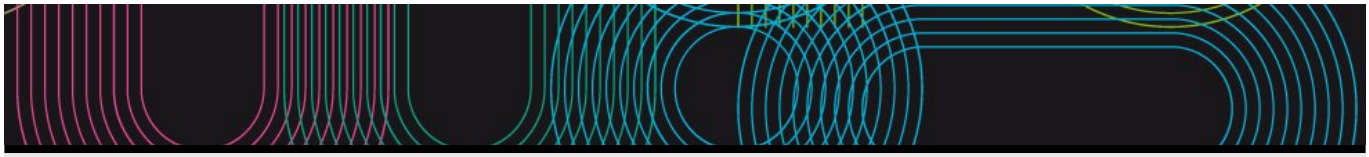

IDENTIFYING DATA				
(*)Dispositivos optoelectrónicos				
Subject	(*)Dispositivos optoelectrónicos			
Code	V05G300V01922			
Study programme	(*)Grao en Enxeñaría de Tecnoloxías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	1st
Teaching language	Spanish			
Department				
Coordinator	Moure Rodríguez, María José			
Lecturers	Cao Paz, Ana María Moure Rodríguez, María José			
E-mail	mjmoure@uvigo.es			
Web	http://faitic.uvigo.es			
General description	This subject deals with the optoelectronic properties of semiconductors and their application in electronic devices for detection, emission, amplification and conversion of optical/electrical signals. Devices include light-emitting diodes, lasers diodes, photodiodes, phototransistors and solar cells. The contents of the course and the laboratory activities coverage the basic operating principles, design considerations, driving circuits and applications of optoelectronic devices. The subject will enable students to apply the physics of optoelectronic devices in optical sensors design and fiber optic communications. Emphasis will also be place on understanding the data sheets of optoelectronic components and their applications to different technologies. Finally integrated optoelectronics, display and image sensor technologies are introduced.			

Competencies

Code	
A1	CG1: The ability to write, develop and sign projects in the field of Telecommunication Engineering, according to the knowledge acquired as considered in section 5 of this Law, the conception and development or operation of networks, services and applications of Telecommunication and Electronics.
A6	CG6: The aptitude to manage mandatory specifications, procedures and laws.
A69	(CE60/OP3) The ability to design circuits based on optoelectronics devices used in telecommunication systems.
A70	(CE61/OP4) The ability to acquire, condition and process the information obtained from optoelectronic sensors.
B4	The ability to use software tools that support problem solving in engineering

Learning aims

Expected results from this subject	Training and Learning Results
The knowledge of the operating principles of the different optoelectronic devices. The ability to design basic control circuits for photoemitters. The ability to design basic control circuits for photodetection. The knowledge of the architecture and operating mode of displays. The knowledge of the architecture and characteristics of image sensors	A69
The knowledge of the different optoelectronic sensors and their applications. The ability to acquire, condition and process the information obtained from optoelectronic sensors	A70
The ability to select de optimal optoelectronic devices for each application. The ability to integrate optoelectronic devices and sensors in information processing systems	A1
The ability to analyze the data sheets and to compare different optoelectronic devices or sensors. The ability to design optical systems following the standards applicable to communications, reliability or environmental protection	A6
The ability to use computer-aided design tools for the design of electronic systems based on optoelectronic devices	B4

Contents

Topic	
Unit 1: Introduction	Fundamentals and classification of optoelectronic devices. Radiometric and photometric units and their relationships.
Unit 2: Light Emitting Diodes	Principles of LED operation. Types of LEDs and properties. Parameters and characteristics. Driving circuits. Basic applications.
Unit 3: Optoelectronic Detectors	Light Dependent Resistors: principles of LDR operation, properties, parameters, driving circuits and applications. Photodiodes: principles of photoconductive detectors, types, parameters, driving circuits and applications. Phototransistor: principles of phototransistor operation, types, parameters, driving circuits and applications. Photodetector comparison.
Unit 4: Solar Cells	Photovoltaic detectors: principles and properties. Manufacture and performance of solar cells, parameters and characteristics. Applications.
Unit 5: Laser Diodes	Principles of Laser operation. Types of lasers. Laser diode operation. Driving circuits and applications.
Unit 6: Image Sensors	Principles of CCD and CMOS operation. Parameters and characteristics. Color detection. Applications.
Unit 7: Optical Sensors	Principles of optical sensing. Internal design, types, parameters and applications of: optocouplers, optical encoders, object sensors, code-bar readers, humidity sensors, color detection, distance sensors, anemometers, temperature sensors and biomedical sensors.
Unit 8: Display Technologies	Principles of Liquid Crytal Display operation. Principles of LED and Organic LED displays. Introduction to plasma, electroluminescence and digital light processor technologies.
Unit 9: Introduction to Fiber Optics	Fiber Optic fundamentals. Classification of fibers. Fiber optic emitters and detectors. Principles of fiber optic communications. Principles of fiber optic sensors.
Laboratory Practices	1. Basic optoelectronic circuits. LEDs and LDRs. Laboratory measurements. 2. Optical detectors. Circuits based on photodiodes. 3. Analog optical modulation. Optical detectors based on photodiodes and phototransistors. 4. Digital communications based on fiber optic. 5. Optoelectronic sensors for object sensing. 6. Optical circuits for color measurement. 7. Basic drive circuit for laser diodes.

