ETY905 - Photonic Materials

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ETE 905	**SEMESTER**	9
COURSE TITLE	Photonic Materials		

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	3
Add rows if necessary. The organization of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialized general knowledge, skills development*	Special background
PREREQUISITE COURSES:	NO
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	http://cmsl.materials.uoi.gr/lidorikis/courses.html

(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*

Knowledge: Familiarization and education of the student in modern optics, photonics and optoelectronic technologies. Identification and understanding of the basic theory and principles of operation relevant devices for the creation, manipulation and detection of light. Understanding his role each material and its configuration within the device.

Skills: Combining knowledge and understanding of the basic physics of the devices the student can choose the appropriate materials and design their appropriate configurations in order to optimize the device operation.

Competences: Combining the knowledge and understanding of the basic physics of devices, the student can understand the basic principles of operation of other devices that he has not been taught of, can compare and evaluate their differences, to utilize literature and take steps to modify, redesign and re-optimize the materials used and their configurations.

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…*
	…….

- Search, analyze and synthesize data and information, using the necessary technologies
- Production of new research ideas
- Autonomous work

(3) SYLLABUS

Electromagnetic Theory: Maxwell Equations, Charge and Polarization Currents, Constitutive Relationships, Plane Waves, Energy and Momentum, Types Summary.

Waves on an interface: Boundary conditions, Reflection and Refraction, Total Reflection, Brewster Angle

Thin Films: Interface Matrix, Transfer Matrix, Film Reflectance, Anti-Reflecting Coating, Film Thickness Measurement

BRAGG Mirrors: Periodic film layout, Photonic band structure, Bragg dielectric mirrors, Multi-color separators, X-Cube, Periodicity defects - photonic cavities, surface-emitting vertical cavity laser

Photonic Crystals: Direct and inverse lattice, Calculation of photonic eigen-states, Photonic band structure in two dimensions, Linear defects - waveguides, Point defects - cavities, 3D photonic crystals, Fabrication methods

Confinement of Photons & Electrons: Wave Equations, Confinement of Electrons, Confinement of Photons

Dielectric Function: Lorentz Oscillator, Dispersion and Absorption, Dielectrics, Semiconductors, Metals

Semiconductors: Electronic Structure, Optical Properties, Material Systems, Quantum Confinement-Wells, Wires, Dots, Quantum Wells in Light Emitting Diodes, Diode Laser

Metals and Plasmons: Metallic Optical Response, Surface Plasmons, Plasmonic Chemical and Biological Sensors, Metal Nanoparticles, Metal Nanoparticle Waveguides

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	In class, lectures
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Communication with the students also through the course website
TEACHING METHODS *The manner and methods of teaching are described in detail.*	

Activity	***Semester workload***
Lectures	39

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*		
	Homework	13
	Self-study and preparation of a project	10
	Self-study for preparing for final examination	13
	Course total	75
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.*	LANGUAGE OF EVALUATION: Greek METHOD OF EVALUATION: Exercises at home (homework) • Developing and resolving problems totaling 10% of the final grade Project • Develop and present a selected project accounts for a total of 40% of the final grade Written final exam: • Development and explanation of theory • Developing and resolving problems accounts for a total of 50% of the final grade	

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

EL.LIDORIKIS, "Photonic Materials", UNIVERSITY PRESS IOANNINA, IOANNINA 2007.