DRIEI
PhD Program in Electronic and Computer Engineering
University of Cagliari, Italy

Course:	Intro to 5G&Beyond Cellular Networks: from theory to practice
Instructor:	Filippo Malandra
SSD:	ING-INF/03 – Telecommunications
Credits / hours:	2.5 credits / 20 hours
Language:	English
Scheduling:	24-28 June 2024
Final Exam:	Written
Website:	NA

Goal of the Course

Mobile cellular networks have become a key infrastructure to share and consume information in our society. The high penetration of mobile phone services in society, as well as the introduction of a large variety of multimedia and data services, has led to unprecedented growth of the traffic volume carried by this type of network. This course will provide the students with the necessary knowledge to understand the basics of mobile cellular communication networks as well as a comprehensive knowledge of the technical aspects of the fifth generation (5G), highlighting how it evolved from the previous Gs and how it will transition to the next Gs. In addition to the theoretical lectures, guided experimental assignments with numerical computing and simulation tools are conducted to better illustrate the concepts learned in the class. The course will also encompass key technologies and tools implemented in the Wireless Networks For Smart Systems (WN4SS) Lab directed by Dr. Malandra at the University at Buffalo.

Prerequisites

There is no particular background required by the students to attend this course.

Intersection with other courses at the University of Cagliari

There is no significant intersection with other courses offered in the PhD programme DRIEI and in the Master Degrees at UniCa.

Course Outline

24/06/2024, 9:00-9:30: welcome

24/06/2024, 9:30-13:00: Module 1: Introduction to Cellular networks and traffic modelling: evolution from 0G to 5G&Beyond and basic principles of cellular networks

25/06/2024, 9:00-12:00: Module 2a: 5G New Radio: Main differences with LTE, Architecture, Overview of the technologies and protocols involved,

25/06/2024, 12:00-13:00: Group activities, practical exercises on 5G NR and its applications to real-life problems.

26/06/2024, 9:00-12:00: Module 2b: 5G New Radio - advanced: Overview of common performance problems involving 5G NR, radio resource scheduling, beamforming, Integrated access and Backhaul (IAB), with a particular focus on the new paradigm of open-RAN (O-RAN) with an eye on the main challenges and real problems of this technology.

26/06/2024, 12:00-13:00: Group activities, and practical exercises on the problems introduced in the first part of the lecture.

27/06/2024, 9:00-12:00: Module 3: 5G Next Generation Core: Basic principles of software-defined networking, network function virtualization (NFV), and Network Slicing.

27/06/2024, 12:00-13:00: Group activities, practical exercises on 5G Next Gen Core and its applications to real-life problems.

28/06/2024, 9:00-11:00: Module 4: 5G Network Performance Analysis.

28/06/2024, 11:00-13:00: Group activities, practical exercises on theoretical and practical applications of 5G network performance analysis theory.