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230477 - PEF2 - Projects of Engineering Physics 2

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering

Teaching unit: 739 - TSC - Department of Signal Theory and Communications
748 - FIS - Department of Physics
710 - EEL - Department of Electronic Engineering
713 - EQ - Department of Chemical Engineering

Academic year: 2019

Degree: BACHELOR'S DEGREE IN ENGINEERING PHYSICS (Syllabus 2011). (Teaching unit Compulsory)

ECTS credits: 6 Teaching languages: Catalan, Spanish, English

Teaching staff

Coordinator: PERE BRUNA ESCUER

Others: MARIA DEL BARRIO CASADO - JOAQUIN PUIGDOLLERS GONZALEZ - CRINA MARIA COJOCARU - JORDI LLORCA PIQUÉ - DAVID ARTIGAS GARCIA - JOSE ANTONIO LAZARO VILLA - ALBERTO AGUASCA SOLE - JORDI ROMEU ROBERT - JOSE FRANCISCO TRULL SILVESTRE - DANIEL CRESPO ARTIAGA - TRINITAT PRADELL CARA - JUAN MANUEL GENE BERNAUS - RICARD GONZALEZ CINCA

Opening hours

Timetable: To be arranged.

Degree competences to which the subject contributes

Specific:

1. Knowledge of experimental techniques and procedures in the field of physics, engineering and nanotechnology. Ability to design experiments using the scientific method and criteria of efficiency, rationality and cost.
2. Knowledge of experimental data analysis techniques. Knowledge of statistical methods for experimental data treatment. Ability to process, analyze and graphically present experimental data.

Generical:

5. ABILITY TO IDENTIFY, FORMULATE, AND SOLVE PHYSICAL ENGINEERING PROBLEMS. Planning and solving physical engineering problems with initiative, making decisions and with creativity. Developing methods of analysis and problem solving in a systematic and creative way.
6. ABILITY TO CONCEIVE, DESIGN, IMPLEMENT, AND OPERATE COMPLEX PHYSICAL ENGINEERING SYSTEMS. Ability to conceive, design, implement, and operate complex systems in the fields of micro and nano technology, electronics, advanced materials, photonics, biotechnology, and space and nuclear sciences.
3. 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.

Transversal:

1. ENTREPRENEURSHIP AND INNOVATION - Level 3. Using knowledge and strategic skills to set up and manage projects. Applying systemic solutions to complex problems. Devising and managing innovation in organizations.
4. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.
2. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.
5. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most

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suitable information sources.

Teaching methodology

There will be six practical sessions in research laboratories (to choose between several options). To perform these laboratory experiments, that will be carried out in small groups, the students will have a working script with all the necessary information prior to the correct understanding and implementation of the practice.

Also in small groups, each one will carry out a different project (to choose from the list) during six weeks in which it should work independently.

Learning objectives of the subject

After the course Physical Engineering Projects 2, the student should be able to:
- Work with various professional laboratory equipment.
- Kknow the basics of experimental data treatment and extract reasoned conclusions based on these data
- Consider experimental problems, design experiments appropriate for their resolution and analyze the results thereof.
- Teamwork.

Study load

Total learning time: 150h	Hours large group:	13h	8.67%
	Hours small group:	30h	20.00%
	Guided activities:	6h	4.00%
	Self study:	101h	67.33%

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Content

0. Physical Engineering Projects

Learning time: 10h
Theory classes: 10h

Description:
Course presentation, working groups formation and group distribution between the several experiments in laboratories.

