# University of Western Macedonia

## POLYTECHNIC SCHOOL

## DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

# Study Guide

# 2024 - 2025

## CONTACT

University of Western Macedonia

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**Edited by Theofano Kollatou (Laboratory teaching staff)**

# WELCOME NOTE

Dear students,

The Study Guide that you are holding in your hands (or reading on your screen) presents the Undergraduate Program of the Department of Electrical and Computer Engineering, of the University of Western Macedonia (DECE-UOWM). It aims to introduce you to the organization of the Department's studies, to give you useful information and mainly to provide you with the outline of the curriculum through the presentation of the syllabus of each course offered.

The guide presents the academic organisation and the administrative structure of the Department. At the same time, information is provided on the professors, the teaching and administrative staff, the location of the University and the teaching and laboratory facilities of the Department. Information is also given on student issues, issues of study organisation, and information on each course. The Curriculum is subject to constant improvements and updates, following the developments in the science and technology of the subjects it treats, which are rapidly evolving. Therefore, you will be trained in modern and evolving areas such as, but not limited to, signal and data analysis, computer systems, information processing, transmission and coding, electronic devices, mobile and satellite communications, automation systems, power systems, renewable energy, smart energy networks, etc. In addition to the classical educational process, the Department offers internship opportunities to link with industry and business, as well as international student exchanges through the IAESTE and ERASMUS+ programmes. In addition, the Department has student groups with an international presence, in which we encourage you to actively participate.

The Department has a very good infrastructure, well-maintained laboratories and during this period a significant investment is being made in the further development of its laboratory and research infrastructure through European Funds of the Region of Western Macedonia. The professors of the Department are characterized by a mixture of experience and freshness, strong extroversion and intense research activity.

**Georgios C. Christoforidis**
**Professor, Head of Department**

**Markos Tsipouras**
**Professor, Vice Head**

# THE UNIVERSITY OF WESTERN MACEDONIA

## FACULTY OF ENGINEERING (Kozani)

Department of Electrical and Computer Engineering (ece.uowm.gr)
Department of Mechanical Engineering (mech.uowm.gr)
Department of Chemical Engineering (chemeng.uowm.gr)
Department of Mineral Resources Engineering (mre.uowm.gr)
Department of Product and Systems Design Engineering ( ide.uowm.gr)

## FACULTY OF SOCIAL SCIENCES AND HUMANITIES (Florina)

Department of Elementary Education (eled.uowm.gr)

Department of Nursery Education (nured.uowm.gr)

Department of Psychology (psy.uowm.gr)

Department of Communication and Digital Media (Kastoria) (cdm.uowm.gr)

## FACULTY OF FINE ARTS (Florina)

Department of Visual and Applied Arts (www.eetf.uowm.gr)

## FACULTY OF ECONOMICS (Kozani)

Department of Regional and Cross-border Development (rdcbs.uowm.gr)
Department of Management Science and Technology (mst.uowm.gr)
Department of Accounting and Finance (accfin.uowm.gr)
Department of Business Administration (Grevena) (ba.uowm.gr)
Department of Statistics and Insurance Science (Grevena) (stat.uowm.gr)
Department of Economics (Kastoria) (econ.uowm.gr)
Department of International and European Economic Studies (iees.uowm.gr)

## FACULTY OF SCIENCES (Kastoria)

Department of Informatics (cs.uowm.gr)

Department of Mathematics (math.uowm.gr)

## FACULTY OF AGRICULTURAL SCIENCES (Florina)

Department of Agriculture (agro.uowm.gr)

**FACULTY OF HEALTH SCIENCES (Ptolemaida)**

| | |
|---|---|
| Department of Obstetrics | (mw.uowm.gr) |
| Department of Occupational Therapy | (ot.uowm.gr) |

## DEPARTMENTAL ADMINISTRATION

**Head**

Christoforidis Georgios, Professor,

**Vice Head**

Tsipouras Markos, Professor,

**Professors**

1. Angelidis Pantelis, Professor
2. Bibi Stamatia, Associate Professor,
3. Bisbas Antonios, Professor,
4. Boulogeorgos Alexandros-Apostolos, Assistant Professor,
5. Bouchouras Angelos, Associate Professor,
6. Dasygenis Minas, Associate Professor,
7. Fragoulis Georgios, Professor,
8. Ganatsios Stergios, Professor,
9. Lazaridis Vasilios, Lecturer,
10. Louta Malamati, Professor
11. Mavrozoumis Konstantinos, Lecturer of Applications,
12. Michalas Angelos, Professor
13. Oureilidis Konstantinos, Assistant Professor,
14. Ploskas Nikolaos, Associate Professor,
15. Poulakis Nikolaos, Professor,
16. Sarigiannidis Panagiotis, Professor,
17. Stergiou Konstantinos, Professor,
18. Stimoniaris Dimitrios, Associate Professor,
19. Tavoultzidou Stavroula, Assistant Professor,
20. Tsalikakis Dimitrios, Assistant Professor,

21. Tsiamitros Dimitrios, Professor,
22. Zygiridis Theodoros, Professor

**Staff representatives**

Laboratory Teaching Staff Representative: Kollatou Theofano

Representative of Specialist Technical Laboratory Personnel: Not elected

**Student representatives**

Undergraduate Student Representative: Not elected

Representative of Doctoral Candidates and Postgraduate Students: Bakaimis Byron

# General Information

The Department of Electrical and Computer Engineering was established in 2005 and is in the city of Kozani. The educational activity and the admission of the first students started from the academic year 2005 - 2006, as the Department of Computer and Telecommunication Engineering, and from the academic year 2019 - 2020 it was transformed into the Department of Electrical and Computer Engineering. The number of admissions for the academic year 2023 - 2024 is 183 and the number of registered active students is 894.

To meet the teaching needs, the Department has 25 professors and lecturers, 6 laboratory teaching staff, 2 laboratory technical staff, professors from other university departments and the required number of temporary lecturers.

# DEPARTMENT STAFF

## PROFESSORS/LECTURERS

### PROFESSORS

**Angelidis Pantelis**

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- Diploma in Electrical Engineering, Dept. Electrical and Computer Engineering, Aristotle University of Thessaloniki (1998)
- MSc Power Electronics & Drives, Department of Electrical & Electronic Engineering, University of Birmingham, England (1999)
- PhD, Dept. Electrical and Computer Engineering, Aristotle University of Thessaloniki (2004)
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- Faculty of Physics, University of Bucharest, Specialization in Nuclear Physics (1981)
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- ΔDoctoral thesis, Faculty of Physics, University of Bucharest (1990)
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**Louta Malamati**

- Diploma, School of Electrical and Computer Engineering, National Technical University of Athens (1997)
- PhD, School of Electrical and Computer Engineering, National Technical University of Athens (2000)
- Master's Degree in "Techno-economic Systems", National and Kapodistrian technical University of Athens, (2004)
- Subject: Communication Network Design and Support for Advanced Telecommunication Services
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**Michalas Angelos**

- Degree in Mathematics, University of Crete (1989)
- Master's degree in Distributed and Parallel Systems, University of London (1992)
- Diploma in Electrical and Computer Engineering, National Technical University of Athens (2011)
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- Subject: Computer networks.
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## ASSOCIATE PROFESSORS

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- Master's degree in Electrical and Computer Engineering, Department of Electrical and Computer Engineering, Democritus University of Thrace (2005).
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## Assistant Professors

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**Oureilidis Konstantinos**

- Diploma in Electrical Engineering, Dept. Electrical and Computer Engineering, Faculty of Engineering, Aristotle University of Thessaloniki (2008)
- Degree in Business Administration and Management, Dept. Business Administration and Management, School of Business Sciences, University of Macedonia (2015)
- Doctoral Degree on the subject: "Methods of Decentralized Control of Microgrid with RES for the Improvement of Operation in Permanent and Transient Condition", Dept. Electrical and Computer Engineering, Faculty of Engineering, Aristotle University of Thessaloniki, Greece (2015)
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## LECTURERS

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# LABORATORY TEACHING STAFF

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**Kollatou Theofano**

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- Postgraduate Diploma, "MRes in electromagnetics in the analysis and design of Communication and High-speed systems", University of *Nottingham, UK* (2006)
- PhD, "Use of metamaterials in electromagnetic compatibility problems _ metamaterial absorbers", Department of Electrical & Computer Engineering, Faculty of Engineering, Aristotle University of Thessaloniki, Greece (2014).
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**Kyriakidis Thomas**

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- Master's Degree in Applied Informatics, University of Macedonia (2014)
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## SPECIAL TECHNICAL LABORATORY STAFF

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- email: gsalakidis@uowm.gr

# ADMINISTRATIVE STAFF

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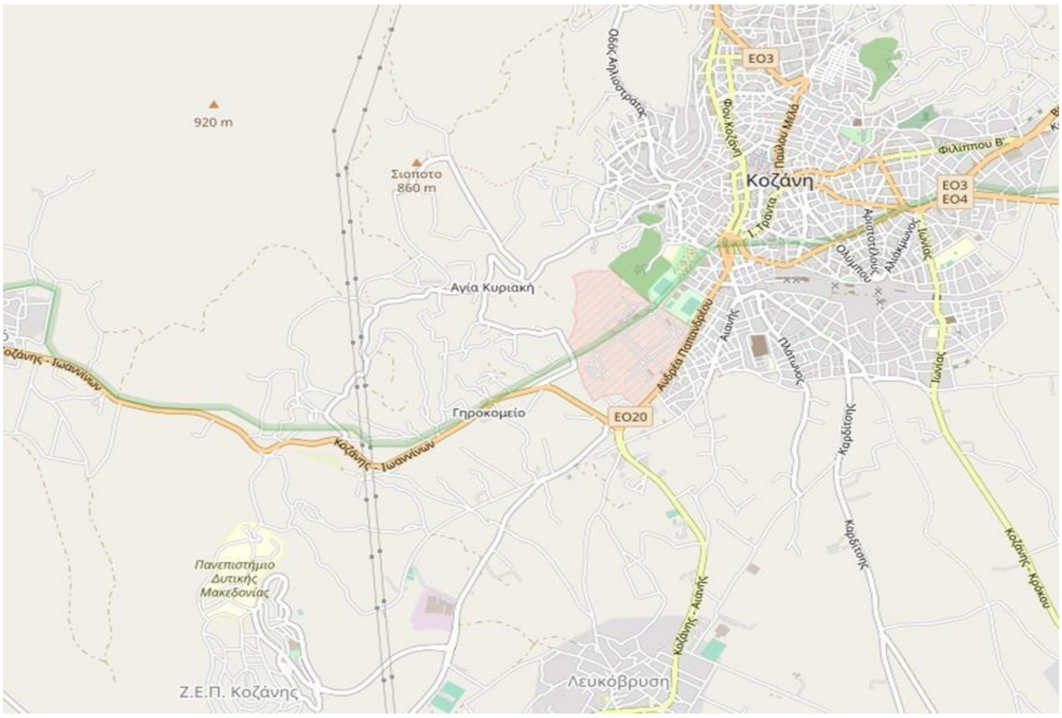
Trigoni Theodora of Ioannis (dtrigoni@uowm.gr )

Trigoni Theodora of Pavlos (ttrigoni@uowm.gr )


ΠΑΝΕΠΙΣΤΗΜΙΟ
ΔΥΤΙΚΗΣ ΜΑΚΕΔΟΝΙΑΣ

# THE DEPARTMENT

The Department of Electrical and Computer Engineering is in the city of Kozani, the capital of the prefecture of the same name with a population of 70,420. It is one of the five departments of the Faculty of Engineering of UOWM. Its facilities are in the university's new private building in the Active Urban Planning Zone (ZEP), south-west of Kozani, where the department's secretariat is also housed. The building is easily accessible by public transport.




Faculty of Engineering of the Hellenic University of Macedonia

# GENERAL TOPICS OF UNDERGRADUATE STUDIES

The program at the Faculty spans five years, divided into ten semesters (autumn and spring). At the start of each semester, students select their courses and exams based on the schedule announced by the secretariat. In the 10th semester, students are required to complete a compulsory thesis.

Upon successful completion of the program, graduates are awarded an integrated Master's degree, a single and indivisible postgraduate qualification, as outlined in Government Gazette No. 2318/2-6-2021. For incoming students in the 2023-2024 academic year, the degree requires the completion of 56 courses and a one-semester thesis.

The academic year begins on September 1st and ends on August 31st of the following year. It is divided into two semesters, each consisting of at least 13 weeks of teaching followed by 3 weeks of exams. The first semester starts in late September, while the second concludes at the end of June. If the minimum teaching weeks for a course are not met, the course will not be considered taught, and no exam will be allowed. The duration of a semester may be extended by up to two weeks, if necessary, by decision of the Senate upon recommendation from the Departmental Assembly to ensure the minimum teaching requirement is fulfilled.

Classes are suspended during the Christmas, Halloween, and Easter holidays, except during examination periods. No classes or exams are held on weekends or during the following public holidays and anniversaries:

| | |
|---|---|
| **11 October** | The Liberation of Kozani |
| **28 October** | Anniversary of "OXI" |
| **17 November** | The National Day of “Polytechnio” (Engineering School) |
| **6 December** | Saint Nicholas - Patron Saint of Kozani |
| **30 January** | Feast of the Three Hierarchs |
| **25 March** | The National Day o 1821 Revolution |
| **1 May** | 1st May/Labor Day |
| **Holy Spirit** | Mobile religious holiday |

In addition, classes are not held on the day of student elections.

Examinations are held exclusively at the end of the winter and spring semesters for the courses taught during those respective semesters. Students are permitted to take exams for courses from both semesters before the start of the winter semester. Examinations are available only for the courses listed in the student's course declaration, submitted at the beginning of the semester.

The grading for each course is determined by the instructor, who may choose to conduct written and/or oral exams, assignments, laboratory exercises, or assessments via the institution's online platform, exams.uowm.gr. If a student fails a compulsory course, they are required to retake it in subsequent semesters.

The selection and distribution of textbooks is managed through the "Eudoxos" program (www.eudoxus.gr). Students are entitled to select one textbook for each course at no charge. In total, they may select and receive free textbooks for the number of compulsory and elective courses required for the diploma. However, if students choose additional elective courses beyond those required for graduation, they will not be eligible to receive free textbooks for these extra courses, even if they count towards the diploma.

For students admitted in the academic year 2021-2022, the maximum duration of study is the minimum required study period, extended by an additional six (6) academic semesters (Law 4777, Article 34, Government Gazette 25/vol.A/17-2-2021). For all other students, the calculation of the maximum study period will begin from the start of the 2023-2024 academic year.

Students may interrupt their studies for up to four (4) semesters by submitting a written request to the Secretariat of the Dean's Office of the Faculty of Engineering (Law 4777, Article 34, Paragraph 4). These interrupted semesters do not count toward the maximum duration of study. During the interruption, the student’s status is suspended. Upon the conclusion of the study interruption, students may resume their studies in the Department.

# INFRASTRUCTURE

The Department of Electrical Engineering and Computer Engineering is located at the ZEP, near the southwestern entrance of Kozani. The Department is equipped with the following **educational laboratories**:

- Renewable Energy Sources & Smart Grids
- Industrial Electrical Installations
- Laboratory of Networks and Advanced Services
- Internal Electrical Installations
- Electricity Generation/Transmission/Distribution Laboratory
- Laboratory of Digital and Electronic Systems
- COMPUTER (4)
- Electrical Machinery
- eHealth & eHealth Biomedical Technology
- Power Electronics and Electrical Drive Systems
- Electrical Circuits and Electrotechnics Laboratory
- Electricity Systems
- Telecommunications
- Robotics, Embedded and Integrated Systems Laboratory
- Intelligent Systems & Intelligent Systems Laboratory Optimization
- Measurement Laboratory
- Laboratory of Automatic Control Systems
- Nuclear Measurements Laboratory
- Solar Air Conditioning Laboratory
- Microcomputers and Computer Networks Laboratory

## COMPUTER LABORATORIES

The Department features four computer laboratory rooms equipped for academic use: one large lab with 50 workstations, one medium-sized lab with 25 workstations, and two smaller labs, each with 20 workstations. All rooms are equipped with projectors to support presentations and lectures.

Each workstation can load a dedicated virtual machine (VM) tailored to the requirements of a course. These VMs can run various Linux operating systems, such as Ubuntu, Fedora, and FreeBSD. Additionally, the workstations can boot into multiple other operating systems based on specific needs.

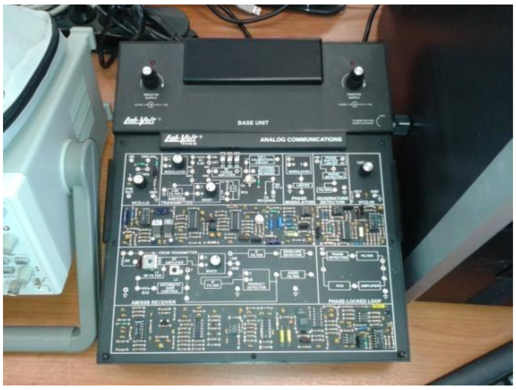
For PCs running Windows 10, the laboratories include a variety of pre-installed applications to support educational activities, such as:

| | | | | | |
|---|---|---|---|---|---|
| SPSS | Microsoft SQL Server | Netbeans | Android SDK | WEKA | GNURADIO |
| Matlab | XAMP | Anaconda | Arduino IDE | ArgoUML | Xilinx |
| Microsoft Office | Java SDK | Dev-C++ | ARM IDE | Opnet | Ns2 |
| Microsoft visual studio | Java ME SDK | Prologue | Multisim | Xsniffer | Modelsim |
| Logisim | Hypersim | | | | |

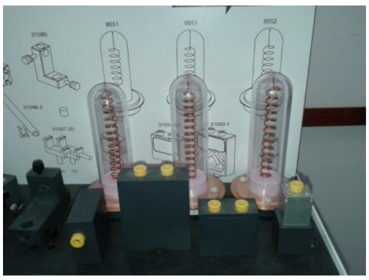
## TELECOMMUNICATIONS LABORATORY

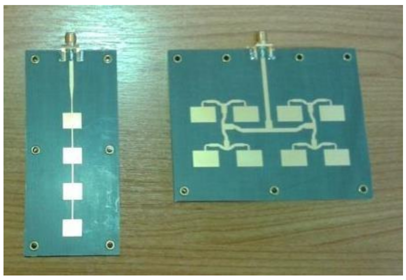
The Telecommunications Laboratory supports educational activities across multiple courses in the curriculum. Its equipment includes the following:

- Telecommunications Training System: Comprising 25 workstations, this system facilitates experimental training in the fundamental principles of Analog and Digital Communications. Each workstation is equipped with a pre-printed circuit board base that connects to a PC. Removable boards are installed on the base, allowing students to conduct hands-on training and experiments related to Analog and Digital Communications.

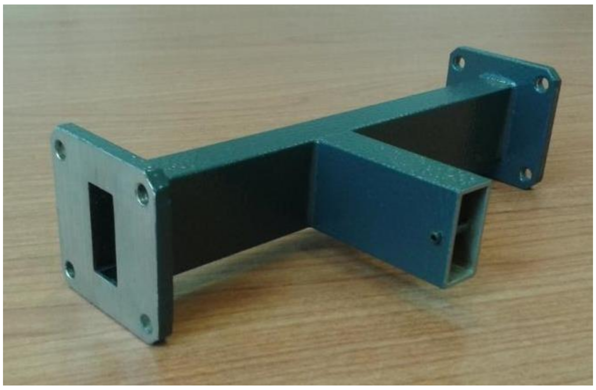


- Antenna Training System (10 workstations), providing hands-on experimentation on different types of antennas (e.g. funnel, helical, flat, Yagi) at 1 GHz and 10 GHz frequencies.





- Educational Microwave Communication Systems (3 stations).



- Spectrum analysers, oscilloscopes, random waveform generators.
- Portable selective radiation meter Narda SRM-3006, with measurement capability in the frequency range 27 MHz - 3 GHz.
- Keysight E5063A network analyzer for measuring passive components such as antennas, cables, filters and printed circuit boards (PCBs) in the 100 KHz range - 4.5 GHz.

- Plastic optical fibre training system, with loss measurement capability, consisting of a dual-channel data transmission system.

- Double Sided Vacuum UV unit with single/double sided PCB production capability through exposure to UV radiation and Tri-Tank unit with triple built-in function: DEVELOP / SPRAY WASH / BUBBLE ETCH.


## LABORATORY OF MICROCOMPUTERS AND COMPUTER NETWORKS

The Microcomputer and Networking lab is equipped with the latest generation of personal computers connected to a modern LAN, a Sun Blade server and specialized educational electronic material to serve multiple courses. It has:

- Personal computers (64bit i5 processors, Windows 10 multiuser environment)
- Gigabit Ethernet LAN
- 2 Gigabit managed Linksys switches (full dublex mode)
- dual ultraSPARC 64bit Sun Blade server
- Xilinx FPGA boards
- Mikroelectronica development boards equipped with Microchips' PICs
- National Instruments PCI and USB Data Acquisition Cards

## LABORATORY OF ROBOTICS, EMBEDDED AND INTEGRATED SYSTEMS

The Robotics, Embedded and Integrated Systems Laboratory satisfies the research and educational needs in core and specialization courses of the Department. The laboratory was officially established by Government Gazette 2311/B' on 15 June 2020.

The laboratory is equipped with the following resources:

**Workstations and Development Kits**:

- 30 Intel i5 workstations with 2GB RAM ,
- 3 development inventor kits featuring Arduino microprocessors,
- 9 Xilinx Spartan 3A reconfigurable logic FPGA boards,
- 2 Devkit8000 development kits with TI OMAP3530 processors (600MHz ARM Cortex-A8) and touchscreens,
- 2 BeagleBoard development kits with ARM Cortex-A8 processors and DSP support,
- 2 Lego Mindstorms kits.

**Specialized Computing Systems**:

- A cluster of 2 computers, each equipped with 4 Nvidia Geforce 9800GTX graphics cards for parallel processing,
- A parallel system featuring 16 Xeon E5520 processors (@2.27GHz) and 76GB RAM,
- 4 servers powered by dual-core Intel Xeon processors (@3.40GHz) with 8GB RAM each.

The operating systems of the computers are FreeBSD 9.0, Ubuntu 12 LTS, Microsoft Windows 7.

The laboratory equipment is used for various courses in the curriculum and for students' theses in related subjects. It is also used for the research needs of the Department on topics related to software and hardware correlation, systems-on-chip (SoC) and multicore systems.

In addition, the laboratory has modern equipment for the educational and research activities of the Department in the field of Robotics, such as:

- Industrial type articulated arm.
- Training devices for the synthesis and programming of robotic structures.
- Humanoid robots of modern type.
- Robots suitable for social assistance applications.
- Mobile robotic platforms for indoor applications (e.g. warehouses), with wireless networking, monitoring, etc.

## LABORATORY OF INTELLIGENT SYSTEMS AND OPTIMISATION

The Intelligent Systems and Optimization Laboratory aims to advance research and development in Artificial Intelligence (AI) and optimization methodologies. Its mission also includes promoting the adoption of computational techniques and methodologies for addressing real-world problems effectively.
Its equipment includes:

- 5 workstations with i7-8700 processor and 16 GB memory
- 2 workstations with AMD Ryzen Threadripper PRO 3975WX 32-Cores processor and 64 GB memory
- Graphics cards for deep learning applications
- Software for artificial intelligence and optimisation applications
- Antenna and sensor equipment for smart city applications
- 3d printer

## LABORATORY OF DIGITAL AND ELECTRONIC SYSTEMS

The Digital and Electronic Systems Laboratory is equipped with twenty fully outfitted workstations. Each workstation includes a range of tools and instruments to support practical training, such as oscilloscopes, low- and high-frequency generators, DC power supplies, AC power supplies, and multimeters. Specifically, each workstation is equipped with:

- HAMEG analog oscilloscope 20MHz,
- Digital oscilloscope TEKTRONIX 100MHz,
- AF HAMEG 5MHz generator,
- Triple output DC power supplies,
- XELTEK Integrated Programmer,
- Breadboard.

MultiSim and ADS (Advanced Design Systems) software are used for the analysis and design of electronic circuits.

The laboratory also facilitates hands-on exercises for the **Electronics I** and **Electronics II** courses, supports student projects on related topics, and contributes to research initiatives focused on the development and construction of prototype electronic systems.

Additionally, the laboratory is equipped with a system for designing and fabricating prototype electronic boards, as well as tools for soldering, IC desoldering, and diagnostic testing of electronic boards.

## LABORATORY OF ELECTRONIC HEALTH AND BIOMEDICAL TECHNOLOGY

The eHealth and Biomedical Technology laboratory supports the courses of "Biomedical Technology", "eHealth" and "Bioinformatics". It allows training students in the following:

Recording and analysis of key biosignatures

- Electrocardiogram recording and analysis with a wireless cardiograph.
- Measurement of blood pressure with a wireless blood pressure monitor.
- Measurement of lung function: Spirometry with a wireless spirometer.
- Measurement of blood oxygenation with a wireless oximeter.
- Receiving a Cardiotocography signal.

Digital Processing of Biological Signals

Methods and techniques for processing signals from biological systems, signals and systems, design and implementation of digital filters applications, use of a fluorescence microscope to obtain and process images of biological samples.

Introduction to Medical Imaging Systems

Management and processing of images from CT, MRI, endoscopic systems, ultrasound. Medical Image Reconstruction Methods: image reconstruction algorithms (simple back projection, filtered image reconstruction, filtered image reconstruction,back projection, iterative reconstruction algorithms), defects in

reconstructed images, 3D tomography.

<u>Online health care</u>

The online provision and demand for medical information, including Internet-based medical interventions such as teletherapy and peer-to-peer (P2P) support networks within virtual medical communities. Applications include the use of online search tools and Internet-based methods to support clinical trials, health portals, and telemedicine services. Additional focus areas include the role of mobile and wireless communications in healthcare.

## Electrical Circuits Laboratory

The laboratory has 12 workstations with appropriately configured energy analysers for three-phase compensation laboratory exercises.

The other equipment of the laboratory includes:

- Volumetric meters, Vineyard meters, Watermeters, Multimeters
- DC/AC power supplies (single-phase, three-phase)
- Constant resistors
- Resistance variables
- Ohmic, inductive, capacitive loads
- RLC variable loads
- Frequency generators
- Digital energy analysers

## Laboratory of Renewable Energy Sources & Smart Grids

The laboratory's equipment is utilized for undergraduate and postgraduate theses on related subjects, as well as for research activities and projects. The equipment includes:

<u>Microgrid No 1:</u>

- Autonomous (island) inverter
- 2 (Two) PV inverters
- 12 PV panels with a nominal power of 2 kWp

- 1 (one) horizontal axis wind turbine 1 kW
- 24 FLA batteries
- Various loads, NI:DAQ 6008 data acquisition cards, Measuring devices

Microgrid No 2 :

- 2 hydrogen fuel cells 1,2 kW with corresponding inverters
- 2 electrolysis units and two hydrogen storage canisters
- 1 standalone inverter
- 1 wind turbine 1,5 kW vertical axis wind turbine
- 10 thin-film PV panels of nominal power 1 kW with PV-inverter
- 24 FLA batteries of 323 Ah capacity each
- 1 electric car
- 1 electric scooter
- 1 electric bicycle
- 2 charging stations (level 1 and level 2) built in the MPA


Microgrid No 3 - charging station for electric cars from RES (In cooperation with the municipality of Kozani):

- 3 electric cars
- 3 floor chargers manufactured in the EPC
- 1 wall charger
- 48 FLA batteries for autonomous systems
- 2 stand-alone inverters (island inverter)
- 36 PV panels on the roof
- 2 PV inverters

Energy inspection equipment for buildings:

- 1 ISO9869 Hukseflux TRSys 01 thermoelectricity meter
- 2 infrared (IR) cameras
- 1 Laser mini temperature gauge
- 1 Fluke Energy Analyzer
- 1 photometer and 1 hygrometer
- 1 Digital exhaust gas analyser

## LABORATORY OF INTERNAL ELECTRICAL INSTALLATIONS

The laboratory equipment of the laboratory is used for the theses of students (undergraduate and postgraduate) in related items. The laboratory has :

- 8 stations - Indoor electrical simulation devices
- Electrical panels
- Complete earthing simulation device
- 4 stations / provisions of the KNX system
- 4 Portable training devices of the KNX system

## ELECTRICAL MACHINERY LABORATORY

The laboratory equipment of the laboratory is used for students' dissertations in related subjects and includes:

**DC Motors:**

- 3 DC motors with composite excitation
- 2 DC motors with series excitation
- 3 DC motors with parallel excitation

**AC Generators and Motors:**

- 5 three-phase synchronous AC generators
- 12 three-phase asynchronous induction motors
- 2 single-phase asynchronous induction motors

**Power Supplies and Transformers:**

- 5 three-phase power supplies with adjustable voltage and DC voltage capability
- 3 three-phase transformers
- 4 single-phase transformers

**Specialized Systems:**

- Three-phase synchronous generator paralleling demonstration system
- 2 modern systems for measuring torque, speed, and engine power
- 2 soft-starter asynchronous motors

**Workstations:**

- 4 new workstations equipped with measuring instruments

  (current, voltage, and speed meters)

## POWER ELECTRONICS LABORATORY

The Power Electronics Laboratory supports the laboratory component of courses related to Power Electronics and Electric Drive Systems. It is also utilized for thesis preparation and research activities.

The laboratory features:

**Workstations:**

- 2 fully equipped group workstations with bench setups, enabling students to perform a wide range of experiments on power electronic converters. These workstations are also equipped for AC and DC motor drive exercises using appropriate inverters.
- A third group workstation for conducting simple rectifier experiments.

**Modular Design:**

A key feature of the laboratory is its modular structure, which allows students to assemble their own experimental setups by interconnecting various physical units. This hands-on approach enhances understanding by enabling students to identify and analyze the role of each circuit component in the system's overall functionality.

The laboratory's core equipment includes:

- Semiconductor devices (diodes, diode bridges, thyristors, thyristor bridges, IGBTs and their bridges, TRIACs, MOSFETs)
- Various AC and DC power supplies, fully controllable (single-phase - three-phase)
- Converter control units of various types and related controllers
- Composite loads consisting of resistors, coils and capacitors, but also loads with lamps
- Isolation amplifier units to assist in taking voltage and current measurements and connection to an oscilloscope
- Waveform generator (sinusoidal, square, triangular, etc.)
- Modular frequency converter, for experiments with AC drives
- Special software for connecting to a computer and performing experiments
- Various motors (asynchronous, ring, DC parallel excitation, etc.)
- Electrodynamic brake for simulating various kinds of mechanical loads
- Various measuring instruments (multimeters, wattmeters, tachometers, etc.)
- Colour oscilloscopes

## LABORATORY OF NETWORKS AND ADVANCED SERVICES

The The Laboratory of Networks and Advanced Services (LNAS) supports both educational and research activities in the fields of communication networks, computer networks, and advanced telecommunication services. The laboratory's focus spans a variety of areas, including:

- Network design, evaluation, performance analysis, optimization, and management.
- Resource control and traffic management in wired and wireless networks.
- Information security and analysis of emerging technologies and protocols.
- Dynamic network restructuring and support for advanced telecommunication services.
- Adaptation of services and applications for heterogeneous network infrastructures.
- Network energy management and telematics applications.

The LNAS offers five workstations with access to modern network devices for switching and routing tasks. Additionally, the laboratory supports the implementation and configuration of point-to-point wireless links, unstructured wireless networks, and optical interfaces. It also includes a suite of servers that provide state-of-the-art services, such as secure switching and routing, digital telephony, virtual networking, digital call center functionality, and cloud computing.

**Equipment Overview:**

**Routers:**

- Two Cisco routers (2921 series).
- One Cisco router (2901 series).

**Switches:**

- Three Cisco switches (2960S series).
- Two Cisco switches (2960X series).
- One Cisco switch (800 series).
- Two MikroTik switches (CCR1009 series).
- Four MikroTik switches (CRS125 series).

**Wireless Equipment:**

- Six 802.11n access points (various types).
- Two pairs of antennas for wireless link creation.

**Servers:**

- Three servers for telephony, security center, and optical interface applications.

**Software Tools:**

- Wireless LAN simulation, radio coverage simulation, and spectrum analysis tools for wireless LANs and the 802.11n protocol.
- Application analysis software.

## LABORATORY OF AUTOMATIC CONTROL SYSTEMS

The **Automatic Control Systems (ACS) Laboratory** (http://sae.thmmy.uowm.gr/) supports educational activities and applied research in the field of Automatic Control Systems. In addition to undergraduate education, the laboratory's activities include:

- Supporting and supervising practical, non-theoretical diploma theses at both undergraduate and postgraduate levels.
- Conducting research on various topics within the broad interdisciplinary field of Automatic Control Systems.

The **Automatic Control Systems (ACS) Laboratory** is equipped with seven workstations that provide access to modern devices and machinery. These systems operate either independently or are computer-controlled via specialized software. The laboratory's equipment includes:

**Experimental Devices:**

**Motor Control Systems:**

- 9 FEEDBACK MS150 experimental devices for analog motor control, comprising: Operational Amplifier (OA 150A), Potentiometer Unit (AU 150B), Preamplifier Unit (PA 150C), Servo Amplifier (SA 150D), Power Supply (PS 150E), Input Potentiometer (IP 150H), Output Potentiometer (OP 150K), Load Unit (LU 150L), and Voltmeter (DC MV 143).
- 9 FEEDBACK 33-004USB experimental devices for analog and digital motor control, including: Mechanical Unit (33-100), Analog Unit (33-110), Digital Unit (33-120), Power Supply (01-100), 93 IMS Software, and 33-921-1V65 compatibility with eight PCs equipped with Advantech PCI-1751 cards.

**Advanced Experimental Systems:**

- 1 FEEDBACK 33-005PCI inverted pendulum experimental device, comprising: Mechanical Unit (33-200), Controller (33-201), 33-936 Software, and a PC with an Advantech PCI-1711 card.

- 1 FEEDBACK 33-007PCI dual rotor experimental device, comprising: TRMS Mechanical Module, Controller (33-220), 33-949 Software, and a PC with an Advantech PCI-1711 card.

**Measurement and Signal Equipment:**

- 9 FEEDBACK signal generators (5 FG601 and 4 FG600).
- 8 dual-beam oscilloscopes:

1 GOLDSTAR Digital Storage OS-3040 (40MHz).
2 GOLDSTAR Digital Storage OS-3020 (20MHz).
1 LG Digital Storage OS-3020D (20MHz).
1 LG Analog OS-5020 (20MHz).
3 HAMEG Analog/Digital Storage HM1007 (100MHz).

