COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL of ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EEE.8-2.1	SEMESTER	8th
COURSE TITLE	Optical Communications		

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
Lab Exercises	1	
Total	4	
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special Background
PREREQUISITE COURSES:	EEE.6.6: Optoelectronics EEE.7-2.7: Photonics Technology
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	eee.uniwa.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*

This is a special compulsory background course in the group of Communications and Networks courses in the 8th semester. The course material deals with the principles of operation of communication systems based on optical fibers. In particular, the basic modules of these systems are analyzed, with emphasis on the medium (optical fiber), the optical transmitter (semiconductor laser) and the optical receiver (PIN photodiode). The object of the course is, also, to analyze the operation of optical components which are required for an optical network such as optical couplers, optical filters, optical amplifiers and modulators. Based on the aforementioned knowledge, a detailed study of basic fiber-optic network topologies such as point-to-point, star, ring and bus topologies, is presented. In this context, the calculation of power budget and high data rate transmissions is carried out, while modern transmission systems with wavelength division multiplexing are also studied.

Upon successful completion of the course the students will be able to:

- Present the principles and operating characteristics of an optical fiber link
- Explain the propagation characteristics in optical fibers.
- Explain the basic characteristics of optical transmitters and optical receivers
- Describe the principle of operation and application of optical network components such as optical couplers, filters, amplifiers and modulators
- Analyze the topologies of fiber optic networks (point-to-point, star, ring and bus)
- Calculate the optical power budget for an optical link in any topology and assess the ability to operate within required specifications

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 for, analysis and synthesis of data and information, with the use of the necessary technology
- Working independently
- Teamwork

(3) SYLLABUS

1. Optical spectrum – propagation velocity in optical media – spectral complex refractive index – ray theory and wave optics – Snell's law
2. Optical waveguides – electromagnetic theory and guided waves
3. Guided modes in planar optical waveguides - propagation characteristics, dispersion and absorption.
4. Optical fibers: Weak guidance - linear polarized modes - dispersion relations – fabrication techniques.
5. Propagation characteristics in fibers – single mode and multimode fibers – attenuation – dispersion (intermodal, intramodal, polarizatiion) – graded index fibers – DCF and DSF fibers.
6. Optical sources: semiconductor Lasers – Photodetectors: PIN and APD.
7. Fiber fused biconical taper coupler – modulation techniques – direct and external modulation.
8. Fabry-Perot interferometer filters - MZI chain filters – Optical amplifiers SOA and EDFA.
9. Evaluation of point to point optical link – data rate specifications – bit error rate (BER)
10. Calculation of losses for star topology, power budget and dispersion for ring and bus topologies. Passive optical networks.
11. Wavelength division multiplexing systems WDM - OADM. Optical switching.
12. Fiber optic link measurements – OTDR.
13. Free space optical communication systems and radio over fiber (ROF)

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of ICT in teaching
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*	

Activity	*Semester workload*
Lectures	78
study and analysis of bibliography	26
laboratory practice, fieldwork,	46
Course total	***150***

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.*	I. Written exams (60% or 80%): - multiple choice questionnaires - short-answer questions - problem solving II. Optional written work, essay/report (20%) III. Laboratory work (20%): - Written exams - Written work - Oral examination

(5) ATTACHED BIBLIOGRAPHY

- GREEN, P., Δίκτυα οπτικών ινών, (μεταφρασμένο) εκδ. Παπασωτηρίου 1994.
- SINGH, J., Οπτοηλεκτρονική (μεταφρασμένο), Εκδ. Τζιόλα, Αθήνα 1998.
- AGRAWAL, G.P. Συστήματα επικοινωνιών με οπτικές ίνες (μεταφρασμένο) εκδ. Τζιόλα 1997.
- SENIOR, J., Optical fiber communications, Prentice Hall 1992.
- HUNSPERGER, R.G., Integrated optic: theory and technology, Springer – Verlag 1991.
- GOWAR, J., Optical communication systems, Prentice Hall 1993.
- CHEO, P., Fiber optics and optoelectronics, Prentice Hall 1990.
- PALAIS, J.C., Fiber optics communications Prentice Hall 2005.
- RAMASWAMI, R. and SIVARAJAN, K., Optical Networks, Elsevier, 2002.

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