

ELKL 7450 Electronic for Digital Communication dersi Bahar döneminde aşağıda listelenen 7 üniversite ile birlikte yürütülecek ve Prof. Dr. Hüseyin Arslan tarafından verilecektir. Aşağıda Prof. Dr. Hüseyin Arslan ve dersin içeriği hakkında bilgi de yer almaktadır. Dersin KTÜ kısmıyla ilgili detaylı bilgi için Prof. Dr. Kadir Türk ile iletişime geçebilirsiniz.

- 1) Karadeniz Technical University
- 2) Istanbul Technical University
- 3) University of South Florida
- 4) Jordan University of Science and Technology
- 5) Yarmouk University
- 6) Medipol University
- 7) Gebze Technical University



Dr. Arslan (IEEE Fellow, IEEE Distinguished Lecturer, Member of Turkish Academy of Sciences) received his BS degree from the Middle East Technical University (METU), Ankara, Turkey in 1992; his MS and Ph.D. degrees were received respectively in 1994 and 1998 from Southern Methodist University (SMU), Dallas, TX. From January 1998 to August 2002, he was with the research group of Ericsson, where he was involved with several projects related to 2G and 3G wireless communication systems. Since August 2002, he has been with the Electrical Engineering Department, at the University of South Florida, where he is a Professor. In December 2013, he joined Istanbul Medipol University to found the Engineering College, where he has worked as the Dean of the School of Engineering and Natural Sciences. In addition, he “including Anritsu Company and The Scientific and Technological Research Council of Turkey.

1.0 Course Description

This course will focus on future radio access technologies. Starting with the background on 4G LTE and its evolution (LTE-Advanced and LTE-Advanced PRO), 5G New Radio and Beyond 5G (B5G) will be discussed in detail. Even though focus of the course will be on Radio Access Technologies (RAT), the basics of the core network architectures and their comparison will also be covered.

1.1 Outline

Background (overview)

- History of wireless from 1G to 5G overview
 - Technology evolution
 - Applications
 - Performance metrics
 - Spectrum usage and wireless spectrum
 - Unlicensed and shared spectrum
- Cellular basics
 - Cellular concept (re-use and interference)

- Basic cellular architecture
- Hand-off
- Spectral efficiency, capacity, and cellular traffic
- Multiplexing and duplexing
- Resource allocation
- Wireless channel
 - Path loss and shadowing
 - Multipath fading
 - Link budget analysis
- Channel compensation and exploitation
 - Diversity
 - Equalization
 - Link adaptation

LTE Basics

- OFDM basics
- MIMO basics
- LTE PHY structure
- LTE network architecture
- Throughput calculation (giving examples for WiFi and LTE)

LTE-Advanced & LTE-advanced Pro

- CoMP – coordinated multi-points (CRAN)
- Beamforming
- Small cells and HetNets, Relays
- Self organizing networks
- Cell-edge issues and solutions
- ICIC and dynamic carrier allocation
- Adaptation and performance measurements
- Carrier aggregation and license assisted
- Re-transmission & H-ARQ

5G

- Applications, verticals and usage scenarios
- PHY structure and radio access techniques
- Multi-numerology OFDM
- Stand alone and non-stand alone
- Mm-wave and massive MIMO (and THz)
- Metrics and performance measures
- Network architecture
- Network function virtualization (NFV)
- Software Defined Networking (SDN)
- Network slicing
- Network Sharing
- Heterogenous and Ultra Dense Networks
- Side-link

- URLLC and Industrial IoT
- World deployment situation
- Challenges and opportunities
- Beyond 5G concepts
- Releases 15, 16 and 17, comparisons
- Low power applications of 5G and IoT
- Dynamic spectrum sharing concept
- Dual connectivity
- NB-IoT and mMTC
- Mini-slot
- Cloud-RAN and Virtual-RAN
- Mobile Edge Computing

Other Critical concepts

- Security issues in 5G and recent developments
- Mobility and hand-off issues
- Sensing, Joint radar & Communication
- Vehicular-to-Everything (V2X) communication
- Cognitive radio and networks
- AI and ML applications for 5G and beyond
- Co-existence and interference issues
- Channel control and intelligent surfaces
- Symbiotic radio
- Non-terrestrial networks (high altitude platforms and low orbit satellites)
- 3GPP timeline 4G, 5G from release 10 to 18
- NOMA
- Open RAN
- Starlink and future of low orbit broadband
- Wifi evolution – Wifi7