**Additional Equipment:**

- 7 analog computers (CE 5a).
- 5 TTi TG230 2MHz signal generators.
- 9 DIGITAL Protek 505 multimeters.

## ELECTRIC POWER SYSTEMS LABORATORY

The Power Systems Laboratory (ESP) supports the Department’s educational needs in the field of power systems. The laboratory provides hands-on experience and practical knowledge through a series of experiments designed to deepen understanding of electricity transmission and distribution.

Students engage in laboratory exercises that include control and fault identification in medium-voltage transformers. These activities are complemented using specialized software, DIgSILENT PowerFactory, enabling students to bridge theoretical knowledge with practical applications in power systems.

**Laboratory Equipment:**

The laboratory is equipped with an extensive range of devices for studying and experimenting with transmission lines, transformers, power supplies, and control systems. Specifically, the equipment includes:

- Transmission and Load Equipment:
- 4 models of 77 kV/136 km long-distance transmission lines.
- 6 variable three-phase inductive loads (2.5 kVAr).
- 4 variable three-phase capacitive loads (2.8 kVAr).
- 5 variable three-phase resistive loads (3.3 kW).

**Transformer Systems:**

- 2 three-phase transformers (15 kV/380 V).
- 3 three-phase 220/380 V transformers with 1 kV charging angle regulation.
- 2 autotransformers (220/380 V, adjustable charging angle, 1 kVA).

- 3 multi-voltage three-phase transformers (2 kVA, 380/127 V).
- 3 0/20 A transformers (Terco).

**Measurement and Analysis Devices:**

- 6 MPR-53 three-phase power analyzers.
- 4 MO-1251 oscilloscopes (20 MHz).
- 1 device for measuring the dielectric strength of 60 kV oil (Megger).

**Motors and Power Supplies:**

- 6 electric motors (220 V/2 A/250 W/1500 rpm).
- 2 three-phase power supplies (de Lorenzo).
- 2 three-phase power supplies (Elettronica Veneta).
- 1 Terco 1300 MV three-phase power supply.

**Additional Equipment:**

- Static relay panel (Terco).
- 7 variable resistance potentiometers.
- 1 synchroscope device for paralleling electrical networks.
- 5 computer workstations.

# USEFUL INFORMATION

## PRACTICAL EXERCISE

The **Student Internship Program** of the Department commenced in the academic year 2010–2011, supported by funding from the Ministry of Education's EPEAEK program and in collaboration with various companies.

During the internship, both the company representative and the assigned faculty member closely monitor the student's progress and evaluate their performance. Students are required to submit detailed reports about their work during and after the internship, following the guidelines outlined in the University's **Internship Regulations**.

Each internship lasts for three months, with the option for an extension. The program is overseen by Associate Professor Minas Dasygenis.

For more information, the **Internship Regulations** can be accessed =>Internship Regulations

## ERASMUS PROGRAMME

**ERASMUS+** is the European Commission's program for education, training, youth, and sport. It aims to enhance skills, improve employability, and modernize education, training, and youth systems across all areas of lifelong learning.

Under the ERASMUS+ program, students from the Department can study abroad for a period of 3 to 12 months at institutions with which the Department has active bilateral agreements. The full list of partner institutions can be accessed at https://erasmus.uowm.gr/bilateral/department/icte/

Studies abroad through the ERASMUS+ program are fully recognized by the home department, ECE-UoWM, provided that the student successfully completes the selected courses. The program is coordinated by Assistant Professor Stavroula Tavoultzidou, who oversees its implementation and supports participating students.

# PROGRAMME OF STUDIES

# GENERAL DESCRIPTION

The undergraduate program at the Department of Electrical and Computer Engineering (ECE), part of the Faculty of Engineering at the University of Western Macedonia, spans a minimum of ten (10) academic semesters and leads to the award of a Diploma in Electrical and Computer Engineering. This structure is outlined in the founding Government Gazette (GG) of the Department. The program is designed in accordance with the European Credit Transfer System (ECTS), requiring the completion of 300 ECTS credits, with 30 credits allocated per semester. The five-year integrated curriculum ensures a solid foundation in both theoretical and technological aspects, while providing in-depth knowledge in specialized fields within Electrical and Computer Engineering.

The Diploma awarded is recognized as a single and indivisible postgraduate-level degree (Integrated Master), as defined in Government Gazette No. B' 2318/2-6-2021.

**Program Structure**

**First Five Semesters:**

The curriculum focuses on compulsory courses that establish a strong foundation in the basic sciences, which are integral to Electrical and Computer Engineering studies. It also introduces core courses covering the full range of subjects within the discipline. These compulsory courses are concentrated in the first six semesters and often include mandatory laboratory components to reinforce practical skills and technical knowledge.

**Progression Requirements:**

To advance to the 7th semester and beyond, students must successfully complete at least 20 core courses from the curriculum within the first six semesters.

**Specialization (7th Semester Onwards):**

From the 7th semester, the curriculum offers advanced specialization in three distinct divisions:

- Energy
- Telecommunications and Networks

- Computers and Electronics

Each division includes both compulsory and elective courses, with the option for students to take courses from other divisions classified as general electives. Additionally, students can enroll in free elective courses that provide broader immersion into various topics.

**Optional Activities:**

- A three-month Practical Training, worth 15 ECTS, offering hands-on industry experience.
- An optional course on Research Methodologies to enhance research skills.
- A specialized research-oriented elective course (Special Project).

**Thesis Requirement:**

In the final semester, students undertake a thesis of analytical, experimental, computational, or combined nature. This project involves in-depth research and study of a specific scientific topic, guided by a faculty member. The successful completion of the thesis, worth 30 ECTS, is an essential requirement for the award of the Diploma in Electrical and Computer Engineering.

## GENERAL LEARNING OUTCOMES

Upon successful completion of the curriculum, graduates of the Department possess the knowledge, skills, and competencies to study, design, analyze, construct, supervise, operate, evaluate, maintain, provide expert opinions, and certify compliance with standards in facilities and applications across the following scientific fields:

- Electricity and Power Systems
- Electrical Installations and Design
- Computers
- Telecommunications and Telecommunication Systems and Networks
- Information Technology and Information Systems
- Automation Systems, including signal, image, sound, speech, and graphics processing

**Core Competencies of Graduates:**

Graduates of the Department of Electrical and Computer Engineering are equipped to:

**Problem-Solving and Decision-Making:** Identify problems, consult the scientific literature, and select optimal solutions.

**Teamwork and Independence:** Work effectively both independently and as part of a team to achieve common goals.

**Project Management:** Plan, schedule, and execute complex projects while adhering to strict timelines.

**Innovation and Research:** Generate new ideas, conduct research, and apply knowledge to produce innovative solutions in their field.

**Adaptability:** Adapt to new situations and respond effectively to challenges.

**Lifelong Learning:** Recognize the importance of continuous learning and education, staying updated with technological advancements in their discipline.

**Advanced Studies:** Pursue doctoral studies or engage in advanced research in fields related to their science.

**Social Responsibility:** Apply their knowledge, skills, and competencies while considering societal needs and fostering sustainable development.

# PROGRAM OF STUDIES OVERVIEW

## 1st SEMESTER

| Course Code | Course | Teaching Hours | ECTS credits |
|---|---|---|---|
| MK1 | Mathematical Analysis I | 4 | 5 |
| MK2 | Linear algebra | 3 | 4 |
| MK4-H | Structured Programming | 5 | 5 |
| MKH3 | Mechanics | 4 | 4 |
| MK9 | Digital Design | 4 | 5 |
| MKH2 | Technical Drawing | 4 | 5 |
| MK7 | English I (English for Electrical and Computer Engineers) | 2 | 2 |

| Number of Courses | Total Teaching Hours | Total ECTS Credits |
|---|---|---|
| 7 | 26 | 30 |

## 2nd SEMESTER

| Course Code | Course | Teaching Hours | ECTS credits |
|---|---|---|---|
| MK8 | Mathematical Analysis II | 4 | 5 |
| MK18-H | Electric Circuits I | 5 | 5 |
| MK10 | Object-oriented Programming I | 4 | 5 |
| MKH1 | Electrical Materials | 3 | 5 |
| MK12 | Discrete Mathematics | 4 | 5 |
| MK16 | Probability Theory and Statistics | 4 | 5 |

| Number of Courses | Total Teaching Hours | Total ECTS Credits |
|---|---|---|
| 6 | 24 | 30 |

# 3rd SEMESTER

| Course Code | Course | Teaching Hours | ECTS credits |
|---|---|---|---|
| MK15 | Applied Mathematics I | 4 | 5 |
| MKH4 | Electrical Measurements | 4 | 5 |
| MK17 | Algorithms and Data Structures | 4 | 5 |
| MKH5 | Electric Circuits II | 5 | 5 |
| MK6 | Introduction to Telecommunications | 4 | 5 |
| E26 | Thermodynamics | 4 | 5 |

| Number of Courses | Total Teaching Hours | Total ECTS Credits |
|---|---|---|
| 6 | 25 | 30 |

# 4th SEMESTER

| Course Code | Course | Teaching Hours | ECTS credits |
|---|---|---|---|
| MK21 | Applied Mathematics II | 4 | 5 |
| MK3 | Electromagnetism | 4 | 5 |
| MK23 | Signal and System Theory | 4 | 4 |
| MK26-H | Numerical Analysis | 4 | 4 |
| MK25 | Electronics I | 5 | 5 |
| MK11 | Telecommunications networks | 4 | 5 |
| MK14 | English II (Academic Skills) | 2 | 2 |

| Number of Courses | Total Teaching Hours | Total ECTS Credits |
|---|---|---|
| 7 | 27 | 30 |

## 5th SEMESTER

| Course Code | Course | Teaching Hours | ECTS credits |
|---|---|---|---|
| MK27 | Electromagnetic Waves | 4 | 5 |
| MKH7 | Introduction to Electric Power Systems | 5 | 6 |
| MK28 | Digital Signal Processing | 4 | 5 |
| MK30 | Electronics II | 4 | 5 |
| MK20 | Computer Architecture | 4 | 5 |
| MKH8 | Techno-economic Analysis | 3 | 4 |

| Number of Courses | Total Teaching Hours | Total ECTS Credits |
|---|---|---|
| 6 | 24 | 30 |

## 6th SEMESTER

| Course Code | Course | Teaching Hours | ECTS credits |
|---|---|---|---|
| E22 | Microprocessors | 4 | 5 |
| MK29-H | Communication systems | 5 | 5 |
| MK38 | Databases | 4 | 5 |
| Y4-H | Automatic Control Systems I | 5 | 5 |
| MK19-H | Computer networks | 4 | 5 |
| MKH9 | Electric Machines I | 5 | 5 |

| Number of Courses | Total Teaching Hours | Total ECTS Credits |
|---|---|---|
| 6 | 27 | 30 |

# 7th SEMESTER - ENERGY

| Course Code | Course | Teaching Hours | ECTS credits |
|---|---|---|---|
| PP1 | Transmission and distribution Power Systems | 4 | 5 |
| PPP2 | Electric Machines II | 4 | 5 |
| YEH3 | Power Electronics I | 4 | 5 |
| YEH4 | Modern Electrical Installations | 4 | 5 |
| | elective | | |
| | elective | | |

## ELECTIVE COURSES (at least 1)

| Course Code | Course | Teaching Hours | Units ECTS |
|---|---|---|---|
| **A GROUP OF COURSES - Energy Direction (Option at least 1 out of 4)** | | | |
| EEH17 | Introduction to Nuclear Technology | 4 | 5 |
| EEH2 | Lighting | 4 | 5 |
| EEH3 | Energy Automation | 4 | 5 |
| EEH4 | Heat Transfer | 4 | 5 |
| E27 | Operational Research | | 5 |

| Number of Courses | Total Teaching Hours | Total ECTS Credits |
|---|---|---|
| 6<br>(4 Compulsory - 2 Elective)<br>(at least 1 Elective Direction and a maximum of 1 Free Elective in total to semesters 7-8-9) | 24 | 30 |

# 7th SEMESTER - TELECOMMUNICATIONS AND NETWORKS

| Course Code | Course | Teaching Hours | ECTS credits |
|---|---|---|---|
| Y2 | Analysis and Simulation of Communication Networks | 4 | 5 |
| Y3 | Antenna systems and wireless propagation | 4 | 5 |
| E45 | Digital Communications | 4 | 5 |
| | elective | | |
| | elective | | |
| | elective | | |

## ELECTIVE COURSES (at least 6 during semesters 7-8-9)

| Course Code | Course | Teaching Hours | ECTS credits |
|---|---|---|---|
| **A GROUP OF COURSES (5) - Direction of Telecommunications & Networks** | | | |
| EF1 | Electromagnetic Compatibility | 4 | 5 |
| E2 | e-Health | 4 | 5 |
| E9 | Queuing Theory | 4 | 5 |
| E48 | Mobile and Satellite Communications | 4 | 5 |
| EVH2 | Information and code theory | 4 | 5 |
| HEY3 | Network Programming | 4 | 5 |
| E27 | Special Assignement | | 5 |
| EF10 | Basic Principles of the Internet of Things | 4 | 5 |

| Number of Courses | Total Teaching Hours | Total Units ECTS |
|---|---|---|
| 6<br>(3 Compulsory - 3 Elective) | 24 | 30 |

| | | |
|---|---|---|
| (at least 6 must be Elective in semesters 7-8-9 and at most 1 Free Choice) | | |

## 7th SEMESTER - COMPUTERS AND ELECTRONICS

| Course Code | Course | Teaching Hours | ECTS credits |
|---|---|---|---|
| PS1 | Automatic Control Systems II | 5 | 5 |
| MK22 | Operating Systems | 4 | 5 |
| Y1 | Artificial Intelligence | 4 | 5 |
| | elective | | |
| | elective | | |
| | elective | | |

### ELECTIVE COURSES (at least 6 during semesters 7-8-9)

| Course Code | Course | Teaching Hours | Units ECTS |
|---|---|---|---|
| E4 | Robotics | 4 | 5 |
| EVH1 | Industrial Communications | 4 | 5 |
| E47 | Digital Electronics | 4 | 5 |
| E27 | Special Assignement | 4 | 5 |
| MK31 | Object Oriented Programming II | 4 | 5 |
| E34 | Computer Graphics | 4 | 5 |
| EVH2 | Information and Code theory | 4 | 5 |
| E2 | e-Health | 4 | 5 |
| EVH8 | Data analysis | 4 | 5 |

| Number of Courses | Total Teaching Hours | Total Units ECTS |
|---|---|---|
| 6<br>(3 Compulsory - 3 Elective) | 25 | 30 |
| (at least 6 must be Electives in semesters 7-8-9 and a maximum of 1 in semesters 7-8-9)<br>Free Choice) | | |

## 7th SEMESTER - FREE ELECTIVE

Students can recognize up to 1 Free Elective elective course from those offered in the semesters 7-8-9. If they succeed in the above free elective courses, those will appear in the diploma annex but are not counted in the final degree.

| Course Code | Course | Teaching Hours | ECTS credits |
|---|---|---|---|
| E7 | Research, Technology and Innovation Policies and Entrepreneurship | 4 | 5 |
| EH2 | English III (Academic Writing) | 4 | 5 |
| 208 | Heating (Department of Mechanical Engineering) | 4 | 5 |
| 230 | Quality Control (Department of Mechanical Engineering) | 4 | **4** |
| 262 | Advanced Materials - Nanomaterials (Department of Mechanical Engineering) | 4 | 5 |
| 260 | Decision Theory and Data Analysis (Department of Mechanical Engineering) | 4 | 5 |
| 228 | Computational Engineering (Department of Mechanical Engineering) | 4 | 5 |

| | | | |
|---|---|---|---|
| AF505 | Econometrics I (Department of Accounting and Finance) | 3 | 5 |

# 8th SEMESTER - ENERGY

## DIVISION OF ENERGY ELECTIVE COURSES (at least 4)

| Course Code | Course | Teaching Hours | Units ECTS |
|---|---|---|---|
| **A GROUP OF COURSES - Energy Direction (Option at least 4 out of 6)** | | | |
| EEH1 | Renewable Energy Sources | 4 | 5 |
| EEH5 | High Voltage Engineering I | 4 | 5 |
| EEH19 | Electro-Hydraulic and Electro-Pneumatic Power Systems | 4 | 5 |
| EEH7 | Power Electronics II | 4 | 5 |
| EEH20 | Special Issues of Electric Power Systems | 4 | 5 |
| EEH14 | Modern Electrical Installations and Buildings' Energy Analysis | 4 | 5 |
| EEH10 | Energy Economics and Energy Markets | 4 | 5 |
| E27 | Special Assignement | | 5 |

| Number of Courses | Total Teaching Hours | Total ECTS Credits |
|---|---|---|
| 6<br>(0 Mandatory - 6 Optional)<br>(at least 4 elective courses and a maximum of 1 Free Elective in total to semesters 7-8-9) | 24 | 30 |

# 8th SEMESTER - TELECOMMUNICATIONS AND NETWORKS

| Course Code | Course | Teaching Hours | ECTS credits |
|---|---|---|---|
| Y5 | Mobile Communication Networks | 4 | 5 |
| Y6 | Optical Communications and Networks | 4 | 5 |
| Y11 | Computer and Network Security | 4 | 5 |
| | elective | | |
| | elective | | |
| | elective | | |

**ELECTIVE COURSES (at least 6 during semesters 7-8-9)**

| Course Code | Course | Teaching Hours | Units ECTS |
|---|---|---|---|
| E14 | Wireless Sensor Networks | 4 | 5 |
| E15 | Biomedical Technology | 4 | 5 |
| E49 | Optics | 4 | 5 |
| E37 | Theory and Management of Telecommunication Traffic | 4 | 5 |
| E39 | Cloud Computing | 4 | 5 |
| E27 | Special Assignement | | 5 |
| E46 | Photonics - Optical Devices | 4 | 5 |
| HY11 | Big Data and Intelligent Applications on the Internet of Things | 4 | 5 |
| EVH6 | Machine Learning | 4 | 5 |

| Number of Courses | Total Teaching Hours | Total Units ECTS |
|---|---|---|
| 6<br>(3 Mandatory - 3 Elective) (at least 6 must be Elective in semesters 7-8-9 and 1 in semesters 7-8-9)<br>very Free Elective) | 24 | 30 |

# 8th SEMESTER - COMPUTERS AND ELECTRONICS

| Course Code | Course | Teaching Hours | ECTS credits |
|---|---|---|---|
| E39 | Cloud Computing | 4 | 5 |
| MK37 | Algorithm Analysis and Design | 4 | 5 |
| MK33 | Software Technology | 4 | 5 |
| | elective | | |
| | elective | | |
| | elective | | |

**ELECTIVE COURSES (at least 6 during semesters 7-8-9)**

| Course Code | Course | Teaching Hours | Units ECTS |
|---|---|---|---|
| E30 | VLSI design | 4 | 5 |
| E15 | Biomedical Technology | 4 | 5 |
| EVH7 | Mechatronics | 4 | 5 |
| EVH3 | SCADA systems | 4 | 5 |
| E27 | Special Assignement | | 5 |
| E33 | Embedded Systems | 4 | 5 |
| E43 | Digital game Development | 4 | 5 |
| E40 | Advanced Databases | 4 | 5 |
| EVH6 | Machine Learning | 4 | 5 |
| Y7-H | Human-Computer Interaction | 4 | 5 |
| MK34 | Parallel and Distributed Processing Systems | 4 | 5 |
| E44 | Geographical Information Systems | 4 | 5 |
| EVH9 | Constraint programming | 4 | 5 |

| Number of Courses | Total Teaching Hours | Total Units ECTS |
| --- | --- | --- |
| 6<br>(3 Compulsory - 3 Elective)<br>(at least 6 must be Electives in semesters 7-8-9 and a maximum of 1 in semesters 7-8-9) Free Elective) | 24 | 30 |

## 8th SEMESTER - FREE ELECTIVES

| Course Code | Course | Teaching Hours | ECTS credits |
| --- | --- | --- | --- |
| E38-H | Project management | 4 | 5 |
| E36 | Operational Research | 4 | 5 |
| EH4 | Principles of Management Organisation and Decision Making | 4 | 5 |
| 209 | Refrigeration - Air Conditioning (Department of Mechanical Engineering) | 4 | 5 |
| 224 | Strategic Management (Department of Mechanical Engineering) | 4 | 5 |
| 258 | Biomedical Engineering (Department of Mechanical Engineering) | 4 | 5 |
| 395 | Total Quality Management (Department of Mechanical Engineering) | 4 | 5 |
| 123 | Industrial Management (Department of Mechanical Engineering) | 5 | 6 |
| DET806 | Blockchain and cryptocurrencies (Department of Management Science and Technology) | 3 | **2** |

# 9th SEMESTER - ENERGY

| Course Code | Course | Teaching Hours | ECTS credits |
|---|---|---|---|
| YEH5 | Industrial Electrical Installations | 4 | 5 |

## ELECTIVE COURSES (at least 3)

| Course Code | Course | Teaching Hours | Units ECTS |
|---|---|---|---|
| **A GROUP OF COURSES - Energy Direction (Option at least 3 out of 6)** | | | |
| EEH11 | Electric Drive Systems | 4 | 5 |
| EEH21 | Power Systems Stability and Protection | 4 | 5 |
| EEH13 | Optimization Methods in Electric Power Systems | 4 | 5 |
| EEH15 | Introduction to Smart Grids | 4 | 5 |
| EEH16 | Energy Storage Technologies | 4 | 5 |
| EEH22 | High Voltages II | 4 | 5 |
| EEH23 | Special Chapters of Power Electronics | 4 | 5 |
| EEH24 | Photovoltaic Systems and Applications | 4 | 5 |
| EEH25 | Electric Vehicle Technology and Integration | 4 | 5 |
| E27 | Special Assignement | | 5 |

| Number of Courses | Total Teaching Hours | Total ECTS Credits |
|---|---|---|

| | | |
|---|---|---|
| 6<br>(1 Compulsory - 3 elective courses at least and 1 in the very Free Elective in the semesters 7-8-9) | 24 | 30 |

# 9th SEMESTER - TELECOMMUNICATIONS AND NETWORKS

| Course Code | Course | Teaching Hours | ECTS credits |
|---|---|---|---|
| Y8 | Microwave Communications | 4 | 5 |
| YH2 | Design and operation of computer networks | 4 | 5 |
| E35 | Management and Optimisation of Communication Networks | 4 | 5 |
| | elective | 4 | 5 |
| | elective | 4 | 5 |
| | elective | 4 | 5 |

## ELECTIVE COURSES (at least 6 during semesters 7-8-9)

| Course Code | Course | Teaching Hours | Units ECTS |
|---|---|---|---|
| E3 | Next Generation Networks and Services | 4 | 5 |
| E24 | Mobile Computing | 4 | 5 |
| E42 | Remote sensing | 4 | 5 |
| E11 | Data mining | 4 | 5 |
| E27 | Special Assignement | 4 | 5 |

| Number of Courses | Total Teaching Hours | Total ECTS Credits |
|---|---|---|
| 6 (3 Mandatory - 3 Elective) (at least 6 must be Elective in semesters 7-8-9 and a maximum of 1 Free Elective) | 24 | 30 |

# 9th SEMESTER - COMPUTER AND ELECTRONICS

| Course Code | Course | Teaching Hours | ECTS credits |
|---|---|---|---|
| YH2 | Design and Operation of Computer Networks | 4 | 5 |
| MK35 | Web programming | 4 | 5 |
| E23 | Advanced Issues of Digital Design | 4 | 5 |
| | elective | | |
| | elective | | |
| | elective | | |

**ELECTIVE COURSES (at least 6 during semesters 7-8-9)**

| Course Code | Course | Teaching Hours | Units ECTS |
|---|---|---|---|
| E5 | Microtechnology and Nanotechnology | 4 | 5 |
| EVH4 | Fuzzy Systems | 4 | 5 |
| E27 | Special Assignement | | 5 |
| MK39 | Compilers | 4 | 5 |
| E11 | Data mining | 4 | 5 |
| Y9 | Bioinformatics | 4 | 5 |
| E17 | Digital Image Processing | 4 | 5 |
| E24 | Mobile Computing | 4 | 5 |
| E10 | Complexity Theory | 4 | 5 |
| EVH10 | Combinational optimization | 4 | 5 |

| Number of Courses | Total Teaching Hours | Total ECTS Credits |
|---|---|---|
| 6<br>(3 Compulsory - 3 Elective) | 24 | 30 |

| |
|---|
| (at least 6 must be Elective in semesters 7-8-9 and at most 1 Free Choice) |

## 9th SEMESTER - FREE ELECTIVES

| Course Code | Course | Teaching Hours | ECTS credits |
|---|---|---|---|
| EH6 | Non-Destructive Control | 4 | 5 |
| E41 | Informatics and Education | 4 | 5 |
| 251 | Energy Design of Buildings (Department of Mechanical Engineering) | 4 | 5 |

## OPTIONAL COURSES

Students may enroll in optional courses offered by the Department. While these courses do not contribute to the degree requirements or the calculation of the final grade, successfully completed courses are recorded in the diploma supplement, along with their corresponding workload (ECTS).

| | | | |
|---|---|---|---|
| EH5 | Methodologies for the preparation of research work | 2 | 2 |
| E12 | Internship | - | 15 |

## 10th SEMESTER

The 10th semester is devoted to the elaboration of a diploma thesis, which is equivalent to 30 ECTS credits.

# TRANSITIONAL PROVISION

The elective courses "Combinatorial Optimization" (offered in the 9th semester of the Computer and Electronics division) and "Electric Vehicle Technology and Integration" (offered in the 9th semester of the Energy division) have been introduced for students admitted in the academic year 2019-2020 and onwards.

## REGULATIONS FOR THE PREPARATION OF DISSERTATIONS

The Diploma Thesis (DT) is undertaken by students during the final year of their studies. Successful completion of the thesis, under the supervision of TRS (Teaching and Research Staff) members of the department, is a mandatory requirement for the award of the Diploma in Electrical and Computer Engineering from the University of Western Macedonia. Each thesis may be carried out by one or two students.

In cases where two students collaborate, separate papers must be submitted, and each paper is graded individually. The regulations for thesis preparation can be accessed here: Regulations for dissertations

**Right of withdrawal**

Students have the right to undertake a DT after the completion of the first 8 semesters of their studies and if the number of credits of the courses they owe does not exceed 50 ECTS. The courses of the 9th semester do not count towards this number.

**Purpose of the DT**

The DT allows students to demonstrate their ability to independently address topics within the field of Electrical and Computer Engineering. It provides an opportunity for practical experience and an in-depth exploration of advanced applications in Computer, Telecommunications, and Energy Sciences. By undertaking a DT, students enhance their existing competencies and develop new skills that will support their future careers. A DT may embody one or more of the following characteristics:

- Research-oriented focus: Producing new findings that could be published in scientific conferences or journals.
- Technological exploration: Investigating emerging technologies and contributing to development projects.
- Interdisciplinary collaboration: Involving joint efforts with faculty members from other departments.

**Selection criteria**

Supervising instructors may consider the following criteria before assigning a Diploma Thesis (DT):

- Academic performance in courses relevant to the DT's subject matter.
- Overall grade point average (GPA).

Furthermore, supervisors reserve the right to decline the assignment of a DT.

**Examination of DT**

The DT is evaluated by the supervisor and two additional co-examiners with expertise relevant to the DT's subject. The final grade is determined as the average of the assessments from all three examiners.

**Presentation of IP**

Candidates publicly present their Diploma Theses at a dedicated conference organized by the Department.

**Procedure for the award of a DT**

The assignment process occurs during the course registration period. Each faculty member proposes at least two topics and serves as both the supervisor and one of the examiners for their proposed topics. The topics are published on the Department's website or the faculty members' personal pages. Students who choose a thesis topic must submit a thesis assignment form to the Department's Secretariat, including the title and the supervisor's details. The form must be signed by the supervisor or co-supervisors.

If a student wishes to change their thesis subject and supervisor, they must first notify their current supervisor and then submit a new application for a Diploma Thesis during the period specified by the Secretariat. A minimum of one academic semester must pass between two consecutive thesis declarations by the same student.

Successfully completed theses must be submitted to the Secretariat on the specified dates for presentation and evaluation

## ADDITIONAL INFORMATION

**Final examinations**

Examinations are held exclusively at the end of the winter and spring semesters for courses taught during those respective periods. Students are also eligible to take exams for courses from both semesters prior to the start of the winter semester. The grading for each course is determined by the instructor, who may choose to conduct written and/or oral exams, or assess students based on assignments and laboratory exercises. The examination regulations are available here: Examination regulations

**Examination and evaluation/grading regulations**

Student performance is evaluated on a ten-point grading scale (0–10), with a minimum passing grade of 5. The grading categories are as follows:

- Excellent: 8.50–10.00
- Very Good: 6.50–8.49
- Satisfactory: 5.00–6.49
- Fail: 0.00–4.99

**Introduction to direction**

To enroll in a course of their choice, a student must have successfully completed at least 20 courses within the first six semesters. Students are allowed to change their academic direction up to three times in total, by submitting a request during the course registration period at the beginning of each semester.

**Official duration of the programme**

The Department of Electrical and Computer Engineering offers a five-year full-time study program, with a total workload of 300 ECTS credits. Each academic year corresponds to 60 ECTS credits, and each semester accounts for 30 ECTS credits. Every course is allocated a specific number of ECTS credits, representing the workload required. This workload reflects the estimated time necessary for a student to complete all learning activities needed to achieve the expected learning outcomes.

# COURSE DESCRIPTIONS

# 1st SEMESTER

## MATHEMATICAL ANALYSIS I

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|---|---|
| **Course unit code** | MK1 |
| **Course unit type** | Compulsory / General Background |
| **Level of study** | Undergraduate |
| **Year of study** | 1st |
| **Semester** | 1st |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY117/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | A. Bisbas(Professor) |
| **Course content** | Outfits. Real numbers. Sequences of real numbers. Series of real numbers. Real functions of one variable. Limits and continuity functions. Derivatives of functions. Applications of derivatives. Indefinite and certain integrals, generalised integrals. Applications of integrals. Power series. |
| **Expected learning outcomes results and skills** | Upon successful completion of the course, students will be able to:<br>• examine the convergence of sequences and series of real numbers, as well as power series,<br>• calculate values of infinite sums,<br>• fully study functions of a real variable, |

- to dierenate parametrically-dened and implicit functions,
- identify tangent lines to flat curves described in various ways,
- calculate indefinite, definite and generalised integrals,
- use the polar coordinate system,
- calculate areas of flat spaces and lengths of flat curves,
- approximate functions with polynomials.

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| **Prerequisites** | None |
| **Teaching methods** | Lectures, tutorial exercises |
| **Evaluation** | Intermediate written examination (25%), final written examination (75%). |
| **Language of instruction/Exams/ Exams** | Greek |
| **Bibliography** | [1] R. L. Finney, M. D. Weir, F. R. Giordano, *Infinitary Logic*, University of Crete Press, 2012.<br>[2] F. Ayres, *Differential and Integral Logic*, Keydarithmos, 2008.<br>[3] Th. Rassias, *Mathematics I*, second edition, TSTOTRAS ATH. 2017.<br>[4] Filippakis M., *Applied Analysis and Elements of Linear Algebra*, Edition: 2nd/2017, CHOTRAS AN ATHANASIOS.<br>[5] Brand, Louis *Mathematical analysis*, I. Simeon Publications, 1984 |

[6] Ghorpade, Sudhir R.Limaye, Balmohan V., *A Course in Calculus and Real Analysis* [electronic resource], Heal-Link
[7] H. Anton, I. Bivens, S. Davis, *Calculus - Early Transcendentals* (9th ed), John Wiley & Sons, 2009.

## LINEAR ALGEBRA

| | |
|---|---|
| **Course unit code** | MK2 |
| **Course unit type** | Compulsory / General Background |
| **Course level** | Undergraduate |
| **Year of study** | 1st |
| **Semester** | 1st |
| **ECTS credits** | 4 |
| **Website** | https://eclass.uowm.gr/courses/HMMY118/ |
| **Teaching weekly hours** | 3 |
| **Lecturer** | A. Bisbas (Professor) |
| **Course content** | Detailed Structure of the Syllabus:<br>Lecture 1: Elements of Convolution Theory and Vector Calculus<br>• Sets and operations on sets<br>• Imagery-Imagery Types and Imagery Composition<br>• Reverse illustration of a costume<br>• Equivalence relations<br>• Definition and operations of vectors-Monadic vectors |

- Directional connotations
- Inner-Outer and mixed vector product

2nd Lecture: Straight Lines, Surfaces and Curves in Space

- Coordinates in space
- Vectors and distance in space
- Parametric equations
- Equations of lines and planes in space
- Arc length for curves in space
- Curvature and vertical vectors 3rd-4th

Lecture:Algebra of Tables

- Definitions-Basic concepts
- Table operations
- Reverse and inverted table
- Specific tables and applications
- Class table
- Similarity of tables
- Applications

Lecture 5-6: Systems of linear equations - Gauss elimination

- Definitions-Basic concepts
- The geometry of linear equations
- Solving m equations with n unknowns
- Gauss elimination method
- Triangular factors and line alternations
- Homogeneous systems
- Applications

7th-8th Lecture: Vector spaces and subspaces.

