Universidad Zaragoza

Academic Year/course: 2022/23

30375 - Analysis and dimensioning of networks

Syllabus Information

Academic Year: 2022/23
Subject: 30375 - Analysis and dimensioning of networks
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 581 - Bachelor's Degree in Telecomunications Technology and Services Engineering
ECTS: 6.0
Year: 3
Semester: First semester
Subject Type: Compulsory
Module:

1. General information

2. Learning goals

3. Assessment (1st and 2nd call)

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) (30 hours). Exhibition by the teacher of the main contents of the subject, combined with the active participation of students. 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 (15 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, and may require work preparation by students (M13).

M9: Lab (15 hours). Students will conduct 2,5-hour weekly practice sessions. 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 resolution of a brief questionnaire at the end (M15). Lab sessions students will learn to use simulation tools and network analysis.

M4 Tutored practical work (24 hours). The students will solve practical cases of modeling, evaluation and dimensioning, associated with different network scenarios. The presentation of the results will be done from the way and date indicated by the teacher.

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 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 may require preparation by students (A07) work.

A03: Laboratory practice. Students will conduct 2,5-hour practice sessions. It will require the delivery of the follow-up of the report.

A04 Tutored practical work. The students will solve practical cases of modeling, evaluation and dimensioning, associated with different network scenarios. The presentation of the results will be done from the way and date indicated by the teacher.

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:

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 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.
- Performance analysis. M/M/1 Queue. M/D/1 Queue.

Unit 2. Dimensioning of markovian systems

- M/M/m, M/M/m/m, M/M/1/K, ?systems
- Modeling, analysis and dimensioning of loss and queuing-loss systems.
- Modeling, analysis and dimensioning of systems with finite population.

Unit 3. Semi-Markovian systems and open queueing networks

- 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.

Unit 3. Mobile Networks

- 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 system

Unit 4. Mobile networks. Performance analysis, planning and dimensioning.

- Fundamentals of mobile communication systems. Radio access challenges. Coverage, capacity and quality of service.
- Functions of a mobile network (mobility management, resource management, etc.). Architecture principles of a mobile network: access and core network and its evolution from 2G to 4G. Signaling requirements and dimensioning.
- Impact of the radio interface structure and resource sharing methods in the performance analysis and dimensioning methodology.
- Examples of application of queuing. Analysis and dimensioning of resources in mobile networks with TDMA / FDMA or OFDMA access.

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 2,5 hours each.. At the end of practice, students will solve a short questionnaire to assess the degree of understanding of the concepts studied. Also, the students will perform supervised practical work related to the subject.

4.4. Course planning and calendar

The timetable of the subject, both the classroom hours (45 hours), as (15hours) 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 (E4) and other scheduled activities will be indicated in advance by the professor.

4.5. Bibliography and recommended resources

http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=30375