Module author:
Max Ammann

Module Description:
This module is an introduction to modern wireless-based communications systems

Module aim:
The aim of this module is to give the student an introduction to the fundamental concepts of wireless communications and to the standards employed in wireless communications systems

Learning Outcomes:
On completion of this module, the learner will be able to:
1. Formulate a global and integrated view of the emerging wireless and mobile systems, taking into account the complexities involved in the wireless environment,
2. Develop empirical models for various wireless channels and identify the limitations of these models.
3. Select suitable numerical techniques (method of moments, time/frequency domain solvers, finite elements etc) for the analysis of wireless antennas and electromagnetic safety issues.
4. Identify the different elements comprising a wireless/cellular communications system, in the context of the different wireless standards and their applications.

Learning and Teaching Methods:
This module will be delivered as a series of lectures supported by laboratory exercises.

Module content:
- **Antennas**: Antennas for personal and wireless communications, antenna parameters and modelling. Introduction to diversity combining: Space diversity, Frequency diversity, Polarization diversity.
- **Mobile radio propagation**
- **Fundamentals of radio propagation and channel models**: Large scale path loss; free space and ground reflection models, modern PCS models. Design of point to point wireless links, link budget. Small scale fading & mitigation techniques. Indoor radio propagation and delay spread.
- **Cellular radio**: Introduction to the cellular concept and frequency re-use. GSM and the IMT-2000 system.
- **Modern wireless architectures**: Digital mobile and wireless transceiver architectures. Duplexing techniques.
- **Modulation techniques and performance in wireless channels**: Signal modulation schemes used in mobile systems, spectral characteristics, and error performance. C/N, S/N, Eb/No and BER relations. Offset-QPSK, Minimum Shift Keying and GMSK, Spread Spectrum techniques and Orthogonal Frequency Division Multiplexing.
- **Selected topics on modern wireless systems**: Emerging systems including ultra wideband (UWB)
- **Access techniques**: FDD, TDD and access techniques, FDMA, TDMA and CDMA.
- **Standards**: Wireless systems and standards (to include GSM, DECT, WLAN 802.11x and emerging systems).
- **Wireless overview**: Evolution of wireless networks. Frequency allocations and regulatory aspects. Reconfigurable and software defined-systems

Laboratory work
- Wireless propagation modelling.
- Wireless antenna design and modelling
- Indoor radio propagation measurements

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### Module Assessment:
Students’ performance in reaching the learning outcomes for this module will be assessed by
(1) Laboratory, accounting for 25% of the overall mark and is continuously assessed throughout the module.
(2) Written examination at the end of the Module, accounting for 75% of the overall module mark.

### Essential reading:

### Supplemental reading:

### Further Details:
Duration of module: 13 weeks
Contact Hours: 3 hrs every week = lectures 2 hrs every week, laboratory 2 hrs every alternate week.
Self Study: 4 hrs every week

Date of Academic Council approval ……………………………