- The concept of vector space
- Subscribers
- Subspaces derived from vectors
- Linear vector dependence
- Vector space bases
- Existence and dimension of bases
- Vertical lacing and rectangular undercuts

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| | • Least squares projections and approximations<br>Lecture 9: Linear representations in the finite dimension and linear representation matrices<br>• Identification of linear representations<br>• Core and linear imaging image<br>• The fundamental dimension equation<br>• Table of a linear display<br>• Base change table<br>Lecture 10: Horizons<br>• Horizon table-Properties of horizontals<br>• Developing a horizon<br>• Sarrus Rule<br>• Calculating the inverse of an invertible matrix<br>• Cramer Rule<br>• Applications<br>11th-12th Lecture: Diagonalization of matrices: eigenvalues and eigenvectors<br>• Definitions (eigenvalue, eigenspace, characteristic polynomial)<br>• In the search for eigenvalues and eigenspaces (finite dimension)<br>• Eigenmanipulation study - Diagonalization table<br>• Cayley-Hamilton theorem-Minimum polynomial<br>13th Lecture: Bilinear-Tetragonal forms<br>• Symmetric bilinear shapes-Square shapes<br>• Orthogonality |
| **Expected learning outcomes**<br>**results and skills** | • to know and manage the general form of curves and surfaces, • to understand and use concepts of vector spaces, • to use matrices as tools in theoretical and numerical computations, • to compute eigenvalues and eigenvectors, • to compute determinants, • to solve systems of linear equations, to manage and use matrix diagonalization |

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| **Prerequisite courses** | None |
| **Teaching methods** | Lectures, exercises |
| **Evaluation** | Final written examination (100 %) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] STRANG GILBERT, *LINEAR ALGEBRA AND APPLICATIONS*, CRETE UNIVERSITY PUBLICATIONS, Publication: 1/2009.<br>[2] A. Kyriazis, *Applied Linear Algebra*, Nikitopoulos E & Co., 2006.<br>[3] G. Strang, *Introduction to Linear Algebra*, 2nd EDITION, 2006<br>[4] Pantelidis G. Kravvaritis D. Nasopoulos V. Tsecrekos P., *Linear Algebra*, 2nd edition, 2015.<br>[5] Margaris Athanasios, *Linear Algebra*, A. TZIOLA & S.A., Edition: 1/2015. |

## STRUCTURED PROGRAMMING

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|---|---|
| **Course unit code** | **MK4-H** |
| **Course unit type** | Compulsory / Special Background |
| **Course level** | Undergraduate |
| **Year of study** | 1st |
| **Semester** | 1st |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE110/ |
| **Teaching weekly hours** | 5 |
| **Lecturer** | T. Kyriakidis (Laboratory teaching staff) |
| **Course content** | Introductory Concepts. Programming Languages. Algorithms<br>2. Running Algorithms and Compilers<br>3. Programming Methodology. Design and Evaluaon<br>4. Introducon to the C programming language<br>5. Data Types, Constants and Variables<br>6. Commands, Basic decision structures (if, switch), loop structures (while do while, for)<br>7. Tables, String, Mul-Dimensional Tables<br>8. Pointers, Pointers and Tables<br>9. Funcons, Parameters, Parameter Passing, Value and Reference-based<br>10. Scope and Duraon of Variables<br>11. Structures, Tables of Structures |

| | |
|---|---|
| | 12. Dynamic memory assignment, Dynamic Tables<br>13. File management. |
| **Expected learning outcomes results and skills** | • Gain experience in algorithm design for simple and complex problems<br>• Knowledge of C programming principles (data types, variables, constants)<br>• Knowledge of the basic components of structured programming languages such as C (loops, tables, alphanumerics, functions, aggregate types, files)<br>• Knowledge of advanced C-specific features (pointers, pointer tables, passing parameters using pointers)<br>• Gain experience in writing and debugging programs with the C language<br>• Understanding and implementation of basic algorithms (search, classification)<br>• Gaining experience and understanding of software engineering principles<br>• Experience in collaborative problem solving<br>Upon successful completion of the course, students will:<br>• know how to design simple algorithms<br>• understand the basics of structured programming<br>• know how to write, compile, and debug programs in C<br>• can write programs in C using iterations, tables, functions, pointers, structures, and files<br>• have a basic knowledge of software technology |
| **Prerequisite courses** | None |
| **Teaching methods** | Lectures, workshops |
| **Evaluation** | The evaluation is carried out through:<br>• a written examination at the end of the semester in which includes short answer questions and exercises<br>• grading the code of laboratory exercises carried out during |

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| | the semester<br>end-of-semester lab exam |
| **Language of instruction/Exams** | Greek, English |
| **Bibliography** | [1] Alexandros Karakos, *Introduction to C, with examples and exercises*, KARAKOS SPYRIDON, Version: 2/2012.<br>[2] N. Hatzigiannakis, *The C language in depth*, Keydarithmos, 2009<br>[3] Kernighan, Ritchie, *The C Programming Language C*, Keydarithmos, 2008<br>Seferidis, *C for Beginners*, Keydarithmos, 2009 |

## MECHANICS

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|---|---|
| **Course unit code** | MKH3 |
| **Course unit type** | Compulsory / General Background |
| **Course level** | Undergraduate |
| **Year of study** | 1st |
| **Semester** | 1st |
| **ECTS credits** | 4 |
| **Website** | https://eclass.uowm.gr/courses/ECE379/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | K. Filippidis (Professor) |
| **Course content** | 1. Introduction: Standards and units, significant digits, vectors and coordinate systems<br>2. Motion in one dimension: smooth, smoothly accelerated, free fall, vertical shot, damped motion, simple harmonic oscillation, damped oscillation, forced oscillation, complex oscillation.<br>3. Motion in the plane, projectile motion, circular motion, relative velocity.<br>4. Newton's laws of motion: particle equilibrium and Newton's first law, mass and second law, Newton's third law, contact and friction forces, dynamics of circular motion.<br>5. Work and kinetic energy: conservation of energy, work of varying force, power.<br>6. Dynamic energy: conservative and non-conservative forces, force and dynamic energy, energy diagrams<br>7. Momentum and impetus: Conservation of momentum, impacts, motion of the center of mass, motion of systems variable mass (rocket propulsion). |

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| | 8. Solid Body: Center of mass, moment of inertia, moment and dynamics of solid bodies, work and power in rotary motion, angular momentum, conservation of angular momentum, gyroscopes.<br>9. Gravity: Gravitational field, satellite motion, Kepler's laws, spherical mass distributions.<br>Oscillations: energy in simple harmonic oscillation, natural pendulum, damped oscillator, forced oscillations,Coordination.<br>10. Mechanical waves: Mathematical description, types and speed of waves, sound waves, energy in wave motion.<br>11. Wave parallelism, standing waves and normal modes of oscillation: transverse standing waves and normal modes of string oscillation, longitudinal transverse waves and normal modes of air column oscillation, wave confluence, resonance. |
| **Expected learning outcomes results and skills** | Upon successful completion of the course the student will be able to:<br>• be able to use vectors to analyse motion problems,<br>• understand the mathematics of position, velocity and acceleration and use the graphical representation of motion,<br>• draw free-body diagrams, solve dynamics and equilibrium problems and understand the relationship between force and motion in one and two dimensions,<br>• analyse explosion and impact problems using the concepts of thrust and momentum and be able to solve the equation of motion of a body of varying mass,<br>• use the concepts of kinetic and dynamic energy and solve problems using the law of conservation of mechanical energy,<br>• solve problems of central motion under the influence of forces inversely proportional to the square of the distance and use Newton's law of gravity to calculate trajectories,<br>• calculate the moment of force and moment of inertia |

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| | of solid bodies of complex shape and analyse their rotation around an axis,<br>• use vector analysis for the description of the rotary motion,<br>• analyse the motion of a body under the influence of restoring forces and evaluate the conditions coordination,<br>• handle mathematical formalism and perform calculations on mechanical wave problems,<br>• find the normal modes of oscillation of standing waves and describe mathematically the confluence of two current waves. |
| **Prerequisite courses** | - |
| **Teaching methods** | Theory lectures (2 hours/week) Laboratory exercises (2 hours/week) |
| **Evaluation** | The assessment is carried out in Greek and if necessary, in English with a written examination. 4 essay development questions or 16 multiple choice questions. |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Young H. "University Physics, Volume A: Mechanics, Thermodynamics", Book Code on Eudox: 68387875.<br>[2] Halliday David et al. "Physics, Volume 1: Mechanics, Wave Mechanics, Thermodynamics", Ref. Eurexo: 33074351.<br>[3] BASIC PRINCIPLES OF PHYSICS, R. SHANKAR |

## DIGITAL DESIGN

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|---|---|
| **Course unit code** | MK9 |
| **Course unit type** | Compulsory / Special Background |

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| **Level course** | Undergraduate |
| **Year of study** | 1st |
| **Semester** | 1st |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE358/ |
| **Teaching weekly hours** | 4 (2 hours theory and 2 hours laboratory) |
| **Lecturer** | D.Ziouzios (Temporary lecturer) |
| **Course content** | The course aims to provide students with a thorough understanding of the structural components of computer system hardware. Beginning with foundational concepts in binary logic and logic circuits, students gain familiarity with the essential building blocks of digital systems. They will learn to analyze and design both combinational and sequential circuits. The course covers the following topics in detail:<br>• Binary Numbers<br>• Logical Gateways and Symbolic Models<br>• Basic Concepts of Logic Circuits<br>• Boolean Algebra, Logical Functions and Simplification Methods<br>• Truth Tables, Circuit Analysis and Synthesis<br>• Combinational and Sequential Circuits<br>• Binary Adder, Semi-Adder, Full Adder, Parallel Adder and Subtractor<br>• Comparator, Decoders - Encoders<br>Descramblers, Multiplexers<br>·ogrammable Logic Table, Reading Memory<br>• Reluctant pulse circuits (RPC), and repeating arrays<br>• Analysis & Design of Asynchronous Sequential Circuits<br>• Minimization and Coding of States, CP |

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| | Stimulation Tables<br>• Design of Counters, Counters, Counters, Counters, and Timing Sequences<br>• Introduction to VHDL<br>Exercises |
| **Expected learning outcomes results and skills** | Upon successfully completing the Digital Design course, students will develop a strong foundation in digital circuits and systems, including both combinational and sequential logic. They will acquire skills in designing and analyzing digital systems. The specific learning objectives include:<br>• Understanding numerical representation systems.<br>• Gaining knowledge of logic gates and Boolean algebra.<br>• Acquiring theoretical knowledge and practical experience with optimization methods.<br>• Designing and analyzing combinational circuits.<br>• Integrating and composing combined subunits.<br>• Designing and analyzing sequential circuits.<br>• Synthesizing sequential subunits.<br>• Analyzing and synthesizing finite state machines.<br>• Gaining introductory knowledge of the hardware description language VHDL. |
| **Prerequisite courses** | - |
| **Teaching Methods** | Lectures, laboratory exercises, design work. |
| **Evaluation** | • Laboratory exercises 20%<br>• Design Works 30%<br>• Final Examination 50% |
| **Language of instruction /Exams** | Greek |

| | |
|---|---|
| **Bibliography** | [1] Roumeliotis Manos, Souravlas Stavros, *Digital Design*, 2nd Edition, A. TZIOLA & sons I,Version 2/2017.<br>[2] Morris Mano, Michael Ciletti, *Digital Design*, A. PAPASOTIRIOU, Edition: 5th/2013.<br>[3] William J. Dally - R. Curtis Harting, *Digital Design*,University Publications of Crete, Publication: 1H/2015.<br>[4] Kostas Efstathiou, *Digital Design*, NEON TECHNOLOGIES PUBLISHINGS, Edition: 2nd/2012. |

## TECHNICAL DRAWING

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|---|---|
| **Course unit code** | MKH2 |
| **Course unit type** | Compulsory / General Background |
| **Course level** | Undergraduate |
| **Year of study** | 1st |
| **Semester** | 1st |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE352/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | D. Stimoniaris (Associate Professor) |

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| **Course content** | The course is structured in two parts, on the lectures/theory and in the laboratory.The lecture section includes:<br>• introduction to Engineering Drawing, types and thicknesses of lines, connecting lines to each other, dimensioning, drawing of elevations. General dimensioning criteria, cross sections and plane sections. Design of bolts and threads.<br>• Introduction to Electrical - Electronic Design.<br>• Standardization, symbols, electrical and electronic design<br>electronic diagrams. Regulations. Design of internal electrical installations. Basic principles of design of automation and weak circuits.<br>currents. Integrated circuits, applications.<br>Printed circuits. Basic principles of design with the help of H/Y.<br>In the laboratory part of the course students practice the basic principles of Technical Design. The aim is to familiarize students with the rules of design in Electrical and Mechanical Design in the laboratory which has blueprints for all students in each department. Then for conducting the workshop, software design packages are used.<br>• Supporting material for the preparation of students for each exercise is available on the e-class platform in the form of notes. |
| **Expected learning outcomes results and skills** | Upon successful completion of the course, the student will be able to effectively apply<br>regulations, standards and norms when preparing a design study. You will be able to:<br>• be familiar with regulations and standards of Mechanical Design and to draw the main faces of simple mechanical components,<br>• to know the possibilities of drawing an Engineering Drawing of components using electronic Computer, |

- know the types of electrical design

  (multilinear, functional and monolinear) and standard symbols,
- design basic internal electrical installations and calculate conductor cross-sections, protection and operational control circuits,
- design circuits for weak current installations in buildings,
- carry out the complete electrical drawing with the electrical symbols of the devices and components on the floor plans of the building,
- carry out the complete one-line diagram of electrical panels
- will have basic knowledge of circuit design software packages using PCs

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| **Prerequisite courses** | - |
| **Teaching methods** | • Traditions and laboratory exercises<br>• Specialised simulation software |
| **Evaluation** | • Submission and assessment of laboratory exercises (20%)<br>• Completion and submission of a major laboratory project (10%)<br>• Final exams (70%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] "Design for Electrical Engineers", Publications A.TZIOLA & YIOI S.A., Gkonos F. Ioannis; Polycrates D. Catherine, ISBN: 978-960-418-819-2<br>[2] "Technical Design for Electrical Engineers", ZITI Publications, Vovos P., Topalis E., ISBN: 978-960-456-462-0<br>[3] "Technical Plan", Tsiotras An Athanasios Publications, Mouroutsos S. Malliaris G., ISBN: 978-618-5066-53-6 |

## ENGLISH I - (ENGLISH FOR ELECTRICAL AND COMPUTER ENGINEERS)

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|---|---|
| **Course unit code** | MK7 |
| **Course unit type** | Compulsory / General Background |
| **Course level** | Undergraduate |
| **Year of study** | 1st |
| **Semester** | 1st |
| **ECTS credits** | 2 |
| **Website** | https://eclass.uowm.gr/courses/ECE355/ |
| **Teaching weekly hours** | 2 |
| **Lecturer** | S. Tavoultzidou (Assistant Professor) |
| **Course content** | • The course focuses on teaching specialized lexical and grammatical elements of language to:<br>• Familiarize students with scientific and technical texts related to Electrical and Computer Engineering, emphasizing content over grammar. This includes training in source research, bibliography usage, and effective utilization of textbooks.<br>• Develop the language skills necessary for participation in postgraduate studies and European programs, as well as for meeting communication needs at both educational and professional levels.<br>Topics Covered:<br>• Electrical and Computer Engineering |

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| | • Energy forms<br>• Methods for generating electricity<br>• Electric power systems<br>• Renewable energy sources<br>• Semiconductors<br>• Integrated circuits<br>• Telecommunications<br>• Robotics and Artificial Intelligence<br>• Computer history and generations<br>• Software and operating systems<br>• Programming languages<br>• Networks |
| **Expected learning outcomes**<br>**results and skills** | Upon successful completion of the course the student will be able to:<br>• applies reading strategies related to the comprehension of scientific and technical texts directly related to his/her field of Specialization, activating his/her cognitive background.<br>• recognise and apply grammatical structures and technical terminology.<br>• applies speaking and listening strategies to meet his/her communication needs. |
| **Prerequisite courses** | Good knowledge of English language (level<br>• B2, according to the Common European Framework of Reference for Modern Languages) |
| **Methods**<br>**teaching** | • Lectures |
| **Evaluation** | I. Written final examination (60%) including:<br>• Multiple choice questions<br>• TRUE -FALSE questions<br>• Word Production (Nouns - Adjectives)<br>• Grammatical Structures<br>• Synonyms-Contrasts<br>• Vocabulary expansion (pre-courses/courses) |

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| | • Production of short academic and technical texts, references and paraphrasing<br>• II. Mid-term evaluation (Progress) (40%) |
| **Language of instruction/Exams** | • English |
| **Bibliography** | [1] Balari-Petrianidi, I. (2016), English for Electrical and Computer Engineering, New Technologies Publications, Athens<br>[2] Peppa, I. (2016), English for Electronics Engineering, Disigma Publications, Athens |

# 2nd SEMESTER

## MATHEMATICAL ANALYSIS II

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|---|---|
| **Course unit code** | MK8 |
| **Course unit type** | Compulsory / General Background |
| **Course level** | Undergraduate |
| **Year of study** | 1st |
| **Semester** | 2nd |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY119/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | A. Bisbas (Professor) |
| **Course content** | • The space Rn and B-grade surfaces<br>• Real multivariable functions<br>• Partial derivatives and the chain rule<br>• Directional derivatives<br>• Extrema of functions<br>• Taylor's formula for multivariable functions<br>• Double and triple integrals<br>• Vector-valued functions and curves<br>• Line integrals<br>• Gradient and vector field derivation<br>• Conservative vector fields<br>• Green's theorem<br>• Surface integrals<br>• Gauss's theorem (Divergence theorem)<br>• Stokes's theorem |

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| **Expected learning outcomes results and skills** | Students who successfully complete the course will be able to:<br>• produce multivariable functions,<br>• use the cylindrical and spherical coordinate systems<br>• identify extremes (free/tied); and pragmatic points,<br>• linearise functions and find tangent planes,<br>• calculate double and triple integrals,<br>• manage vectors,<br>• produce vector functions,<br>• identify starbursts and tubular fields,<br>• determine potential functions of conservative fields,<br>• describe curves and surfaces parametrically,<br>• calculate the circulation along a curve and the flow through a vector field surface,<br>• exploit the Green, Gauss and Stokes theorems. |
| **Prerequisite courses** | - |
| **Teaching methods** | Lectures, tutorial exercises |
| **Evaluation** | Final written examination (100%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] J. Marsden, A. Tromba, *Vector Logic*, University Publications of Crete, 2010.<br>[2] R. L. Finney, M. D. Weir, F. R. Giordano, *Infinitary Logic*, University of Crete Press, 2012.<br>[3] Konstantinidou M., Serafimidis K., *Logic multivariable functions and vector analysis*, Publisher "Sophia", 2012.<br>[4] Filippakis E. Michael, *Applied Fourier Analysis and Theory*, CHOTRAS AN.<br>Papachinopoulos G., Schinas C., Mylonas N., Multi-variable Function Logic and Induction in Differential Equations, Editions A. Tziola & Yios S.A., Edition: 1/2016. |

## Electric Circuits I

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| **Course unit code** | MK18-H |
| **Course unit type** | Compulsory / Special Background |
| **Course level** | Undergraduate |
| **Year of study** | 1st |
| **Semester** | 2nd |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE373/ |
| **Teaching weekly hours** | 5 |
| **Lecturer** | N. Poulakis (Professor) |
| **Course content** | Electrical Quantities and Circuit Elements<br><br>• International System of Units (SI)<br>• Voltage and current<br>• Power and energy<br>• Voltage and current sources<br>• Electrical resistance (Ohm's law)<br>• Kirchhoff's laws<br>• Circuit analysis with dependent sources<br><br>Simple Ohmic Elements<br><br>• Resistors in series and parallel<br>• Voltage dividers and divider circuits<br>• Measuring voltage, current, and resistance<br>• Wheatstone bridge<br>• Circuit equivalence: triangle-to-star (Δ-to-Y) transformations |

Circuit Analysis Techniques

- Node voltage method (including cases with independent and dependent sources)
- Loop current method (including cases with independent and dependent sources)
- Comparison of the two methods

Inductance and Capacitance

- Series and parallel combinations of inductors and capacitors
- Mutual inductance

First-Order RL and RC Circuits

- Physical response and step response
- General solution for step and physical responses
- Analysis of circuits with sequential switches

RLC Circuit Responses

- Physical response of parallel RLC circuits
- Response modes: underdamped, critically damped, overdamped
- Step response of parallel RLC circuits
- Physical and step responses of series RLC circuits

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| **Expected learning outcomes**<br>**results and skills** | circuit and judge which method is preferable<br>for a particular circuit,<br>• understand source transformation and be able to use it to solve a circuit,<br>• understands the concept of the Thevenin equivalent and Norton of a complex circuit and be able to calculate it,<br>• understand and estimate the load value that satisfies the condition for maximum power transfer,<br>• know and be able to use the equations for voltage, current, power and energy in an inductive coil or capacitor and in their parallel or serial combinations,<br>• understand the concept of mutual induction and |

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| | can use the dot convention to formulate the loop current equations for a circuit involving magnetically coupled coils,<br>• calculates the transient response of RL and RC circuits and their response to step excitation,<br>• can analyse a circuit with sequential switching operation, calculates the transient response of parallel and series RLC circuits and their response to step excitation. |
| **Prerequisite courses** | - |
| **Teaching methods** | Theory lectures, Laboratory exercises,<br>Laboratory exercises<br>Design, circuit simulation in Multisim and/or<br>PSpice |
| **Evaluation** | • Three written progress exams at the end of chapters 2, 4 and 6 (according to "Course Content" (25%)<br>• Final written exam on circuit solving problems (35%)<br>12 weekly laboratory exercises: Oral examination during performance and written report on the processing of measurements (40%) |
| **Language of instruction/Exams** | Greek, English |
| **Bibliography** | [1] Nilsson/Riedel "ELECTRICAL CIRCUITS" 9th Edition, Publisher.<br>Fountas, Book Code in Eudoxos: 50657746<br>[2] Papadopoulos K. "Analysis of Electrical Circuits" 2nd Edition, Publisher.<br>ATHANASIOS, Book Code in Eudoxos: 68374128<br>[3] Alexander C., Sadiku M. "Electrical Circuits" 4th<br>Publication, Publisher (Publisher): EKΔOSISIS A.<br>TZIOLA & S.A., Book Code in Eudoxos: 18548946 |

## OBJECT ORIENTED PROGRAMMING I

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|---|---|
| **Course unit code** | MK10 |
| **Course unit type** | Compulsory / Special Background |
| **Course level** | Undergraduate |
| **Year of study** | 1st |
| **Semester** | 2nd |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE209/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | S. Bibi (Associate Professor) |
| **Course content** | The course introduces students to the fundamental concepts of Object-Oriented Programming (OOP), with a focus on mastering Java, one of the most popular OOP languages. Key topics include abstraction, polymorphism, and their implementation through inheritance, encapsulation, and interconnections.<br>The course covers:<br>Stream and file management<br>Debugging techniques<br>Dynamic data structure management<br>Multi-threading and creating multi-threaded applications<br>Students will gain hands-on experience with these concepts through Java programming, participating in laboratory sessions and completing programming assignments.<br>Course modules:<br>• Module 1: Introduction to Object Oriented |

Programming, basic concepts, types and generations of programming languages, the Java language (history, versions,
technologies, advantages)

• Unit 2: Java code development, the first program, operators, control statements, iteration structures, input/output statements, basic libraries/packages, IDE environments

Module 3: Classes & Objects, implementation of classes and objects in Java, class design, ways to create and use classes, member data, member functions, constructors, data access types and functions.

• Module 4: Classes & Objects, modifiers, functions get, set, toString, concepts const, static, the concept of
overload, string management.

• Module 5: Data sets, one-dimensional and two-dimensional tables, Arraylists, access modes, Iterators

• Section 6: Content, objects as data members of classes , how to handle objects, examples of using content

• Section 7: Inheritance, implementation of class hierarchy, superclasses, subclasses, function override, examples of using inheritance in relation to the choice of inclusivity.

• Section 8: Polymorphism, abstract classes, dynamic and static linking, data type conversion, examples of polymorphism

• Section 9: Interfaces, definition, objectives,

"multiple" inheritance

• Section 10: Exceptions, exception management, hierarchy, chained exceptions, how to implement new exceptions
exceptions, identification of errors.

• Module 11: Graphical user interface, introduction to the Swing library, graphical interface components, colours, fonts, shapes,

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| | event managers<br>• Module 12: Parallel Programming, Threads, Priorities, Scheduling, Timing<br>Module 13: Files/Databases, input and output to files, creating a database, connecting to a program, POJO (Plain Old Java Objects) |
| **Expected learning outcomes results and skills** | Upon successful completion of the course students will be able to:<br>• Understand in depth the basic principles of Object Oriented Programming.<br>• Design object-oriented applications.<br>• They understand in depth the concepts of encapsulation, polymorphism and heredity.<br>• They understand in depth the structure of classes, their members and their methods.<br>• They have an in-depth understanding of abstract classes and their use.<br>• Understand the use and function of tables, strings and collections in Java.<br>• Design and develop simple and complex applications using the Java language.<br>• Design and develop graphical user interfaces using the Java language.<br>• Understand in depth the Java exception mechanism and create new exceptions.<br>• Understand in depth and create parallel code using threads.<br>• Identify errors in code and correct them.<br>• Evaluate solutions and select the most appropriate one to apply to real problems. |
| **Prerequisite courses** | - |
| **Teaching methods** | Lectures and workshops |

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| **Evaluation** | Student assessment is based on the following components:<br><br>• Written Exam<br>• Laboratory Examination<br>• Team-Based Application Development<br><br>Written Exam<br>The written exam evaluates students' understanding and mastery of the material taught. It includes:<br><br>• Multiple-choice questions<br>• Short and open-ended questions<br>• Code analysis and development tasks<br><br>Laboratory Examination<br>The laboratory exam assesses students' proficiency in developing real-time Java applications. It involves creating short applications within a controlled environment.<br><br>Team-Based Application Development<br>Students work in teams of two to develop Java applications. These assignments are submitted electronically and test the ability to apply course concepts in practical scenarios.<br><br>Final Grade Composition<br><br>• 60% Written Exam<br>• 20% Team-Based Application Development<br>• 20% Laboratory Examination |
| **Language of instruction/ Exams** | Greek, English |
| **Bibliography** | [1] Savitch Walter, Absolute Java, STELLA PARIKOU & CO.<br>[2] Deitel P. J.,Deitel H. M., Java programming, H. GIOURDA |

[3] H. Schildt. Guide to Java, Gourd Publications.

[4] E. Lervik and V.B. Havdal, Java with UML. Keydarithm Publications.

[5] Γ. Liakes, Introduction to Java, Keydarithmos Publications.

[6] R. Cadenhead and L. Lemay, The Complete Java 2 Handbook, M. Gourdas.

## ELECTRICAL MATERIALS

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|---|---|
| **Course unit code** | MCH1 |
| **Course unit type** | Compulsory / Special Background |
| **Level course** | Undergraduate |
| **Year of study** | 1st |
| **Semester** | 2nd |
| **ECTS credits** | 5 |
| **Website** | [https://eclass.uowm.gr/courses/ECE350/](https://eclass.uowm.gr/courses/ECE350/) |
| **Teaching weekly hours** | 4 |
| **Lecturer** | N. Poulakis (Professor) |
| **Course content** | • Atomic structure, atomic bonds and types of solids.<br>• Molecular kinetic theory of matter, thermal expansion, thermal oscillations and noise.<br>• Crystal state, types and defects of crystals<br>• Classical theory of electrical and thermal conductivity: Drude model, dependence of resistivity on temperature, electrical conductivity in non-ideal metals and solid solutions.<br>• Heat conduction in metals, thermal resistance<br>• Electrical conductivity in non-metallic materials.<br>• AC conductivity. |
| **Expected learning outcomes results and skills** | Upon successful completion of the course, students will be able to:<br>• understand the macroscopic properties - mechanical, thermal, electrical and magnetic - of the main materials of modern technological applications based on their |

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| | microstructure, ionic or crystalline,<br>• understand qualitative and quantitative phase diagrams and electrical and magnetic curves<br>sizes and<br>• approximate the values of basic physical quantities of materials by calculation. |
| **Prerequisite courses** | - |
| **Teaching methods** | Lectures and tutorial exercises |
| **Evaluation** | • One written progress exam at the end of the 6th or 7th week of the course (25%)<br>Final written examination on problems describing the state of materials and calculating the value of physical quantities (75%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Kasap S. O. "Electrotechnical Materials" 4th Edition, Publications A. Giola & Sons S.A., Book Code in Eudoxos: 68374085<br>[2] Callister W. D. "Materials Science and Technology", Publications A. Giola & Sons S.A., Book Code in Eudoxos: 50655973<br>[3] Spyrou Nikolaos S. "Conductive properties of Electrotechnical Materials" 4th Edition, A. Tziola & Sons S.A., Book Code in Eudoxos: 18548947 |

## Discrete Mathematics

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|---|---|
| **Course unit code** | MK12 |
| **Course unit type** | Compulsory / Special Background |
| **Course level** | Undergraduate |
| **Year of study** | 1st |
| **Semester** | 2nd |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE201/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | N. Ploskas (Associate Professor) |
| **Course content** | • Logic and Evidence.<br>• Finite and Infinite Sets.<br>• Calculability.<br>• Languages and Grammars.<br>• Transfers.<br>• Combinations and Discrete Probability.<br>• Relationships and Relationships.<br>• Graphs and Trees.<br>• Finite State Machines.<br>• Arithmetic Functions and Generating Functions.<br>• Algorithms and Complexity.<br>Retrospective Relationships. |
| **Expected learning outcomes**<br>**results and skills** | • Understanding methods of solving discrete mathematics problems.<br>• Applying solution methods to unknown problems.<br>• Creative thinking, development of problem-solving skills. |

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| | • Understanding the basic concepts of set theory.<br>• Understanding the basic concepts of computability.<br>• Understanding of basic language concepts and grammatical structures.<br>• Experience in calculating combinations and Transfers.<br><br>• Ability to solve basic graph problems and trees.<br>• Study of discrete functions.<br>• Understanding basic concepts of algorithmic complexity.<br>• Ability to calculate recursive relations and functions |
| **Prerequisite courses** | • - |
| **Teaching methods** | • Lectures, tutorial exercises |
| **Evaluation** | • The mode of assessment is through two intermediate progressions (20%) and a final written examination (80%). The progressions and the final examination include multiple choice, short answer and problem-solving questions. |
| **Language of instruction/Exams** | • Greek |
| **Bibliography** | [1] Rosen Kenneth H., *Discrete Mathematics and its Applications*, 7th Edition, A. JIOLA PUBLICATIONS, Ed:7th/2014.<br>[2] Lipschutz Seymour, Lipson Marc Lars, *Discrete Mathematics*, Publications A. JIOLA, Edition: 2nd ed./2003.<br>[3] LIU C.L., *MATHEMATICS INTERPRETERS' DATA*, CRETE UNIVERSITY PUBLICATIONS, Edition: 1/2009. |

## Probability Theory And Statistics

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| **Course unit code** | MK16 |
| **Course unit type** | Compulsory / General Background |
| **Level course** | Undergraduate |
| **Year of study** | 1st |
| **Semester** | 2nd |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY116/ |
| **Teaching weekly hours** | 4 (Theory: 2 hours, Care: 2 hours) |
| **Lecturer** | A. Bisbas (Professor) |
| **Course content** | Descriptive Statistics<br>• Data collection and processing<br>• Frequency distribution and histograms<br>• Measures of central tendency: mean, median, mode<br>• Measures of variability: range, variance, standard deviation<br><br>Probability Theory<br>• Fundamental principles of probability<br>• Events and conditional probability<br>• Additive and multiplicative probability laws<br>• Bayes' theorem<br><br>Probability Distributions<br>• Discrete and continuous random variables<br>• Expected value, variance, and standard deviation<br>• Common distributions: Bernoulli, binomial, geometric, Poisson, uniform, exponential, Gamma, normal distribution<br>• Central Limit Theorem |

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| | • Student's t-distribution, χ^2-distribution, and F-distribution<br><br>Statistical Estimates<br><br>• Sampling distributions<br>• Point estimation and properties of estimators<br>• Confidence intervals<br><br>Statistical Control<br><br>• Type I and Type II errors<br>• Sample size determination<br><br>Goodness-of-fit tests |
| **Expected learning outcomes results and skills** | This course serves as a foundational introduction to the concepts, techniques, and tools of statistics. Its primary goal is to familiarize students with the basic principles of probability and statistics while presenting the key tools and scientific methods of both descriptive and inferential statistics. Additionally, the course aims to demonstrate the practical applications of various statistical methods in solving a wide range of operational and other types of problems. It provides the essential groundwork upon which specialized statistical methodologies and techniques are further developed and applied in advanced courses within the discipline.<br><br>Upon successful completion of the course the student will:<br>• Has understood the basic concepts of probability and statistics<br>• Has knowledge of the tools and techniques of statistics and how they are used to describing and solving problems in a stochastic environment.<br>• Can use the basic statistical distributions.<br><br>It can construct confidence intervals and perform hypothesis testing. |

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| **Prerequisite courses** | - |
| **Teaching methods** | Oral lectures |
| **Evaluation** | Written final examination |
| **Language of instruction/Exams** | English |
| **Bibliography** | [1] *Statistics*, D. P. Psoinos. Ziti, 1999.<br>[2] *Probability and Statistics for Engineers*, C. H. Zioutas, Ziti Publishers, 2013.<br>[3] Zoutas G., Probability and Statistics for Engineers",Version 3/2016. |

# 3rd SEMESTER

## APPLIED MATHEMATICS I

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| **Course unit code** | MK15 |
| **Course unit type** | Compulsory / General Background |
| **Course level** | Undergraduate |
| **Year of study** | 2nd |
| **Semester** | 3rd |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE109/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | T. Zygiridis (Professor) |
| **Course content** | Introduction to Differential Equations<br>• Basic concepts and definitions<br>First-Order Ordinary Differential Equations<br>• Equations with separable variables<br>• Exact equations and integrating factors<br>• Linear equations<br>• Solving through substitution<br>Higher-Order Ordinary Differential Equations<br>• Linear equations with constant coefficients<br>• Order reduction techniques<br>• Solving non-homogeneous equations |

Laplace Transform

- Definition and properties
- Application in solving differential equations

Power Series Solutions

- Solving differential equations with power series
- Regular and singular points

Systems of Differential Equations

- Solving using the matrix method

Complex Numbers and Functions

- Introduction to complex numbers
- Complex functions and their derivatives
- Analytic continuation of complex functions

**Expectedly Learning results and skills**

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

- Understand mathematical models used for specific physical problems.
- Identify and classify the general forms of differential equations.
- Apply appropriate methods to determine general and solutions.
- Solve initial value problems effectively.
- Find solutions expressed as series expansions.
- Utilize the Laplace transform for solving differential equations.
- Analyze and solve systems of differential equations.
- Graphically solve specific classes of differential equations.
- Address fundamental concepts and problems in complex analysis.