Planning

	Class hours	Hours outside the classroom	Total hours
Master Session	15	30	45
Case studies / analysis of situations	4	8	12
Projects	6	30	36
Presentations / exhibitions	1	3	4
Laboratory practises	14	9	23
Multiple choice tests	2	24	26
Reports / memories of practice	0	4	4

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Master Session	The professor explains the theoretical contents of the course, encouraging critical discussion and the student involvement. Reading assignments for each session will be previously available via FaiTIC, and students are expected to come to the theoretical class having completed the assigned reading.
Case studies / analysis of situations	The study and analysis of actual technological solutions completes the theoretical presentations. This activity includes the study of different alternatives, commercial devices or systems, cost and power estimation, environmental impact and performance analysis.
Projects	This activity focuses on applying the techniques described in the lecture classes and the skills developed at laboratory to a mini-project implementation. These sessions are developed in a laboratory with skilled equipment. Students should obtain well founded solutions, choosing appropriate methods and devices. These projects are planned and tutored in small size groups.
Presentations / exhibitions	The project developed by the students must be oral presented by the authors.
Laboratory practises	During laboratory sessions the student learns the design, hardware implementation, verification and measurement of basic optoelectronics circuits. All the sessions are guided and supervised by the professor.

Personalized attention	
Methodologies	**Description**
Master Session	Students have the opportunity to solve doubts in personalized attention sessions. The appointment with the corresponding professor should be required and agreed by e-mail, preferably in the timetable and place officially assigned. Besides, the group of students developing a project will attend periodic follow-up meetings
Laboratory practises	Students have the opportunity to solve doubts in personalized attention sessions. The appointment with the corresponding professor should be required and agreed by e-mail, preferably in the timetable and place officially assigned. Besides, the group of students developing a project will attend periodic follow-up meetings
Projects	Students have the opportunity to solve doubts in personalized attention sessions. The appointment with the corresponding professor should be required and agreed by e-mail, preferably in the timetable and place officially assigned. Besides, the group of students developing a project will attend periodic follow-up meetings

Assessment		
	Description	Qualification
Projects	The students should present a tutored project which deserves the 40% of the final qualification. The progress of this job will be supervised from continuous assessment but the final work should be oral presented by the authors	40
Multiple choice tests	A multiple choice test, performed preferably online via the FaiTic platform. This test covers all of the contents taught in the theoretical classes. The estimated date will be the 11th week, after the completion of the theoretical classes. This test will deserve the 30% of the final qualification	30
Reports / memories of practice	The assistance to the laboratory practices is mandatory: at least the student should complete 6 of the 7 sessions. The implementation of the circuits described in the practice guidelines and the reports submitted at the end on each session will deserve the 30% of the final qualification	30

Other comments on the Evaluation

1. Continuous assessment

The course can be passed with full marks from continuous assessment, with no need to sit the final exam. Students who assist to more than 2 laboratory sessions may not be listed as "Not Present".

The weighting and content of each continuous assessment part are as follows:

1.1 Test (NTest):

- It covers all of the contents taught in the theoretical classes.
- The estimated date will be the 11th week of the course.
- The student pass this part if he/she gets a mark greater than or equal to 5.

1.2 Laboratory practices (NPrac):

- The student should complete 6 of the 7 sessions in order to pass this part.
- The student should correctly implement the circuits described in the guidelines of the practice and submit a report corresponding to each laboratory session. The qualification of each practice depends on these achievements.
- It can be developed individually or by groups of 2 students.
- The student will pass this part if he/she gets an average greater than or equal to 5. The weighting of each practice is the same to obtain the NPrac mark.

