

## Course guide

### 300474 - 5GNET - Network Support for 5G

**Last modified:** 06/06/2024

<b>Unit in charge:</b>	Castelldefels School of Telecommunications and Aerospace Engineering	
<b>Teaching unit:</b>	744 - ENTEL - Department of Network Engineering.	
<b>Degree:</b>	MASTER'S DEGREE IN APPLIED TELECOMMUNICATIONS AND ENGINEERING MANAGEMENT (MASTEAM) (Syllabus 2015). (Optional subject). MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Optional subject). ERASMUS MUNDUS MASTER IN COMMUNICATIONS ENGINEERING AND DATA SCIENCE (Syllabus 2024). (Optional subject).	
<b>Academic year:</b> 2024	<b>ECTS Credits:</b> 3.0	<b>Languages:</b> English

#### LECTURER

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<b>Coordinating lecturer:</b>	Defined in the course webpage at the EETAC website.
<b>Others:</b>	Defined in the course webpage at the EETAC website.

#### PRIOR SKILLS

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Cellular mobile communications networks (3G and 4G): architecture, elements and functions

#### REQUIREMENTS

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Next-generation Wireless Communications and IoT (WICOM)

#### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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##### Transversal:

06 URI N1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.  
03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.  
05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

##### Basic:

CB6. Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context.  
CB9. Students will be able to communicate their conclusions and the knowledge and ultimate reasons that support them to specialized and non-specialized audiences in a clear and unambiguous manner.

#### TEACHING METHODOLOGY

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The teaching methodology combines the following components:

- Traditional lectures incorporating student's participation (short questions, debates, presentations done by the students)
- Laboratory sessions
- Autonomous work, whereby students complete the information provided by the professors, and develop activities for knowledge consolidation
- Collaborative work, whereby teams of students are mutually responsible for the learning process within a team

## LEARNING OBJECTIVES OF THE SUBJECT

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

- Understand the 5G ecosystem and differentiate it from previous generations of mobile communications
- Analyze the 5G architecture, transport and access networks
- Evaluate transport and access networks mechanisms and QoS provision in 5G

## STUDY LOAD

Type	Hours	Percentage
Self study	48,0	64.00
Hours large group	27,0	36.00

**Total learning time:** 75 h

## CONTENTS

### Unit 1: Introduction to 5G ecosystem

#### Description:

This unit provides an introduction to the 5G ecosystem, differentiating 5G from previous generations of mobile communications, and introducing its capabilities, service pillars and enablers. This unit also introduces the 5G network architecture and the migration strategies from previous generations. It also presents the use cases and the regulation status.

#### Related activities:

Final exam

#### Full-or-part-time: 6h

Theory classes: 2h

Self study : 4h

### Unit 2: Timing and synchronization in 5G

#### Description:

This unit presents the concept of timing and synchronization in networks, and its role in 5G.

- Introduction to timing and synchronization. Precision Time Protocol (PTP)
- Time-Sensitive Networking (TSN)
- Timing and Synchronization in 5G networks

#### Related activities:

Laboratory Sessions

Final Exam

#### Full-or-part-time: 18h 45m

Theory classes: 5h 15m

Practical classes: 1h 30m

Self study : 12h

### Unit 3: Network softwarization in 5G

**Description:**

This unit presents network softwarization and slicing as technologies to be adopted in 5G networks to allow end-to-end flexibility and fast re-configuration of the network, based on the delivered services, and the automation of the network management. The fundamental requirements, the enabling technologies, and the operations management are presented:

- Drivers and motivations for a new architecture. Limitations of traditionally networks
- Network services evolution. 5G network architecture. Softwarization and programmability
- Introduction to NFV. Reference model. ETSI MANO
- NFV Management and Orchestration
- Service Function chaining (SFC). IETF architecture. NSH
- Network Slicing
- Use cases
- Standardization efforts. Open projects

**Related activities:**

Laboratory Sessions

Final Exam

**Full-or-part-time:** 18h 45m

Theory classes: 2h 30m

Practical classes: 4h 15m

Self study : 12h

### Unit 4: Transport and radio access networks in 5G

**Description:**

This unit presents the 5G transport network, distributed and centralized radio access networks, the enabling technologies, focusing on the joint access-backhaul concept and the available mechanisms. The concepts of Flexible RAN and functional splits, together with its functionalities, architecture and performance implications are presented.

**Related activities:**

Assignments

Final Exam

**Full-or-part-time:** 15h 45m

Theory classes: 4h

Guided activities: 1h 45m

Self study : 10h

### Unit 5: Quality of Service in 5G networks

**Description:**

This unit focuses on the provision of Quality of Service (QoS) in 5G networks and the QoS enablers. The 5G QoS scenario and its architecture implications are presented, together with the available mechanisms and the performance implications.

**Related activities:**

Assignments

Final Exam

**Full-or-part-time:** 15h 45m

Theory classes: 4h

Guided activities: 1h 45m

Self study : 10h



## ACTIVITIES

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### Unit 2: Laboratory Sessions

**Full-or-part-time:** 8h

Practical classes: 8h

### Unit 3: Assignments

**Full-or-part-time:** 1h 30m

Practical classes: 1h 30m

### Unit 4: Assignments

**Full-or-part-time:** 1h 30m

Practical classes: 1h 30m

### Final Exam

**Full-or-part-time:** 3h

Theory classes: 3h

## GRADING SYSTEM

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Defined in the course webpage at the EETAC website.

## EXAMINATION RULES.

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Attendance is mandatory in laboratory activities and in classes involving oral presentations of tasks performed by students

## BIBLIOGRAPHY

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### Basic:

- Marsch, Patrick. 5G system design : architectural and functional considerations and long term research. Hoboken, New Jersey: John Wiley & Sons, Inc, [2018]. ISBN 978-1-119-42512-0.

### Complementary:

- Chayapathi, Rajendra; Shah, Paresh; Farrukh Hassan, Syed. Network functions virtualization (NFV) with a touch of SDN. Boston: Addison-Wesley, [2017]. ISBN 9780134463056.