

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:	2018
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 - PABLO LOZA ALVAREZ - ALEJANDRO ANTONIO RODRIGUEZ GOMEZ - ENRIQUE GARCIA-BERRO MONTILLA - BLAS ECHEBARRIA DOMINGUEZ - GLÒRIA SALA CLADELLAS - MARIA ANGELES RIERA MORA

Opening hours

Timetable:	To be arranged.
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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

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relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most 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.
- Know 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
<p>Description: Course presentation, working groups formation and group distribution between the several experiments in laboratories.</p>	
1. Thermodynamical, cristalographic and dielectric characterization of amorphous materials	Learning time: 12h Laboratory classes: 6h Self study : 6h
<p>Description: Location: GCM laboratory in Barcelona (ETSEIB) Person in charge: Maria del Barrio</p>	
2. Mechanical and surface characterization of materials	Learning time: 12h Laboratory classes: 6h Self study : 6h
<p>Description: Location: GCM laboratory in Castelldefels (EETAC) Person in charge: Pere Bruna</p>	
3A. Infrared Spectroscopy	Learning time: 12h Laboratory classes: 6h Self study : 6h
<p>Description: Location: CRnE in Campus Sud Person in charge: Jordi Llorca</p>	

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<p>3B. X-Ray Photoelectron Spectroscopy</p>	<p>Learning time: 12h Laboratory classes: 6h Self study : 6h</p>
<p>Description: Location: CRnE in Campus Sud Person in charge: Jordi Llorca</p>	
<p>4. Organic Thin-Film Transistors (TFT)</p>	<p>Learning time: 12h Laboratory classes: 6h Self study : 6h</p>
<p>Description: Location: CRnE in Campus Nord Person in charge: Joaquim Puigdollers</p>	
<p>5A. Coffee can radar</p>	<p>Learning time: 12h Practical classes: 6h Self study : 6h</p>
<p>Description: Location: RSLab laboratory in Campus Nord Persons in charge: Albert Agasca and Jordi Romeu</p>	
<p>5B. Radiometry and radiotelescopes</p>	<p>Learning time: 12h Laboratory classes: 6h Self study : 6h</p>
<p>Description: Location: RSLab laboratory in Campus Nord Persons in charge: Albert Agasca and Jordi Romeu</p>	

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<p>6. High and super-high Resolution Fluorescence Microscopy</p>	<p>Learning time: 12h Laboratory classes: 6h Self study : 6h</p>
<p>Description: Location: ICFO in Castelldefels Persons in charge: David Artigas and Pablo Loza</p>	
<p>7A. Photonics in fiber telecommunications</p>	<p>Learning time: 12h Laboratory classes: 6h Self study : 6h</p>
<p>Description: Location: GCO laboratory in Campus Nord Person in charge: José Antonio Lázaro</p>	
<p>7B. From quantized energy levels to a telecommunications revolution</p>	<p>Learning time: 18h Theory classes: 6h Laboratory classes: 6h Self study : 6h</p>
<p>Description: Location: GCO laboratory in Campus Nord Person in charge: José Antonio Lázaro</p>	
<p>8A. Laser Range Finder</p>	<p>Learning time: 12h Laboratory classes: 6h Self study : 6h</p>
<p>Description: Location: DONLL laboratory in Terrassa Campus. Persons in charge: Crina Cojocar and Jose Trull</p>	

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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 Cojocarú and Jose Trull	
9. Projects	Learning time: 68h Guided activities: 6h Self study : 62h
Description: It will be possible to choose between the following offer (in parenthesis you will find the Person in charge): 1. Design and development of aerodynamic tests on bodies and wing profiles. (Daniel Crespo) 2. Study of the polymorphism in a compound with orientationally disordered phases: construction of the P, v, T diagram. (Maria del Barrio) 3. Dielectric relaxation dynamics in a glass-forming molecular liquid. (Maria del Barrio) 4. Stability of drugs inferred from experimental and topological P-T diagrams. (Maria del Barrio) 5. Production of an Organic-CMOS inverter. (Joaquim Puigdollers) 6. Production of organic solar cells. (Joaquim Puigdollers) 7. Visualizing life: embryogenesis and development. (David Artigas and Pablo Loza) 8. Measuring the rotational speed with a coherent lidar. (Alejandro Rodríguez) 9. Design, fabrication and application of lasers based on optical fiber doped with Erbium. (José Antonio Lázaro) 10. Controlling light with light. (José Antonio Lázaro) 11. Model Rocket Workshop (Enrique García-Berro) 12. Cell contraction: modeling and visualization of the intracellular calcium (Blas Echebarria) 13. Cardiology: simulation of arrhythmias and ECG (Blas Echebarria) 14. Dynamics of gene expression in bacteria. (Jordi Garcia Ojalvo) 15. Analysis of complex networks of proteins. (Jordi Garcia Ojalvo) 16. Modeling brain activity with neural mass models. (Jordi Garcia Ojalvo) 17. Unconventional computation with neuronal networks. (Jordi Garcia Ojalvo) 18. Determination of the mass of a black hole from X-ray observations (Glòria Sala) 19. Shocks and outflow kinematics in Planetary Nebulae (Àngels Riera)	

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 (Pr_n where n=1,2,...,6) and from the Physical Engineering Project (PEF) according to the following expression:

$$N = 0.5 * (Pr_1 + Pr_2 + Pr_3 + Pr_4 + Pr_5 + Pr_6) / 6 + 0.5 * PEF$$

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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.