**Prerequisite courses**

Prerequisite knowledge includes:

- Mathematical Analysis I

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| | • Mathematical Analysis II<br>Linear algebra |
| **Teaching methods** | Lectures, tutorial exercises |
| **Evaluation** | Intermediate written examination (25%), final written examination<br>(75%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] W. E. Boyce - R. C. Diprima, Elementary Differential Equations & Boundary Value Problems, NTUA, Edition: 2/2015.<br>[2] Th. Rassias, Mathematics II 2nd edition, Chotras An Athanasios, Edition: 2nd/2017.<br>[3] Trahanas Stefanos, Ordinary Differential Equations, CRETE UNIVERSITY PUBLISHINGS, 2008.<br>[4] K. Serafimidis, Differential Equations, "Sophia" Publishers, 2010.<br>[5] N. M. Stavrakakis, Differential Equations: Common and Some. Theory and Applications from Nature and Life, Chotras An Athanasios, Edition. |

## ELECTRICAL MEASUREMENTS

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| **Course unit code** | MKH4 |
| **Course unit type** | Compulsory / Special Background |
| **Course level** | Undergraduate |
| **Year of study** | 2nd |
| **Semester** | 3rd |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE351/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | N. Poulakis (Professor) |
| **Course content** | **Systems of Units of Measurement**<br>• International System (SI) and Anglo-Saxon System of Units<br>• Measurement standards and electrical measurement benchmarks<br>**Error Theory**<br>• Types of measurements and errors<br>• Precision and uncertainty<br>• Error calculation methods and principles of metrology<br>**Measuring Instruments**<br>• Classification of instruments<br>• Static and dynamic characteristics<br>• Analog and digital instruments<br>• Classical electrical measuring devices |

**Measuring Devices and Systems**

- Capacitors and lossy inductors
- Ammeters and voltmeters in measurement setups
- Voltage dividers and instrument transformers

**Measurement Bridges and Balancing Methods**

- DC and AC bridges for precise measurements

**Power and Energy Measurement**

- Power measurement in DC and AC circuits
- Power measurement in single-phase circuits
- Power measurement in three-phase and multi-phase systems

**Sensors and Their Characteristics**

- Static and dynamic characteristics of sensors
- Sensor signal conditioning

**Types of Sensors**

- Electromechanical sensors for position, displacement, force, and mechanical stress
- Temperature sensors
- Light and radiation sensors

**Expected learning outcomes**

**results and skills**

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

- process sets of measured values, estimate errors and present the results in a statistically correct way,
- know the basic principles of operation and the structure of electrical measurement instruments, with emphasis on modern digital instruments and their differences (advantages-disadvantages) compared to traditional analogue,
- be familiar with the basic electrical measurement devices, techniques and elements that are used for measurements across the entire electrical power range,
- be able to analyse the main measurement bridge circuits and calculate their output voltage,
- know in detail the operation of the digital

  electrical measuring instruments, to be able to select the most appropriate sampling characteristics according to the required sampling performance in each application sensitivity and spectral resolution,
- to know the importance and be able to appreciate the

  value of the static and dynamic characteristics of the basic physical sensors and transducers sizes
- know the basic circuits and techniques of power supply and signal processing

electromechanical sensors and temperature, light sensors.

**Teaching methods**

Theory lectures (2 hours/week)

Laboratory exercises (2 hours/week)

Use of Excel spreadsheets for processing and graphing measurements.

Design and simulation of measurement circuits in

Multisim

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| **Evaluation** | • Final written examination on problems of design and solution of measurement and statistical circuits data processing and calculation of uncertainties<br>(70%)<br>• 6 weekly laboratory exercises: Oral examination during performance and written report on the processing of the measurements (30%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] N.I Theodorou "Electrical Measurements, Theory and Exkies", Edition 2018, Publisher: ΕΚΔΟΣΙSIS A. TZIOLA & Book Code in Eudoxos: 77106794.<br>[2] Psomopoulos K. "Electrical Measurements", 2η Edition, Publisher: TSTOTRAS ATH., Eudoxos Code: 41955686.<br>[3] King R. E. " Measurement systems", Distributor (Publisher). YIOS S.A., Code Eudoxos: 18548830.<br>[4] Petridis Vasilios " Measurements", Publisher: Ziti Pelagia & Zela Petit Zela, Zela Petit Zela, Sia I.K.E., Book Code in Eudoxos: 68392760. |

## ALGORITHMS AND DATA STRUCTURES

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|---|---|
| **Course unit code** | MK17 |
| **Course unit type** | Compulsory / Special Background |
| **Course level** | Undergraduate |
| **Year of study** | 2nd |
| **Semester** | 3rd |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE267/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | N. Ploskas (Associate Professor) |
| **Course content** | • Abstract Data Types<br>• Compound Data Structures.<br>• Arrays, Pointers, Linked Lists.<br>• Stacks, Queues.<br>• Algorithms and Complexity<br>• Recursive Algorithms.<br>• Searching and Sorng Algorithms.<br>• Graphs and Trees.<br>• Search Trees.<br>• Priority Queues.<br>• Heap.<br>• Hashing.<br>• Programming in C. |

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| **Expected learning outcomes results and skills** | Upon successful completion of this course, students will:<br>• Analyze and compare the efficiency of algorithms in terms of their theoretical complexity.<br>• Use, develop, and extend data structures such as arrays, lists, queues, stacks, and trees, and understand their applications.<br>• Apply the algorithms studied in the course to solve unknown problems.<br>• Select and/or develop appropriate data structures and algorithms for implementing abstract data types.<br>• Design and implement efficient solutions to complex computational problems.<br>• Understand and implement sorting algorithms.<br>• Use various hashing techniques for data storage.<br>• Handle basic functions in priority queues.<br><br>General Competences:<br>• Search for, analyze, and synthesize data and information using appropriate technologies.<br>• Decision-making.<br>• Independent/Individual work.<br>• Algorithmic thinking.<br>• Solving complex algorithmic problems. |
| **Prerequisite courses** | - |
| **Teaching methods** | Lectures, blackboard exercises, implementation of basic algorithms in C, computer exercises |
| **Evaluation** | Intermediate progress (10%), three papers (30%), final written examination (60%). |
| **Language of instruction/Exams** | Greek, English |

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|---|---|
| **Bibliography** | [1] Robert Sedgewick, Algorithms in C, parts 1 - 4: fundamental concepts, data structures, classification, search, Keydarithmos Publications, 1st Greek edition/2005<br>[2] Sahnii Sartaj, Data structures, algorithms and applications in C++, Giola Publications, Version: 1/2004<br>[3] Panagiotis Bozanis, Data Structures, Tziola Publications, Edition: 2/2016<br>[4] Georgios Georgakopoulos, Data Structures, University Publications of Crete, Publication: 2nd/2002 |

## Electric Circuits II

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|---|---|
| **Course unit code** | MKH5 |
| **Course unit type** | Compulsory / Special Background |
| **Course level** | Undergraduate |
| **Year of study** | 2nd |
| **Semester** | 3rd |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE354/ |
| **Teaching weekly hours** | 5 |
| **Lecturer** | D. Tsiamitros (Professor) |
| **Course content** | • Electric parameters definition in sinusoidal alternating current during steady-state operation – Voltage and current representation as a function of time.<br>• Electric parameters representation as phasors.<br>• R, L, C in AC current. Voltage-current phasor representation.<br>• Impedance, series and shunt circuits analysis.<br>• Typical AC current circuits analysis. |

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| | • AC power and power triangles.<br>• Power factor correction – Compensation in single-phase circuits.<br>• Resonance, comparison with power factor correction.<br>• Three-phase circuits, Y and Δ connections, AC power in three-phase systems.<br>• Power factor correction in three-phase circuits.<br>• Magnetic-coupled circuits, ideal transformers, and mutual inductance.<br>• Laplace and Fourier transform.<br>Frequency response and filters. |
| **Expected learning outcomes**<br>**results and skills** | **On successful completion of this module, the learner will be able to:**<br>1. Understand, analyze, and design simple AC circuits.<br>2. Know the basic power and energy formulas.<br>3. Make power factor correction in new or old one-phase installations.<br>4. Understand and analyze three-phase circuits.<br>5. Make power factor correction in new or old three-phase installations.<br>6. Understand and analyze resonance circuits.<br>7. Understand and analyze magnetic-coupled circuits. |
| **Prerequisite courses** | Knowledge of the courses is required:<br>Electrical Circuits I, Mathematical Analysis I and II |
| **Teaching methods** | - Classroom teaching using a projector and tutorial exercises<br>Laboratory exercises with assignments |
| **Evaluation** | - Laboratory Exercises: Completion and assessment of laboratory exercises (20%)<br>- Tests: Two unannounced tests and one scheduled test (30%)<br>- Final Exam: Comprehensive final examination (50%) |
| **Language of instruction/Exams** | - Greek, English |
| **Bibliography** | [1] "Basic Theory of Electrical Circuits-Volume I", Art of Text Publications, Nikolaos Margaris, ISBN 960- 312- |

001-4.
[2] "Basic Theory of Electric Circuits-Volume II", Art of Text Publications, Nikolaos Margaris, ISBN 960- 312-003-0.
[3] Notes in Electrotechnics II, TEI of Western Macedonia, 2009, edited by Dimitrios Tsiamitros.
[4] Electrotechnics. 2nd Volume, Book Code in Eudoxos: 14608, Publication: Touloglou Stefanos, ISBN: 978-960-405-183-0, Publisher: S. PARIKOU & CO. S.S. & CO.

- ELECTRONICS II, Ref. Book at Eudoxos: 2104, Edition 1η , Authors: GAROUTSOS YANNIS, ISBN: 960-8250-31-5.

## INTRODUCTION TO TELECOMMUNICATIONS

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| **Course unit code** | MK6 |
| **Course unit type** | Compulsory / Special Background |
| **Course level** | Undergraduate |
| **Year of study** | 2nd |
| **Semester** | 3rd |
| **ECTS credits** | 5 |
| **Website** | http://eclass.uowm.gr/courses/ICTE172/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | Ch. Stergiou (Adjunct Lecturer) |
| **Course content** | Historical Review. Telecommunications Model Systems. Information Transmission. Bandwidth, Spectrum. Transmission Rate and Channel Capacity. Synchronization. Synchronous and Asynchronous Transmission. Information Formatting and Coding. Information Transmission |

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| | Media. Multiplexing. Noise. Control, Detection, Error Management. Techniques<br><br>Retransmission. Introduction to Telecommunication Networks. Classification. Network Design & Layered Architecture. OSI Reference Model. General Principles of Network Management. Examples of Networks. |
| **Expectedly learning outcomes and skills** | The course aims to provide students with an understanding of the fundamental concepts of data communications, networking, and communication protocols. It introduces the model of telecommunication systems, communication functions, and the layered protocol architecture, focusing on the OSI reference model and the TCP/IP protocol stack. Special emphasis is placed on the first two layers (physical layer and data link layer).<br><br>**Learning Outcomes**<br><br>Upon completing the course, students will be able to:<br><br>• Understand the basic components of telecommunication systems.<br>• Comprehend essential communication functions.<br>• Identify and differentiate between the main categories of networks based on coverage area, topology, and information transmission techniques.<br>• Grasp the concept of protocols and layered architecture.<br>• Explain the OSI reference model.<br>• Classify and interpret different types of signals.<br>• Understand the concepts of spectrum and signal bandwidth.<br>• Differentiate between analog and digital signals.<br>• Describe the signal digitization process.<br>• Identify key design parameters for telecommunication systems.<br>• Explain transmission rate and communication channel capacity.<br>• Understand asynchronous and synchronous communication.<br>• Analyze transmission media (directional and non-directional).<br>• Explain data encoding and modulation techniques, including:<br>    ○ Non-Return-to-Zero Code |

- Multilevel Binary Encoding
- Self-synchronization techniques
- Frequency, Phase, and Amplitude Shift Keying
- Pulse Code Modulation (PCM)
- Differential Pulse Code Modulation (DPCM)
- Delta Modulation
- Frequency Modulation (FM), Amplitude Modulation (AM), and Phase Modulation (PM)
- Error detection and management techniques

This foundational knowledge prepares students to design and analyze telecommunication systems effectively.

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| **Prerequisite courses** | None |
| **Teaching methods** | The course is taught through lectures with discussion and active participation of students. The lectures are supported by power point presentations, which are available to students through the platform asynchronous tele-education. The training of students combines additional thematic examples and deepening exercises. |
| **Evaluation** | The course is assessed by written examinations in the middle and at the end of the semester, which include development questions, multiple choice questions and exercises covering the course material (30% and 70%, respectively). In addition, students turn in a series of assignments during the semester. |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] William Stallings, *Computer and Data Communications*, 8th Edition, 2011, Giola<br>[2] Telecommunications and Computer Networks, 8th Edition, 2012, Ed. ,Papasotiriou Publications, A. Alexopoulos and C. A. Papasotiriou. |

## THERMODYNAMICS

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| **Course unit code** | E26 |
| **Course unit type** | Compulsory / General Background |
| **Course level** | Undergraduate |
| **Year of study** | 2nd |
| **Semester** | 3rd |
| **ECTS credits** | 5 |
| **Website** | http://eclass.uowm.gr/courses/MECH261/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | I. Vassiliadis (Adjunct Lecturer) |
| **Course content** | • Introduction -Basic concepts and definitions (thermodynamics, system and situation, pressure, temperature, the thermodynamic process, mechanical work, energy, heat, reversibility).<br>• The first thermodynamic axiom/principle of conservation energy (internal energy, enthalpy, work, closed systems, steady-state processes).<br>• The second thermodynamic axiom/principle of energy quality degradation (entropy and thermodynamic equilibrium, heat engines, heat pumps, h e a t pumps, entropy of a perfect gas, ideal Carnot cycle for a perfect gas, application to energy conversions).<br>• Mathematical foundation of thermodynamics (total differential and constitutive functions, relations transformation, Legendre transformations, basic property relations for PVT systems of variable composition and heat capacities for PVT systems of |

constant composition, equilibrium in closed heterogeneous systems).

- Third thermodynamic axiom (absolute zero, entropy of an ideal crystal, consequences of the 3rd thermodynamic axiom).
- Ideal gases and gas and gas-vapour mixtures (ideal gases, ideal gas mixtures, gas-vapour mixtures, liquid air). Thermodynamic analysis of steady flow processes (work, energy, flow processes, mixing processes, work processes).
- Air power cycles (internal combustion engines, Carnot, Otto, Diesel, Diesotto, Brayton-Joule, Stirling, Ericson Kalina) and steam.
- Thermodynamic power generation cycles with steam (Rankine, regeneration/reheating), co-production and combined cycles.
- Thermodynamics of power plants with air and steam heat and combustion (conversion of chemical and nuclear energy into project and electricity generation , steam project, improvements, gas project generation).
- Thermodynamic analysis of processes according to the 2nd law of thermodynamics (reversible process work, energy not convertible to work, exergy, exergy destruction, entropy production)
- Thermodynamics of cooling and liquefaction (heating and cooling as basic thermodynamic problems, cooling production methods, Carnot refrigeration cycle, vapour compression and absorption refrigeration cycle, gas liquefaction cycles, pumps
- heat).

**Expected learning outcomes results and skills**

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

- Understand the basic concepts of thermodynamics and know the relevant definitions
- Knows and explains the thermodynamic axioms and the elementary thermodynamic processes, conservation of energy, entropy, exergy, destruction
- of energy and entropy production
- Calculate parameters and solve related

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| | thermodynamics problems using the constitutive equations, the thermodynamic axioms and analyse the mathematical foundation of thermodynamics<br>• Evaluate and classify the various fluid processes (open and closed systems)<br>• Describes and explains the thermodynamic processes (thermodynamic cycles) in power generation with air (Carnot, Otto, Diesel, Diesotto, Brayton-Joule, Stirling, Ericson) and steam (Rankine, with regeneration/reheating), cogeneration and combined cycles<br>• Analyze the cooling production cycles (ideal and real with gas compression, with absorption,<br>• liquefaction of gases), heat pumps |
| **Prerequisite courses** | - |
| **Teaching methods** | Oral presentations and tutorial exercises |
| **Evaluation** | Written examination, 70% final examination, 30% intermediate examination |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Thermodynamics. Introduction to fundamentals and technical applications, Hans Dieter Baehr, 2011.<br>[2] Thermodynamics for Engineers , Yunus A. Cengel.<br>[3] Gyftopoulos E., Veretta Gian P., Thermodynamics, Editions A. Giolas, 1st ed./2007. |

# 4th SEMESTER

## APPLIED MATHEMATICS II

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| **Course unit code** | MK21 |
| **Course unit type** | Compulsory / General Background |
| **Course level** | Undergraduate |
| **Year of study** | 2nd |
| **Semester** | 4th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE217/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | T. Zygiridis (Professor) |
| **Course content** | Introduction to partial differential equations (PDEs). Examples of PDEs. First order PDEs. Linear, semi-linear and quasi- linear PDEs. Characteristic curves. The Cauchy problem. Second order PDEs, classification, standard forms. The eigenvalue problem.<br>Laplace's equation, solution in Cartesian and polar coordinates, cases of non-homogeneous and homogeneous boundary conditions and infinite domains. Orthogonal functions, Fourier series and Fourier integral. Heat Equation, infinite and finite spaces. Special functions. Wave equation, finite and infinite strings. |
| **Expected learning outcomes results and** | • **Learning Outcomes**<br>• Upon successful completion of this course, students will be able to: |

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| **skills** | • Identify different types of partial differential equations (PDEs).<br>• Derive mathematical models for various physical and engineering problems.<br>• Solve PDEs using the method of characteristics.<br>• Tackle eigenvalue problems effectively.<br>• Transform PDEs into their canonical forms for simplification.<br>• Apply separation of variables and other analytical techniques to solve PDEs.<br>• Solve problems in various coordinate systems, including Cartesian, polar, and spherical.<br>• Address problems in finite, semi-infinite, and infinite spatial domains.<br>• Utilize orthogonal functions and apply Fourier series and integrals in solving PDEs.<br>• **General Competences**<br>• Ability to search, analyze, and synthesize data and information using appropriate technologies.<br>• Development of decision-making skills.<br>• Capacity for individual and independent work. |
| **Prerequisite courses** | Knowledge of the courses is required:<br>• Linear algebra<br>• Mathematical Analysis II<br>• Applied Mathematics I |
| **Teaching methods** | • Lectures, tutorial exercises |
| **Evaluation** | Intermediate written examination (25%), final written examination<br>• (75%) |
| **Language of instruction/Exams** | • Greek |
| **Bibliography** | [1] Stephanos Trachanas, *Partial Differential Equations*, University Publications of Crete, 2009.<br>[2] Pantelidis Georgios N., Kravvaritis Dimitris, *Introduction to differential equations of partial* |

*derivatives*, Ziti, 2003.
[3] Richard Haberman, *Applied Partial Differential Equations*, Gregorios Chrysostomou Fountas, 2014
[4] Kyventidis Thomas, *Some differential equations*, Ziti, 2009.
[5] N. M. Stavrakakis, *Some Differential Equations. Complex Functions: Theory and Applications*, Version: 1/2016.

## ELECTROMAGNETISM

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|---|---|
| **Course unit code** | MK3 |
| **Course unit type** | Compulsory / General Background |
| **Course level** | Undergraduate |
| **Year of study** | 2nd |
| **Semester** | 4th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE364/ |
| **Teaching weekly hours** | 4 (Theory: 2 hours, Care: 2 hours) |
| **Lecturer** | T. Zygiridis (Professor) |
| **Course content** | • Electrostatic field: point and distributed electric charges, Coulomb's law, electric field intensity, graded electric potential, dielectric displacement, Gauss's law, conditions at interfaces.<br>• Conductors, capacitors<br>• Dielectric polarization.<br>• The method of images.<br>Fields due to constant electric currents: current intensity, |

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| | current density, Ohm's law, electrical resistance, Ohm's law, Joule's law, grounding systems.<br>• Magnetostatic field: the law of Ampere, vector magnetic potential, Biot-Savart law, magnetic flux, self inductunce, forces in current-carrying conductors.<br>• Electromagnetic induction, Faraday's law. |
| **Expected learning outcomes results and skills** | Upon successful completion of this course, students will be able to:<br>• Explain the sources of static electric and magnetic fields and understand the physical significance of the relevant quantities.<br>• Calculate the electric field intensity produced by point charges or charge distributions.<br>• Understand the interaction between electric fields and conductors.<br>• Determine the capacitance of various configurations and the resistance of conducting objects.<br>• Analyze the behavior of basic grounding elements.<br>• Compute the magnetic field intensity resulting from known current distributions.<br>• Calculate induced voltages on conductors and the forces exerted on current-carrying wires. |
| **Prerequisite courses** | Mathematical Analysis II. |
| **Teaching methods** | Lectures, tutorial exercises |
| **Evaluation** | Intermediate written examination (25%), final written examination<br>(75%) |
| **Language teaching** | Greek, English |

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| **Bibliography** | [1] Tsiboukis D. Theodoros, *Electromagnetic Field (Single Volume)*, Foundation for Technology and Technology - Hellas, Greece. Research - University of Crete Publications, Publication: 1/2014<br>[2] Roumeliotis I.-Tsalamegas I., *Electromagnetic Fields, Volume B*, A. Tziola & Yios S.A., Publication: 1st Edition /2010.<br>[3] Griffiths J. David, *Introduction to Electrodynamics (In One Volume)*, Foundation for Technology & Society, Foundation for Technology & Society. Research - University Publications of Crete, Publication: 1/2012.<br>[4] R. A. Serway, J. W. Jewett, *Physics for Scientists and Engineers: Electricity and Magnetism, Light and optics, Modern Physics*, Ed. Modern Physics, Modern Physics, Modern Physics, Modern Physics, Modern Physics, Publishers of the Modern World, published by Klidarithmos, 8th American edition/2013. |

## SIGNAL AND SYSTEM THEORY

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| **Course unit code** | MK23 |
| **Course unit type** | Compulsory / Special Background |
| **Course level** | Undergraduate |
| **Year of study** | 2nd |
| **Semester** | 4th |
| **ECTS credits** | 4 |
| **Website** | https://eclass.uowm.gr/courses/ICTE234/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | M. Tsipouras (Professor) |

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| **Course content** | Signal and system classification, Elementary signals, Generalized functions, Linear time-invariant systems Convolution, Impulse response, Fourier transform and series Frequency response, Laplace transform, Transfer functions Stability, Sampling, Filters |
| **Expected learning outcomes results and skills** | Upon successful completion of the course, students will be able to:<br>• Classify signals and systems based on their properties.<br>• Compute convolutions.<br>• Describe signals using Fourier transform/series.<br>• Apply the Laplace transform.<br>• Handle generalized functions.<br>• Analyze the stability of linear systems.<br>• Compute system responses.<br>• Assess the effect of filters on signals.<br>• Apply the sampling theorem and explain the connection between continuous and discrete-time signals.. |
| **Prerequisite courses** | None |
| **Teaching methods** | Lectures using slides, exercises on the blackboard |
| **Evaluation** | Two compulsory sets of assignments (30%)<br>Final Written Examination (70%) |
| **Language of instruction/Exams** | Greek, English |
| **Bibliography** | [1] Theodoridis S., Berberidis K., Kofidis L., *Introduction to signal and system theory*, C. Dardanos 2003.<br>[2] Oppenheim, Willsky, Nawab, Signals and Systems, Gregorios Chrysostomou Fountas, 2011.<br>[3] Theodoros Alexopoulos, Introduction to Signal Analysis, University of Cyprus, Emp Publications, 2011. |

## NUMERICAL ANALYSIS

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| **Course unit code** | MK26-H |
| **Course unit type** | Compulsory / General Background |
| **Course level** | Undergraduate |
| **Year of study** | 2nd |
| **Semester** | 4th |
| **ECTS credits** | 4 |
| **Website** | https://eclass.uowm.gr/courses/ICTE300/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | M. Tsipouras (Professor) |
| **Course content** | • Introduction to Numerical Analysis, Numerical Systems, Representation of Numbers, Conversions, Floating – point numbers, Errors, Absolute and relative error, Propagation of uncertainty, Accuracy.<br>• Linear Systems, Linear System Solving, Cramer's Rule, Gauss Method, Gauss – Jordan Method, Thomas' algorithm, LU decomposition, Cholesky decomposition<br>• Iterative Methods for Solving Linear Systems, Convergence Conditions, Jacobi method, Gauss – Seidel method.<br>• Solving nonlinear equations and systems, Roots of nonlinear equations, Long Division, Bisection method, Newton Raphson method, Intersection method, Nonlinear System Solving.<br>• Numerical integration, Rectangle method, Simpson's 1/3 rule, Simpson's 3/8 rule, Composite functions.<br>• Interpolation and Extrapolation, Numerical Approach, Polynomial interpolation, Lagrange polynomial, Newton polynomial, Least squares.<br>• Solving first order linear differential equations, Euler |

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| | Method, Runge – Kutta Method. |
| **Expected learning outcomes results and skills** | Upon successful completion of this course, students will be able to:<br>• Understand basic numerical methods<br>• Assess the advantages and disadvantages of methods.<br>• Distinguish the differences between the methods to choose the most appropriate one for the problem they are asked to solve.<br>• Design and develop mathematical modelling and numerical analysis algorithms.<br>• Compose and/or use appropriate software to implement the required application.<br>• Explain the results of different methods based on absolute and relative errors.<br>• Evaluate and compare methods of Numerical Analysis<br>• Judge the suitability of each numerical method for specific problems |
| **Prerequisite courses** | Knowledge of the courses is required:<br>Mathematical Analysis I, II, Applied Mathematics I, Introduction to Structured Programming |
| **Teaching methods** | Traditions and laboratory exercises |
| **Evaluation** | Two compulsory sets of papers (30%) and a final written examination (70%), |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Sarris I.- Karakasidis Th., *Numerical Methods and Applications for Engineers*, A. Giola Publications, Edition: 3/2015.<br>[2] Papageorgiou G., Tsitouras C., *Numerical Analysis with Applications in Mathematica and Matlab*, Edition: 1/2015. |

[3] Chapra S. - Canale R., *Numerical Methods for Engineers*, A. Giola Publications, Edition: 7th/2016.
[4] Ariveis G.D., Dougalis V.A., *Introduction to Numerical Analysis*, University Press, University Press, University of Cyprus. Cretis, Edition: 4/2015.

## ELECTRONICS I

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| **Course unit code** | MK25 |
| **Course unit type** | Compulsory / Special Background |
| **Course level** | Undergraduate |
| **Year of study** | 2nd |
| **Semester** | 4th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE366/ |
| **Teaching weekly hours** | 5 |
| **Lecturer** | S. Ganatsios (Professor) |
| **Course content** | **Chapter 1**: Semiconductors<br>1.1 Energy Bands<br>Understanding the structure of energy bands in semiconductors.<br><br>1.2 Enriched Semiconductors<br>Exploration of doped semiconductors and their properties.<br><br>1.3 Semiconductor Elements<br>Key materials and elements used in semiconductors.<br><br>**Chapter 2**: Recovery Pathways |

2.1 The PN Junction
Structure and operation of the PN junction.

2.2 Forward and Reverse Bias
Polarization behaviors of the PN junction under correct and reverse biases.

2.3 The Characteristic Curve of the Diode
Understanding and analyzing the diode's I-V curve.

2.4 Diode Models
Threshold voltage, diode body resistance, and practical models for circuit analysis.

2.5 Effect of Temperature
Impact of temperature changes on diode performance.

2.6 Manufacturer Specifications
Interpreting maximum power and reverse voltage ratings from datasheets.

**Chapter 3**: Special Diodes
3.1 LED (Light Emitting Diodes)
Principles and applications of LEDs.

3.2 Zener Diodes
Operation and characteristics of Zener diodes.

3.3 Voltage Stabilization with Zener Diodes
Using Zener diodes for voltage regulation.

**Chapter 4**: Diode Applications
4.1 Half-Wave Rectification
Design and operation of semi-rectification circuits.

4.2 Full-Wave Rectifiers
Central contact and bridge rectifier circuits.

4.3 The Capacitor Filter
Smoothing rectified waveforms using capacitor filters.

4.4 Voltage Stabilization
Techniques for voltage regulation using diodes.

4.5 Clipping Circuits
Applications of diodes in clipping (scissor) circuits.

**Chapter 5**: Bipolar Junction Transistors (BJTs)
5.1 Structure of BJTs
Understanding the construction of BJTs.

5.2 Forward and Reverse Bias
Analyzing the polarization behavior of BJTs.

5.3 Common Emitter Configuration
Characteristic curves and operation of the common emitter circuit.

5.4 Base Bias
Direct biasing of the transistor base.

5.5 Voltage Divider Bias
Effective base biasing with a voltage divider.

5.6 Alternative Biasing Circuits
Exploration of other BJT biasing methods.

5.7 Fault Diagnosis
Techniques for identifying and troubleshooting faults in BJT circuits.

**Chapter 6**: Common Emitter Amplifiers
6.1 DC and AC Equivalent Circuits
Analysis of circuits in DC and AC conditions.

6.2 AC Resistance
Understanding resistance in AC operation.

6.3 Voltage Gain Analysis
Detailed study of voltage gain in common emitter amplifiers.

6.4 Emitter Resistance Neutralization

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| | Techniques for reducing emitter resistance effects.<br><br>6.5 Multi-Stage Amplifiers<br>Design and operation of multi-stage amplification circuits.<br><br>**Laboratory Exercises**<br>Exercise 1: The Diode Curve<br>Characterizing the diode's I-V relationship.<br><br>Exercise 2: The DC Resistance of the Diode<br>Measuring and analyzing the diode's resistance in DC.<br><br>Exercise 4: The Zener Diode<br>Studying the operation of Zener diodes.<br><br>Exercise 5: The Zener Voltage Stabilizer<br>Building and testing voltage stabilization circuits with Zener diodes.<br><br>Exercise 6: Common Emitter (CE) Wiring<br>Assembling and analyzing a CE circuit.<br><br>Exercise 7: Operating Ranges of Transistors<br>Investigating the operating regions of contact transistors.<br><br>Exercise 8: Fixing the Transistor Q-Point<br>How to stabilize the transistor's operating point.<br><br>Exercise 9: PNP Transistor Biasing<br>Polarization techniques for PNP transistors.<br><br>Exercise 10: Coupling and Bypass Capacitors<br>Using capacitors for coupling and bypassing in amplifier circuits.<br><br>Exercise 11: The CE Amplifier<br>Building and analyzing the common emitter amplifier circuit. |
| **Expected learning outcomes and skills** | Upon successful completion of the course the student will be able to:<br>• Be able to polarize a semiconductor diode and describe its IV characteristic curve. |

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| | • Analyse the operation, design and implement the three basic rectification circuits : semi-rectifier, central contact rectifier, rectification bridge.<br>• Plan, implement and measure performance power supplies with filters and output voltage stabilization.<br>• Be able to explain the three types of bias of a bipolar junction transistor (BJT): base, voltage divider and emitter.<br>• Analyse the function of the transistor as a low signal amplifier.<br>• Be able to describe how a BJT is used in a switch circuit.<br>• Be able to design and analyse an electronic circuit using software packages (Multisim) |
| **Prerequisite courses** | None |
| **Teaching methods** | Lectures, Laboratory and Tutorial Exercises |
| **Evaluation** | The final grade for the course is determined as follows:<br>Theory Component: The grade for the theory portion is based on the written final examination and any progress examinations completed during the course.<br>Laboratory Component: The grade for the laboratory portion is determined by the final laboratory examination, which also considers the quality of work delivered.<br>The overall course grade is calculated using the following formula:<br>Final Grade = 0.75 × (Theory Grade) + 0.25 × (Lab Grade), if (Theory Grade) ≥ 5<br>Final Grade = Theory Grade, if (Theory Grade) < 5<br>This ensures that a minimum performance threshold in the theory component is required for successful completion of the course. |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Harintanis G., *Electronics 1*, Demertzis P., Edition: 1/2013.<br>[2] Loutridis Spyridon, Introduction to Electronics, |

Editions A. Tziolas, Edition: 2nd/2017.
[3] Schultz, *Grob's Basic Electronics W/Student Cd*, Epikentro Publications, 2007.
[4] Malvino A., Bates D., *Electronics*, 8th Edition, Editions A. Giola & Sons S.A., 2016.

