Universidad Zaragoza

Academic Year/course: 2022/23

30383 - Optical Transmission Devices and Systems

Syllabus Information

Academic Year: 2022/23
Subject: 30383 - Optical Transmission Devices and Systems
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 581 - Bachelor's Degree in Telecomunications Technology and Services Engineering
ECTS: 6.0
Year: 4
Semester: First semester
Subject Type: Optional
Module:

1. General information

1.1. Aims of the course

The aim of this course is to provide the student with the basic and technical knowledge required to design fiber-based communication links.

In addition, the course aims to help to reach the following Sustainable Development Goals:

Goal 7: Clean energy

Goal 8: Economic growth

Goal 9: Industry and infrastructure

Goal 11: Sustainability

1.2. Context and importance of this course in the degree

This course is centered on the study of fiber-guided optical communications integrated in the subject: Information Transmission Technologies. It is a compulsory course for the students of the specific technology: Telecommunication systems of the Bachelor's Degree in Telecommunications Technology and Services Engineering.

1.3. Recommendations to take this course

To be able to follow this course, it is convenient that the students has previous knowledge of Electromagnetism and Waves, Radiation and propagation, and Transmission Media.

2. Learning goals

2.1. Competences

After successfully completing this course, the student will have acquired the following skills:

- To combine general and specific knowledge to make innovative and competitive proposals (C3) To solve problems and make decisions based on creativity and critical reasoning (C4)
- To transmit knowledge, abilities and skills in Spanish (C5)
- To have the ability to apply techniques, skills and tools needed to engineering practice (C6)
- To analyze and evaluate the social and environmental impact of technical proposals acting from the vantage point of ethics, professional responsibility, and social commitment (C6)
- To work in interdisciplinary and multilingual environments (C8)
- To manage information, technical specifications and laws needed to engineering activities (C9).
- To develop strategies of continuous and autonomous learning (C10).
- To apply information and communication technologies to the engineering practice (C11)
- To analyze the specifications of guided and un-guided communication system components (CST3)

- To be able to select devices, sub-systems and systems for radio communications (CST4)
- To be able to select antennas, devices for guided and un-guided transmission systems (CST5)

2.2. Learning goals

- Understanding the characteristics of light transmission by optical fibers
- Knowledge of the different types of optical fibers and their specific properties
- Knowledge the lineal and non-lineal effects over light propagation in optical fibers
- Knowledge of passive optical devices required for fiber communication systems
- Knowledge of active optical devices required for fiber communication systems
- Knowledge of the different types of optical emitters and the driver circuits for the transmitters Knowledge of the different types of photodetectors and receiver circuits
- Understanding of the principles of wavelength division multiplexing
- Understanding optical amplification
- Knowledge of characterization standards and measurement systems for optical networks

2.3. Importance of learning goals

This course is focused on techniques and devices for communications using the optical range of the electromagnetic spectrum. Optical fibers have been the base of the physical layer of trunk continental and submarine networks and nowadays, optical fiber communications are closer to the user as more and more FFTH networks are being deployed. Thus, to engineer communication systems it is necessary to know how to design, evaluate, control and manage optical networks. In addition, the technologies to increase bandwidth and flexibility are leaded led by all-optic techniques.

3. Assessment (1st and 2nd call)

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

Grading can be achieved by obtaining a minimum of 5 in the weighted average of the following learning activities:

Theory exams: multiple-choice and short answer questions (25%). A minimum grade of 5 for each individual exam is required to perform the weighted average with the marks of the other activities.

Practical exam: problem-solving questions (35%). A minimum grade of 4.5 is required to make the weighted average with the marks of the other activities

Laboratory assignments (15%). A minimum grade of 5 for each individual assignment is required to perform the weighted average with the marks of the other activities.

Practical case study assignments (25%)

Students that 1) have not obtained the minimum grade at any of the learning activities; 2) have not obtained the minimum average of 5, can be graded in a global assessment exam whose dates are stated by "Escuela de Ingeniería y Arquitectura " (https://eina.unizar.es/). The global assessment includes theory and practical written exams as well as a specific assignment related to the laboratory and case study activities.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. It is based on participation and the active role of the student favours the development of communication and decision-making skills. A wide range of teaching and learning tasks are implemented, such as lectures, guided assignments, laboratory sessions, autonomous work, and tutorials.

Students are expected to participate actively in the class throughout the semester.

Classroom materials will be available via Moodle. These include a repository of the lecture notes used in class, the course syllabus, as well as other course-specific learning materials.

Further information regarding the course will be provided on the first day of class.

4.2. Learning tasks

Lectures: the teacher will explain the theoretical contents of the course (40 hours per term) and solve illustrative applied problems (10 hours per term). These problems and exercises can be found in the problem set provided at the repository available via Moodle. Although it is not a mandatory activity, regular attendance is highly recommended.

Laboratory sessions: sessions will take place in the laboratory. There will be 6 two-hour laboratory sessions (12 hours per term). The presence of the student is mandatory in this task. Students will work together in groups actively doing tasks using software specific for the simulation of optical links.

Guided assignments: students will complete assignments, problems and exercises related to concepts seen in laboratory sessions and lectures. They will be submitted when specified by the teachers.

Autonomous work: students are expected to spend about 75 hours to study theory, solve problems, prepare lab sessions, and take exams.

Tutorials: the professor's office hours will be posted on Moodle and the degree website to assist students

4.3. Syllabus

The course will address the following topics:

Theory sessions:

Topic 1. Transmission properties of optical fibers

Topic 2. Optical emitters

Topic 3. Optical detectors and receivers

Topic 4. Optical amplifiers. Erbium doped optical amplifier (EDFA)

Topic 5. Characterization of passive devices

Topic 6. Design of optical links. Power and dispersion balance

Topic 7. Optical networks simulation software

Laboratory sessions: In the Laboratory sessions the students will apply some of the topics addressed in the theory lessons using optical networks simulation software.

4.4. Course planning and calendar

For further details concerning the timetable, classroom and further information regarding this course, please refer to the "Escuela de Ingeniería y Arquitectura " website (https://eina.unizar.es/)

4.5. Bibliography and recommended resources

http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=30383

Using the digital support available in University of Zaragoza, the students of the course will have access to all documentation provided by the teachers.