

Introduction to Next Generation Cellular Technology-5G

What you will learn in this course

Air Interface is one of the most important elements that differentiate between 2G, 3G, 4G and 5G. While 3G was CDMA based, 4G was OFDMA based; this course reveals the contents of air interface for 5G. While 4G brought in a deluge of infotainment services, 5G aims to provide extremely low delay services, great service in crowd, enhanced mobile broadband (virtual reality being made real), ultra reliable and secure connectivity, ubiquitous QoS, and highly energy efficient networks. The above-mentioned requirements are expected to be met by several advancement in technologies then we will discuss 5G new radio waveform, its genesis and variants. Thereafter we will introduce non orthogonal multiple access scheme. Next we will discuss various aspects of mmwave communication technology. Massive MIMO will be presented next, wherein we will discuss the essential building blocks and design challenges. While all these will be discussed that propagation models which are essential for performance analysis will also be briefly presented. This will be followed by performance analysis of heterogeneous networks including small cells and device to device communication. Then we will present energy saving methods for radio access network through multi objective optimization.

1. Introduction to Wireless Communication Systems

- 1.1 A Brief History of Wireless Communications
- 1.2 The Mobile Communications Environment
- 1.3 How a cellular telephone call is made
- 1.4 Trend in cellular radio and personal communication

2. Cellular concepts- system design fundamentals

- 2.1 Frequency Reuse
- 2.2 Channel Assignment strategy
- 2.3 Handoff strategy
- 2.4 Interference and system capacity
- 2.5 Improving coverage and capacity in cellular system

3. Multiple Access Techniques for Wireless Communication

- 3.1 Frequency-Division Multiple Access
- 3.2 Time-Division Multiple Access
- 3.3 Code-Division Multiple Access
- 3.4 Orthogonal Frequency-Division Multiple Access

4. Wireless Communication Networks: Principles and Practice

- 4.1 Wireless Network Architectures
- 4.2 Cellular Wireless Networks
- 4.3 Cordless Systems and Wireless Local Loop
- 4.4 Personal Communication Systems and Satellite Systems

5. Cellular Network Evolution & Fundamental

- 5.1 The Global System for Mobile Communications (GSM)
- 5.2 The IS-95 Standard
- 5.3 The IS-2000 Standard
- 5.4 Comparative analysis of 4G and 5G

6. Network Architecture and Deployment strategies

- 6.1 Detailed architecture of 4G Network
- 6.2 LTE architecture component eNODE, EPC and interface.

7. Evolution of Radion access network

- 7.1 Comparison 2G,3G,4G and 5G RAN technologies
- 7.2 Spectrum utilisation improvements: Carrier Aggregation and MIMO

8. Deployment strategies for 5G networks

- 8.1 Standalone vs Non-standalone architecture.
- 8.2 Benefits and challenges of both approaches.
- 8.3 5G deployment scenarios Urban, suburban, rural

9. Core Network transformation and cloud-native architecture

- 9.1 Architectural Evolution from 4G EPC to 5G core
- 9.2 5G core network functions: AMF, SMF,UPF,NEF etc.
- 9.3 Network Slicing in core network

10. Enriching services with Advanced multimedia

- 10.1 Evolution of multimedia services in mobile network
- 10.2 Introduction to multimedia services in cellular networks
- 10.3 From SMS to rich media content delivery.
- 10.4 Multimedia role in shaping the evolution of cellular networks.
- 10.5 Next generation video experience 4K, VR and beyond
- 10.6 Enhancement in video quality, resolution and immersive experiences