## TELECOMMUNICATIONS NETWORKS

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| **Course unit code** | MK11 |
| **Course unit type** | Compulsory / Special Background |
| **Course level** | Undergraduate |
| **Year of study** | 2nd |
| **Semester** | 4th |
| **ECTS credits** | 5 |
| **Website** | http://eclass.uowm.gr/courses/ICTE203/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | M. Louta (Professor) |
| **Course content** | • Networking Technologies: An introduction to key networking principles and their applications.<br>• Switching Techniques: Fundamentals of switching, including circuit switching and packet switching methods.<br>• Routing and Traffic Management: Principles of routing, traffic management, and congestion control in networks.<br>• Access Networks: Exploration of access technologies, including X-DSL and other broadband solutions. |

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| | • Legacy and Modern Network Protocols: Overview of X.25, Frame Relay, and ATM technologies.<br>• Telephone Networks: Architecture and operation of traditional telephone networks.<br>• Mobile Communication Networks: Understanding mobile network structures and protocols.<br>• Synchronous Digital Hierarchy (SDH): Fundamentals of SDH and its role in digital communications.<br>• Signaling Systems: Introduction to signaling systems, including Common Channel Signaling No. 7 (CCS7).<br>• Call and Service Control: Mechanisms for managing calls and advanced services.<br>• Intelligent Networks (IN): Advanced features and capabilities of intelligent networking systems.<br>• Quality of Service (QoS): Techniques for ensuring reliable and high-quality network performance.<br>• Telecommunication Traffic Modeling: Analysis and modeling of traffic patterns in telecommunication networks.<br>• Network Management: Tools and strategies for monitoring and managing network performance effectively. |
| **Expected learning outcomes**<br>**results and skills** | The aim of the course is to understand and learn about existing telecommunication network technologies.<br>In this context, a wide range of topics is included which attempts to provide a comprehensive overview of telecommunication networks and the methods used for their design, deployment, management and evaluation.<br>Upon completion of the course, students will be able to know:<br>• Network technologies and switching techniques<br>• Routing techniques<br>• Traffic management and congestion control techniques<br>• Multiplexing techniques<br>• Phone<br>• Key features of mobile communication systems |

- Introductory elements of service control systems &
- intelligent networks

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| **Prerequisite courses** | None |
| **Teaching methods** | The course is taught through lectures with discussion and active participation of students. The lectures are supported by power point presentations, which are available to students via the platform asynchronous tele-education. The training of students combines additional thematic examples and deepening exercises. Finally, laboratory exercises are carried out with the help of simulation programs. |
| **Evaluation** | The course is assessed by written examinations in the middle and at the end of the semester, which include open questions, multiple choice questions and exercises covering the course material (30% and 70%, respectively). In addition, students turn in a series of assignments during the semester. |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] A. Alexopoulos and C. A. Papasotiriou.<br>[10] Iakovos Venieris, "Broadband Networks", 3rd Edition, 2012, Tziola Publications. |

## ENGLISH II-ACADEMIC SKILLS

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| **Course unit code** | MK14 |
| **Course unit type** | Compulsory / General Background |
| **Course level** | Undergraduate |
| **Year of study** | 2nd |
| **Semester** | 4th |
| **ECTS credits** | 2 |
| **Website** | https://eclass.uowm.gr/courses/ECE382/ |
| **Teaching weekly hours** | 2 |
| **Lecturer** | S. Tavoultzidou (Assistant Professor) |
| **Course content** | • Curriculum Vitae: Writing an English CV, Resume, or Europass format.<br>• Cover Letter: Crafting effective cover letters.<br>• Statement of Purpose: Writing personal statements for academic or professional purposes.<br>• Professional Correspondence: Application letters and other formal correspondence.<br>• PowerPoint Presentations: Designing and presenting effective slides in English.<br>• Compound Words and Academic Collocations: Mastering academic language and word combinations.<br>• Research Paper Structure: Understanding the key components of a research paper.<br>• Abstract Writing: Creating concise and impactful research paper abstracts. |

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| | • Referencing and Bibliography Styles: Using APA, MLA, Chicago, IEEE, and other citation formats.<br>• Citing and Referencing Sources: Properly crediting bibliographic sources. |
| **Expected learning outcomes results and skills** | Upon successful completion of the course, students will be able to:<br>• Compose a professional **Curriculum Vitae (CV)/Resume**.<br>• Write an effective **Cover Letter** to accompany a CV/Resume.<br>• Draft **Application Letters** for job opportunities or postgraduate studies.<br>• Create a compelling **Personal Statement** for scholarships or academic applications.<br>• Design and deliver **PowerPoint Presentations** in English.<br>• Prepare and present a **Pecha Kucha Presentation** in English.<br>• Create an impactful **Conference Poster**.<br>• Understand and apply the process of writing a **Research Paper**.<br>• Draft concise and effective **Abstracts** for research papers.<br>• Utilize various **Citation Styles** (APA, MLA, Chicago, IEEE, etc.).<br>• Properly record and reference **Bibliographic Sources** in academic writing.<br>• |
| **Prerequisite courses** | Good knowledge of English language (level<br>• B2, according to the Common European Framework of Reference for Modern Languages) |
| **Teaching methods** | • Lectures |
| **Evaluation** | • Written final examination (60%)<br>• Interim evaluation (Progress) (20%)<br>• Preparation of Work (20%) |

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| **Language teaching** | • English/Greek |
| **Bibliography** | [1] Integrating Technical & Academic Writing into your English Course - Theory and Practice - Κωδ. Book Details: 86199178 Edition: 1/2019, Authors. Panourgia<br>[2] University Writing Course Student's Book with answers, Κωδ. Book on Eudoxos: 10686, Edition: 1st ed./2007, Morley John,Doyle Peter,Pople Ian<br>• Academic Writing, Ref. Book Code in Eudoxos: 68391268, Publication: 3rd/2017, Evdoridou Elsa - Karakasidis Theodoros |

# 5th SEMESTER

## ELECTROMAGNETIC WAVES

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| **Course unit code** | MK27 |
| **Course unit type** | Compulsory / Special Background |
| **Course level** | Undergraduate |
| **Year of study** | 3rd |
| **Semester** | 5th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE174/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | T. Zygiridis (Professor) |
| **Course content** | Time-varying fields, displacement current, Maxwell's equations, wave equation, dynamics delay, Poynting vector. Wave plane, polarization, propagation. Reflection and refraction. Transmission lines, TEM waves, telegrapher's equation. Waveguides, TE and TM rates, dielectric waveguides. Electromagnetic radiation and antennas, short dipole, half wave antenna, antenna arrays, radiation pattern. |
| **Expected learning outcomes and skills** | Upon successful completion of this course, students will be able to:<br>• Differentiate between **static** and **time-varying fields**.<br>• Determine the **electric field** from the magnetic field intensity, and vice versa.<br>• Utilize **complex representations** for electromagnetic |

quantities.

- Understand the **properties** and **behavior** of electromagnetic fields.
- Analyze the impact of **propagation media** on wave characteristics.
- Solve basic problems involving the **reflection** and **transmission** of waves.
- Address problems related to **transmission lines** using circuit models.
- Identify the characteristics of **waveguide structures** that meet specific constraints.
- Study the properties and operation of **simple antennas**.

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| **Prerequisite courses** | Knowledge from the courses is needed:<br>• Electromagnetism,<br>Mathematical Analysis II. |
| **Teaching methods** | Lectures, tutorial exercises |
| **Evaluation** | Intermediate written examination (25%), final written examination<br>(75%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Tsiboukis D. Theodoros, *Electromagnetic Field*, University Publications of Crete, 2014.<br>[2] Shen Liang Chi, Kong Jin Au, *Applied Electromagnetism*, Stella Parikos & Co., 2007<br>[3] Kraus John D., *Electromagnetism*, Ed. A. Giola, 2011.<br>[4] Tsalamegas Ioannis L., Roumeliotis Ioannis A., *Electromagnetic Fields*, Volume A, Ed. A. Tziola, Edition: 1st Edition /2010. |

[5] David Cheng, *Electromagnetic Fields and Waves*, Gregorios Chrysostomou Fountas, Version: 1/2013.

## INTRODUCTION TO ELECTRIC POWER SYSTEMS

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| **Course unit code** | MKH7 |
| **Course unit type** | Compulsory / Special Background |
| **Course level** | Undergraduate |
| **Year of study** | 3rd |
| **Semester** | 5th |
| **ECTS credits** | 6 |
| **Website** | https://eclass.uowm.gr/courses/ECE353/ |
| **Teaching weekly hours** | 5 |
| **Lecturer** | G. Christoforidis (Professor) |
| **Course content** | **Module I: Introduction to Power Systems (EBD 1)**<br>• Historical evolution and structure of electricity generation, transmission, and distribution systems.<br>• Overview of the Greek electricity system: elements, structure, and unique features.<br>• Electricity pricing and market operations.<br>• Basic operating characteristics of Electrical Energy Enterprises (EEE).<br><br>**Module II: Basic Concepts and Calculation Elements (EBD 2 & 3)**<br>• Representation of quantities using **phasor diagrams**. |

- Symmetrical three-phase systems and their equivalents.
- **Power calculations** in three-phase systems.
- Analysis using **symmetrical components**.
- Introduction to the **per-unit system** for simplifying calculations.

**Module III: Electricity Generating Stations (EBD 4 & 5)**

- **Steam Power Plants**: Thermal processes and power flow.
- **Gas Turbines** and Combined Cycle Power Plants.
- **Hydroelectric Power Stations**: Design and operation.
- Stations based on **Renewable Energy Sources** (RES).
- Overview of other electricity-generating stations.

**Module IV: Modern Generators (EBD 6-8)**

- Types of modern generators in **UNEs** (Utility Network Elements) and their characteristics.
- Generator modeling, parameters, and equivalent circuits.
- Operation under **steady-state** and **transient conditions**.
- Active and reactive power control, including voltage regulation.
- Synchronizing generators with the electrical grid.
- Power balance and efficiency, including loss calculations.

**Module V: Transformers in the Network (EBD 9-11)**

- Single-phase and three-phase transformers: equivalent circuits, construction, and losses.
- Determination of transformer parameters through **open-circuit** and **short-circuit tests**.
- Different types of transformers: power, measuring, three-winding, and autotransformers.
- **Three-phase transformer configurations** and their applications.

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| | • Concepts of transformer parallelism and phase-shifting for load balancing.<br><br>**Module VI: Electricity Transmission and Distribution Lines and Cables (EBD 12 & 13)**<br>• Introduction to transmission and distribution systems: construction elements and parameters.<br>• Modeling of **short transmission lines**.<br>• Power transfer equations and voltage drop calculations for short lines. |
| **Expectedly learning results and skills** | After successfully completing this course, students will be able to:<br>• Identify the basic components of a power system and understand their operation.<br>• Perform and analyze **per-unit calculations** in power systems.<br>• Describe and evaluate the power generation processes in various types of power plants.<br>• Compare and assess different power production technologies and plant types.<br>• Analyze the operation of **synchronous generators** connected to the grid, including their characteristics and behavior.<br>• Understand and evaluate the operation of **power transformers**, including different winding configurations.<br>• Recognize the electrical characteristics of power lines and cables and apply the **short-line model** for power flow analysis. |
| **Prerequisite courses** | - |
| **Teaching methods** | - Classroom teaching using a projector and tutorial exercises<br>Selected laboratory exercises in student groups |

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| **Evaluation** | - Laboratory exercises (30%)<br>Final exams (70 %) |
| **Language of instruction/Exams** | Greek, English |
| **Bibliography** | [1] D. Lambrides, P. Dokopoulos, C. Papagiannis, Electric Power Systems, Ziti Publications, Ref. Eudoxos 11294.<br>[2] N. Vovos, C. Giannakopoulos, Introduction to Electrical Power Systems, Ziti Publications, Ref. Eudoxos 11248.<br>[3] Introduction to Electric Power Systems, Vournas Konstantinos, Kontaxis G., Cod. Eudoxos 45429 |

## DIGITAL SIGNAL PROCESSING

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| **Course unit code** | MK28 |
| **Course unit type** | Compulsory / Special Background |
| **Course level** | Undergraduate |
| **Year of study** | 3rd |
| **Semester** | 5th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE113/ |
| **Teaching weekly hours** | 4 (Theory: 2 hours, Laboratory: 2 hours) |
| **Lecturer** | M. Tsipouras (Professor) |

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| **Course content** | Introductory Concepts: Continuous and discrete signals, analog-to-digital conversion, sampling, Nyquist/Shannon theorem, quantization, and coding.<br>Discrete-Time Signals: Properties, transformations of independent and dependent variables, and signal characteristics.<br>Discrete-Time Systems: System classification, LTI system analysis, convolution methods, solving difference equations, and impact response analysis.<br>Fourier Analysis: Discrete-Time Fourier Transform (DTFT), Discrete Fourier Series (DFS), Discrete Fourier Transform (DFT), and their properties.<br>Fast Fourier Transform (FFT): Purpose, butterfly network, frequency and time-division multiplexing, overlap-add/save methods, and discrete cosine transform.<br>Z-Transform: Properties, solving difference equations, analysis of discrete LTI systems, inverse Z-transform, and applications.<br>Frequency Response and Transfer Function: Poles' effect on frequency response and discrete system implementation.<br>Filters: FIR and IIR filters, linear phase concept, median filtering, FIR and IIR design, lowpass analog filters, and digital filter implementation. |
| **Expectedly Learning results and skills** | Upon successful completion of the course, students will be able to:<br>• understand simple and complex concepts of digital media signal processing<br>• perform signal sampling, oversampling and undersampling<br>• calculate signals convolution and correlation<br>• apply DFT and ZT to real or complex signals<br>• design FIR and IR digital filters<br>• develop software for all the above in MatLab |
| **Prerequisite courses** | None |

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| **Teaching methods** | Lectures, blackboard exercises, examples in MatLab, exercises in MatLab |
| **Evaluation** | An optional paper with a final oral examination (40%)<br>Final Written Examination (60%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] *Digital Signal Analysis*, Proakis J., Manolakis D., Ion Publications, 2010.<br>[2] *Basic Digital Signal Processing Techniques*, Mustakidis G.V., Editions A. Giolas & S.A., 2004.<br>[3] *Digital Signal Processing*, Hayes M.H., Editions A. Giola & S.A., 2000.<br>[4] *Digital Signal Processing*, Fotopoulos S.D., Olympia Publications, Olympia Ann. Olympus Photopoulos, 2010. |

## ELECTRONICS II

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| **Course unit code** | MK30 |
| **Course unit type** | Compulsory / Special Background |
| **Course level** | Undergraduate |
| **Year of study** | 3rd |
| **Semester** | 5th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY138/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | S.Ganatsios (Professor) |

**Course content**

**Bipolar Junction Transistor (BJT) Analysis**

- AC analysis of BJTs: small-signal models and characteristics.

**Field Effect Transistors (FET, MOSFET, CMOS)**

- Fundamentals of FETs, MOSFETs, and CMOS technology.
- Polarization techniques for proper transistor operation.
- MOSFET amplifiers: operation, characteristics, and design.

**Frequency Effects in Amplifiers**

- Frequency response analysis.
- Voltage and power gain evaluation.
- Understanding Bode diagrams and the Miller effect.

**Differential Amplifiers**

- DC and AC analysis of differential amplifiers.
- Common-mode gain and rejection.

**Operational Amplifiers (Op-Amps)**

- Negative feedback principles and topology analysis.
- Bandwidth considerations and design.
- Linear circuits:
  - Inverting and non-inverting amplifiers.
  - Differential amplifiers.
  - Instrumentation amplifiers.
  - Summation amplifier circuits.
  - Current amplifiers.

**Non-Linear Circuits**

- Power amplifiers and their applications.

**Oscillators and Signal Generation**

- Design and analysis of oscillators, including phase-locked loop oscillators.
- 555 Timer applications.

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| **Expected learning outcomes results and skills** | Instrumentation and Measurement: Students are trained in the effective use of instruments and the detailed processing of measurements.<br><br>Theoretical and Laboratory Knowledge: Students gain both theoretical understanding and practical experience in the design and analysis of electronic circuits, focusing on Power Amplifiers, MOSFETs, Differential Amplifiers, Linear and Non-Linear Amplifiers, and special Oscillators like the 555 Timer.<br><br>Problem-Solving Skills: Through this training, students develop the ability to address and solve problems related to the content of the Electronics II course.<br><br>Circuit Analysis and Understanding: Students acquire the knowledge and practical skills to analyze and comprehend complex electronic circuits.<br><br>Circuit Identification: Students learn to quickly identify known circuits, enabling them to understand the functionality of various electronic systems.<br>Fault Detection: Training includes identifying faults in electronic circuits, equipping students with essential diagnostic skills.<br><br>Circuit Design Skills: The knowledge gained enables students to design and create their own amplifier circuits, applying the principles learned throughout the course. |
| **Prerequisite courses** | Knowledge from the course is required:<br>Electronics I |
| **Teaching methods** | Lectures, Classroom Exercises and Laboratory Exercises |

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| **Evaluation** | The grade of the course is derived from the grade of the written examination and that of any progress examinations, considering the assigned tasks. |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Rizzoni G., Kearns J., Christidis C., *Circuit Theory and Basic Electronics*, Papazisis Publications, 2018.<br>[2] Malvino A.P., Bates D.J., *Electronics Principles*, Epikentro Publications S.A., 2007.<br>[3] Jaeger Richard C., *Microelectronics*, Volume B, A. Giola & Co. Sons, 1999.<br>[4] Millman Jacob, Grabel Arvin, *Microelectronics*, Volume B, A. Giola Publications & Sons, 2000.<br>Tombras Sp., *Introduction to Electronics*, Ed. Diavlos, 2006. |

## Computer Architecture

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| **Course unit code** | MK20 |
| **Course unit type** | Compulsory / Special Background |
| **Course level** | Undergraduate |
| **Year of study** | 3rd |
| **Semester** | 5th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE155/<br>https:// arch.ece.uowm.gr/courses/arch/ |

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| **Teaching weekly hours** | 4 |
| **Lecturer** | M. Dasygenis (Associate Professor) |
| **Course content** | Introduction to Computer Systems: Overview of fundamental concepts.<br>CPU Architecture and Organization: CISC/RISC design, datapath, and control.<br>Memory Systems: Types, hierarchy, cache memory, and storage systems.<br>Input/Output: Functionality and CPU interrupt handling.<br>Advanced Architectures: Multicore, superscalar, VLIW, and pipeline design.<br>Performance and Reliability: System performance metrics, branch prediction, out-of-order execution, and reliability challenges.<br>Microprogramming: Concepts and applications.<br>Laboratory: x86 assembly language programming assignments. |
| **Expected learning outcomes and skills** | Upon successful completion of this course, students will have a comprehensive understanding of:<br><br>Types of CPUs and their characteristics.<br>Architectural mechanisms for enhancing CPU speed.<br>CPU datapath and pipeline functionality.<br>Input/output mechanisms and peripheral integration with the CPU.<br>Operation and management of data buses and cache memory.<br>CPU control through assembly language instructions.<br><br>Through laboratory assignments, students will develop practical skills, including:<br>Programming at the assembly language level.<br>Evaluating the benefits and limitations of assembly programming.<br>Developing, debugging, and optimizing assembly programs. |

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| | Mastering x86 assembly constructs and understanding input/output techniques.<br>Manipulating strings and handling software/hardware interrupts.<br>Designing and implementing interrupt handlers.<br>Visualizing graphic elements using assembly programming.<br><br>**Course Objectives**<br>The course aims to enhance students' abilities in:<br>Independent Work: Strengthening individual problem-solving and analytical skills.<br>Team Collaboration: Encouraging effective group work and communication.<br>Project Planning and Management: Organizing and executing technical projects.<br>Bibliographic Research: Conducting in-depth research using relevant sources.<br>Critical Thinking: Developing logical reasoning and critical analysis skills. |
| **Prerequisite courses** | Knowledge from the course is required:<br>• Digital Design |
| **Teaching methods** | Lectures, powerpoint slides, lecturer notes, e-class quizzes, automated multiple-choice I-exams,<br>taped opencourses lectures, laboratory exercises, semester group project. |
| **Evaluation** | 50% theory final exam, 10% laboratory final exam, 10%, three short exams 15%, 12 laboratory exams<br>exercises 10%, 1 group project 15%. |
| **Language of instruction/Exams** | Greek |

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| **Bibliography** | [1] Stallings William, *Organization and Computer Architecture*, A. Giolas & Sons S.A., 2011.<br>[2] Peter Norton, John Socha, *The Assembly's Book About The Pc*, Keydarithmos Publications, 1994.<br>[3] D. Patterson, J. Hennessy, *Computer Organization and Design: the Hardware and Software Interconnection*, Clitarithmos, 2010.<br>[4] Hammacher C., Vranesic Z., Zaky Safwat, *Organization and Architecture of Computers*, Eds. Epikentro S.A., 2007. |

## TECHNOECONOMIC STUDY

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| **Course unit code** | MKH8 |
| **Course unit type** | Compulsory/ Special Background |
| **Level course** | Undergraduate |
| **Year of study** | 3rd |
| **Semester** | 5th |
| **ECTS credits** | 4 |
| **Website** | https://eclass.uowm.gr/courses/ECE361/ |
| **Teaching weekly hours** | 3 (Theory: 2 hours, Care: 1 hour) |
| **Lecturer** | K. Anastasiadou (Adjunct Lecturer) |
| **Course content** | Businesses face a variety of challenges daily, requiring strategic decisions that shape their economic future. This course focuses on key concepts and practical methods, including:<br>1. **The Concept of Enterprise**: Understanding the foundations of business operations.<br>2. **The Time Value of Money**: Exploring the significance of |

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| | money over time.<br>3. **Uniform Payment Series**: Analysis of regular payment streams.<br>4. **Loan Calculations**: Methods for determining loan parameters.<br>5. **Investment Feasibility**: Techniques to evaluate the viability of investments.<br>6. **Break-Even Analysis**: Calculating the turnover point for profitability.<br>7. **Risk Management**: Approaches and calculations for assessing and managing risks.<br>The tutorial exercises emphasize repetitive combinatorial problems and practical applications, integrating theoretical and practical methods covered in earlier courses into real-world scenarios. |
| **Expected learning outcomes results and skills** | The course aims to provide students with a solid understanding of:<br>• The fundamental objectives of financial management.<br>• The financial environment in which businesses operate.<br>• Theoretical and practical methodologies for evaluating fixed asset investments under conditions of certainty.<br>• Techniques for stock valuation, business valuation, and risk management under uncertainty.<br>**Learning Outcomes**<br>Upon successful completion of the course, students will be able to:<br>• Understand the objectives of financial management from a business perspective.<br>• Grasp the concept of the **time value of money** and its applications.<br>• Apply various methods to evaluate **fixed asset investments** under conditions of certainty.<br>• Analyze and manage risks in uncertain scenarios.<br>• Calculate the **break-even point** for a company's turnover.<br>• Integrate multiple tools and methodologies to solve complex financial problems.<br>• Use computational tools, such as **Microsoft Excel**, to assess investment projects effectively. |

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| **Prerequisite courses** | None |
| **Teaching methods** | Lectures and tutorial exercises |
| **Evaluation** | • Interim evaluation progress (30 %)<br>• Group work on an econometric analysis in an energy investment case study (30%)<br>Written Final Examination (40 %) |
| **Language teaching** | • Greek |
| **Bibliography** | [1] Handbook for the preparation of economic and technical studies, Nikolaidis Michael.<br>[2] Econometric Studies, Anastasiou Theodoros H.<br>[3] Techno-economic study, Kyriazis Kostas Ch.,Papadakis Evangelos C.<br>• Modern Financial Analysis, Th. Lazaridis, G. N. Sarianidis. |

# 6th SEMESTER

## MICROPROCESSORS

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| **Course unit code** | E22 |
| **Course unit type** | Compulsory / Special Background |
| **Course level** | Undergraduate |
| **Year of study** | 3rd |
| **Semester** | 6th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE377/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | (Adjunct Lecturer) |
| **Course content** | The course is about understanding how microprocessors (and large-scale digital circuits in general) work and are programmed. It includes extensive reference to the architecture and programming of AVR microcontrollers, specifically the ATmega328, the various sensors and actuators, and the electronics needed to integrate all of these into a single integrated system.<br>In addition, the architecture and programming of Broadcom's BCM2835 microprocessors will be discussed. |
| **Expected learning outcomes** | Upon successful completion of the course, students<br>gain knowledge and understanding of the following topics: |

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| **Results and skills** | • Understanding the architecture of microelectronics and microprocessors<br>• Understand how to program microcontrollers and microprocessors in machine language,<br>• of the data path to the processors,<br>• the connection of peripherals and sensors to the central processing unit,<br>• of the channels<br>• the operation of the memory,<br>• of controlling the processor via assembly commands.<br><br>Upon successful completion of the laboratory part of the course, students will acquire knowledge and understanding of the following topics:<br>• Programming in assembly language<br>• Programming and debugging in assembly language for ARM processors and AVR microcontrollers,<br>• of input/output in assembly language on AVR and ARM microcontrollers and microprocessors,<br>• the use of software and hardware interruptions,<br>• the creation of exception handling functions and ways of addressing memory access. |
| **Prerequisite courses** | • Digital Design |
| **Teaching methods** | Lectures, powerpoint slides, lecturer's notes, laboratory exercises, semester-long group work. |
| **Evaluation** | 50% theory final exam, 50% laboratory final exam<br>50% |
| **Language of instruction/Exams** | Greek |

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| **Bibliography** | [1] Pogaridis Dimitrios, Microprocessor Systems Design, Murgos Ioannis, Edition: 2/2010.<br>[2] N. Petrellis, C. Alexiou, Microprocessors and Microcomputer Systems Design, Keydarithmos, Edition: 2/2012.<br>[3] Pogaridis D., *Microcomputer Systems Design*, Maria Parikos, Version: 1/2013.<br>[4] Papazoglou Panagiotis, *Microprocessors*, Editions A. Tziolas, Edition: 1/2015.<br>Kalofolias Dimitrios, *Programming the Avr Atmega328 Microcontroller*, Editions A. Tziolas, Version: 1/2017. |

## COMMUNICATION SYSTEMS

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| **Course unit code** | MK29-H |
| **Course unit type** | Compulsory / Special Background |
| **Course level** | Undergraduate |
| **Year of study** | 3rd |
| **Semester** | 6th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY143/ |
| **Teaching weekly hours** | 5 |
| **Lecturer** | Al. Ap. Boulogeorgos (Assistant Professor) |
| **Course content** | The course aims to provide students with a comprehensive understanding of the fundamental concepts of telecommunication systems. It emphasizes:<br>• **Signal Theory**: Exploring the properties of telecommunication signals and the mathematical transformations (Fourier, Hilbert) essential for |

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| | analyzing communication signals.<br>• **Analog Signal Modulation**: Learning the principles and processes of modulation in analog systems, including:<br>  ◦ **Amplitude Modulation (AM)**: Study of AM systems and the demodulation process.<br>  ◦ **Angle Modulation**: Examination of Frequency Modulation (FM) and Phase Modulation (PM) systems, along with their respective demodulation techniques.<br>• **Noise Analysis**: Understanding the impact of noise on both amplitude and angle modulation systems. |
| **Expected learning outcomes results and skills** | • Telecommunication Systems: Introduction to both analog and digital communication systems.<br>• Signal and System Representation: Focus on frequency domain analysis.<br>• Fourier Transforms: Applications in telecommunication signal processing.<br>• Filters: Understanding signal transmission through filters and their role in communication.<br>• Modulation and Demodulation:<br>Amplitude modulation and demodulation techniques.<br>Orthogonal width modulation and frequency division multiplexing.<br>Angle modulation and demodulation.<br>• Telecommunication Systems Laboratory:<br>Familiarization with the laboratory environment.<br>Hands-on experience with laboratory equipment.<br>AM Configuration: Practical implementation and analysis of Amplitude Modulation (AM).<br>FM Modulation: Hands-on exercise in Frequency Modulation (FM) techniques.<br>PM Configuration: Experimentation and study of Phase Modulation (PM). |

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| **Prerequisite courses** | • None |
| **Teaching methods** | • Lectures<br>• Exercises<br>• Laboratory exercises |
| **Evaluation** | Final written examination (70%), Laboratory exercises<br>• (30%) |
| **Language of instruction/Exams** | • Greek, English |
| **Bibliography** | [1] Georgios Karagiannidis, Koralia Pappi, Telecommunication Systems, 3rd edition, 2016.<br>[2] Athanasios Kanatas, Introduction to Telecommunications, 2nd edition, 2017.<br>[3] Panagiotis Kottis, Introduction to Telecommunications: Signal Modulation and Transmission, 2012. |

## DATA BASES

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| **Course unit code** | MK38 |
| **Course unit type** | Compulsory / Special Background |
| **Course level** | Undergraduate |
| **Year of study** | 3rd |
| **Semester** | 6th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE215/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | K. Stergiou (Professor) |
| **Course content** | Introduction to Databases (DB) and<br>DB Management Systems. DB Systems Architecture. Entity-Association Model. Relational Model.<br>Relational algebra. SQL language. Associative Dependencies and Normalization. Physical organization of DB and media<br>Storage. Indexes. Query Processing and Optimization. |
| **Expected learning outcomes**<br><br>**results and skills** | Upon completing this course, students will:<br>1. Understand the fundamental principles of **database system design and implementation**.<br>2. Gain proficiency in using **Entity-Relationship (ER) Diagrams** for data modeling.<br>3. Comprehend the concepts and structure of the **Relational Model**.<br>4. Acquire foundational knowledge of **Relational Algebra** and **SQL**.<br>5. Develop advanced skills in **SQL programming**.<br>6. Gain hands-on experience with **MySQL** database management. |

7. Understand the core principles of **normalization** and its application in database design.
8. Learn about **database storage** and basic **indexing structures** for optimized performance.
9. Develop experience in **collaborative database implementation**.

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| **Prerequisite courses** | • None |
| **Teaching methods** | • Lectures, Exercises, Laboratory exercises |
| **Evaluation** | • 60% Written Examination, 20% Laboratory Exercises, 20% Term Paper |
| **Language of instruction/Exams** | • Greek |
| **Bibliography** | [1] Elmasri Ramez, Navathe Shamkant B., *Fundamental principles of database systems*, DIAYLOS S.A. Publications, 2007.<br>[2] Ramakrishnan Raghu, Gehrke Joahannes, *Database Management Systems*, $3^{n}$ Edition, A. JIOLA & SONS, 2012.<br>• Abraham Silberschatz, Henry F. Korth, S. Sudarshan, *Database Systems*, Ch. GIOURDA, 6th ed./2011. |

## CONTROL SYSTEMS I

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| **Course unit code** | Y4-H |
| **Course unit type** | Compulsory / Special Background |
| **Course level** | Undergraduate |
| **Year of study** | 3rd |
| **Semester** | 6th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE369/ |
| **Teaching weekly hours** | 5 |
| **Lecturer** | (Adjunct Lecturer) |
| **Course content** | • Introduction to Control Systems: Overview of control systems with applied examples from various technical fields.<br>• Mathematical Modeling: Developing mathematical models for physical systems and describing their governing ordinary differential equations.<br>• System Types: Exploration of open-loop and closed-loop systems.<br>• Laplace Transform: Fundamentals of Laplace transform and partial fraction expansion for system analysis.<br>• System Analysis:<br>Zero initial value and zero input response.<br>System transfer functions and transfer matrices.<br>• Block Diagrams and Signal-Flow Graphs: Representation and transformations for control systems.<br>• State-Space Analysis: Introduction to state variables and state differential equations for dynamic systems.<br>• Time Response Analysis: |

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| | Time response of first-order and second-order systems.<br>Performance indices and steady-state error analysis.<br>• Simulation with Simulink: Practical system simulation and modeling.<br>• Control System Stability:<br>Stability analysis using the Routh-Hurwitz criterion.<br>Root Locus Method for system design and evaluation. |
| **Expected learning outcomes**<br><br>**results and skills** | The course aims to provide students with a comprehensive introduction to the theory and applications of Automatic Control Systems, with a strong emphasis on system analysis. Students will engage in computer simulations of physical systems, evaluate performance design criteria through assignments, and solve targeted exercises. Additionally, hands-on laboratory exercises will involve experimental devices and the use of Tele Amplifiers (TE) for system simulation.<br><br>Upon successful completion of the course, students will be able to:<br><br>Understand and distinguish between open-loop and closed-loop systems and grasp the concepts of feedback and comparison.<br><br>Develop mathematical models for physical systems and derive the corresponding differential equations.<br><br>Utilize the Laplace transform to calculate system responses.<br><br>Represent a system using its transfer function and state equations.<br><br>Use functional block diagrams and signal-flow graphs to model and analyze systems.<br><br>Draw and interpret Root Locus diagrams for system stability and performance.<br><br>Operate experimental devices and apply Tele Amplifiers (TE) for system simulation in a laboratory environment. |

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| **Prerequisite courses** | Knowledge from the course is required:<br>Applied mathematics. |
| **Teaching methods** | Traditions, exercises, laboratory. |
| **Evaluation** | • Written examination at the end of the semester (70%).<br>Laboratory examination (30%). |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Modern Automatic Control Systems, 13th Edition, Dorf Richard C., Bishop Robert H., A. JIOLA & SONS, 2017.<br>[2] Automatic Control Systems, Ogata K., GRIGORIOS CHRYSOSTOMOU FUNTA, 2011.<br>Automatic Control Systems, 2nd Edition, Malatestas Pantelis, A. TZIOLA & YIOI, 2017. |

## COMPUTER NETWORKS

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| **Course unit code** | MK19-H |
| **Course unit type** | Compulsory / Special Background |
| **Course level** | Undergraduate |
| **Year of study** | 3rd |
| **Semester** | 6th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE370/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | G. Fragoulis (Professor) |
| **Course content** | **Theory**<br>• **Introduction**: Overview of computer networks and the Internet, network edges, core, access networks, physical media, packet delay/loss, switching, protocol layers, and Internet history.<br>• **Application Layer**: Principles of network applications, Web (HTTP), FTP, Email, DNS, peer-to-peer applications, and socket programming.<br>• **Transport Layer**: Services, digital modulation, multiplexing, TCP/UDP protocols, remote procedure calls, TCP congestion control, and performance considerations.<br>• **Network Layer**: Design issues, devices (routers, switches, etc.), IP protocol, addressing, NAT, IPv6, shortest path routing, and |

network control protocols.

- **Network Security**: Cryptography, digital signatures, SSL, web and wireless security (802.11i), firewalls, VPNs, and DDOS mitigation.

**Laboratory**

- Network experiments and result analysis.
- **Wireshark**: Protocol analysis and packet addressing.
- Ethernet framework, ARP protocol, encapsulation, and TCP/IP stack headers.
- Internet exploration (Ping, traceroute, RTT, TTL, DNS).
- IP protocol: Fragmentation, service type, and lifetime.
- ARP, ICMP, TCP/UDP protocol analysis, TCP dump, and sender window exploration.
- Protocols: TELNET, FTP, TFTP, SMTP, DHCP.
- OSI & TCP/IP stack, switching, multiplexing, synchronization, ADSL, ATM.
- **Socket Programming**: HTTP implementation and analysis.

**Expected learning outcomes results and skills**

This course introduces students to data network technologies, focusing on packet routing, Internet protocols, new network technologies, security, and management. It also explores current trends and advancements in network technology.

By the end of the course, students will:

- Understand and apply the principles of **structured cabling**.
- Recognize the importance of the **OSI/ISO standard** for protocol operation.
- Understand how **Ethernet networks** and other network technologies function.

- Grasp the basic principles and operation of the **Internet** and its protocols.
- Comprehend the functionality and significance of **routing protocols**.
- Learn the fundamentals of **network management** and **security**.
- Understand and apply **network management systems** in practice.
- Identify and address basic **security issues** related to network connectivity.
- Stay informed about **technological advancements** in networking.
- Apply theoretical knowledge in **real-world network environments**.

