

## COURSE PROGRAM

Academic Year: 2024/25

Identification and characteristics of the course			
Code	401075	ECTS Credits	6
Name	NETWORK AND SERVICES PLANNING AND DESIGN		
Degrees	Master in Informatics Engineering Master in Telecommunications Engineering Master in ICT Management		
Centre	Escuela Politécnica (EP)		
Semester	First	Character	Mandatory Studies
Module	Computer Technologies		
Material	Computer Technologies and Communications		
Lecturers			
Name	Office	e-mail	Web page
Francisco J. Rodríguez Pérez	71	fjrodri@unex.es	
Manuel Luis Romero Ramírez		mromerojd@unex.es	
Subject Area	Telematics Engineering / Signal Theory and Communications		
Department	Department of Informatics and Telematics Systems Engineering / Department of Computers Technology and Communications		
Coordinating lecturer	Francisco J. Rodríguez Pérez		
Competencies			
Basic and general competencies:			
<p>CB7 - Ability to apply the acquired knowledge and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.</p> <p>CB8 - Ability to integrate knowledge and face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on social and ethical responsibilities linked to the application of their knowledge and judgments</p> <p>CG4 - Capacity for mathematical modeling, calculation and simulation in technological centers and engineering of company, particularly in research, development and innovation tasks in all fields related to Informatics Engineering.</p> <p>CG9 - Ability to understand and apply ethical responsibility, legislation and professional deontology of the activity of the Informatics Engineering profession.</p> <p>CG10 - Ability to apply the principles of economics and the management of human resources and projects, as well as legislation, regulation and standardization of information technology.</p>			
Specific competencies:			
<p>CETI1 - Ability to model, design, define architecture, deploy, manage, operate, manage and maintain applications, networks, systems, services and IT contents.</p> <p>CETI2 - Ability to understand and apply the operation and organization of the Internet, the technologies and protocols of new generation networks, component models, intermediary software and service.</p> <p>CETI8 - Ability to design and develop systems, applications and IT services in embedded and</p>			

ubiquitous systems.

**Cross-curricular competencies:**

CT1 - Innovative and entrepreneurial spirit.

CT4 - Skills to communicate conclusions, along with the knowledge and the reasons behind them, to specialized and non-specialized audiences, both orally and in writing, in Spanish and English.

CT7 - Critical thinking skills and creativity as a means to have the opportunity to be original in the generation, development and / or application of ideas in a research or professional context

CT10 - Focus on quality and continuous improvement.

CT11 - Autonomous learning capacity

CT12 - Ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts.

CT13 - Ability to integrate knowledge and face the complexity of formulating opinions from incomplete or limited information.

**Basic and general competencies:**

CB7 - Ability to apply the acquired knowledge and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.

CB8 - Ability to integrate knowledge and face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on social and ethical responsibilities linked to the application of their knowledge and judgments

CG4 - Provide a global approach to ICT management (IT + Telecommunications + Business) from a comprehensive point of view.

CG9 - Provide graduates with the necessary skills for the management of ICT Departments.

CG10 - Provide graduates with the necessary leadership skills and knowledge of tools for managing human teams in the field of ICT.

**Specific competencies:**

CETEC1 - Ability to model, design, define architecture, deploy, manage, operate, manage and maintain applications, networks, systems, services and IT contents.

CETEC2 - Ability to understand and apply the operation and organization of the Internet, the technologies and protocols of new generation networks, component models, intermediary software and services.

CETEC3 - Knowledge of hardware description languages for high complexity circuits.

**Cross-curricular competencies:**

CT1 - Innovative and entrepreneurial spirit.

CT4 - Interpersonal relationship skills.

CT7 - Respect for and promotion of human rights, democratic principles, the principles of equality between women and men, solidarity, universal accessibility and design for all, prevention of occupational risks, protection of the environment and promotion of the culture of peace.

CT10 - Ability to adapt to new problematic situations and changes.

CT11 - Leadership capacity

CT12 - Capacity for management of teams and organizations.

CT13 - Organization and planning capacity.