1. Thermodynamical, cristalographic and dielectric characterization of amorphous materials

Learning time: 12h
Laboratory classes: 6h
Self study : 6h

Description:
Location: GCM laboratory in EEBE
Person in charge: Maria del Barrio

2. Optical and surface characterization of materials

Learning time: 12h
Laboratory classes: 6h
Self study : 6h

Description:
Location: GCM laboratory in EEBE
Person in charge: Trinitat Pradell i Daniel Crespo

3. Infrared Spectroscopy

Learning time: 12h
Laboratory classes: 6h
Self study : 6h

Description:
Location: Barcelona Research Centre in Multiscale Science and Engineering (EEBE)
Person in charge: Jordi Llorca

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4. Organic Thin-Film Transistors (TFT)	Learning time: 12h Laboratory classes: 6h Self study : 6h

Description:
Location: Laboratory of the micro and nano-Technologies group (Campus Nord)
Person in charge: Joaquim Puigdollers

5. Maxwell at Work. The Doppler Radar	Learning time: 12h Practical classes: 6h Self study : 6h

Description:
Location: RSLab laboratory in Campus Nord
Persons in charge: Albert Aguasca and Jordi Romeu

6A. Unveiling properties of matter: microscopy, optical trapping and diffraction	Learning time: 12h Laboratory classes: 6h Self study : 6h

Description:
Location: ICFO (Castelldefels)
Persons in charge: David Artigas

6B. Photovoltaic efficiency measurement for a given solar cell	Learning time: 12h Laboratory classes: 6h Self study : 6h

Description:
Location: ICFO in Castelldefels
Persons in charge: David Artigas

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7A. Photonics in fiber telecommunications	Learning time: 12h Laboratory classes: 6h Self study : 6h

Description:
Location: GCO laboratory in Campus Nord
Person in charge: José Antonio Lázaro and Joan Gené

7B. From quantized energy levels to a telecommunications revolution	Learning time: 18h Theory classes: 6h Laboratory classes: 6h Self study : 6h

Description:
Location: GCO laboratory in Campus Nord
Person in charge: José Antonio Lázaro and Joan Gené

8A. Laser Range Finder	Learning time: 12h Laboratory classes: 6h Self study : 6h

Description:
Location: DONLL laboratory in Terrassa Campus.
Persons in charge: Crina Cojocaru and Jose Trull

8B. Nd:Y AG-Laser	Learning time: 12h Laboratory classes: 6h Self study : 6h

Description:
Location: DONLL laboratory in Terrassa Campus.
Persons in charge: Crina Cojocaru and Jose Trull

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9. Fluid physics in microgravity	Learning time: 12h Laboratory classes: 6h Self study : 6h

Description:
Location: Laboratori de microgravetat a Castelldefels (EETAC)
Person in charge: Ricard González

9. Projects	Learning time: 68h Guided activities: 6h Self study : 62h

Description:
The students can choose between several projects that change from academic year to academic year and they can propose own projects if they are choherent with the subject aims.

Some of the most done projects in the past years (in parenthesis the person in charge):

a) Design and aerodinamics measures of objects (Jordi Gutierrez)
b) Electronic plastics. Fabrication of organic devices (Joaquim Puigdollers)
c) Design, constructions and application of an Erbium-fiber laser for the study of carcinogenic cells (José Antonio Lázaro)
d) Extragalactic nova explosions (Glòria Sala)
e) Design, simulation and measures of a microwave circuit (Maria Concepción Santos)

You can find all the past projects in the web:
https://enginyeriafisica.etsetb.upc.edu/ca/estudis/pla-estudis/pef2

Qualification system

The six laboratory experiments have a weight of 50% on the final mark while the project will have the remaining 50%.

The final score (N) will be obtained from each of the 6 laboratory experiments (Prn where n=1,2,...,6) and from the Physical Engineering Project (PEF) according to the following expression:
N=0.5*(Pr1+Pr2+Pr3+Pr4+Pr5+Pr6)/6+0.5*PEF

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Bibliography

Basic:

Kirkup, L. Experimental methods : an introduction to the analysis and presentation of data. Brisbane: Wiley, 1994. ISBN 0471335797.

Complementary:

Isaacson, E. St. Q. Dimensional methods in engineering and physics. Edward Arnold, 1975. ISBN 047042866X.