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| **Prerequisite courses** | None |
| **Teaching Methods** | Lectures, Laboratory Exercises |
| **Evaluation** | Written Final Examination (30%), Presentation (20%), Laboratory Examination (50%) |
| **Language of instruction/Exams** | Greek, English |
| **Bibliography** | [1] Computer Networking, 7th Edition, J. F. Kurose, Keith W. Ross<br>[2] Computer Networks, A. S. Tanenbaum, David J. Wetherall<br>[3] Computer Organization and Architecture, 11th Edition, William Stallings |

## ELECTRICAL MACHINES I

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| **Course unit code** | MKH9 |
| **Course unit type** | Compulsory / Special Background |
| **Course level** | Undergraduate |
| **Year of study** | 3rd |
| **Semester** | 6th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE365/ |
| **Teaching weekly hours** | 5 |
| **Lecturer** | D. Tsiamitros (Professor) |
| **Course content** | **Direct Current Machines**<br>• **Generator Operation**: Foreign excitation and parallel excitation modes.<br>• **Motor Operation**: Foreign and parallel excitation configurations.<br>**Single-Phase Transformers**<br>• **Introduction**: Basics of ideal and practical single-phase transformers.<br>• **Construction and Characteristics**: Design and operational features.<br>• **Equivalent Circuit**: Analysis and modeling.<br>• **Testing**: Short circuit and open circuit tests.<br>• **Load Sharing**: Charging and discharging cycles.<br>• **Paralleling**: Matching corresponding ends for parallel operation.<br>**Three-Phase Induction Motors** |

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| | • **Structure**: Construction and design aspects.<br>• **Equivalent Circuit**: Parameter determination and analysis.<br>• **Performance**: Power output and torque characteristics. |
| **Expected learning outcomes results and skills** | The course aims to equip students with the ability to:<br>1. Understand the operating principles of **DC motors**, **single-phase transformers**, and **asynchronous machines**.<br>2. Identify the key components of these machines.<br>3. Recognize the various types of these machines and their applications.<br>4. Analyze their **equivalent circuits** for performance evaluation.<br>5. Understand the **power and torque relationships** in these machines.<br>6. Apply the **per-unit (pu) system** for analyzing electrical machine performance. |
| **Prerequisite courses** | Electromagnetism, Electrical Circuits I and II |
| **Teaching methods** | - Classroom teaching using a projector<br>Laboratory exercises with preparation tasks in Multisim simulation software before conducting the laboratory exercises, |
| **Evaluation** | - Assessment of laboratory exercises (20 %)<br>- Two unannounced tests and one advance (30 %)<br>Final exams (50 %) |
| **Language teaching** | - Greek, English |

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| **Bibliography** | N. Scraparlis, V. Molasiotis, D. Tsiamitros, "Laboratory Exercises of Direct and Alternating Current Electrical Machines", Synchronic Education, ISBN: 978-960-357-114-8.<br>- Chapman S., Electrical Machinery Fundamentals, Fourth Edition, McGraw-Hill Inc. |

# 7th SEMESTER - DIVISION OF ENERGY

## ELECTRIC POWER TRANSMISSION AND DISTRIBUTION

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| **Course unit code** | YEH1 |
| **Course unit type** | Compulsory / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY101/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | A. Bouchouras (Associate Professor) |
| **Course content** | **Transmission Line and Cable Characteristics (SBC 1)**<br><br>Underground and overhead transmission lines.<br>Calculation of sag and tension in overhead lines.<br>**Electric Power Line Models (EBD 2-4)**<br><br>Models for short, medium, and long transmission lines.<br>Two-wire circuits, power transfer, and transmission limits.<br>**Voltage and Reactive Power Regulation (EBD 5-6)**<br><br>Compensation techniques: special transformers, variable capacitors, and combined methods.<br>**AC Power Flow Analysis (EBD 7-9)**<br><br>Basic concepts and radial system power flow.<br>Simplified power flow, Gauss-Seidel method, Newton-Raphson method, and decoupled power flow for large |

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| | systems.<br>**Medium and Low Voltage (MV and LV) Distribution Networks (EBD 10)**<br><br>Types of distribution networks, their operation, and substation roles.<br>**Analysis of Distribution Systems (EBD 11)**<br><br>Voltage drop calculations in networks with distributed loads.<br>Distribution network losses and voltage regulation at nodes.<br>**Distribution System Loads (EBD 12-13)**<br><br>Load curve, peak and average load, energy demand, demand factor, utilization factor, and consumption behavior patterns. |
| **Expected learning outcomes**<br><br>**results and skills** | Upon successful completion of the course, students will be able to:<br><br>Differentiate between the structural and operational aspects of electricity transmission and distribution systems.<br>Calculate basic parameters in transmission lines and analyze their single-phase equivalent circuits.<br>Apply appropriate voltage and power compensation techniques and regulation procedures to transmission line circuits.<br>Understand the flow of active and reactive power in transmission lines and develop mathematical models for power flow.<br>Perform AC load flow analysis in power systems and calculate voltage drops using various methods.<br>Evaluate network losses and voltage drops in power systems.<br>Identify the topologies and structural characteristics of distribution networks.<br>Analyze energy demand patterns for different consumer types and calculate key system load values. |

Study power systems using simulation software such as DIgSILENT.

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| **Prerequisite courses** | - |
| **Teaching methods** | - Classroom teaching using a projector and tutorial exercises<br>-Laboratory Exercises<br>- Use of software packages for network simulation (DigSilent)<br>Support for the learning process through the e-class platform |
| **Evaluation** | - Laboratory exercises (30%)<br>- Individual work (30%)<br>Final exams (40 %) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Electricity transmission and distribution Weedy B. M., Cory B. J. ION Publications, Ref. Book at Eudoxo [14651]<br>[2] Power System Analysis, John Grainger, William Stevenson, Jr.<br>[3] Power Systems, 2nd Edition, P. Malatestas, Ref. Book on Eudoxos [59388044]<br>Electric Power Systems, Nasar Syed A., Ref. Book on Eudox [18548740] |

## ELECTRICAL MACHINES II

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| **Course unit code** | YEH2 |
| **Course unit type** | Compulsory / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE386/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | D. Tsiamitros (Professor) |

**Course content**

**Direct Current Machines II**

- **Generators**: Operation with series and compound excitation.
- **Motors**: Operation with series and compound excitation, starting, speed control, and braking.

**Three-Phase Transformers**

- Construction and equivalent circuits.
- Types of assemblies and parallel operation.
- Short circuit and open circuit tests.

**Modern Generators**

- Structure, operating principles, and types (e.g., turbine generators).
- Key parameters: speed, voltage, equivalent circuits, power, torque, and operating limits.
- Parallel operation and transient phenomena.

**Induction Motors**

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| | • Torque-speed characteristics, starting methods, and specifications.<br>**Motors for Special Applications**<br>• Single-phase asynchronous motors, universal motors, and other specialized motor types. |
| **Expected learning outcomes**<br>**results and skills** | The course aims to equip students with the ability to:<br>1. Understand the operating principles of three-phase transformers and modern generators.<br>2. Apply the per-unit (pu) system in analyzing electrical machines.<br>3. Familiarize themselves with various starting methods for electrical machines.<br>4. Recognize the typical electrical parameters associated with these types of machines.<br>5. Bridge theoretical knowledge with practical applications involving electrical machines. |
| **Prerequisite courses** | Electromagnetism, Electrical Circuits I and II, Electrical Machines I |
| **Teaching methods** | - Classroom teaching using a projector<br>- Laboratory exercises with preparation tasks in<br>Multisim and Matlab simulation software before conducting the laboratory exercises, |
| **Evaluation** | - Assessment of laboratory exercises (20 %)<br>- Two unannounced tests and one advance (30 %)<br>- Final exams (50 %) |
| **Language of instruction/Exams** | - Greek |
| **Bibliography** | [1] N. Scraparlis, V. Molasiotis, D. Tsiamitros, "Electrical Machinery Laboratory Exercises Continuous and Alternating Current", Synchronic Education Publications.<br>- Chapman S., Electrical Machinery Fundamentals, Fourth |

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| | Edition, McGraw-Hill Inc. |

## Power Electronics I

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| **Course unit code** | YEH3 |
| **Course unit type** | Compulsory / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY108/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | K.Oureilidis (Assistant Professor) |
| **Course content** | **Power Semiconductors**<br>• Overview of power semiconductors used as switches (e.g., diodes, thyristors, MOSFETs, IGBTs).<br>• Operating characteristics, applications, loss calculations, and performance comparison.<br>**Uncontrolled Rectifiers**<br>• Single-phase and three-phase rectifiers.<br>• Output voltage smoothing, harmonic analysis, and transition effects.<br>**Controlled Rectifiers**<br>• Single-phase and three-phase rectifiers with controllable output.<br>• DC/DC converters, harmonic resolution, transition effects, and power reversal functionality. |

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| | **AC-AC Converters**<br>• **AC Regulators**: Single-phase and three-phase configurations, analysis, and applications.<br>• **Cycloconverters**: Structure, operation, and use cases. |
| **Expected learning outcomes**<br>**results and skills** | The course aims to introduce students to the **theory and applications of Power Electronics Systems**, focusing on two key categories: **AC-DC rectifiers** and **AC-AC converters**.<br>Upon successful completion of the course, students will be able to:<br>• Identify and describe the main **power semiconductor devices**, compare their characteristics, and calculate their losses.<br>• Understand and explain the **fundamental principles of power electronics**.<br>• Analyze and detail the core functions of power converters studied in the course.<br>• Compare and evaluate different circuit designs within each category of power converters.<br>• **Implement experimental devices** in the laboratory and analyze their operation.<br>• Simulate and explain the behavior of basic power converters.<br>• Design power converter circuits within the **AC-DC** and **AC-AC** categories.<br>• Apply theoretical knowledge to **practical applications** involving converter topologies.<br>• Collaborate effectively with peers on group projects. |
| **Prerequisite courses** | Electrical Circuits 1 and 2 |
| **Teaching methods** | - Classroom teaching with projector and tutorial exercises<br>- Support for the learning process through e-class |

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| | - Use of power electronics simulation software<br>Laboratory exercises on AC-DC and AC- AC converters |
| **Evaluation** | - Laboratory exercises with group reports (30 %)<br>- Individual work on the design/analysis of converters using simulations (30%)<br>Final exams (40 %) |
| **Language of instruction/Exams** | Greek, English |
| **Bibliography** | [1] Mohan Ned,Undeland Tore A.,Robbins William P. 2010, Introduction to Power Electronics, A. Giola & Sons Ltd.<br>[2] M. Rashid, 2010, Power Electronics, ION Publications.<br>[3] Manias St., 2017, Power Electronics, Ed. Ellie Kalamara, P.S., Ed.<br>[4] D. Hart, 2011, Introduction to Power Electronics,<br>Prentice Hall Publications |

## MODERN ELECTRICAL INSTALLATIONS

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| **Course unit code** | YEH4 |
| **Course unit type** | Compulsory / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY106/ |

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| **Teaching weekly hours** | 4 |
| **Lecturer** | D. Stimoniaris (Associate Professor) |
| **Course content** | This course covers the design and construction of internal electrical installations in buildings, aligned with applicable standards and national regulations.<br><br>**Key Topics**<br>• **Electrical Energy Distribution**: Basics of low-voltage electrical installations, connection methods, and overhead power supply.<br>• **Indoor Electrical Installations**: Classification, power calculation, conductor types, materials, components, protection devices, and earthing systems.<br>• **Domestic Electrical Installations**: Wiring for luminaires, sockets, and appliances, voltage drop calculations, and installation tables.<br>• **Outdoor and Special Installations**: Electrical systems for unique buildings and environments.<br>• **Standards and Regulations**: Compliance with HD384 and modern practices in domestic installations.<br>• **Electrical Design with Software**: Use of computer tools for installation planning.<br><br>• **Laboratory Exercises**: Practical tasks covering the above topics.<br>• **Written Assignment**: Complete electrical design for a building, presented at semester-end.<br>• **Additional Topics**:<br>  ○ Electrical hazards and protection devices.<br>  ○ Cable types, installation fittings, and capacity per standards (ELOT HD384, VDE, IEC, DIN).<br>  ○ Overvoltage/short-circuit protection and thermal relays for motors.<br>  ○ Calculations for power lines, voltage drops, and HV networks. |

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| | ○ Electrical panels and special installations (e.g., elevators, shops, boiler rooms). |
| **Expected learning outcomes**<br><br>**results and skills** | Upon successful completion of the course, the student will be able to:<br>• Develop and draft Electrical Studies for buildings with a strong theoretical foundation.<br>• Apply relevant regulations and standards effectively for building electrical installations.<br>• Utilize modern technologies in electrical systems, including the KNX model.<br>• Implement and analyze experimental devices in a laboratory setting.<br>• Operate advanced technical software tools commonly used in the design of electromechanical building installations. |
| **Prerequisite courses** | Knowledge of the courses is required:<br>Introduction to EEE, Electrical Circuits I and II |
| **Teaching methods** | - Classroom teaching using a projector.<br>- Laboratory exercises<br>Use of specialised software |
| **Evaluation** | I) - Type: deliveries (50% of total)<br>- Description: theoretical background<br>- Examination date: End of semester<br>II) - Type: laboratory (30% of the total)<br>- Description: laboratory exercises<br>- Examination date: End of semester<br>III) - Type: presentation (Thesis/Technical Study) (20% of the total)<br>- Description:Complete Internal Electrical Installation Study<br>Examination date: End of semester |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Vassilis D. Bitzionis Industrial Electrical |

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| | Installations 2010 Giolas Publications<br>[2] Touloglou Stefanos Electrical Installations of Buildings 2004 Publications Ion<br>[3] IEC 60364: Low-voltage electrical installations<br>[4] ELOT HD384, "Requirements for electrical installations"<br>Schneider-Electric, Electrical Installation Guide. |

## INTRODUCTION TO NUCLEAR TECHNOLOGY

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| **Course unit code** | EEH17 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY137/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | S. Ganatsios (Professor) |
| **Course content** | This course introduces key concepts in nuclear technology and energy, covering:<br>• **Nuclear Science**: Atomic and nuclear physics, radiation interactions, and natural radiation sources.<br>• **Reactor Technology**: Fission, fusion, reactor operation, neutron diffusion, and next-generation electricity production.<br>• **Radiation Safety**: Measurement, shielding, units, and biological effects. |

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| | • **Industrial Applications**: Uses of nuclear radiation in various industries.<br>• **Environmental Protection**: Reactor safety and minimizing environmental impact.<br>The course combines foundational theory with practical applications in nuclear energy and technology. |
| **Expected learning outcomes**<br>**results and skills** | Upon successful completion of the course, the student will be able to:<br>• Understand the principles of **radioactive decay** and the **interactions of radiation with matter**.<br>• Demonstrate knowledge of **industrial applications of radiation**.<br>• Describe and apply **safety measures** for nuclear power plant operation and **radiation protection**.<br>• Perform **radiation measurements** using appropriate instruments.<br>• Understand the **structure and operation** of nuclear reactor power plants.<br>• Comprehend the **biological effects of radiation** and associated risks. |
| **Prerequisite courses** | None |
| **Teaching methods** | - Classroom teaching and tutorials<br>Support for the learning process through e-class |
| **Evaluation** | - Individual work (50 %)<br>Final exams (50 %) |
| **Language**<br>**teaching** | Greek |
| **Bibliography** | [1] INTRODUCTION TO PYRIC TECHNOLOGY, Antonopoulos -Domis Michalis, Ziti Publications, Code. Eudoxos: 11266<br>[2] Introduction to Nuclear Technology, J. Lamarsh, A. Baratta, 4th edition, edited by N. Petropoulos ,Giola Publications. |

## LIGHTING

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| **Course unit code** | EEH2 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY104/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | Z. Datsios (Associate Professor) |
| **Course content** | The course consists of the following modules:<br>• Electromagnetic radiation and light<br>• Human vision<br>• Color temperature, colorimetry<br>• Fundamental laws, quantities, units of measurement of phototechnology<br>• Light sources: types of lamps and their comparison<br>• Interior lighting<br>• Exterior lighting<br>• Utilisation of natural lighting<br>• Energy management and economic analysis<br>• Photometric measurements<br>• Lighting design software |
| **Expected learning outcomes results and skills** | • Understand the **principles of lighting** and photometric quantities.<br>• Identify and compare **light sources and fixtures**.<br>• Apply techniques for **interior and exterior lighting** |

**design**.

- Conduct lighting studies for various environments.
- Use **modern software tools** for lighting analysis.
- Collaborate on **group projects**.

**General Competences**

- **Data Analysis** using appropriate technologies.
- **Independent Work** and **Team Collaboration**.
- **Creative and Inductive Thinking**.

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| **Prerequisite courses** | • None |
| **Teaching methods** | - Classroom teaching with projector and tutorial exercises<br>- Support for the learning process through the e-class platform<br>- Use of specialised simulation software<br>• Preparation of a study of indoor and outdoor lighting |
| **Evaluation** | - Semi-annual work on the study of indoor and outdoor lighting (50%)<br>• Final examination on the semester project (50%) |
| **Language of instruction/Exams** | • Greek |
| **Bibliography** | [1] Φ. B. Topalis, L. Economou, S. Kourtesi, Phototechnics, Scientific Editions. Tziola, 2nd, ISBN: 978-960-418-422-4, 2014.<br>[2] W. van Bommel, Interior Lighting, Springer Nature Switzerland, ISBN: 978-3-030-17195-7, 2019 |

## AUTOMATION OF ENERGY SYSTEMS

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|---|---|
| **Course unit code** | EEH3 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE387 |
| **Teaching weekly hours** | 4 |
| **Lecturer** | G. Christoforidis (Professor) |
| **Course content** | • Introduction to PLCs: Overview of programmable controllers and their applications.<br>• Components and Systems: Processors, memory, discrete and analog I/O systems, dedicated I/O functions, and serial communication interfaces.<br>• Basic PLC Programming: Introduction to PLC programming languages, including Structure List (STL), Ladder Logic, Sequential Function Chart (SFC), and Functional Block Diagram (FBD).<br>• Automation Design: Solving automation problems using Karnaugh maps and Boolean algebra.<br>• Advanced PLC Programming: Techniques for more complex programming tasks.<br>• AC Drive Integration: Operation and interaction between AC drives and PLCs.<br>• Input/Output Devices: Control transformers, fuses, switches, relays, and analog signal transducers/transmitters for voltage, current, |

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| | temperature, pressure, liquid level, and flow.<br>• Analog Signal Processing: Conversion and processing techniques for analog signals.<br>• Application Design: Developing programs with a focus on power supply and management systems. |
| **Expected learning outcomes results and skills** | Upon successful completion of the course, students will be able to:<br>• Identify and explain the **design features**, **internal architecture**, and **operating principles** of programmable logic controllers (PLCs).<br>• Operate **input and output devices** commonly used in PLC systems and utilize basic communication interfaces.<br>• Develop and implement **ladder logic programs** incorporating internal relays, timers, counters, shift registers, and sequence registers for application data handling.<br>• Recognize and address **safety concerns** associated with PLC systems.<br>• Apply **fault diagnosis methods** and perform system checks effectively. |
| **Prerequisite courses** | None |
| **Teaching methods** | Theory lectures and laboratory exercises |
| **Evaluation** | The evaluation is conducted in Greek. It consists of 30% of the laboratory exercises (Problem Solving), 20% of the written work and its public presentation and 50% of the final examination. For the successful completion of the course, the student will be required to take part in the final examination. the average of the above criteria must be equal to or greater than 5.<br>The criteria are accessible to all on the course website. |
| **Language of instruction/Exams** | Greek |

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| **Bibliography** | [1] Hanssen "Programmable Logic Controllers-A a practical approach using CoDeSys codes", 2015, Wiley.<br>[2] E.A. Parr, "Programmable controllers-guide engineering [electronic version]", 2003, HEAL-Link Elsevier Referex.<br>[3] Petruzella F. "Programmable logic controllers" 5th edition, publisher: JIOLAS, book code in Eudoxos: 59421534.<br>[4] Collins D., Lein E. "Programmable controllers - A practical guide", 2nd edition, publisher: Chotras Athanasios.<br>[5] GOURGOULIS D. - PAPASTAMOULIS A. - PRASSAS CH. "Digital Systems - Computer Networks", Chapter 3 - Programmable logic controllers, EVGENIDOS FOUNDATION.<br>[6] L.A. Bryan - E.A. Bryan, "Programmable Controllers - Theory and Application" 2nd edition. |

## HEAT TRANSFER

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| **Course unit code** | EEH4 |
| **Course unit type** | Elective/ Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY122/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | I. Vassiliadis (Adjunct Lecturer) |
| **Course content** | The course consists of the following modules:<br>• Introduction to heat transfer mechanisms<br>• Conduction - thermal conductivity, conduction equation, thermal resistance<br>• Convection - convection coefficient, boundary layers, flow types<br>• Blades - forms and types, performance, optimization<br>• Heat exchangers - Types, thermal permeability, energy balance, temperature difference<br>• Transient phenomena - concentrated capacitance, temperature/space relationship, Heisler diagram<br>• Radiation - blackbody, emission in zone and from surface, Kirchoff's law, thermal radiation transaction |

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| **Expected learning outcomes results and skills** | The purpose of this course is to introduce the student to the basic mechanisms of heat transfer.<br>Upon successful completion of the course the student will be able to:<br>• Understand and explain the basic mechanisms of heat transfer.<br>• Analyze the specific characteristics and compare the heat transfer mechanisms<br>• Calculates heat transfer parameters in typical problems<br>• Understand and analyse the characteristics and operation of heat exchangers.<br>• Describes and analyses transitional conduction phenomena |
| **Prerequisite courses** | Knowledge from the course is required:<br>Thermodynamics |
| **Teaching methods** | - Classroom teaching and tutorials<br>- Supporting the learning process through e-class |
| **Evaluation** | - Final examination (80%), Assessment of assignments (20%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Bergman T. L., and Lavine A. S., Fundamentals of Heat and Mass Transfer, 8th ed. John Wiley & Sons., 2017.<br>[2] Cengel Y. A. and Ghajar A. J., Heat and Mass Transfer: Fundamentals and Applications, Mc Graw - Hill Education, 2015. |

[3] Lienhard IV J., H. and Lienhard V J., H., A Heat Transfer Textbook, Phlogiston Press Cambridge - Massachusetts, 2003.
[4] Pitts D. R. and Sissom L. E., Theory and Problems of Heat Transfer, Schaum's Outline Series, McGraw-Hill, 1998.
[5] Cengel Y. A. and Boles M. A., Thermodynamics-An Engineering Approach, 8th ed. New York: McGraw-Hill, 2015.

# 8th SEMESTER - DIVISION OF ENERGY

## RENEWABLE ENERGY SOURCES

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| **Course unit code** | EEH1 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY107/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | D. Stimoniaris (Associate Professor) |
| **Course content** | **Theory**<br>Solar Energy:Analysis of solar radiation methods.<br>Solar panels: types, efficiency, and calculations.<br>Active and passive solar systems for heating and |

cooling, including heat storage methods.

Photovoltaics:

Electricity production via photovoltaic systems.

Agricultural and industrial applications of solar energy.

Wind Energy:Wind and mechanical power generation systems.

Wind turbines: estimation of wind potential and site selection.

Biomass Energy:Production, storage, and utilization of biomass products.

Marine and Geothermal Energy:Energy from waves, tides, and temperature differences.

Geothermal energy and small hydroelectric projects.

Energy Optimization:Parameter optimization for harnessing renewable energy sources.

**Laboratory**

Hybrid Network Familiarization:Hands-on experience with a real 3 kW hybrid network of renewable energy sources.

Demonstration, measurements, and analysis of photovoltaic panels, inverters, wind turbines, and battery packs.

Smart Microgrids:Introduction to smart microgrid technology and architecture.

Real-time measurement processing from PCs and inverter screens.

Autonomous Network Operation:Managing energy sources including photovoltaic panels, wind turbines, batteries, and auxiliary sources like PPC.

Meteorological data collection and system performance analysis.

Bioenergy Systems:Electricity production from ethanol solutions, beer, and wine.

Hydrogen production and storage using wind turbine-generated electricity.

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| | Performance Analysis:Comparing fuel performance (ethanol, beer, wine) and analyzing the effect of temperature.<br>Water electrolysis using wind turbines and batteries.<br>Measuring hydrogen fuel cell output under varying electrical loads. |
| **Expected learning outcomes**<br>**results and skills** | The course aims to provide students with a comprehensive introduction to the production and management of energy from renewable sources, focusing on methods most relevant and applied in our region. Students gain both theoretical knowledge and hands-on experience through laboratory sessions involving real-world renewable energy systems.<br>• **Laboratory Exercises**: Students engage with installed renewable energy systems, covering all major resources, and complete weekly assignments.<br>• **Simulation Tools**: Training in the simulation and analysis of renewable energy installations using specialized software.<br>Upon successful completion of the course, students will be able to:<br>• Understand the operation of systems for **solar, wind, biomass**, and **geothermal energy utilization**.<br>• Measure and calculate the **performance** of renewable energy systems.<br>• Evaluate renewable energy systems from **energy, environmental**, and **social perspectives**.<br>• Comprehend the principles and operation of **hybrid systems** and **smart grids**.<br>• Monitor and assess the performance of real-world renewable energy plants. |

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| **Prerequisite courses** | Knowledge required from the course Introduction to RES |
| **Teaching methods** | - Classroom teaching using a projector.<br>Laboratory exercises |
| **Evaluation** | • Evaluation of laboratory exercises (20%)<br>• Delivery of a large laboratory exercise (10%)<br>Final exams (70%) |
| **Language of instruction/Exams** | Greek, English |
| **Bibliography** | [1] "Electric power generation systems from renewable energy sources", Field Publications, Gilbert M. Masters,<br>[2] "Laboratory applications of mild forms of energy", Stamouli Publications SA Kaldellis Ioannis K, Kavvadias Kosmas<br>[3] "Renewable Energy Sources", A.PAPASOTIRIOU & Co., Tsoussos Th., Kanakis I.<br>[4] "Energy, Environment and Sustainable Development", Polizakis Apostolos |

## High Voltage Engineering I

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| **Course unit code** | EEH5 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE374/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | Z. Datsios (Adjunct Lecturer) |
| **Course content** | Introduction to High Voltages: Fundamentals of high-voltage concepts and systems.<br>Applications of High Voltages: Overview of general applications in industrial and power systems.<br>Transient Phenomena and Insulation Coordination: Study of surges, transient phenomena, and power system insulation strategies.<br>High Voltage Generation and Measurement: Laboratory techniques for generating and measuring:<br>AC high voltages<br>DC high voltages<br>Impulse (shock) high voltages<br>Strong Shock Current Measurement: Laboratory methods for generating and measuring high shock currents.<br>Dielectric Measurements: Techniques for testing and analyzing dielectric properties.<br>• Partial Discharge Detection: Methods for identifying and |

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| | measuring partial discharges in high-voltage systems. |
| **Expected learning outcomes results and skills** | The course aims to provide students with a comprehensive introduction to the theory, applications, and laboratory techniques of High Voltage systems.<br>**Learning Outcomes**<br>Upon successful completion of the course, students will be able to:<br>Understand and identify the general applications of High Voltage systems.<br>Recognize the causes of surges in power systems and explain insulation coordination processes and protective measures.<br>Explain the principles of operation of laboratory circuits and devices for high-voltage and high-current generation and measurement.<br>Understand and operate laboratory devices for partial discharge detection and dielectric measurements.<br>Apply modern techniques and tools to solve High Voltage problems and applications.<br>Simulate steady-state and transient phenomena in power systems using specialized software.<br>Collaborate effectively with peers on projects related to High Voltage systems. |
| **Prerequisite courses** | Knowledge from the course is required:<br>Introduction to Electric Power Systems |
| **Teaching methods** | - Classroom teaching and tutorials<br>- Supporting the learning process through e-class<br>- Laboratory exercises using power system transient simulation software<br>Laboratory exercises for high voltage production/measurement |

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| **Evaluation** | - Laboratory exercises with group reports (40 %)<br>-Final exams (60 %) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] E. Kuffel, W. S. Zaengl, J. Kuffel, High Trends, Giola Scientific Publications, 2nd Edition, ISBN: 978- 960-418-261-9, 2013<br>[2] I. Stathopoulos, High Trends I, Simeon Publications,ISBN: 960-7888-63-4, 1997 |

## ELECTRO HYDRAULIC AND ELECTROPNEUMATIC POWER SYSTEMS

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| **Course unit code** | EEH19 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY126/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | A. Bouchouras (Associate Professor) |

| Course content | The course introduces students to the **theory, applications**, and **control** of hydraulic and pneumatic power systems, emphasizing their advantages over electrical systems in specific scenarios. Students will analyze the main components and characteristics of hydraulic and pneumatic circuits and gain practical experience through theoretical presentations, tutorial exercises, and laboratory work.<br><br>**Learning Approach**<br>• **Simulation Tools**: Use of **Automation Studio** for simulating hydraulic and pneumatic systems to enhance understanding and design control strategies.<br>• **Laboratory Exercises**: Students perform selected laboratory tasks, submit individual reports analyzing circuit operations, and interpret recorded measurements with commentary.<br>• **Practical Applications**: Emphasis on designing hydraulic and pneumatic systems for real-world problems.<br><br>**Course Content**<br>1. **Hydraulic Power Systems**:<br>o Hydraulic fluids and basic principles.<br>o Components: pumps, motors, cylinders, valves, and accessories.<br>o Applications in various systems.<br>2. **Pneumatic Power Systems**:<br>o Fundamentals of pneumatics.<br>o Components: pneumatic cylinders, motors, compressors.<br>o Circuit design, applications, and electrical control integration.<br>3. **Electrical Control and PLC**:<br>o Implementation of **Programmable Logic Controllers (PLCs)** for controlling hydraulic and pneumatic systems.<br>4. **Analog Hydraulic and Pneumatic Circuits**:<br>o Simulation and analysis of hydraulic and pneumatic systems with control mechanisms. |
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| **Expected learning outcomes results and skills** | Upon completion of the course, students will be able to:<br>• Identify and describe the **basic components** of hydraulic and pneumatic power systems.<br>• Understand and explain the **principles** underlying these systems.<br>• Compare and evaluate the **advantages and disadvantages** of hydraulic and pneumatic power systems.<br>• Implement and analyze the operation of **experimental devices** in a laboratory setting.<br>• Simulate and explain the operation of hydraulic and pneumatic systems, accurately recording their **functional characteristics**.<br>• Analyze and design **hydraulic and pneumatic power systems** for practical applications.<br>• Design **control circuits** for these systems, properly dimensioning circuit elements to meet functional requirements.<br>• Apply the knowledge gained to understand and optimize systems for various **real-world applications**. |
| **Prerequisite courses** | Knowledge of the courses is required:<br>Energy Automation |
| **Teaching methods** | - Classroom teaching and tutorials<br>Laboratory exercises in appropriate software with assignments |
| **Evaluation** | - Work on laboratory exercises (20 %)<br>- Interim progress (20 %)<br>-Final exams (60 %) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | 1. Andrew Parr, Hydraulic and Pneumac Systems, Code Eudoxus: 94688941<br>2. Th. N. Kostopoulos – Hydraulic and Pneumatic power systems,<br>Symeon publications, ISBN:978-960-7888-97-6, Code Eudoxus:<br>50658650. |

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| | 3. A. Routoulas, Hydraulic and Pneumatic power systems – applicaons, Sychrnoni Ekdoki publicaons, ISBN:978-960-6674-26-6, Code Eudoxus:16083 |

## POWER ELECTRONICS II

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| **Course unit code** | EEH7 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY125/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | K. Oureilidis (Assistant Professor) |
| **Course content** | **DC-DC Converters**<br>• Basic circuits: **Step-down**, **Step-up**, and combined configurations.<br>• Advanced circuits: **Cuk** and **Flyback** converters.<br>• Analysis, design, and practical applications.<br>**DC Pulse Transformers**<br>• Isolated converters: **Flyback**, **Forward**, and **Push-Pull** configurations.<br>• Bridge converters and their control mechanisms.<br>• Power factor correction and design considerations.<br>**Power Inverters**<br>• Single-phase and three-phase inverters.<br>• Harmonic analysis and square wave inverters. |

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| | • Amplitude and harmonic control techniques.<br>• **Multilevel inverters** and inverters with **Pulse-Width Modulation (PWM)**, including sinusoidal PWM.<br>• Applications in modern systems. |
| **Expected learning outcomes results and skills** | The course aims to provide students with a thorough understanding of the **theory and applications of Power Electronic Systems**, with a focus on **DC-DC converters** and **DC-AC inverters** in the second part.<br>**Learning Outcomes**<br>Upon successful completion of the course, students will be able to:<br>• Explain in detail the **functions** of the power converter types studied.<br>• Compare and evaluate **circuits** within each category of power converters.<br>• Implement and analyze **experimental setups** in the laboratory for DC-DC converters and inverters.<br>• Simulate and explain the operation of **basic DC-DC and DC-AC converters**.<br>• Design power converter circuits within the **DC-DC** and **DC-AC** categories.<br>• Collaborate effectively with peers on **group projects**. |
| **Prerequisite courses** | Knowledge from the course is required:<br>Power Electronics I |
| **Teaching methods** | - Classroom teaching and tutorials<br>- Use of power electronics simulation software<br>Laboratory exercises on DC-DC and DC-AC converters |
| **Evaluation** | - Laboratory exercises with group reports (25 %)<br>- Individual work in the design/analysis and construction of inverters using simulations (35%)<br>Final exams (40 %) |
| **Language teaching** | Greek |

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| **Bibliography** | [1] Mohan Ned,Undeland Tore A.,Robbins William P. 2010, Introduction to Power Electronics, A. Giola & Sons Ltd.<br>[2] M. Rashid, 2010, Power Electronics, ION Publications.<br>[3] Manias St., 2017, Power Electronics, Ed. Ellie Kalamara, P.S., Ed.<br>D. Hart, 2011, Introduction to Power Electronics, Prentice Hall |

## SPECIAL TOPICS OF ELECTRIC POWER SYSTEMS

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| **Course unit code** | EEH20 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY123/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | G. Christoforidis (Professor) |
| **Course content** | **Transmission System Operation and Development (TSO)**<br>• Economic load sharing, DC load flow, optimal power flow (DC and AC), charge transport, and optimal phasor measurement placement.<br>**Flexible Power Transmission Systems (FACTS)**<br>• Types of FACTS systems, power transfer, and AC power flow calculations with FACTS.<br>**Direct Current Transmission Systems** |

- DC transmission using current source and voltage source converters.

**Transmission Network Reliability**

- Reliability indicators, improvement strategies, and failure analysis in transmission networks.

**Distribution Network Analysis and Operation**

- Existing and transitional operating regimes, ancillary services to transmission systems, and centralized/distributed storage unit installation.

**Distributed Generation in Distribution Systems**

- Impact of CI and RES penetration, optimal placement and sizing, and effects of electric vehicle integration.

**Optimal Operation and Development of Distribution Systems**

- Automation upgrades, billing, network restructuring, and expansion.

**Distribution Network Reliability**

- Reliability indicators, improvement strategies, common failures, and restoration processes.

**Power Quality**

- Issues such as harmonics, voltage dips, and flicker; mitigation methods; and compliance with IEC 50160 standards.

**Expectedly learning outcomes and skills**

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

1. Perform **DC load flow analysis** and **optimal load flow analysis**.
2. Understand the advantages, disadvantages, and characteristics of **AC and DC power transmission** and **flexible power transmission systems (FACTS)**.
3. Calculate the **reliability** of transmission and distribution systems using appropriate indicators and propose strategies to improve reliability.
4. Analyze the impact of **distributed generation (CI, RES)**, **electric vehicle penetration**, and **electricity storage**

**units** on distribution networks.

5. Understand current trends in the **upgrading of transmission and distribution networks**, focusing on equipment and operational control tactics.
6. Solve **optimization problems** related to network operation, expansion, and **reconfiguration** to enhance network performance.
7. Identify **power quality issues** in networks (e.g., harmonics, voltage dips) and propose effective mitigation methods.