1.3 Project (NPro):

- It can be developed individually or by groups of 2 students.
- It should be oral presented by the authors.
- The student will pass this part if he/she gets a mark greater than or equal to 5.

1.4 Final qualification of continuous assessment (Final_ca)

The final qualification (Final_ca) of continuous assessment is obtained as follows:

Final_ca: = (NTest*0.3 + NPrac*0.3 + NPro*0.4) if NTest≥5 and NPrac≥5 and NPro≥5;

Final_ca = min [(NTest*0.3 + NPrac*0.3 + NPro*0.4), 4] in other case;

The student who fails one or more of the parts of continuous assessment has another opportunity to pass any part in the Final exam:

- He/she can repeat the test and this mark replaces the previous one (NTest).
- He/she student can improve his/her Laboratory mark (NPrac) by means of an exam. This exam consists of several problems related to the contents of laboratory practices.
- He/shet can complete and present his/her project before the date of the final exam.

2. Final exam and qualification

There is a final exam at the end of each quadmester.

- In the final exam, all content is evaluated. It usually consists of several questions and problems and lasts about 2.5 hours. The pass mark for this exam is 5 out of 10 and deserves 60% of the final qualification.
- In order to pass the subject the students should present a project with the same objectives and complexity of the project developed in continuous assessment. This project deserves 40% of the final qualification (NPro) and should be presented before the date of the final exam.

The final qualification (Final_ex) is obtained as follows:

Final_ex = (NEx*0.6 + NPro*0.4) if NEx≥5 and NPro≥5;

Final_ex = min [(NEx*0.6 + NPro*0.4) , 4] in other case;

3. Other comments

- The grades obtained from the continuous assessment and final exams are only valid for the current academic year.
- The use of books, notes or electronic devices such as phones or computers is not permitted in any test or exam. Mobile phones must be turned off and out of reach of the student.

Sources of information
S.O. Kasap, **Optoelectronics and Photonics**, Pearson,
Vaughn D. Martin, **Optoelectronics**, PROMPT Publications,
John Wilson, John Hawkes, **Optoelectronics. An introduction**, Prentice-Hall,
Francis T.S. Yu, Xiangyang Yang, **Introduction to optical Engineering**, Cambribge University Press,
Endel Uiga, **Optoelectronics**, Prentice-Hall,
J.E. Midwinter, Y.L. Guo, **Optoelectronics and Lightwave Technology**, Wiley,
Gerald C. Holst, **CCD Arrays, Cameras and Displays**, Optical Engineering Press,
Josephn J. Carr, **Electro-Optics. Electronic Circuit Guidebook**, Prompt Publications,
Ed. W. Göpel, J. Hesse, J.N. Zemel, **Sensors. A comprehensive Survey**,
A. Goetzberger, J. Knobloch, B. Voss, **Crystalline Silicon Solar Cells**, Wiley,
J. Watson, **Optoelectrónica**, Limusa,
S. Desmond Smith, **Optoelectronic Devices**, Prentice Hall,
Albert J.P. Theuwissen, **Solid-state Imaging with Charge-Coupled Devices**, Kluwer,
R.C. Lasky, U.L. Österberg, D.P. Stigliani, **Optoelectronics for Data Communication**,
David Wood, **Optoelectronic Semiconductors Devices**, Prentice Hall,
David R. Goff, **Fiber Optic Reference Guide. A Practical Guide to the Technology**, Focal Press,
Eric Udd, **Fiber Optic Sensors. An Introduction for Engineers and Scientists**, John Wiley&Sons,
R.M. Marston, **Circuitos de optoelectrónica**, CEAC,
Kasap, Ruda, Boucher, **Cambridge Illustrated Handbook of Optoelectronics and Photonics**, Cambridge University Press,

In addition to the bibliography above, the student have access to the following support material:

- Notes of the course which cover the contents of theoretical sessions.
- Documentation for laboratory which includes the guidelines of the practices and the data sheets of optoelectronic devices or sensors.

This material is available viaFaiTIC platform (http://faitic.uvigo.es)

Recommendations

Subjects that it is recommended to have taken before

(*)Física: Fundamentos de electrónica/V05G300V01305
(*)Tecnoloxía electrónica/V05G300V01401