



2EL2620 – Mobile communication networks and services

Instructors: Mohamad Assaad

Department: DÉPARTEMENT SIGNAL, INFORMATION, COMMUNICATION

Language of instruction: FRANCAIS

Campus: CAMPUS DE PARIS - SACLAY

Workload (HEE): 60

On-site hours (HPE): 35,00

Elective Category : Engineering Sciences

Advanced level : No

Description

Communication networks have been widely developed and spread across the globe in less than half a century. Due to the emergence of new concepts and services (smart cities, industry 4.0, Internet of Things, etc.), networks are in great (r) evolution, especially with the development of 5G, to support the transformation of many so-called vertical sectors (telecommunications, transport, energy, health, agriculture, industry ...). Various types of services are thus transmitted over wireless networks nowadays.

The objective of this course is to understand the architectures of the current networks and to provide a prospective vision of their evolutions, as well as the cellular concept and the main radio techniques used to transmit data over wireless networks. This course presents also the theoretical foundations and tools used for the design, optimization, deployment and management of communication systems and networks. It addresses the dimensioning of a network and the determination of its coverage in practice, as well as the link between the capacity of a network and the quality of service to be offered to each user, using traffic engineering tools.

Quarter number

SG6

Prerequisites (in terms of CS courses)

none

Syllabus

- General introduction and architecture of mobile networks
 - Standard bodies. Spectrum allocation
 - Services (VoIP, multimedia content broadcast,...). New services (IoT, factory of the future, etc.)
 - Introduction to cellular networks (GSM, UMTS, LTE, 5G).



- Cellular Concept
 - a. Cellular concept: Propagation models, radio access techniques
 - b. Radio resource management: power control, interference management, Optimisation
 - c. Network dimensioning, deployment, optimisation
- Traffic Engineering and Quality of Service
 - Traffic and Quality of Service. Quality of Experience. Quality of coverage and connectivity.
 - Traffic models and dimensioning: Erlang formula, queueing models, etc.
 - Mobility management: handover, routing, roaming

Class components (lecture, labs, etc.)

Organization of the lectures

- General Introduction: 3h (CM)
- Cellular Concept and Radio Access: 6h (CM) - 3 (TD) - 6h (TP)
- Traffic engineering and Quality of Service: 6h (CM) - 6 (TD) - 3h (TP)

TP 1: Performance of radio access techniques (3h)

TP 2: Capacity and coverage of wireless networks (3h)

TP 3: Traffic engineering and dimensioning of networks (3h)

Grading

Grading: - Final Exam: 2h (70% of the final mark)- TP: 30% of the final mark

Resources

Lecturers: Mohamad Assaad and Salah Eddine Elayoubi

Exercices sessions (TD): 25 students per classroom

software to use (TP): Matlab

Learning outcomes covered on the course

At the end of the course, the student will be able to:

- 1- know the architecture and different function of wireless networks
- 2- model a cellular network with its main functions
- 3- perform a cellular network planning
- 4- know the principles of network management and quality of service in wireless networks.
- 5- implement cellular network models and network management function using Matlab.



Description of the skills acquired at the end of the course

Learning outcomes 1, 2 and 4 lead to the achievement of milestone 1 of competence C1.1, i.e. "List the parameters that influence the system under study, list the elements with which it is related" and "Identify the important parameters with regard to the problem at hand". Learning outcomes 3 and 5 lead to the achievement of milestone 1 of competence C1.2, i.e. "Know how to use a model presented in class in a relevant way". Selecting simplifying hypotheses that are appropriate to the problem at hand". Learning outcome 5 also leads to the achievement of milestone 2B of competency C1.3, i.e., "Knowing the limitations of numerical simulations and what can be expected from them, knowing how to criticize the results of numerical simulations.