### **Basic and general competencies:**

CB7 - Ability to apply the acquired knowledge and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.

CB8 - Ability to integrate knowledge and face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on social and ethical responsibilities linked to the application of their knowledge and judgments.

CB10 - Learning skills that enable to continue studying in a way that will be largely self-directed or autonomous.

CG2 - Capacity for project management and facilities for telecommunications systems, complying with current legislation, ensuring the quality of service.

CG4 - Capacity for mathematical modeling, calculation and simulation in technology centers and engineering companies, particularly in research, development and innovation in all areas related to the Telecommunications Engineering and related multidisciplinary fields.

CG6 - Capacity for the overall direction, technical direction and project management research, development and innovation, in companies and technology centers.

CG10 - Ability to apply principles of economics and human resource management and projects as well as legislation, regulation and standardization of telecommunications.

CG11 - Ability to learn to communicate (oral and written) findings, and the knowledge and rationale underpinning these, to public-skilled and unskilled in a clear and unambiguous way.

### **Specific competencies:**

CETT4 – Ability to design and dimension transport, broadcast and distribution networks for multimedia signals.

CETT6 - Ability to model, design, implement, manage, operate, manage and maintain networks, services and content.

CETT7 - Capacity for planning, decision making and packaging of networks, services and applications considering the quality of service, direct costs and operating plan implementation, monitoring, safety procedures, scaling and maintenance and manage and ensure quality in the development process.

CETT8 - Ability to understand and know how to apply the operation and organization of the Internet, Internet technologies and protocols for next generation models of components, middleware and services.

CETT9 - Ability to resolve convergence, interoperability, and design of heterogeneous networks with local, access and backbone networks, as well as the integration of telephony, data, television and interactive services.

CETT13 - Ability to design communication components such as routers, switches, hubs, transmitters and receivers in different bands

CETT14 - Ability to apply advanced knowledge of photonics and optoelectronics, and high frequency electronics.

CETT15 - Ability to develop electronic instrumentation and transducers, actuators and sensors.

### **Cross-curricular competencies:**

CT1 - Innovative and entrepreneurial spirit.

CT4 - Skills to communicate conclusions, along with the knowledge and the reasons behind them, to specialized and non-specialized audiences, both orally and in writing, in Spanish and English.

CT7 - Critical thinking skills and creativity as a means to have the opportunity to be original

in the generation, development and / or application of ideas in a research or professional context.  
 CT10 - Focus on quality and continuous improvement.  
 CT11 - Autonomous learning capacity  
 CT12 - Ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts.  
 CT13 - Ability to integrate knowledge and face the complexity of formulating opinions from incomplete or limited information.

**Themes and syllabus**

**Brief description of the syllabus**

Analysis of Communication Network Requirements. Top-Down and Bottom-Up Design Methodologies. Network Planning. Information Flow Analysis. Traffic Theory. Queueing Theory. Modeling, Specification, and Design of Protocols, Networks, and Services. Specification Tools. Routing, Addressing, Security, and Fault Tolerance. Network and Service Design. Performance Evaluation Tools for Protocols and Networks. Cost Analysis. Performance Evaluation Tools for Protocols and Networks. Optimization and QoS. Network and Service Management. Teletraffic.

**Course Syllabus**

Title of Topic 1: Introduction to Network Planning and Design.  
 Contents of Topic 1: Network Planning.  
 Description of Practical Activities for Topic 1: Modeling various types of corporate needs.

Title of Topic 2: Needs Analysis.  
 Contents of Topic 2: Protocol Specifications.  
 Description of Practical Activities for Topic 2: Review of needs analysis.

Title of Topic 3: Transmission Media.  
 Contents of Topic 3: Performance Analysis of Transmission Media.  
 Description of Practical Activities for Topic 3: Analysis of the deployment of different transmission media.

Title of Topic 4: Topologies.  
 Contents of Topic 4: Performance Analysis of Different Network Topologies.  
 Description of Practical Activities for Topic 4: Methods for configuring network topologies.

