MODERN DIGITAL COMMUNICATION TECHNIQUES

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IIT Kharagpur

PRE-REQUISITES :

- Analog communications in UG level
- Digital communications in UG level
- Signals and systems in UG level

INTENDED AUDIENCE :

- Students belonging to Electrical sciences with specialization in communication engineering.
- Students on IT
- Instrumentation, etc. may also take this subject as per curriculum requirement.

INDUSTRIES SUPPORT :

- All telecommunication equipment manufacturers and service providers
- Defense officials
- Research laboratories
- ISRO,
- BEL etc.

COURSE OUTLINE :

The course Modern Digital Communication Techniques in taught in IIT Kharagpur as a 4 credit (4 hrs / week) core subject in the Masters program of Telecommunications systems engineering in the department of Electronics and Electrical Communication Engineering. It is taken in the first semester by master degree students, PhD students and Masters by research students. It is also taken as elective by final year UG students. It is also taken as a core subject by Dual degree students who specialize in the field of communication engineering. Digital communications has had one of the most profound influences in the development of the mankind. It is behind the success of today's networked society. The objective of this course is to present the engineering principles, theories and practices, which are fundamental to the successful design of a digital communication system.

The course will delve into the design principles of transmitter and receiver so as to establish a reliable communication link. This course aims at enabling the participants to establish unambiguous mathematical statements describing every step of transmitting and receiving a signal through a communication link. It aims at exposing the details of noise, its modeling and its effect on communication systems design. It will cover methods of performance analysis of digital communication systems. Through use of fundamental knowledge developed in related areas of signal processing, the course aims at presenting a unified way of analyzing and designing a digital communication system. It will encompass fundamental aspects of estimation and detection theory, which are crucial in designing a complete receiver (synchronization, channel equalization, etc.).

ABOUT INSTRUCTOR :

Prof. Suvra Sekhar Das is currently serving as associate professor at the G. S. Sanyal School of Telecommunictions in Indian Institute of Technology Kharagpur. He has completed Ph.D. from Aalborg University, Aalborg, Denmark. He has worked as Senior Scientist with the Innovation Laboratory of Tata Consultancy Services. His research interests include cross-layer optimization of mobile broadband cellular networks, 5G, Broadband Mobile Communications, 5G Waveform design GFDM FBMC UFMC, heteogeneous networks Femto Cells Device to Device communication, Multi objective optimization for radio access networks, Green radio network design Packet Scheduling and radio resource allocation with link adaptation, MIMO communications, base-band transceiver design for broadband wireless communication systems. He has delivered several tutorials and seminars on next generation wireless communications. He has guided several PhD students, published several research papers in international journals and conferences. He has co-authored two books titled " Adaptive PHY-MAC Design for Broadband Wireless Systems"and "Single- and Multi-Carrier MIMO Transmission for Broadband Wireless Systems" . He has developed teaching resource "fading channel and mobile communications " freely available as interactive web material for learners of mobile communications (http://fcmcvlab.iitkgp.ac.in/ with nearly 2 lacs hits). He has taught several subjects such as Modern digital communication techniques, Broadband access systems, mobile communications and fading, teletraffic engineering, introduction to wireless communication and MIMO communications.

COURSE PLAN :

Week 01 : Introduction to digital communication systems
Week 02 : Source Coding
Week 03 : Characterization of Communication Signals & Systems
Week 04 : Signal space Representation
Week 05 : Representation of Memory less Modulation Methods
Week 06 : Nonlinear modulation methods
Week 07 : Optimal receivers of AWGN
Week 08 : Receiver for non-ideal channel
Week 09 : Probability of error of different modulation schemes
Week 10 : Fundamentals of estimation and detection theory used in digital communication
Week 11 : Carrier phase and symbol timing synchronization techniques
Week 12 : Channel estimation and equalization techniques, Power Adaptation methods for colored noise channel