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| **Prerequisite courses** | • Transmission and distribution of electricity |
| **Teaching methods** | - **Lectures**: Delivered using **PowerPoint slides** and projected presentations.<br>- **Tutorials**: Interactive sessions to reinforce theoretical concepts.<br>**E-Learning Support**: Access to course materials and resources via the **e-class platform**.<br>- **Laboratory Exercises**: Hands-on experience through **software simulations** to apply theoretical knowledge. |
| **Evaluation** | - Individual or group work (30%)<br>- Laboratory exercises (30%)<br>- - Final exams (40 %) |
| **Language of instruction/Exams** | - Greek |
| **Bibliography** | [1] Power Systems Analysis, Vovos A. Nikolaos, Giannakopoulos V. Gabriel<br>[2] Analysis of Electric Power Systems,Grainger/Stevenson<br>[3] Modern transmission and distribuon networks, P. Goergilakis, Code Eudoxos [320144] |

## ELECTROMECHANICAL INSTALLATIONS AND ENERGY ANALYSIS OF BUILDINGS

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| **Course unit code** | EEH14 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY129/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | D. Stimoniaris (Associate Professor) |
| **Course content** | 1. Thermal insulation and thermal losses of buildings<br>2. Building materials and building elements - Thermal resistance and thermal transmittance - Method of calculation<br>3. Heating, cooling and air conditioning systems in buildings – Methods for calculating the design thermal/cooling load<br>4. Energy Efficiency of Buildings (Methodology for calculating the energy efficiency of a building in accordance with the requirements and specifications of the legislation and the Energy Efficiency of Buildings Regulation - KENAK<br>5. Fire safety (active and passive fire protection)<br>6. Elevators (hydraulic/electric)<br>Pumping stations. |

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| **Expected learning outcomes**<br><br>**results and skills** | **Course Overview**<br><br>This course equips students with foundational knowledge and techniques for designing **electromechanical installations in buildings**, focusing on the correct and safe sizing of electrical devices and systems. It emphasizes compliance with current standards and national regulations while addressing the professional rights of department graduates.<br><br>**Learning Outcomes**<br><br>Upon completion of the course, students will be able to:<br><br>• Apply **regulations and standards** for electromechanical installations in buildings.<br>• Safely size electrical devices and systems in compliance with applicable standards.<br>• Utilize **technical software** widely used for preparing electromechanical installation studies and evaluating energy efficiency in buildings.<br>• Develop and draft comprehensive **electromechanical installation studies** based on the theoretical knowledge provided in the course. |
| **Prerequisite courses** | None |
| **Teaching methods** | - Classroom teaching and tutorials<br><br>-Specialised Software (energy efficiency of buildings etc.) |
| **Evaluation** | I. Written final examination (35%) including:<br><br>- Multiple choice questions<br><br>- Questions to understand the basic concepts of the course<br>- Solving problems-exercises<br><br>II. Group work (15%) on the analysis of a complete case study<br>III. Individual laboratory work (20%)<br><br>IV. Final laboratory examination (30%) |

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| **Language of instruction/Exams** | Greek |

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| **Bibliography** | [1] Energy Inspection of Buildings and Industries, Stamatis D. Perdios<br>[2] New energy inspection guide for buildings, Pantelidis C |

## Energy Economics and Energy Markets

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| **Course unit code** | EEH10 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE371/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | (Adjunct Lecturer) |
| **Course content** | **Course Structure**<br>1. **Theoretical Component**:<br>○ Fundamentals of energy economics and market organization.<br>○ Analysis of current challenges in the energy sector.<br>○ Overview of electricity systems at the national (Greek) and European levels.<br>2. **Tutorial Component**: |

- Practical exercises focused on the **operation and clearing** of electricity markets, using representative scenarios.

3. **Laboratory Component**:
    - Training in **GAMS (General Algebraic Modeling System)** for optimization and mathematical programming.
    - Applications include:
        - Long-term energy planning at national or regional levels.
        - Modeling energy market operations and clearing on daily or annual scales.

**Key Topics**

1. **Energy Economics and International Relations**:
    - Security of energy supply and the interaction between energy, the economy, and the environment.
2. **Energy Markets**:
    - Principles of market organization, with an emphasis on the Greek and European electricity systems (e.g., European electricity exchanges).
3. **Power System Optimization**:
    - Economic allocation of power systems and optimal integration of generation units.
4. **Renewable Energy Integration**:
    - Challenges and opportunities for electricity systems with high penetration of renewable energy sources.
5. **Long-Term Energy Planning**:
    - Current realities and future challenges in energy system development.
6. **Energy Policy and Regional Focus**:
    - Characteristics of Greek and European energy policies.

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| | ○ Analysis of energy systems in Greece, Southeastern Europe, and leading EU countries in renewable energy integration. |
| **Expected learning outcomes**<br><br>**results and skills** | Energy Economics and Policy refers to an interdisciplinary area involving issues of energy supply and use. It is an integral part of the organisation and functioning of the current energy sector at global level. The purpose of this course is to introduce the student to concepts included in the subject of energy economics and energy markets.<br>Upon completion of the course the student will be able to:<br>• is familiar with the main energy production technologies and consumption sectors.<br>• understand the key challenges of the modern energy sector and the position of its economy energy in today's energy environment.<br>• understand and analyse the basics of economics quantities related to the planning and operation of power systems.<br>• is familiar with the structure and functioning of energy markets.<br>• understand the basic characteristics of the energy market in Europe and Greece.<br>• understand the short-term dynamics of the functioning of electricity markets, as well as the medium and long-term dynamics of energy planning<br>• can formulate, model and solve in a computer-based optimisation tool common problems of energy policy, economics and energy markets<br>• comment on and critically analyse the results of the models developed on issues of energy markets and the economic viability of energy investments.<br>• is aware of the current situation and future challenges of the energy sector at national and international level. |
| **Prerequisite courses** | None |
| **Teaching methods** | - Classroom teaching and tutorials<br><br>- Use of General Algebraic Modeling System (GAMS), a computational modeling tool for solving various types of |

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| | mathematical programming and optimization problems<br>- Use of Long-range Energy Alternatives Planning software<br>- Laboratory exercises on applications<br>optimisation in power systems |
| **Evaluation** | - Laboratory exercises with group reports (50 %)<br>- Final exams (50 %) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] E. Lekatsas, "Economic analysis of electrical systems", Technical Chamber of Greece, Athens, Greece, 2000<br>[2] A. Bakirtzis, "Economic operation of electricity systems", Ziti Publications, Thessaloniki, Greece, 1998<br>[3] C. Harris, "Electricity markets, pricing, structures and economics", John Wiley & Sons Inc.: West Sussex, UK, 2006<br>S.C. Bhattacharyya, "Energy Economics: Concepts, Issues, Markets and Governance", Springer-Verlag, London, UK, 2011 |

# 9th SEMESTER - DIVISION OF ENERGY

## INDUSTRIAL ELECTRICAL INSTALLATIONS

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| **Course unit code** | YEH5 |
| **Course unit type** | Compulsory / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |

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| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY128/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | A. Bouchouras (Associate Professor) |
| **Course content** | • The course covers the following main areas:<br>• **Low Voltage (LV) and Medium Voltage (MV) Grounding**:<br>• Types of grounding systems.<br>• Measurement of grounding resistance.<br>• **Short Circuit Analysis**:<br>• Calculation of short-circuit currents and power.<br>• **Motor Installations**:<br>• Asynchronous motor startup and braking.<br>• Motor selection, electrical characteristics, load definition, protection, and connection.<br>• **Medium Voltage Substations**:<br>• Coupling equipment, protection methods, substation types, and grounding.<br>• Feasibility studies and reactive power compensation (electricity billing and power factor improvement).<br>• **Lightning Protection**:<br>• Protection of buildings and installations using surge arresters and specialized methods.<br>• **Switching Equipment**:<br>• Relays, load switches, sectionalizers, and fuses.<br>• **Lighting Installations**:<br>• Types of lamps and lighting installation studies. |
| **Expected learning outcomes**<br><br>**results and skills** | **Learning Outcomes**<br>Upon completing the course, students will be able to:<br>• Select **materials, cables, and appliances** for industrial electrical installations using technical catalogs and analyze their characteristics. |

- Design and study **integrated industrial installations**, including simple and automated production units.
- Conduct calculations for **regional facilities** in industrial setups.
- Perform **earthing**, **lightning protection**, and **outdoor lighting analysis** for industrial buildings.
- Analyze and implement **reactive power compensation** and select appropriate electricity supply contracts.
- Design and calculate **electrical automation panels** for individual machines and production units, integrating them with main electrical panels.
- Understand **standards and regulations** for industrial electrical installations.
- Ensure **safety** in industrial environments and protect against accidents.
- Understand the operation and maintenance of **low- and medium-voltage substations**.
- Develop energy-saving strategies for **electricity and other energy sources** in industrial plants.

**General Competences**

- Data analysis and synthesis using advanced technologies.
- Decision-making and project management.
- Teamwork and collaborative problem-solving.
- Creative and critical thinking.
- Development of new research ideas.

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| **Prerequisite courses** | Modern Electrical Installations |
| **Teaching methods** | - Classroom teaching and tutorials<br>-Use of special software<br>- Laboratory exercises |
| **Evaluation** | I) - Type: deliveries (50% of total)<br>- Description: theoretical background |

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| | - Examination date: End of semester<br>II) - Type: laboratory (30% of the total)<br>- Description: laboratory exercises<br>- Examination date: End of semester<br>III) - Type: presentation (Thesis/Technical Study) (20%)<br>- Description.<br>- Examination date: End of semester |
| **Language of instruction/Exams** | - Greek |
| **Bibliography** | [1] **V. Bitzionis**, *Industrial Electrical Installations*, Tziola Publications.<br>○ Eudoxus Code: 41958897<br>[2] **S. Touloglou**, *Industrial Electrical Installations and Medium Voltage Substations*.<br>○ Eudoxus Code: 14582<br>[3] **P. Dokopoulos**, *Electrical Installations for Consumers*, Zi Publications.<br>○ Eudoxus Code: 11044<br>**Relevant Scientific Journals**<br>• *IEEE Transactions on Power Systems*<br>• *IEEE Transactions on Smart Grid*<br>• *Electric Power Systems Research* (Elsevier) |

## ELECTRIC DRIVE SYSTEMS

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| **Course unit code** | EEH11 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |

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| **ECTS credits** | 5 |
| **Website** | https://ece.uowm.gr/courses.php?view_course=150 |
| **Teaching weekly hours** | 4 |
| **Lecturer** | K. Oureilidis (Assistant Professor) |
| **Course content** | This course introduces students to **electric drive systems**, focusing on motor operation, control, and braking for DC and AC motors. It covers motor-load interaction, traditional and advanced control methods using **power electronics** and **intelligent algorithms**, preparing students to design and analyze industrial drive systems.<br><br>**Course Modules**<br>1. **Introduction to Electric Drive Systems (EDS)**<br>o System requirements, selection parameters, drive profiles, and load torque-speed characteristics.<br>2. **DC Motor Drive Systems**<br>o **Classical Methods**: Magnetic flux, drum voltage, and resistance variation.<br>o **Power Electronics**: Controlled rectifiers and DC-DC converters.<br>3. **AC Motor Drive Systems**<br>o **Control Techniques**: Voltage and frequency variation, rotor resistance adjustment, V/f ratio adjustments, and power-slip recovery.<br>o **Power Electronics**: Inverters and AC voltage regulators.<br>4. **Intelligent Control Methods**<br>o Nonlinear system identification, supervisory and diagnostic control, motion control, and generator control algorithms.<br>5. **DC and AC Motor Braking**<br>o Methods for effective braking in electric drive systems. |

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| **Expected learning outcomes results and skills** | Upon successful completion of the course, students will be able to:<br>• Identify the **key parameters** for selecting an electric drive system.<br>• Understand **transmission modes** and the characteristics of major load types.<br>• Compare and evaluate **DC motor control methods**.<br>• Analyze and select appropriate **DC motor drive systems**.<br>• Compare and evaluate **AC motor control methods**.<br>• Analyze and select appropriate **AC motor drive systems**.<br>• Design **intelligent control algorithms** for AC/DC motors and generators.<br>• Develop practical skills in controlling various types of electric motors through **laboratory exercises**.<br>• Understand and apply **braking methods** for electric motors. |
| **Prerequisite courses** | Power Electronics I and II, and Electrical Machines I and II |
| **Teaching methods** | - Classroom teaching and tutorials<br>- Use of special software<br>-Laboratory exercises and circuit simulations |
| **Evaluation** | - Individual work (40 %)<br>- Group work in the laboratory (30%)<br>Final examination (30 %) |
| **Language teaching** | - Greek |
| **Bibliography** | [1] P. Malatesta, Electric Motion, Giola Publications, 2010.<br>[2] Krishnan, Electric Drive Systems, Keydarithm 2009<br>- M. El Sharkawi, Fundamentals of Electric Drives, Brooks, 2000. |

## PROTECTION AND STABILITY OF POWER SYSTEMS

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| **Course unit code** | EEH21 |
| **Course unit type** | Elective |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY102/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | A. Tsiakalos (Adjunct lecturer) |
| **Course content** | **Transient Phenomena in Power Systems**<br>• Wave phenomena in transmission lines, traveling wave terminations, and multiple reflections.<br>**Couplings, Disconnections, and Short Circuits**<br>• Single-phase load couplings with and without transient frequencies.<br>• Load disconnections with one or two transient frequencies and three-phase load decoupling.<br>**Steady-State and Transient Stability**<br>• Modern generator dynamics and the equal area criterion.<br>**Short Circuit Analysis in Power Systems**<br>• IEC 60909 standard, symmetrical and asymmetrical short circuits.<br>• Calculation of currents and voltages at fault points using numerical methods.<br>**Power System Protection**<br>• Fundamentals of electrical equipment protection, relay types, and selectivity.<br>• Line protection with distance/overcurrent relays and |

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| | fuses.<br>• Single-line protection with differential relays and transformer protection. |
| **Expected learning outcomes**<br><br>**results and skills** | Upon successful completion of the course, students will be able to:<br>1. Understand **traveling wave phenomena** in transmission line terminations, including multiple reflections and their impact on power transformers and insulators.<br>2. Calculate **surges** and **overcurrents** resulting from coupling and decoupling of short circuits.<br>3. Apply the **equal area criterion** to assess transient stability in power systems.<br>4. Analyze **symmetrical** and **asymmetrical short circuits** in power systems. |
| **Prerequisite courses** | Transmission and distribution of electrical energy |
| **Teaching methods** | - Classroom teaching and tutorials<br>Laboratory simulation exercises |
| **Evaluation** | - Interim progress (30%)<br>- Final exams (70 %) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] N. Vovos, C. Yiannakopoulos, Control and Stability of Power Systems, 2017<br>[2] Kundur Prabha, D. Lambridis, Stability and Control of Power Systems, 2019.<br>[3] N. Vovos, Protection of power systems, 2009 |

## OPTIMIZATION METHODS IN ELECTRIC POWER SYSTEMS

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| **Course unit code** | EEH13 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE376/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | (Adjunct Lecturer) |
| **Course content** | This course covers the **mathematical formulation** of various power system problems and their corresponding **computational modeling** using the **GAMS** software tool.<br>1. **Optimization Techniques**:<br>o Linear programming, quadratic programming, and mixed-integer linear and nonlinear programming.<br>2. **Economic Unit Commitment**:<br>o Static and dynamic formulations for optimal unit allocation.<br>3. **Optimal Power Plant Integration**:<br>o Methods for integrating power plants into power systems efficiently.<br>4. **Long-Term Energy Planning**:<br>o Strategic planning of power systems over extended time horizons.<br>5. **Distributed Generation and Scheduling**: |

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| | ◦ Optimal planning and scheduling of distributed production units.<br>◦ Analysis of the impact of **electric vehicle penetration** and **energy storage**. |
| **Expected learning outcomes results and skills** | The General Algebraic Modeling System (GAMS) is a computational tool designed for solving a variety of mathematical programming and optimization problems. This course focuses on the key optimization challenges in energy systems modeling, particularly power systems, covering both:<br><br>The theoretical formulation of problems, including objective functions, equations, and constraints.<br>The computational techniques and methods used for solving these problems through GAMS.<br>Learning Outcomes<br>Upon successful completion of the course, students will be able to:<br><br>Understand the fundamental principles of programming in computational environments.<br>Apply optimization techniques to modern energy applications.<br>Recognize the importance of optimization in decision-making processes for energy systems. |
| **Prerequisite courses** | - |
| **Teaching methods** | - Classroom teaching with projector and tutorial exercises<br>- Use of special software<br>-Laboratory simulation exercises |
| **Evaluation** | - Laboratory exercises with group reports (30 %)<br>- Individual work on computational implementation in an optimization problem in power systems (30%) |

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| | Final exams (40 %) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Power System Optimization Modeling in GAMS [electronic resource] Book Code in Eudoxos: 754908<br>[2] Continuous Nonlinear Optimization for Engineering Applications in GAMS Technology, Ref. Eudoxo Book Code: 75483709<br>[3] Nonlinear Optimization Applications Using the GAMS Technology [electronic resource] Ref. in Eudoxo: 73248321<br>[4] Process and System Optimization with Applications in MATLAB and GAMS |

## INTRODUCTION TO SMART GRIDS

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| **Course unit code** | EEH15 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY114/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | A. Bouchouras (Associate Professor) |
| **Course content** | **Introduction to Smart Grids**<br>• Overview, regulations, and virtual power stations.<br>**Smart Grid Architecture and Communication**<br>• Architecture, monitoring, standards, and connectivity.<br>**Communication in Smart Grid Applications**<br>• Management systems, Distributed Generation, Microgrids, SCADA, and data analysis.<br>**Smart Grid Security**<br>• Vulnerabilities, privacy, mitigation techniques, and security requirements.<br>**Flexibility in Smart Grids**<br>• Flexible generation, demand, and active network management.<br>**Trends in Smart Grids** |

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| | • Smart buildings, electrification, and energy storage.<br>**Energy Forecasting**<br>• Load and production forecasting with variable time horizons.<br>**Case Studies and Tools**<br>• Peer-to-peer markets, Microgrids, and local energy communities. |
| **Expected learning outcomes results and skills** | Upon successful completion of the course, students will be able to:<br>• Understand the concept of **Smart Grids** and the challenges associated with their implementation.<br>• Analyze the **communication structures** in Smart Grids and their technical specifications.<br>• Recognize **cybersecurity challenges** and describe mechanisms for protection.<br>• Gain knowledge of **current trends** in Smart Grid development.<br>• Understand and apply methods for **load and energy production forecasting**. |
| **Prerequisite courses** | Transmission and Distribution of Electrical Energy, Stability of Power systems, Renewable Energy Sources, Power electronics, Electricity Market |
| **Teaching methods** | - Classroom teaching with projector and utorial exercises<br>-Use of special software |
| **Evaluation** | The course assessment consists of two components:<br>1. **Written Examination (70%)**<br>o The written exam will account for 70% of the final grade and will include:<br>▪ Multiple-choice questions.<br>▪ Short-answer questions.<br>▪ Problem-solving exercises. |

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| | 2. **Coursework and Presentation (30%)**<br>◦ This component will account for 30% of the final grade and may include:<br>▪ Written assignments, essays, or reports.<br>▪ Oral examinations or presentations.<br>◦ Students will be evaluated on both the **content** and the **presentation** of their work. |
| **Language of instruction/Exams** | Greek, English |
| **Bibliography** | [1] Renewable Energy Sources, Asimakopoulos D., Arampatzis G., Angelis - Dimakis A., Kartalidis A., Tsiligiridis G.<br>[2] P. Georgilakis, Modern Electricity Transmission and Distribution Systems, Code in Eudoxos: 320144.<br>[3] Sato, Smart Grid Standards, Code in Eudoxos: 80504766 |

## ENERGY STORAGE TECHNOLOGIES

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| **Course unit code** | EEH16 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY112/ |
| **Teaching weekly hours** | 4 (Theory: 2 hours, Tutoring: 1 hour, Laboratory: 1 hour) |
| **Lecturer** | A. Tsiakalos (Adjunct lecturer) |

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| **Course content** | The course is divided into the following sections:<br>1. Introduction. The need and importance of energy storage in classical and modern power systems.<br>2. Physical energy storage systems<br>• Pumping<br>• Compressed air storage<br>• Kinetic energy storage - Flywheels<br>3. Electrical energy storage systems<br>• Electrochemical systems and accumulators. Available technologies<br>• Supercapacitors<br>• Superconducting energy storage systems<br>• Fuel cells and hydrogen storage<br>• Flow batteries<br>4. Benchmarking of storage technologies. Energy and power density, efficiency, lifetime, cost, economic viability.<br>Sizing of energy storage systems with accumulators<br>6. Applications and case studies of energy storage in power grids<br>In the laboratory part, special software is used for the sizing of storage systems, as well as exercises with the laboratory equipment of the Department, including superconducting energy storage system, electronic load for battery control,<br>PV system with battery storage. |
| **Expected learning outcomes results and skills** | Upon successful completion of the course the student will be able to:<br>• Know the different methods of energy storage and understand the principle of their operation<br>• Describe and distinguish the importance of energy storage in modern power systems<br>• Compare and evaluate storage methods and rank them according to their specific characteristics and costs.<br>• Model energy storage systems in a network and implement appropriate simulations<br>• It analyses storage applications and the individual advantages of each case study.<br>• Use their knowledge to design from scratch an energy |

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| | storage system with accumulators |
| **Prerequisite courses** | - |
| **Teaching methods** | - Classroom teaching and tutorials<br>- Support for the learning process through e-class<br>- Use of simulation software<br>- Laboratory exercises |
| **Evaluation** | - Laboratory exercises with group reports (30 %)<br>- Individual project -dimensioning of storage systems (30%)<br>- Final exams (40 %) |
| **Language of instruction/Exams** | - Greek |
| **Bibliography** | [1] Electric power generation systems from renewable energy sources, Gilbert M. Masters,<br>[2] Power Plants, Polizakis Apostolos<br>[3] Renewable Energy Sources, 2nd Edition, Kioskeridis I.<br>- Electrochemical Sources of Energy, Bagotsky Vladimir |

## HIGH VOLTAGE ENGINEERING II

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| **Course unit code** | EEH22 |
| **Course unit type** | Elective |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY103/ |
| **Teaching weekly hours** | 4 |

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| **Lecturer** | Z. Datsios (Adjunct lecturer ) |
| **Course content** | **High Voltage Applications in Power Systems**:<br>• Insulators, power cables, circuit breakers, disconnectors.<br>• Gas Insulated Lines (GIL) and Substations (GIS).<br>• High voltage capacitors and inductors.<br>**Lightning**: Mechanisms, effects, and surge protection.<br>**Grounding Systems**: Design and measurement for high voltage installations.<br>**Electrical Breakdown**:<br>• Gaseous, liquid, and solid dielectrics.<br>• Surface flashover and vacuum breakdown.<br>• Electric arcs. |
| **Expected learning outcomes results and skills** | The course aims to introduce students to High Voltage applications and the mechanisms of electrical breakdown.<br>**Learning Outcomes**<br>Upon successful completion of the course, students will be able to:<br>Identify and understand High Voltage applications in power systems.<br>Comprehend the lightning phenomenon, its effects on electrical equipment, and basic protection principles.<br>Understand, explain, and apply the principles of grounding.<br>Analyze and explain the mechanisms of electrical breakdown in different materials.<br>Utilize modern tools and techniques for solving High Voltage problems and applications.<br>Simulate transient phenomena in electrical systems using specialized software.<br>Perform field resistivity and grounding resistance measurements. |

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| | Conduct laboratory tests to evaluate the dielectric strength of insulating oil under high voltage.<br>Collaborate effectively on team projects. |
| **Prerequisite courses** | - |
| **Teaching methods** | - Classroom teaching and tutorials<br>- Laboratory exercises using power system transient simulation software<br>- Laboratory exercises to measure soil resistivity, earth resistance and grounding resistance and to evaluate the dielectric strength of insulating oils |
| **Evaluation** | - Laboratory exercises with group reports (40 %)<br>- Final exams (60 %) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] M. C. Danikas, High Voltage Elements, Herodotus Publications, 3rd edition, ISBN: 978-960-485-305-2, 2019.<br>[2] I. Stathopoulos, Protection of technical installations against overvoltages, Simeon, 1st ed., ISBN: 978-960-788-98-3, 1989. |

## SELECTED TOPICS IN POWER ELECTRONICS

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| **Course unit code** | EEH23 |
| **Course unit type** | Elective/ Specialization |
| **Level course** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |

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| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY115/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | K. Oureilidis(Assistant Professor) |
| **Course content** | **Control of DC-DC Converters and Pulse Transformers**<br>• Feedback circuits, small-signal analysis, power factor correction, and state-space averaging.<br>**Semiconductor Driver Circuits**<br>• MOSFET, IGBT, and thyristor driver circuits, snubber design, thermal management, and heat sink optimization.<br>**Resonant Converters**<br>• ZCS, ZVS, series, parallel, and combinational configurations with comparative evaluation. |
| **Expected learning outcomes**<br>**results and skills** | Upon successful completion of the course, students will be able to:<br>• Analyze the **dynamic operation** of DC-DC converters.<br>• Design **control systems** for DC-DC converters and pulse transformers.<br>• Develop **driver circuits** for MOSFETs, IGBTs, and thyristors.<br>• Calculate and select appropriate **snubber circuits** for switch protection.<br>• Identify and evaluate suitable **cooling systems** for power switches.<br>• Understand, analyze, and compare various **resonant converters**.<br>• Simulate and explain the operation of **inverters** and **power electronic systems**.<br>• Collaborate effectively with peers on **team projects**. |
| **Prerequisite courses** | Power Electronics I and II |

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| **Teaching methods** | - Classroom teaching and tutorials<br>- Use of power electronics simulation software<br>- Laboratory exercises |
| **Evaluation** | - Laboratory exercises with group reports (25 %)<br>- Individual work in the design/analysis and construction of inverters using simulations (35%)<br>Final exams (40 %) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Mohan Ned,Undeland Tore A.,Robbins William P. 2010, Introduction to Power Electronics, A. Giola & Sons Ltd.<br>[2] M. Rashid, 2010, Power Electronics, ION Publications.<br>[3] Manias St., 2017, Power Electronics, Ed. Ellie Kalamara, P.S., Ed. D. Hart, 2011, Introduction to Power Electronics, Prentice Hall |

## Photovoltaic Systems and Applications

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| **Course unit code** | EEH24 |
| **Course unit type** | Elective / Specialization |
| **Level course** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY132/ |
| **Teaching weekly hours** | 4 (Theory: 2 hours, Tutoring: 1 hour, Laboratory: 1 hour) |
| **Lecturer** | G. Christoforidis (Professor) |
| **Course content** | Autonomous and Interconnected PV Systems:<br>Grid interconnection methods and challenges with high power integration. |

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| | Operation during islanding and strategies for islanding prevention.<br>Production Calculations:<br>Estimation of production and parameter influence.<br>Inverters:<br>Selection of suitable inverters.<br>Advantages of next-generation smart inverters with grid-support services.<br>PV System Types:<br>Rooftop PV systems and large-scale PV installations.<br>Consumption and Forecasting:<br>Impact of consumption on self-producers.<br>Importance of production forecasting for large systems.<br>Policies and Market Participation:<br>Support policies for PV systems and participation in energy markets.<br>Hybrid Systems with Storage:<br>Topologies, equipment, and techno-economic analysis of system parameters. |
| **Expected learning outcomes results and skills** | Upon successful completion of the course, students will be able to:<br><br>Calculate estimated PV production, accounting for all influencing parameters.<br>Explain the methods of grid interconnection for PV systems.<br>Understand support policies for PV plants and their participation in the energy market.<br>Analyze and study simple grid-connected PV systems.<br>Design basic PV systems, selecting appropriate inverters and topologies.<br>Evaluate and analyze PV systems with storage, including their economic feasibility.<br>Simulate the operation of PV stations using specialized software.<br>Collaborate effectively with peers on team projects. |
| **Prerequisite courses** | Power Electronics I and II and Renewable Energy Sources |
| **Teaching methods** | Classroom teaching and tutorials<br>Use of simulation software<br>Laboratory exercises |
| **Evaluation** | Laboratory exercises with group reports (20 %)<br>Individual work in PV system design/analysis (40%) |

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| | Final exams (40 %) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | Photovoltaic Systems, Book Code in Eudoxos: 86199736, Edition: 4th ed./2019, Fragiadakis I., Ziti Publishers<br>[2] The Science and Technology of Photovoltaics Systems, Code in Eudoxos: 86199370, Ed.: 1/2019, S.Kaplanis |

## ELECTRIC VEHICLE TECHNOLOGY AND INTEGRATION

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| **Course unit code** | EEH25 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **ECTS credits** | 5 |
| **Website** | |
| **Teaching weekly hours** | 4 |
| **Lecturer** | D. Tsiamitros (Professor); D. Stimoniaris (Associate Professor) |
| **Course content** | **Electric Motors for Electric Vehicles**<br>• **Induction Machines**: Operating principles, application in EVs, modeling, simulation, and control.<br>• **Permanent Magnet Machines (PMSMs)**: Operating principles, types, modeling, simulation, and control strategies.<br>**Power Electronics for Electric Vehicles**<br>• **Converters**:<br>  ○ Typical, multi-level, and modular converters (operation, configuration, control). |

- DC-DC converters and inverters for non-motion applications.

- **Battery Chargers**: Embedded, off-vehicle chargers, and new topologies.
- **Energy Management**: Power electronics role and approaches to energy management.

**Energy Storage Technologies**

- **Batteries**: Types, operating principles, technical characteristics (efficiency, degradation, safety), management systems, and recycling.
- **Supercapacitors**: Structure, operation, technical specifications, and applications.
- **Fuel Cells**: Types, operation, technical features, and applications.
- **Hybrid Storage**: Comparison of storage technologies, emerging trends, and innovation challenges.

**Integration of EVs into Electrical Systems**

- **Charging Infrastructure**: Categories (Level 1-3), financial projections, and pricing strategies.
- **Energy System Interaction**: Grid integration and energy management in EV systems.

**Expected learning outcomes results and skills**

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

1. Select appropriate **power electronics** for specific Electric Vehicle (EV) applications.
2. Develop **control algorithms** for power electronic converters.
3. Design basic **energy management solutions** for EVs.
4. Analyze and compare the characteristics and parameters of **energy storage technologies** used in EVs.
5. Model and evaluate **energy storage technologies** for EV applications.
6. Assess the impact of **charging strategies** on consumers and the distribution network.
7. Model **optimization problems** for smart EV charging.

