### (1) GENERAL

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>Department of Computer Engineering &amp; Informatics</td>
</tr>
<tr>
<td>LEVEL OF STUDIES</td>
<td>Undergraduate</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>NE574</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>5, 7, 9</td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>Optical Networks</td>
</tr>
</tbody>
</table>

#### INDEPENDENT TEACHING ACTIVITIES

<table>
<thead>
<tr>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures and tutorials</td>
<td>3</td>
</tr>
<tr>
<td>laboratory exercises</td>
<td>2</td>
</tr>
</tbody>
</table>

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.

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

#### COURSE TYPE

- Specialized general knowledge
- Skills development

#### PREREQUISITE COURSES:

None

#### LANGUAGE OF INSTRUCTION and EXAMINATIONS:

Greek

#### IS THE COURSE OFFERED TO ERASMUS STUDENTS:

No

#### COURSE WEBSITE (URL)

- [https://www.ceid.upatras.gr/el/node/21448](https://www.ceid.upatras.gr/el/node/21448)

### (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

Upon successful completion of the course, a student will be able to:

1. Understand the basic principles of optical networks
2. Design optical networks with multiple wavelength multiplexes
3. Understand the concept of the optical lightpaths
4. Understand the concepts Optical switching techniques
5. Study OADM and OXC architectures
6. Study signaling and routing protocols governing optical networking
(7) Familiarize with PON architectures and PON standards
(8) Familiarize with advanced issues of “elastic” optical networks, and optical burst switching

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
- Adapting to new situations
- Working independently
- Team work
- Working in an international environment
- Working in an interdisciplinary environment
- Production of new research ideas

Other competences:
- Project planning and management
- Respect for difference and multiculturalism
- Respect for the natural environment
- Showing social, professional and ethical responsibility and sensitivity to gender issues
- Criticism and self-criticism
- Production of free, creative and inductive thinking

SYLLABUS

A. Lectures and Tutorials
- Introduction to optical networks
- Wavelength multiplexing networks
  - Optical Line terminals,
  - Optical add/drop multiplexers
  - Architectural design and operation of OADMs
  - Optical switches (OXC).
- Client layer technology
  - The SONET / SDH, ATM, Optical Gigabit and 10-Gigabit Optical Ethernet protocol
- IP over WDM
  - Layering in in IPoverWDM,
  - Multi-protocol label switching and GMPLS,
  - Protection in IP over WDM networks
- Lightpath Setup and Routing
  - Signaling protocols for the installation of optical paths
  - Routing and assignment of wavelength algorithms (RWA).
  - Dynamic RWA algorithms and Re-routing algorithms
- Traffic aggregation
  - Static and dynamic traffic aggregation
- Signaling in optical networks
  - The LDP protocol
  - Signaling in GMPLS networks
  - The RSVE-TE and OSPF-TE protocols
- Introduction in Passive Optical networks
  - PON Network Architectures
  - WDM-PON, TDM-PON networks
  - PON network standardization and spectrum management
  - GPON, NGN-PON, 10GPON networks
- Metropolitan Optical Networks
- Elastic optical networks
- Optical Burst Bursting
  - Optical burst assembly algorithms,
  - Signaling and collision management protocols

B. Lab projects
- Optical Network simulation and performance exercises using OMNeT ++ (Total: 3 tasks).
- One (1) personal simulation work for each student.

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

Wide use of ICT and more specifically:
- The course is backed up by a web page providing all course material. This page is duly updated.
- Homeworks are announced electronically through this page, submitted also through this page and marking for them is also announced electronically.
- The preferred communication method with the students is email.

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.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>26 hours</td>
</tr>
<tr>
<td>Tutorials</td>
<td>26 hours</td>
</tr>
<tr>
<td>Laboratory exercises</td>
<td>10 hours</td>
</tr>
<tr>
<td>Laboratory exercises preparation</td>
<td>35 hours</td>
</tr>
<tr>
<td>Lab report preparation</td>
<td>15 hours</td>
</tr>
<tr>
<td>Study – problem solving</td>
<td>15 hours</td>
</tr>
<tr>
<td>Theory exams</td>
<td>6 hours</td>
</tr>
<tr>
<td>Laboratory exams</td>
<td>1 hour</td>
</tr>
<tr>
<td><strong>Course total</strong></td>
<td><strong>134 hours</strong></td>
</tr>
</tbody>
</table>

STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure

The evaluation is performed in Greek language and is based on two independent parts.

- The theory evaluation is performed through a final written test that includes multiple choice questions, short-answer questions and problem solving. Sample solutions to the written test are announced so that a reference point for marking is provided. After the test marks are announced the students have the opportunity to see their mistakes.
- The evaluation for the laboratory part is based:
  - on the quality of the project reports submitted
  - on a final oral exam on the per student lab project implemented

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
  - Digital Design, Mano Morris, Ciletti Michael
  - Microelectronics, Jaeger Richard - Blalock Travis
  - Microelectronics Circuits, part B ADEL. S. SEDRA & KENNETH C. SMITH,

- Related academic journals:
  - IEEE Transactions on Circuits and Systems
  - IEEE Transactions on VLSI Systems