30320 - Networks Planning and Dimensioning

Información del Plan Docente

Academic Year	2018/19
Subject	30320 - Networks Planning and Dimensioning
Faculty / School	110 - Escuela de Ingeniería y Arquitectura
Degree	438 - Bachelor's Degree in Telecomunications Technology and Services Engineering
ECTS	6.0
Year	3
Semester	First semester
Subject Type	Compulsory
Module	---

1.General information

1.1.Aims of the course

1.2.Context and importance of this course in the degree

1.3.Recommendations to take this course

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The learning process that has been designed for this course is based on the following:

The teaching and learning methodologies to achieve the proposed learning outcomes are as follows:

M1: Lectures (participatory master class) (32 hours). Exhibition by the teacher of the main contents of the subject, combined with the active participation of students. This activity will take place in the classroom in person. This methodology, supported by the individual study of the student (M14) is designed to provide the students with the theoretical underpinnings of the subject content.

M8: Practices in classroom (16 hours). Problem solving and case studies proposed by the teacher, with the possibility of presentation by students individually or in groups. This activity will take place in the classroom in person, and may require work preparation by students (M13).

M9: Lab (12 hours). Students will conduct 2-hour weekly practice sessions. This activity will take place in person at the 2.03 laboratory (laboratory of telematics) in Ada Byron building. The work will consist on network simulation tools used to resolve issues related to the theoretical concepts presented in classroom lectures and practical classes. Each complete practice (considered as unit) may consist of one or more sessions. It will require the presentation of studies or previous work where these are necessary for the development of the practice (M13) and resolution of a brief questionnaire at the end (M15). Lab sessions students will learn to use simulation tools and network analysis.

M10: Tutoring. Opening hours of personalized attention to students in order to review and discuss the concepts presented in both theoretical and practical classes.

M11: Evaluation. A set of theoretical and practical tests and presentation of reports or questionnaires used in the evaluation of the student's progress. The detail of the assessment is in the section for evaluation activities.

4.2.Learning tasks

The activities of teaching and learning to achieve the proposed learning outcomes are as follows:

A01: participatory master class. Presentation by the teacher of the main contents of the subject, combined with the active participation of students. This activity will take place in the classroom in person. This methodology, supported by the individual study of the student (A07) is designed to provide the students with the theoretical underpinnings of the subject content.

A02: Resolution of problems and cases. Problem solving and case studies proposed by the teacher, with the possibility of presentation by students individually or in groups authorized by the teacher. This activity will take place in the classroom in person, and may require preparation by students (A07) work.

A03: Laboratory practice. Students will conduct 2-hour practice sessions. This activity will take place in person. To develop work will take place in small groups. It will require the presentation of studies or previous work where these are necessary for the development of practice (A07) and delivery of the follow-up of the report.

A06: It protects personalized one-to-one. Opening hours of personalized attention to students in order to review and discuss the materials and themes presented in both theoretical and practical classes.

A08: Evaluation tests. A set of theoretical and practical written tests and presentation of reports or papers used in the evaluation of the student's progress. The detail is in the section for evaluation activities.

4.3.Syllabus

The program that the student is offered to achieve the expected results includes the following activities ...

Theoretical / practical sessions whose main contents are organized into the following thematic units:

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Unit 0. Introduction.
Presentation of the subject. Introduction to the problem of planning, dimensioning and analysis of communications networks.

Unit 1. Mathematical tools

- Evaluation based on mathematical models. Queueing Theory: General characteristics, types of problems and notation. Kendal notation. Evaluation objectives and related parameters.
- Little's law.
- Models based on Markov chains. Statistical modeling. Markov processes. Discrete-Time Markov chains. Solution and properties. Continuous time Markov chains. Solution and properties.
- Arrival Process characterization. Poisson processes. Pure birth process continuous in time. Binomial process. Pure birth processes discrete in time. PASTA Principle.
- Time Service Characterization.
  Traffic characterization. On-Off Sources. N On-Off sources.
- Performance analysis. M/M/1 Queue. M/D/1 Queue.

Unit 2. Analysis of media access methods in broadcast networks

- Performance analysis of random access protocols. ALOHA, Slotted ALOHA, CSMA, CSMA-CD.

Unit 3. Dimensioning of circuit-switched networks

- Dimensioning of transport networks. Fixed networks problems. Links dimensioning and switch design.
- Dimensioning of blocking circuit-switching systems. Erlang B. Infinite servers systems. Application examples.
- Overflow systems.
- Dimensioning of circuit-switching systems with queues. Erlang C.
- Dimensioning of circuit-switching systems with finite population.
- Switch design. Fundamentals of design by analysis of blocking probability.
- Planning and dimensioning of mobile cellular networks.

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Unit 4. Dimensioning of packet-switching networks

- Transport links dimensioning. Overview of M/M/m system.
- Process analysis with generic time service. Semi-Markovian systems. Evaluation of M/G/1 queue. M/G/1 system with holidays. Application to the analysis of protocol error recovery, access protocols.
- Analysis of systems with traffic priorities. M/G/1 system priorities. Preemptive and non-preemptive priorities.
- Networks of markovian queues. Queues in tandem. Burke's theorem.
  Kleinrock's principle of independence. Feedback systems.
- Planning and dimensioning of packet-switching networks. Mean network delay estimation.

Unit 5. Application of queuing theory to traffic control.

- Application of queuing theory to traffic control, admission and traffic regulation.

Laboratory class sessions are aimed at developing techniques and procedures described in theoretical and problem sessions. Laboratory practices are organized in 6 sessions of 2 hours each. As a preliminary to the practice of laboratory, students will perform a preliminary study. At the end of practice, students will solve a short questionnaire to assess the degree of understanding of the concepts studied.

4.4.Course planning and calendar

The timetable of the subject, both the classroom hours in classroom (48 hours), as (12 hours) lab sessions will be defined by the EINA in the academic calendar of the corresponding course. The dates for the tests based on the resolution of problems (E3) and other scheduled activities will be indicated in advance by the professor.

4.5.Bibliography and recommended resources

Bibliography and resources as collection of notes:

* slides of the course.

* Collection of issues of the subject.

Bibliography:

1. Akimaru, Haruo. Teletraffic: Theory and applications / Haruo Akimaru, Konosuke Kawasima Springer Verlag, 1993

2. Kleinrock, Leonard. Queueing systems : problems and solutions / Leonard Kleinrock, Richard Gail New York [etc.] :

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John Wiley and Sons, cop. 1996

3. Schwartz, Mischa. Telecommunication networks : Protocols, modeling and analysis / Mischa Schwartz . - [1st ed.], repr. with corrections Reading, Massachusetts : Addison-Wesley, 1988

4. Bertsekas, Dimitri P. Data networks / Dimitri Bertsekas, Robert Gallager . - 2nd ed. Upper Saddle River, NJ: Prentice Hall, cop. 1992