Title of Topic 5: Technologies.  
 Contents of Topic 5: Data Link Layer Technologies.  
 Description of Practical Activities for Topic 5: Evaluate Layer 2 technologies.

Title of Topic 6: Network Management.  
 Contents of Topic 6: Evaluation of Network Management Protocols. SNMP.  
 Description of Practical Activities for Topic 6: Compare network management protocols.

Title of Topic 7: Operational Research and Teletraffic.  
 Contents of Topic 7: Analysis of Teletraffic Models.  
 Description of Practical Activities for Topic 7: Solving teletraffic scenarios.

**Educational activities**

Student hours of work per theme	Classrom	Monitoring	Non-
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				activity	classroom
Theme	Total	LG	SL	PT	PS
1	8	2	0	0	6
2	15	4	2	0	9
3	18	5	2	0	11
4	22	8	3	0	11
5	25	8	3	0	14
6	29	10	3	0	16
7	29	8	2	0	19
<b>Evaluation</b>	4				
<b>Total</b>	150	45	15	0	86

LG: Large Group (100 students).

SL: Seminar/Laboratory (computer laboratory sessions = 30, problem classes or seminars or case studies = 40).

PT: Programmed Tutorials (educational monitoring, in the form of ECTS tutorials).

PS: Personal study, individual or group tasks, and reading the literature.

### Teaching methodology

- Problem-based learning.
- Project-based learning
- Cooperative and collaborative learning.
- Participatory lectures.
- Problem resolution.
- Portfolios.

### Learning outcomes

- Ability to design, calculate, and plan products, processes, and installations in all areas of Telecommunication Engineering.
- Ability to lead, plan, and supervise multidisciplinary teams.
- Ability to manage telecommunication systems projects and installations, ensuring compliance with current regulations and guaranteeing service quality.
- Ability for mathematical modeling, calculation, and simulation in technology centers and corporate engineering, particularly in research, development, and innovation tasks in all areas related to Telecommunication Engineering and related multidisciplinary fields.

### Evaluation systems

According to the current Evaluation Regulations, there are two evaluation modalities: Continuous Evaluation and Global Evaluation. The student must choose between one modality or the other during the first quarter of the semester in a specific space created for this purpose in the Virtual Campus of the course. Choosing the Global Evaluation modality implies the forfeiture of the right to continue being evaluated through the activities of the Continuous Evaluation modality that remain and the grades obtained up to that point in any that have already taken place. In the absence of an express request by the student, the assigned modality will be Continuous Evaluation.

#### Continuous Evaluation Modality

Continuous evaluation will be the primary evaluation tool. Thus, various activities and/or projects will be proposed for the student to develop, both individually and in groups. Specifically, learning activities will be conducted in the form of individual work in the

practice laboratory, as well as a group project that delves into one of the course topics. Since the evaluation is carried out continuously, it is necessary to pass all the proposed learning activities to pass the course.

### **Global Evaluation Modality**

As an alternative to the previous evaluation, an alternative evaluation procedure will be available for students who indicate this preference, based on a series of theoretical/practical tests that will determine the acquisition of all the knowledge and competencies of the course. These tests will be conducted on the dates corresponding to the official examination schedule.

The final grade will be calculated as follows:

$$FN = 0.66 * \text{Written Exam} + 0.34 * \text{Learning Activities.}$$

### **Bibliography and other resources**

Data Network Design. Darren L. Spohn. Ed. McGraw-Hill, 1997.  
Alta velocidad y calidad de servicio en Redes IP. García Tomás, Jesús y otros. Ed. Ra-Ma 2002.  
SNMP, SNMPV2, SNMPv3 and RMON 1 and 2. Stallings, William. Ed. Addison-Wesley, 1999.  
Total SNMP. Exploring the Simple Network Protocol. Harnedy, Sean. Ed. Prentice Hall, 1998.  
Protocolos de comunicaciones para sistemas abiertos. Alonso, Jose Miguel. Ed Addison-Wesley Iberoamericana, 1996.

### **Other Resources and Complementary Teaching Materials**