COURSE OUTLINE

(1) GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	ELECTRICAL AND COMPUTER ENGINEERING DEPT.		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**ECE_ELE_940**	**SEMESTER**	**9TH**
COURSE TITLE	ORGANIC ELECTRONIC COMPONENTS AND CIRCUITS		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	5
Seminars / Practice exercises	1	
Laboratory		
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (4).		

COURSE TYPE *general background, special background, specialised, general knowledge, skills development*	SPECIALIZED
PREREQUISITE COURSES:	No. Students are advised to have already attended the courses: BASIC ELECTRONICS, ELECTROTECHNIC MATERIALS
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://www.ece.uop.gr/

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning*

and Appendix B

- *Guidelines for writing Learning Outcomes*

In the course the student seeks to become familiar with and acquire knowledge in the technology of organic semiconductors & hybrid structures used in modern electronic applications such as organic photodiodes (OLED), organic photovoltaic (OPV), organic (photo) transistors (OFET). In particular, the aim of the course is to acquire theoretical and practical skills in a very modern field of applications in the electronic technology in the very last years with direct penetration into the market.

In recent years, organic electronics have become one of the fastest growing kind of material's science. The term organic electronics refers to the study of organic conductive polymers and conductive small molecules as well as their applications in modern electronic devices. Upon completion of the course, students will have:

a. specialized knowledge in a rapidly growing sector required by the global electronic market,

b. comparative knowledge between conventional technology of conventional semiconductors (based on Si and Ge) and organic materials technology,

c. technological advantage from the study of completely new techniques of creation and characterization of organic electronics,

d. knowledge in circuit design with organic materials and circuit simulations.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

1. Search, analyze and synthesize data and information using the necessary technologies
2. Decision making
3. Autonomous work
4. Teamwork

(3) SYLLABUS

The course is organized in thirteen weeks' lectures like below:

1. Introduction to optoelectronics materials and data, overview of organic / polymeric electro-active materials and elements.
2. Electronic structures of conjugated electrically active organic / polymeric materials, main types and chemical structures of organic / polymeric optoelectronic materials.
3. Light emission devices based on organic materials, organic photodiodes (OLED / PLED).
4. Studies of characterization of luminescence and luminous efficiency of organic photodiodes.
5. Organic photovoltaic devices (OPVs) I: materials are used and connections.
6. Organic photovoltaic devices (OPVs) II: characterization methods and aging studies.
7. Organic thin film transistors (OTFT): principles of operation and polarization.
8. Modeling and simulation of organic / polymeric transistors.
9. Design of CMOS logic circuits based on organic semiconductors.
10. Organic (photo) transistors (OFET): principles of operation and polarization.
11. Methods of depositing and creating electronic devices, organic electronic devices of large dimensions, development of organic transistors in large dimensions, connection.
12. Organic electrochemical transistors in bioelectronics.
13. Organic electrochemical transistors, development of organic sensors, RFID circuits.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Face to face in class</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>View slides. View computer animations to describe the time evolution of photovoltaic phenomena. Demonstration of laboratory experiments at the time of teaching. Informational material to the eclass.</td></tr>
<tr><td>TEACHING METHODS

The manner and methods of teaching are described in detail.

Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures.</td><td>39</td></tr>
<tr><td>Problem solving.</td><td>13</td></tr>
<tr><td>Project</td><td>13</td></tr>
<tr><td>Study of literature and material exist to the eclass</td><td>60</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course Total</td><td>125 hours (5 ECTS)</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION

Description of the evaluation procedure

Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td><td>Student evaluation is carried out with a three-hour written examination in Greek language. This examination counts for the 80% of the final grade, while an optional 20% refers to the examination of the project assigned. The latter is examined orally during a common presentation in presence of all Groups.</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*

H. Klauk, Organic electronics: Materials, manufacturing and applications, Wiley VCH, 2006.

H. Klauk, Organic electronics II: More materials and applications, Wiley VCH, 2012.

S. Ogawa, Organic electronics, materials and devices, Springer, 2015.

F. Cicoira, C. Santato, Organic electronics: Emerging concepts and technologies, Wiley VCH, 2013.

F. So, Organic electronics: Materials, processing, devices and applications, CRC Press, 2009.

G. Lanzani, The photophysics behind photovoltaics and photonics, Wiley VCH, 2012.

- *Related academic journals:*

1. H. Dong, X. Fu, J. Liu, Z. Wang, W. Hu, Key points for high-mobility organic field-effect-transistors, Advanced Materials Journal, Wiley VCH, vol. 25, pp. 6158-6183, 2013.

2. J. Mei, Y. Diao, A. L. Appleton, L. Fang, Z. Bao, Integrated materials design of organic semiconductors for field-effect transistors, Journal of the American Chemical Society, vol. 135, pp. 6724-6746, 2013.

3. X. Gao, Y, Hu, Development of n-type organic semiconductors for thin film transistors: A viewpoint of molecular design, Journal of Materials Chemistry C: Materials for optical, magnetic and electronic devices, Royal Society of Chemistry, vol. 2, pp. 3099-3117, 2014.