

230151 - SIX - Network Simulation

Coordinating unit:	230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit:	744 - ENTEL - Department of Network Engineering
Academic year:	2019
Degree:	BACHELOR'S DEGREE IN TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY (Syllabus 2010). (Teaching unit Optional) BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Optional) BACHELOR'S DEGREE IN ELECTRONIC SYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Optional) BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2010). (Teaching unit Optional) BACHELOR'S DEGREE IN NETWORK ENGINEERING (Syllabus 2010). (Teaching unit Optional) BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Teaching unit Optional)
ECTS credits:	6
Teaching languages:	Spanish

Teaching staff

Coordinator:	Alfonso Rojas Espinosa
Others:	Alfonso Rojas Espinosa Israel Martín Escalona

Degree competences to which the subject contributes

Generical:

1. ABILITY TO IDENTIFY, FORMULATE AND SOLVE ENGINEERING PROBLEMS Level 3. To identify and model complex systems. To identify methods and tools appropriate to pose the equations and descriptions associated with the models and to solve them. To carry out qualitative analysis and approaches. To determine the uncertainty of the results. To formulate hypotheses and experimental methods to validate them. To set up and manage undertakings. To identify major components and establish priorities. To develop critical thinking.
2. They will have acquired knowledge related to experiments and laboratory instruments and will be competent in a laboratory environment in the ICC field. They will know how to use the instruments and tools of telecommunications and electronic engineering and how to interpret manuals and specifications. They will be able to evaluate the errors and limitations associated with simulation measures and results.

Teaching methodology

Theoretical classes
Laboratory classes
Individual homework
Exercises
Long-answer examination (Final Exam)
Laboratory practice

Learning objectives of the subject

The aim of this course is to train students in the methods of evaluation of networks and systems through simulation.

230151 - SIX - Network Simulation

First the types of simulation are presented and so the necessary generation of random variables to feed them. Next you will see how you can design experiments and finally, using this knowledge, how you can model and evaluate the most typical communication networks.

Learning outcome:

- It has capacity to build, operate and manage networks, services, processes and telecommunications applications from the point of view of telematic services.
- Understand and apply the concepts of quality of service in different network environments.
- Use easily necessary to build, operate and manage tools telematic services, especially those related to Internet, web and multimedia information.
- Familiarization with the protocols and communication interfaces at different levels of network architecture and able to describe, schedule, validate and optimize them.
- Know the technological progress of transmission, switching and process for improving networks and telematic services.
- Identify and model complex systems. Conducts analysis and qualitative approaches, establishing the uncertainty of the results. Raises hypotheses and experimental methods to validate them. Identifies the major components and establishes commitments and priorities.
- Design experiments and measurements to test hypotheses and validate the operation of equipment, processes, systems or services in the information and communication technologies field. Select the equipment and appropriate and performs advanced data analysis software tools.

Study load

Total learning time: 150h	Hours large group:	26h	17.33%
	Hours small group:	26h	17.33%
	Self study:	98h	65.33%

230151 - SIX - Network Simulation

Content

<p>Tema 1. Introduction to Simulation.</p>	<p>Learning time: 13h Theory classes: 3h Laboratory classes: 2h Self study : 8h</p>
<p>Description: Systems, models and simulation Monte Carlo and the discret event simulation Development environments</p> <p>Laboratory: Construction of a system by means of the network development environment OMNeT++</p>	
<p>Tema 2. Random variables generation in simulation</p>	<p>Learning time: 40h Theory classes: 10h Laboratory classes: 10h Self study : 20h</p>
<p>Description: Random number generation Methods of generation of discrete and continuous random variables variables Uniformity and independence verification for random generators</p> <p>Laboratory: Generation and analysis of random variables</p>	
<p>Tema 3.Experiments design</p>	<p>Learning time: 31h Theory classes: 5h Laboratory classes: 6h Self study : 20h</p>
<p>Description: Basic concepts and methods Initial conditions, transient and steady state Horizon time for the simulation Results analysis</p> <p>Laboratory: Study of a system with theoretical support</p>	

230151 - SIX - Network Simulation

Tema 4. Modelling in communication networks.	Learning time: 56h Theory classes: 12h Laboratory classes: 12h Self study : 32h
<p>Description:</p> <ul style="list-style-type: none">Voice, video and data modelsWired network modelsWireless network modelsAvailable models in a development environment <p>Laboratory:</p> <ul style="list-style-type: none">Simulation project	

230151 - SIX - Network Simulation

Planning of activities

(ENG) Exercises	Hours: 0h Theory classes: 0h
Description: Non-classroom complementary activities	
(ENG) Laboratory practice	Hours: 0h Theory classes: 0h
Description: Experimental work in a laboratory	
(ENG) Short-answer examination (Exam)	Hours: 2h Theory classes: 2h
Description: Exam	
(ENG) Laboratory practice	Hours: 0h Theory classes: 0h
Description: Tema 1. Introduction to simulation.	
(ENG) Laboratory practice	Hours: 0h Theory classes: 0h
Description: Tema 2. Random variables generation in simulation.	
(ENG) Laboratory practice	Hours: 0h Theory classes: 0h
Description: Tema 4. Modelling in communication networks.	
(ENG) Laboratory practice	Hours: 0h Theory classes: 0h

230151 - SIX - Network Simulation

Description:
Tema 3.Experiments design.

(ENG) Long-answer examination (Final Exam)

Hours: 2h
Theory classes: 2h

Description:
Final Exam

Qualification system

Complementary activities: 30%

Laboratory practice: 40%

Final examination: 30%

In this subject the following generic competences will be evaluated:

- Capacity to identify, formulate and solve engineering problems (Level High)
- Experimentation and knowledge of instrumentation (Level High)

Bibliography

Basic:

Law, A.M. Simulation modeling and analysis. 5th ed. New York: McGraw-Hill, 2015. ISBN 1259254380.

Knuth, D.E. The art of computer programming: seminumerical algorithms (Vol. 2). 3rd ed. Reading, Mass.: Addison-Wesley, 1998. ISBN 0201896842.

Ross, S.M. Simulation. 4th ed. San Diego: Academic Press, 2006. ISBN 0125980639.

Complementary:

Rubinstein, R.Y.; Melamed, B. Modern simulation and modeling. New York: John Wiley & Sons, 1998. ISBN 0471170771.

Morgan, B.J.T. Elements of simulation. London; New York: Chapman and Hall, 1986. ISBN 0412245906.

Fishman, G.S. Discrete-event simulation: modeling, programming and analysis. New York: Springer, 2001. ISBN 0387951601.

Rubinstein, R.Y; Kroese, D.P. Simulation and the Monte Carlo method [on line]. 3rd ed. Hoboken, NJ: John Wiley & Sons, 2017 [Consultation: 23/03/2017]. Available on: <<http://onlinelibrary.wiley.com/book/10.1002/9781118631980>>. ISBN 9781118631980.