engineering, Practicing engineers, Technical and Non-technical managers of

telecomm companies, Students preparing for competitive exams with Signals and Systems subject

INDUSTRIES APPLICABLE TO : Most companies in Electronics, Communication and Signal Processing. Examples are Qualcomm, Broadcom, Intel, Sasken etc.

COURSE OUTLINE :

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).
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.

ABOUT INSTRUCTOR :

Prof. Aditya K. Jagannatham 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 was a part of the Qualcomm CDMA technologies (QCT) division. His research interests are in the area of next-generation wireless cellular and WiFi networks, with special emphasis on various 5G technologies such as massive MIMO, mmWave MIMO, FBMC, NOMA, Full Duplex and others. 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 at the University of California San Diego and the Upendra Patel Achievement Award at Qualcomm.He is currently a Professor in the Electrical Engineering department at IIT Kanpur, where he holds the Arun Kumar Chair Professorship, and is also associated with the BSNL-IITK Telecom Center of Excellence(BITCOE). He has been twice awarded the P.K. Kelkar Young Faculty Research Fellowship for excellence in research, the Qualcomm Innovation Fellowship (QInF) and the IIT Kanpur Excellence in Teaching Award. 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). He has also successfully conducted several Massive Open Online Courses (MOOCs) on various topics such as Applied Game Theory, MIMO OFDM Wireless Systems, Probability and Random Processes, Signals and Systems, Principles of Communication Systems, which have been widely adopted and appreciated. A book authored by him titled Principles of Modern Wireless Communications Systems has been published by McGraw Hill Education and comprehensively covers several key aspects of modern wireless technologies.

COURSE PLAN :

Week 1 : Introduction to Signals, Signal Classification, Continuous/ Discrete Time Signals

Week 2 : Definition and Classification of Systems, Linear Time Invariant (LTI) Systems

Week 3 : Properties of LTI Systems, Impulse Response, Convolution, Causality, Stability

Week 4 : Impulse Response of Discrete Time Systems, Discrete Time Convolution, Difference Equations and Analysis

Week 5 : Laplace Transform, Properties of Laplace Transform, Inverse Laplace Transform

Week 6 : Introduction to z-Transform, Properties of z-Transform, Region of Convergence, Inverse z-Transform

Week 7 : Introduction to Fourier Analysis, Fourier Series for Periodic Signals, Properties of Fourier Series

Week 8 : Introduction to Fourier Transform, Properties of Fourier Transform, Frequency Response of Continuous Time Systems, Examples of Frequency Response

Week 9 : Fourier Analysis of Discrete Signals, Discrete Time Fourier Transform (DTFT), Properties of DTFT, Examples of DTFT

Week 10 : Frequency Response of Discrete Time Systems, Discrete Fourier Transform (DFT), Properties of DFT, Examples of DFT

Week 11 : IIR/ FIR Filters, Direct Form Realization, Cascade and Parallel Form Realization, Problem Solving

Week 12 : Concept of State, State Space Analysis, State Space Representation of Continuous Time Systems, Solution of State Equations for Continuous Systems