EEE.9-2.10 Telecommunication Systems Design

The course aims to offer a comprehension of the basic postulates and concepts as well as practical skills development for the design and implementation of telecommunication systems and subsystems based on the Software Defined Radio (SDR) approach. On successful completion the student will:

- Comprehend the methodology for designing and implementing telecommunication subsystems using SDR.
- Comprehend and appreciate telecommunication subsystems and realize how they can be implemented with software.
- Comprehend and be familiar with hardware development boards and platforms (FPGA-based SDR development boards, DSP boards etc.).
- Comprehend and be familiar with software development environments and platforms (Matlab/Simulink, GNU Radio, Python, C/C++ etc.).
- Bridge the gap between theory and practice and be able to justify design choices.
- Develop design and development skills. :

More particularly, the course focuses on the physical layer by studying the subsystems that comprise the contemporary architecture of the digital model of a telecommunication system that is, the Digital Radio, as well as how these subsystems are implemented via software (Software Defined Radio - SDR) and is divided as follows,

Introduction: Introduction to the Digital Radio and to the SDR technology. Review and connection with basic Digital Signal Processing.

Software Defined Radio: SDR transmitter and receiver architectures. Signal representation. Complex signals and spectrum. Quadrature modulation.

Hardware and Software tools: Hardware and software development tools and platforms and digital implementation of telecommunication subsystems (FPGA-based SDR development boards e.g., ETTUS and ADALM-PLUTO, Matlab/Simulink, GNU Radio, Python, C/C++).

Design and Implementation: Methodology, applications and implementation examples in modulation and demodulation in analog (AM, DSBsc, SSB) and digital communications (M-PSK, M-QAM).

Special topics: Channel modelling, figures of merit, synchronization, carrier recovery, symbol time estimation, resampling, special filters, channel estimation and equalization etc.

Laboratory exercises and experiments on:- Introduction to SDR, hardware and software tools - Digital implementation of amplitude (AM, DSB, SSB) modulation and demodulation, development on ETTUS and ADALM-PLUTO, -Digital implementation of digital modulation and demodulation (M-PSK, M-QAM), development on ETTUS and ADALM-PLUTO