COURSE OUTLINE

(1) GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	ELECTRICAL AND COMPUTER ENGINEERING DEPT.		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**ECE_K520**	**SEMESTER**	**5**
COURSE TITLE	COMPUTER NETWORKS		

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	
Seminars / Practice exercises	0	
Laboratory	1	
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (4).	4	5

COURSE TYPE *general background, special background, specialised, general knowledge, skills development*	Special background
PREREQUISITE COURSES:	
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*

This course aims to introduce students to the scientific and technological fields of data networks and communication protocols. During the course, a thorough analysis is provided concerning the protocol layering, error detection and correction, encapsulation/decapsulation, multiplexing/demultiplexing and addressing. Also, the major protocols of each layer according to the TCP/IP model are studied as well as the Internet services and the operation of the networking devices (switches, routers, etc.). In addition to the detailed study of the relevant networking technologies, laboratory exercises are carried out aiming at the consolidation of the students' acquired knowledge under realistic operational conditions.

Keywords: Communication networks, protocol layering, physical layer, data link layer, network layer, transport layer, application layer, local area networks, internet.

At the end of this course the students should:

At the knowledge level:

1. Know the basic principles of networking.
2. Have understood the protocol layering.
3. Know the functionality of each layer.
4. Have understood the point-to-point, end-to-end and process-to-process communication.

5. Know the mechanisms of error detection and error correction.
6. Know the concept of addressing at each layer.
7. Know the routing protocols and algorithms.
8. Know the details of the transport layer protocols, having understood concepts, such as addressing, multiplexing and demultiplexing, error, flow and congestion control.
9. Know the major application protocols.

At the skill level - abilities:

1. Calculate packet transmission delay, throughput and protocol performance.
2. Calculate the probability of successful transmission at random-access protocols.
3. Interconnect local networks through bridges.
4. Handle fluently IP addresses and create subnetworks.
5. Calculated the optimal packet path applying shortest path algorithms.
6. Calculate the performance of transport protocols based on their operational parameters.
7. Analyze the operations of the protocols at each layer through the study of the transmitted packets and their headers.

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, analysis and synthesis of data and information, with the use of the necessary technology.
- Working independently.
- Teamwork (at the laboratory).
- Production of free, creative and inductive thinking

(3) SYLLABUS

Lectures

1. Introduction to communications and data networks, topologies, network models, internet, data transmission, media, line coding.
2. ISO/OSI reference model and TCP/IP, principles of communication protocols, layering, encapsulation/decapsulation, addressing (physical, logical, ports, specific addresses).
3. Physical layer: data and transmission media, waveforms, time-and frequency-domain analysis, digital transmission, signal coding, asynchronous/synchronous transmission, multiplexing, circuit switching.
4. Data link layer: Error detection and correction, framing, flow control, error control, data link layer protocols.
5. Medium access control: Random access protocols (ALOHA, CSMA, CSMA/CD, CSMA/CA), controlled access protocols (reservation, token passing).
6. Wired local area networks: IEEE 802.3 (Ethernet), Full-duplex/Fast/Gigabit Ethernet, interconnection of local networks (hubs, bridges, switches).
7. Network layer: IPv4, logical addressing, packet header, fragmentation, NAT, ICMP, ARP, IPv6.
8. Routing protocols (RIP, OSPF, BG), packet forwarding.
9. Subnetting: Mask and subnetworks.
10. Transport layer: Process-to-process communication, port numbers, multiplexing/demultiplexing, protocols (UDP, TCP).
11. Connection establishment, data transfer, connection, termination, sequence numbers, header, flow- error- and congestion control.
12. Application layer: DNS and FTP.

13. Application layer: WWW and HTTP.

Laboratory exercises

1. **Serial communication between two PCs (point-to-point)**

   Familiarity with the serial communication (EIA 232) and practicing on the details of a point-to-point connection. Transfer of ASCII characters and files as well as calculation of file transmission delay and the performance of the stop and wait protocol.

2. **Wireshark: network protocol analyzer**

   Familiarity with Wireshark, demonstration of its functionality and its capabilities, examples of packet capture and analysis.

3. **Ethernet and ARP**

   Study of Ethernet protocol (frame structure, header fields, trailer) and ARP (Address Resolution Protocol).

4. **IP and ICMP**

   Study of the Internet Protocol (IP) and its structure, practicing with ICMP messages through the ping and tracert applications.

5. **TCP**

   Detailed study of Transmission Control Protocol (TCP), connection establishment and termination, sequence and acknowledgement numbers, congestion control, flow- and error control, round-trip time.

6. **FTP**

   Study of File Transfer Protocol (FTP), use of protocol commands for the management of files and directories in an FTP server.

The students will elaborate the above exercises and the ones that will be assigned to them, by using a series of educational tools:

1. Computer network protocol analysis software. In particular, **Wireshark** software will be used, which is a free and open source software used for network analysis, network monitoring, network detection, troubleshooting, and training.
2. Computer network simulation software. Specifically, free computer simulator software (**OPNET IT GURU Academic Edition, NS2**) will be used to understand the operation of protocols in a real environment.
3. Programming in the laboratory environment of the department in order for the students to implement real case studies.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	• Face-to-face in the class and in the laboratory. • Distance learning through the asyncronou e-learning platform e-Class.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Power Point presentations of the course lectures, which have been uploaded to the e-Class page of the course. • Laboratory guide, at the e-Class page of the course. • Support of educational procedure through the e-Class platform for discussion and solving of relevant problems.

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	39
Laboratory exercises	13
Preparation for the laboratory exercises	13
Personal study	60
Course Total	***125 hours (5 ECTS)***

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.

(a) Final written exam of the theoretical part of the course.

(b) Examination per laboratory exercise and final written examination on the laboratory part of the course.

The laboratory exercises are mandatory.

The final grade of the course is derived as follows:

Grade = (a)*60% +(b)*40%

Evaluation language: Greek

(5) ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*

1. W. Stallings, DATA AND COMPUTER COMMUNICATIONS, Pearson; 10th ed., 2013.
2. A. Forouzan, F. Mosharraf, Computer Networks: A Top Down Approach 1st Ed., McGraw-Hill Education, 2011.
3. A. Forouzan, Data communications and networking, 5th edition, McGraw-Hill, 2013.
4. J. Kurose, K. W. Ross., Computer Network A - Topdown Approach, Pearson; 7th ed., 2016
5. L. L. Peterson, B. S. Davie, Computer Networks: A Systems Approach, ELSEVIER, 5th ed. 2011.
6. A.S. Tanenbaum. D.J. Wetherall Computer Networks, 5th Ed., Pearson, 2012)