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| | 8. Analyze the role of EVs as **flexible loads** in energy markets.<br>9. Develop key business skills such as **leadership**, **problem-solving**, and **decision-making**.<br>10. Identify opportunities and conduct **market research** in the growing EV industry, including target market identification, consumer preference analysis, and competition assessment. |
| **Prerequisite courses** | - |
| **Teaching methods** | eclass platforms<br>Use of bibliographic databases - scientific papers.<br>Simulation software (PowerSim) |
| **Evaluation** | - Laboratory exercises<br>Final examinations |
| **Language of instruction/Exams** | Greek, English |
| **Bibliography** | [1] D. Stimoniaris, D. Tsiamitros, Th. Xenitopoulos, G. Tsiranidis, "Electrokinesis", INNORA, ISBN: 978-618-86853-0-7<br>[2] Ehsani,Gao,Longo,Ebrahimi, ELECTRIC, HYBRID AND FUEL CELLULAR VEHICLES, Ref: 112697644, Edition: 3/2022, ISBN: 9789603308140 |

# 7th SEMESTER – DIVISION OF TELECOMMUNICATIONS AND NETWORKS

## ANALYSIS AND SIMULATION OF COMMUNICATION NETWORKS

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| **Course unit code** | Y2 |
| **Course unit type** | Compulsory / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE175/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | P. Sarigiannidis (Professor) |
| **Course content** | **Fundamentals of Modeling and Simulation**:<br>• Concepts of systems, models, and types of simulation.<br>• Monte Carlo simulation and tail system modeling.<br>• Modeling of complex systems.<br>**Simulation Tools**:<br>• Software: Matlab, ns-2/3, Opnet, OmNET++, NetSim.<br>**Input Data and Random Generation**:<br>• Selection of input distributions.<br>• Random number and variable generation.<br>**Statistical Analysis of Results**:<br>• Calculation of means, dispersion, confidence intervals, and more.<br>**Communication Systems and Networks**: |

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| | • Simulation-based performance analysis, behavior study, and validation. |
| **Expected learning outcomes results and skills** | Upon successful completion of the course, students will achieve the following:<br>**Knowledge**<br>• Demonstrate understanding of **analysis, modeling, and simulation** techniques, including genome-driven programming.<br>• Identify and solve problems using **Monte Carlo modeling** and interpret real-world scenarios requiring randomness.<br>• Understand the **theory of large numbers** and apply techniques for generating pseudo-random numbers in simple and complex problems.<br>**Skills**<br>• Analyze and define **key simulation parameters**: input/output variables, performance metrics, constants, and critical variables.<br>• Determine required evaluation variables, performance limits, and simulation times for accurate results and conclusions.<br>• Solve problems using simulation and validate results with **analytical techniques** (e.g., probability and large number theories).<br>• Communicate and present **conclusions and insights** effectively to both technical and non-specialist audiences.<br>**Competencies**<br>• Manage complex simulation techniques and methodologies, taking responsibility for decision-making using **fact-driven simulations**.<br>• Simulate problems across platforms like **Matlab, ns-2, ns-3, and OMNeT++**, and adapt solutions to unpredictable, diverse environments.<br>• Apply knowledge and problem-solving skills to interdisciplinary and **unfamiliar contexts**, leveraging simulation results for research and societal impact.<br>• Lead professional development in team settings while minimizing risk and cost associated with equipment acquisition. |

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| **Prerequisite courses** | None |
| **Teaching methods** | Lectures, Laboratory, Semester Project |
| **Evaluation** | Final Written Examination (60%), Laboratory Exercises (30%), Presentation of Semester Work (10%),<br>Oral Examination (20%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Kuikoglou V., Constantas D., *Simulation Systems of Discrete Events*, Murgos I., Version: 1/2016.<br>[2] Sfakianakis Michalis, *Simulation and applications*, S. PATAKIS, Edition: 1st ed./2001.<br>[3] Roumeliotis, Suravlas, Simulation Techniques,<br>Giola Publications, 978-960-418-372-2 2011.<br>[4] B. Tsaousidis, et al., Laboratory Courses in Computer Networks and Networks, Keydarithmos Publications, 2010.<br>[5] A. M. Law W. D. Kelton, Simulation Modeling and Analysis, McGraw-Hill, Inc, 1991. |

## ANTENNA SYSTEMS AND WIRELESS PROPAGATION

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| **Course unit code** | Y3 |
| **Course unit type** | Compulsory / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE289/ |

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| **Teaching weekly hours** | 4 |
| **Lecturer** | N. Nai (Adjunct lecturer) |
| **ourse content** | **E/M Waves and Antennas**:<br>• Characteristics at radio frequencies, radiation pattern, gain, polarization, impedance, and matching.<br>• Radiation principles: reciprocity, Friis equation, RADAR basics.<br>**Antenna Types**:<br>• Linear antennas (dipoles, Yagi-Uda, logarithmic-periodic).<br>• Loop antennas (small and large).<br>• Specialized antennas (horn, reflector, microstrip, patch).<br>• Array design and synthesis techniques.<br>**Wireless Communication**:<br>• Signal degradation (path loss, multipath) and propagation mechanisms (reflection, scattering, diffraction).<br>• Radio links (terrestrial, cellular, satellite), coverage estimation models (LOS/NLOS, Friis equation).<br>**Advanced Systems**:<br>• Cellular networks (macro/micro/pico/femto cells), smart antennas, repeaters, MIMO, Ad-hoc, and Body Area Networks (+SAR).<br>**Laboratory**:<br>• Antenna measurements using Lab Volt/Festo Didactic equipment. |
| **Expected learning outcomes**<br><br>**results and skills** | Upon successful completion of the course, students will be able to:<br>• Understand the **basic principles** of antennas and their operation.<br>• Categorize and select antennas based on application requirements, and calculate their key parameters.<br>• Design antennas to meet specific **performance specifications**.<br>• Grasp the fundamental concepts and quantities in **radio link propagation models**. |

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| | • Categorize and utilize wireless channels for various applications.<br>• Design simple radio links and calculate **power budgets**.<br>• Recognize and perform measurements on real **antenna arrays**.<br>• Communicate the **technological, social, and economic impacts** of these systems to non-experts, including their benefits and potential risks. |
| **Prerequisite courses** | None. |
| **Teaching methods** | Lectures, tutorials, laboratory exercises and report writing. |
| **Evaluation** | Lab grade (from assignment reports), 25%, and final written exam, 75%. Optional topics<br>an additional mark (if there is a promotional mark). |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Balanis K., Theory of Antennas, 4th ed., Papasotiriou, 2019.<br>[2] Kraus J. D., Antennas, A. Giolas & Sons, 1998.<br>[3] Kapsalis C., Kottis P., Antennas wireless links, Editions A. Tziola & Yios, 2008.<br>[4] Kanatas A., Konstantinou F., Pantos C., Wireless Communications, Kanatas Athanasios, 2010.<br>[5] Saunders S., Aragón-Zavala A., Antennas and propagation for wireless communication systems, Eds. Field S.A., 2016. |

## DIGITAL COMMUNICATIONS

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| **Course unit code** | E45 |
| **Course unit type** | Compulsory |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE302/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | Al. Ap. Boulogeorgos (Assistant Professor) |
| **Course content** | This course covers the fundamental concepts and techniques underlying modern **digital communication systems**, both wired and wireless, including **fiber optic systems**, **5G communications**, and **satellite systems**. The course combines theoretical instruction with **well-structured laboratory exercises** to bridge theory and practical application, reinforced by examinations.<br>**Topics Covered**<br>• **Core Concepts**:<br>  ○ Pulse amplitude modulation (PAM).<br>  ○ Sampling theorem and live signal sampling.<br>  ○ TDM multiplexing.<br>  ○ Pulse width and position modulation.<br>  ○ Digital pulse shaping and modulation codes.<br>• **Modulation Techniques**:<br>  ○ ASK, FSK, PSK, QPSK, MSK, DPSK. |

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| | ◦ Memory modulation signals.<br><br>• **Advanced Topics**:<br>◦ Pulse code modulation.<br>◦ Trellis diagrams and maximum likelihood detection.<br>◦ Digital transmission in channels with additive white Gaussian noise (AWGN).<br>◦ Interference and noise impact on communication systems. |
| **Expected learning outcomes**<br><br>**results and skills** | Upon successful completion of the course, students will acquire knowledge and skills in:<br><br>**Core Concepts**<br>• Analysis, design, and optimization of **telecommunication systems**.<br>• Performance evaluation of digital communication systems, including metrics such as:<br>◦ Error rate, failure probability, communication interruption probability, energy efficiency, and spectral efficiency.<br><br>**Laboratory Skills**<br>• Proficient use of laboratory equipment and tools.<br>• Development of experimental **analog-to-digital** and **digital-to-analog conversion systems**, as well as integrated digital communication systems.<br>• Design and implementation of **new digital communication systems**.<br>• Problem-solving and scenario analysis in laboratory settings.<br><br>**Critical Thinking and Communication**<br>• Enhance critical thinking and problem-solving abilities related to course topics.<br>• Formulate reasoned judgments and solutions for telecommunication challenges.<br>• Communicate conclusions clearly and effectively to both |

**specialist** and **non-specialist** audiences.

**Independent Learning**

- Gain the skills necessary to pursue advanced studies or professional development in a largely autonomous manner

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| **Prerequisite courses** | None |
| **Teaching methods** | • Lectures<br>• Tutorial exercises<br>• Laboratory exercises |
| **Evaluation** | Final written examination (100%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Karagiannidis G., *Telecommunication Systems*, Publications A. Giola & Sons, 2010.<br>[2] J. Proakis, M. Salehi, *Telecommunication Systems*, Asset Management Company of University of Cyprus. Athens, 2003.<br>[3] Simon Haykin, *Digital Communication Systems*, A. Papasotirios, Edition: 1st Edition /2014. |

## ELECTROMAGNETIC COMPATIBILITY

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| **Course unit code** | ETH1 |
| **Course unit type** | Elective / Specialization |
| **Level course** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |

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| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY133/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | T. Kollatou (Laboratory Teaching staff) |
| **Course content** | This course introduces the principles and challenges of electromagnetic compatibility (EMC), focusing on interference mechanisms, standards, measurement techniques, and protection methods.<br>**Introduction to EMC**<br>• Definitions, concepts, and electromagnetic interference (EMI).<br>• Susceptibility, immunity, and interference categorization between systems.<br>**Regulations and Standards**<br>• CE marking, directives, and compliance requirements.<br>**Interference Mechanisms**<br>• EMI in transmission lines, signal integrity, and effects of discontinuities.<br>• Non-linear behavior of components and their emission/immunity to radiation.<br>**EMC in Circuits and Components**<br>• Filters, stabilizers, coupling mechanisms, and effects of higher-order harmonics.<br>• Cross-talk and inductive-spatial coupling models.<br>**Shielding and Grounding**<br>• Shielding systems, shielded cables, grounding types, circuit spacing, and protection devices.<br>**EMC Measurements**<br>• Facilities for EMC measurement: open field test sites, anechoic chambers, resonance chambers, and |

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| | TEM cells.<br>**Biological Effects and Computational Techniques**<br>• EMC's impact on living beings.<br>• Computational methods for solving EMC-related problems. |
| **Expected learning outcomes results and skills** | • Gain familiarity with basic concepts and definitions of electromagnetic compatibility (EMC), building on foundational knowledge of electromagnetism.<br>• Understand the mechanisms of interference, their suppression techniques, the non-linear behavior of key circuit components, and cross-talk phenomena.<br>• Develop a detailed understanding of shielding systems and grounding, supported by practical examples.<br>• Learn methodologies for measuring key EMC quantities and indicators.<br>• Assimilate EMC concepts through:<br>Theoretical analysis of electromagnetic phenomena.<br>Simulation and parametric analysis of device characteristics. |
| **Prerequisite courses** | None |
| **Teaching methods** | Lectures, tutorial exercises |
| **Evaluation** | Written examination (60%), assignments (40%) |
| **Language of instruction/Exams** | Greek, English |
| **Bibliography** | [1] P. Chatterton and M. Houlden, Electromagnetic Compatibility (EMC), Giola & Yios S.A., Thessaloniki, 2000.<br>[2] X. Kapsalis and P. Trakadas, Electromagnetic Compatibility (EMC), Tziola & Yios S.A., Thessaloniki, 2010.<br>[3] C. R. Paul, Introduction to Electromagnetic Compatibility, 2nd edition, Wiley-Interscience, 2006.<br>[4] D. Morgan, A Handbook for EMC Testing and Measurement, IET Electrical Measurement Series, |

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| | 2007. |

## QUEUING THEORY

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| **Course unit code** | E9 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE176/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | (Adjunct Lecturer) |
| **Course content** | Introduction to Queuing Systems:<br>Overview of waiting queues and queue theory.<br>Performance design and evaluation techniques for queuing systems.<br><br>Key Concepts and Models:<br>Little's Law and its applications.<br>Queue Theory I: Analysis of M/M/-/- queue types.<br>Queue Theory II: Arrivals, stages, and serial arrivals.<br>Birth-Death processes.<br><br>Queue Analysis:<br>Simple queues: M/M/1 and M/G/1. |

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| | Queues with losses: M/M/1/N.<br>Multi-server queues: M/M/m/m, M/M/m/K, M/M/m/m (Erlang-B).<br><br>Applications and Simulation:<br>Packet scheduling in modern high-speed networks.<br>Queuing models in modern wireless networks. |
| **Expected learning outcomes**<br>**results and skills** | Upon successful completion of the course, students will achieve the following:<br>**Knowledge**<br>• Demonstrate a strong understanding of **queuing systems**, **stochastic processes**, and simple and complex queuing models.<br>• Identify, describe, and solve real-world problems using **queuing system modeling** techniques.<br>**Skills**<br>• Analyze and solve problems involving various **queuing models** such as M/M/1, M/M/m, M/M/∞, M/M/1/m, M/M/m/m, M/M/1/K, M/G/1, and G/M/1.<br>• Interpret and generalize conclusions from stochastic problems and communicate findings effectively to both specialists and non-specialists.<br>**Competencies**<br>• Manage complex methodologies and decision-making processes using **queuing system modeling** in dynamic and competitive environments.<br>• Leverage simulations to predict outcomes and optimize solutions before implementing real-world systems, reducing costs and risks.<br>• Apply knowledge and problem-solving skills in **unfamiliar, interdisciplinary settings**, utilizing queuing systems for research, social applications, and collaborative projects. |
| **Prerequisite courses** | None |
| **Teaching methods** | Lectures, Tutorial Exercises, Programming Exercises, Semester Work |

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| **Evaluation** | Final Written Examination (70%), Programming Exercises (30%) |
| **Language teaching** | Greek |
| **Bibliography** | [1] D. Fakinos, *Waiting Tails*, Symmetry Publications, 2008.<br>[2] I. Tryfon, P. Daras, Th. *T.*, *P. T.*, *P. T.*, T. Sypsas, *Stochastic Analyses*, Ziti Publications, 2003.<br>[3] Chuchoulas, *Theory of Waiting*, Symmetry Publications, 2008.<br>[4] Kokolakis Spiliotis, *Probability Theory and Statistics with Applications*, Simeon Publications, 2010.<br>[5] L.Kleinrock, *Queuing systems; volume 1: theory*, J. Wiley & Sons, New York, 1975. |

## MOBILE AND SATELLITE COMMUNICATIONS

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| **Course unit code** | E48 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE328/ |
| **Teaching weekly hours** | 4 (Theory: 2 hours, Tutoring: 1 hour, Lab: 1 hour) |
| **Lecturer** | Al. Ap. Boulogeorgos (Assistant Professor) |

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| **Course content** | **Introduction**: Fundamentals of mobile and satellite communication systems.<br>**Mobile Communication Channels**:<br>• Channel models, including loss mechanisms and multiplexing techniques.<br>**Transmission and Reception Systems**:<br>• Differential transmission and reception.<br>• MIMO systems, CoMP, and multi-carrier techniques (OFDM, SC-FDMA, etc.).<br>• CDMA systems.<br>**Wireless Transponders**: Key principles and applications.<br>**Satellite Communication Channels**: Characteristics and performance analysis.<br>**Multiple Access Techniques in Satellite Systems**: Methods for efficient resource utilization. |
| **Expected learning outcomes**<br><br>**results and skills** | Understand propagation mechanisms in mobile and satellite communications using deterministic and stochastic models.<br><br>Familiarize with key performance metrics (SNR, SINR, BER, SER, outage probability, capacity) and their theoretical calculations.<br><br>Learn techniques to improve system performance, including adaptive modulation, MIMO, multi-carrier transmission, and transponders.<br><br>Gain knowledge of the main components of satellite communication systems. |
| **Prerequisite courses** | - |
| **Teaching methods** | Lectures, tutorial exercises, laboratory |
| **Evaluation** | • Written Work<br>• Written Examination with Problem Solving<br>• Laboratory Work |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] T. Rapaport, "Wireless Communications," Ed. Giourda<br>[2] W. Stalling, B. Cory, "Wireless Communications and Networks", A. Giola Publications & Sons S.A. |

[3] M. Genard, M. Bousquet, "Satellite Communications," Publications A. Giola & M. Moussa, M. Moussa, M. Moussa, M. B. B. Sons S.A.

## INFORMATION THEORY AND CODES

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| **Course unit code** | EYH2 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY113 |
| **Teaching weekly hours** | 4 |
| **Lecturer** | K. Chatzisavvas (Adjunct lecturer) |
| **Course content** | **Coding Principles and Applications**<br>• Prefix-free codes, source encoding, and optimal codes (e.g., Huffman coding).<br>**Information Theory**<br>• Information, entropy, and mutual information.<br>• Communication channel capacity and Shannon's first theorem.<br>**Data Compression**<br>• Compression techniques and algorithms.<br>• Numeric and lexicographical coding.<br>**Error Correction**<br>• Communication channels with noise, Hamming distance, and error-correcting codes. |

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| | • Noise coding theorems and Shannon's second theorem.<br>• Linear codes (Hamming, Bauer, Golay, MDS) and non-linear codes (Reed-Muller).<br>• Circular codes.<br><br>**Cryptography**<br>• Basic principles, popular encryption schemes, and public key cryptography (e.g., RSA).<br>• Introduction to quantum cryptography. |
| **Expected learning outcomes and skills** | **Knowledge**<br>• Understand core concepts such as **information**, **entropy**, communication systems, Shannon theorems, coding methodologies, data compression, error correction codes, and cryptography (including RSA encryption and public key schemes).<br>• Grasp advanced applications like **quantum cryptography**.<br>• Identify and describe coding and cryptography problems using **information theory**.<br>• Apply mathematical tools such as probability distributions, entropy, number theory, and finite fields.<br>**Skills**<br>• Explain and analyze concepts like **information entropy**, communication channel capacity, code size and rate, and error detection/correction limits.<br>• Generalize conclusions from problem-solving and communicate results effectively to non-specialist audiences.<br>**Competencies**<br>• Apply advanced methodologies involving probability, algebra, and number theory to solve problems in **information theory**, **coding**, and **cryptography**.<br>• Use software tools (e.g., R, Python) to simulate and solve complex problems.<br>• Adapt knowledge to interdisciplinary and unfamiliar environments, identifying innovative solutions and applications across different fields. |

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| **Prerequisite courses** | - |
| **Teaching methods** | Lectures, Laboratory exercises |
| **Evaluation** | Written assignments-exercises during the semester / Written examination |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Introduction to Information, Code and Information Theory Cryptography, 2015, N. Alexandris, V. N, (ISBN: 978-960-7996-39-8)<br>[2] Information Theory, 2011, David Luenberger (ISBN: 978-960-491-020-5)<br>An Introduction to Algebraic Code Theory, 2016, D. Varsos, (ISBN: 978-960-603-040-6) |

## NETWORK PROGRAMMING

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| **Course unit code** | ETH3 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY105/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | A. Michalas (Professor) |
| **Course content** | **Fundamental Tools**:<br>• Development tools for the World Wide Web.<br>• Asynchronous client-server model and application architectures (client-server, n-tier).<br>**Protocols and Architectures**:<br>• Middleware architectures and communication protocols.<br>**Markup and Programming Languages**:<br>• HTML, CSS, and programming languages (JavaScript, PHP, Java) for web application development.<br>**Database Interaction**:<br>• Methods for interfacing with databases (DB), XML, DTD, and DOM.<br>**Asynchronous Communication**: |

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| | • Server-client interaction using AJAX and JSON.<br>**Web Services and Frameworks**:<br>• Integration of web services and frameworks like Java/Spring Boot, PHP/Laravel, Java/Heroku, and PHP/Symfony.<br>**Version Control**:<br>• Introduction to versioning control systems and Git. |
| **Expected learning outcomes**<br>**results and skills** | Upon successful completion of the course, students will:<br>• Understand **internet protocols** (HTTP(S)/TCP/IP).<br>• Grasp the **three-tier application model** and its application in web development.<br>• Learn to deploy and run applications on the internet.<br>• Understand the structure, functionality, and implementation of **web servers**.<br>• Develop dynamic web applications using modern technologies and programming languages.<br>• Utilize **APIs** for communication between networked applications.<br>• Effectively search for and apply the latest **internet technologies**. |
| **Prerequisite courses** | |
| **Methods**<br>**teaching** | Lectures and workshop |
| **Evaluation** | 50% of the written theory exam. 20% from laboratory exercises, 30% from term paper. |
| **Language of instruction/Exams** | Greek |

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| **Bibliography** | [1] "Programming for the Web". Randy Connolly,Ricardo Hoar, Gourdas M. Publications, December 2015<br>[2] "Internet and World Wide Web Programming", Deitel Paul J., Deitel Harvey M., Eds. Gourdas M., 4th Edition, 2011<br>[3] "Internet Technologies : Principles of Operation and Programming on the Internet", Douligeris,_Mavropodi_Kopanaki, New Technologies Publications, December 2013.<br>[4] "Web Application Development with PHP and MySQL", Thomson Laura, Welling Luke, Gourdas M. Publications, 5th edition, 2017.<br>[5] "Learn PHP, MySQL and Apache All in One", Julie C. Meloni, Gourdas M. Publications, 5th Edition, April 2014 |

## BASIC PRINCIPLES OF THE INTERNET OF THINGS

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| **Course unit code** | ETH10 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY120/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | P. Sarigiannidis (Professor) |
| **Course content** | **Fundamentals of Wireless Sensor Networks (WSNs)**:<br>• Architecture, protocols, operating systems, and programming. |

**IoT Devices and Communication**:

- Device communication and data processing in IoT environments.

**Key IoT Protocols**:

- CoAP, MQTT, AMQP, and 6LoWPAN.

**Industrial IoT**:

- Industrial protocols, applications, and integrations.

**IoT and Cloud Integration**:

- Synergies between IoT infrastructures and cloud technologies.

**Security and Privacy**:

- Data security, infrastructure protection, and privacy challenges in IoT.

**IoT Applications**:

- Telemetry, quality of service, and energy consumption optimization.

**Expected learning outcomes**

**results and skills**

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

- Understand **wireless sensor network architectures** and protocols.
- Comprehend the **technological frameworks, components, applications,** and tools of the Internet of Things (IoT).
- Analyze, design, and implement **intelligent environments** for IoT applications.
- Manage information and data flows across various **structures, formats, and layers** in IoT systems.
- Recognize and interpret the role of IoT in **information and communication technologies (ICT)**.
- Implement and support mechanisms for **data security** and infrastructure protection in IoT systems.
- Apply and maintain **privacy mechanisms** in IoT environments.
- Transfer theoretical knowledge into practical skills through **laboratory demonstrations** and hands-on

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| | applications. |
| **Prerequisite courses** | - |
| **Teaching methods** | Lectures, Tutorial exercises, Laboratory |
| **Evaluation** | Final Written Examination (60%), Laboratory Exercises (30%), Presentation of Semester Work (10%), Oral Examination (20%) |
| **Language of instruction/Exams** | Greek, English |
| **Bibliography** | [1] O. Hersent, D. Boswarthick, & O. Elloumi, 'The internet of things: key applications and protocols.' J. Wiley & Sons, 2011. [2] F. Behmann, & K. Wu, 'Collaborative internet of things (C-IoT): For future smart connected life and business', Wiley,2015 |

# 8th SEMESTER – DIVISION OF TELECOMMUNICATIONS & NETWORKS

## MOBILE COMMUNICATION NETWORKS

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| **Course unit code** | Y5 |
| **Course unit type** | Compulsory / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE202/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | M. Louta (Professor) |
| **Course content** | **Basic Principles**: Fundamentals of mobile communication systems.<br>**Propagation and Interference**: Understanding signal behavior and interference in mobile networks.<br>**Cellular System Architecture**: Overview of system architecture in 2G, 2.5G, 3G, and 4G technologies.<br>**Functionalities and Operations**: Key operations and functionalities of mobile communication systems.<br>**System Design**: Principles of designing mobile communication systems.<br>**Resource Allocation**: Strategies for efficient resource distribution.<br>**Radio-Channel Management**: Techniques for managing radio channels.<br>**Mobility Management**: Processes for ensuring seamless |

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| | connectivity during user movement.<br>**Handover Techniques**: Methods for transitioning between cells.<br>**Signaling Systems**: Protocols for communication and coordination within networks. |
| **Expected learning outcomes results and skills** | Upon successful completion of the course, students will be able to:<br>• Understand the **fundamental principles** of cellular mobile communication systems.<br>• Comprehend the **architecture** of cellular networks.<br>• Analyze **telecommunication traffic** in mobile systems, including service levels.<br>• Address issues related to **signal propagation** and **interference**.<br>• Understand and evaluate **mobility support procedures**.<br>• Learn about **forwarding architectures**, procedures, and algorithms.<br>• Identify key features of **1G to 5G and beyond** mobile communication systems. |
| **Prerequisite courses** | None |
| **Teaching methods** | The course is taught through lectures with<br>discussion and active participation of students. The lectures are supported by power point presentations, which are available to students through the platform asynchronous tele-education. The training of students combines additional thematic examples and comprehensive exercises |
| **Evaluation** | The course is assessed by written examinations in the middle and at the end of the semester, which include development questions, multiple choice questions and exercises covering the course material (30% and 70%, respectively). In addition, students turn in a series of assignments during the semester. |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Louvros Spyridon, *The LTE Network*, New Technologies Publications, Version: 1/2014.<br>[2] Stallings W. - Beard C., *Wireless Communications, Networks and Systems*, A. JIOLA PUBLISHINGS, |

Edition: 1/2016.
[3] M. Theologou, *Mobile and Personal Communications Networks*, 2nd Edition, 2010, Tziola Publications.
[4] W. Stallings, *Wireless Communications and Networks*, 1st Edition, 2007. Giola Publications.

## Optical Communications and Networks

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| **Course unit code** | Y6 |
| **Course unit type** | Compulsory / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE199/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | Al. Ap. Boulogeorgos (Assistant Professor) |
| **Course content** | **Wave Guidance and Optical Fibres**: Attenuation, dispersion, and nonlinear phenomena.<br>**Optical Signal Generation and Reception**: Transmitters, receivers, and amplifiers.<br>**Optical Networks**:<br>• Wavelength Division Multiplexing (WDM), switching, and routing in access and trunk networks.<br>• Optical burst and ripple switching.<br>• Modern and broadband optical networks (Passive Optical Networks, Hybrid Wireless-Optical Networks).<br>**Wireless Optical Communications**: Integration of wireless |

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| | and optical communication systems. |
| **Expected learning outcomes**<br><br>**results and skills** | Upon successful completion of the course, students will be able to:<br><br>• Understand **wave guidance** principles.<br>• Comprehend optical technology and the key characteristics of **optical fibres**.<br>• Explain and analyze the phenomena of **attenuation** and **scattering** in optical fibres.<br>• Understand the operational principles of optical devices, including **transmitters**, **receivers**, and **amplifiers**.<br>• Gain knowledge of **modern optical networks** and their architecture.<br>• Learn and apply the principles of **optical burst switching** and **passive optical networks**, including problem-solving.<br>• Simulate next-generation optical networks using specialized tools. |
| **Prerequisite courses** | None |
| **Teaching methods** | Lectures, Tutorial Exercises, Semester Work |
| **Evaluation** | Final Written Examination (60%), Semester Paper (40%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Green Paul, *Fiber Optic Networks*, 978-960-7510-00-6, A. Papasotiriou Publications, & CO., 1994.<br>[2] G. I. Papadimitriou, et al., *WDM Optical Networks: local and metropolitan area networks*, 960-209-871-6, Keydarithmos<br>[3] G. Agrawal, *Optical Fibre Communication Systems*,<br>Giola Publications, 2011. |

[4] N. Uzounoglou, *Optical Fibre Telecommunications*, Simeon Publications, 1999.

[5] B. Mukherjee, *Optical WDM Networks (Optical Networks)*, Springer, 2006.

[6] E. Kriezis, "Optical Communications", 2024, Tziolas Publications, with code EYDOXOU: 122086587

## COMPUTER AND NETWORK SECURITY

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| **Course unit code** | Y11 |
| **Course unit type** | Compulsory / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE198/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | P. Sarigiannidis (Professor) |
| **Course content** | Security background, threat analysis, and vulnerability points are introduced alongside techniques in cryptography, including symmetrical and asymmetrical cryptography, authentication, and digital signatures. The course covers security-providing protocols such as IPSec, SSL, SSH, PGP, MIME, and SET. TCP/IP security, port scanning, network security, and information system security are also discussed, with a focus on database security, firewalls, sniffing tools, and defense tools. Intrusion Detection Systems (IDSs), OpenSSL, certificates, signatures, security framework institutions, security standards, security policies, and legal |

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| | issues are included, providing a comprehensive understanding of cybersecurity principles and practices. |
| **Expected learning outcomes**<br><br>**results and skills** | Upon successful completion of the course, students will:<br>**Knowledge**<br>• Demonstrate a solid understanding of **systems, network security**, and privacy principles.<br>• Identify and address **data protection** issues in systems, networks, and databases, resolving challenges related to secrecy, digital privacy, digital signatures, and integrity assurance.<br>• Apply cryptographic techniques to simple and complex problems using concepts from cryptography and number theory.<br>**Skills**<br>• Understand and analyze the complexities of **public and private key encryption**, authentication, and digital signatures, including cryptographic tools like Hash and MAC.<br>• Design and solve security challenges in **communication systems** and networks using tools like logging systems, security frameworks, threat detection, and proxy services.<br>• Interpret and communicate results and conclusions effectively to both specialist and non-specialist audiences.<br>**Competencies**<br>• Manage complex security and privacy projects in diverse work environments, ensuring compliance with legal frameworks like **GDPR**.<br>• Assess and develop effective strategies for **security planning** and **professional team management**.<br>• Apply problem-solving skills and tools to address challenges in new interdisciplinary contexts, leveraging research and collaboration for security and privacy solutions. |

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| **Prerequisite courses** | None |
| **Teaching methods** | Lectures, Laboratory, semester assignment |
| **Evaluation** | Final Written Examination (60%), Laboratory Exercises (30%), Presentation of Semester assignment (10%), Oral Examination (20%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Stefanos Gritzalis, Dimitris A. Gritzalis, Socrates Socrates Katsikas, *Computer Network Security*, Papasotiriou, 2003.<br>[2] William Stallings, *Network Security Fundamentals: Applications and Standards*, Keydarithmos Publications, 2008.<br>[3] William Stallings, *Cryptography for Network Security*, Principles and Applications, Maria Parikou & CO., 2011. |

## Wireless Sensor Networks

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| **Course unit code** | E14 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | http://wsnlab.icte.uowm.gr/ <br> http://eclass.uowm.gr/courses/ICTE165/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | P. Aggelidis(Professor) |
| **Course content** | This course explores recent advancements in **wireless sensor networks (WSNs)**, focusing on their architecture, protocols, and implementation scenarios. <br> **Topics Covered** <br> • **Introduction to WSNs**: Applications, characteristics, and limitations. <br> • **Self-Organization and Routing**: Approaches and challenges. <br> • **Programming and Middleware**: Key issues and an overview of operating systems for WSNs. <br> • **Applications**: Environmental telemetry and wireless health sensor networks, addressing quality and consumption concerns. <br> **Laboratory Component** <br> The course emphasizes practical learning through a series of tasks leading to the development of a comprehensive **six-month project** using Micaz (TinyOS) nodes. |
| **Expected learning outcomes** | Upon successful completion of the course, students will be able to: |

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| **results and skills** | • Understand key concepts including **wireless sensor networks**, sensor nodes, gateways, routing, and security.<br>• Utilize laboratory equipment effectively.<br>• Develop experimental **sensor networks** based on layered protocols.<br>• Create and implement **algorithmic software** for sensor networks.<br>• Design and build **electronic circuits**.<br>• Develop applications for **precision agriculture**, monitoring quality of life and health parameters, and environmental interventions.<br>• Analyze and solve problems through laboratory experiments and scenario-based exercises.<br>• Program **sensor nodes** for various applications.<br>• Understand the roles and responsibilities of participants in **Distributed Processing Architectures (DPAs)**. |
| **Prerequisite courses** | None |
| **Teaching methods** | Lectures and workshop |
| **Evaluation** | 30% from written lab theory exam 70% from term paper |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Gardner Julian W., *Microsensors*, Ed. A. Giola & Sons<br>Measurement Technology - Sensors, Gasteratos, Mouroutsos, Andreadis |

## Biomedical Technology

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| **Course unit code** | E15 |
| **Course unit type** | Elective / Specialization |

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| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | [http://eclass.uowm.gr/courses/ICTE149/](http://eclass.uowm.gr/courses/ICTE149/) |
| **Teaching weekly hours** | 4 (Theory: 2 hours, Laboratory: 2 hours) |
| **Lecturer** | P. Aggelidis(Professor) |
| **Course content** | Biomedical Technology and Biomedical Engineering, present and future. Cellular Engineering-Bioelectronics: The cell, biological macromolecules. Membranes, Structure<br>membranes. Electrical membrane potentials. Non-equilibrium potentials. Diffusion, Nerst - Plank equations. Mosaic membrane. Neurons, Neuronal anatomy, Dynamics (Bias and Active). Digital Processing of Biological Signals: methods and techniques for processing signals from biological systems, signals and systems, design and implementation of digital filters, applications. Physiology of the Heart and Electrocardiogram (ECG): the myocardium, rhythmic stimulation of the heart, the normal cardiogram, cardiac arrhythmias and their electrocardiographic interpretation, the electronic equipment needed to record the heart signal. Measurement of blood pressure: arterial, pulmonary and venous blood pressure, systolic and diastolic pressure, blood pressure waveforms, propagation and reflection, ways of measuring blood pressure.<br>pressure measurement, direct way, indirect way.<br>Brain Physiology and Electroencephalogram (EEG): |

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| | elements of brain neurophysiology, function of the EEG, characteristics of the EEG and electroencephalogram research, experiential dynamics of<br>brain, EEG processing and extraction of information on intracranial function. Electromyography: structure<br><br>skeletal muscle, nerve impulse, electromyography (EMG), EMG with electrical stimulation, EMG applications<br>Introduction to Medical Imaging Systems. Reconstruction Methods<br><br>Medical Image. Computed tomography. Nuclear Medicine and SPECT: Nuclear Magnetic Resonance Imaging Methods. |
| **Expected learning outcomes**<br><br>**results and skills** | The course aims to introduce students to the evolving field of biomedical technology, which applies scientific and technological principles to address challenges and provide solutions in the critical healthcare sector.<br><br>Given its interdisciplinary nature, the course exposes students to various scientific domains, including the production and analysis of biosignals and the use of specialized instruments for their study and evaluation. This foundation prepares students to engage with biomedical technology's diverse applications and advancements. |
| **Prerequisite courses** | None |
| **Teaching methods** | Lectures and laboratory exercises |
| **Evaluation** | 50% of the written theory exam.<br>50% by practical lab exam. |
| **Language of instruction/Exams** | Greek, English |
| **Bibliography** | [1] Pantelis Angelidis, *Medical Informatics Volume A*, "wisdom," 2011. |

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| | [2] Koutsouris D., Nikita K., Pavlopoulos Sotiris A., *Medical imaging systems*, A. Tziolas & YIOI, 2005.<br>[3] Sergiadis George D., *Biomedical Technology*, University Studio Press, 2009.<br>[4] Koutsouris D., Pavlopoulos S., Prentza A., Introduction to biomedical technology and analysis of medical marks, Publications A. Giolas & Sons, 2003. |

## OPTICS

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| **Course unit code** | E49 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **Credit units ECTS** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE329/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | (Adjunct Lecturer) |
| **Course content** | Geometrical Optics: Approximation, laws, ray tracing, Huygens principle, Fermat principle, and optical path length.<br>Gaussian Optics: Ray tracing, optical systems, transition matrices, mirrors, lenses, and applications.<br>Apertures: Entrance apertures, irises, field apertures, optical field, focal depth, and field depth.<br>Aberrations: Types of aberrations (monochromatic: spherical, coma, astigmatism, curvature, distortion; chromatic).<br>Light Interference: Two-wave interference, |

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| | coherence, fringes, point source interference, Young's experiment.<br>Interferometry: Principles and operation of Michelson, Mach-Zehnder, and Fabry-Perot interferometers; resolution and spectral range.<br>Scalar Diffraction Theory: Light propagation, Green's function, Kirchhoff's boundary conditions, Fresnel, and Fraunhofer diffraction.<br>Fourier Optics: Spatial frequency domain propagation, angular spectrum, frequency filters, transmittance function, and elementary optical processes.<br>Optical Processing: Reflection, refraction, thin lenses, image formation, and systems with coherent/incoherent light.<br>Holography: Hologram construction, reconstruction, types, and applications. |
| **Expected learning outcomes**<br>**results and skills** | This course provides a foundational introduction to **classical optics** and its applications, focusing on the fundamental principles and quantities used in optics and their relationship to other areas of electrical engineering. Students will gain knowledge of optical devices, their operation, and practical applications while developing analytical and synthetic thinking skills.<br>The course also prepares students for advanced topics in **photonics technology** and **optical communications** and introduces them to classical and contemporary optical applications.<br>**Learning Outcomes**<br>Upon successful completion of the course, students will:<br>• Understand the **basic principles** of optical wave propagation.<br>• Recognize and analyze the operation of **optical devices**.<br>• Design simple optical devices for classical applications and gain introductory knowledge of methodologies for complex device design. |

- Be familiar with a broad range of **classical and modern optical applications**.

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| **Prerequisite courses** | Knowledge from the course "Electromagnetic Waves" is required |
| **Teaching methods** | Lectures, tutorial exercises, demonstration of simulated optics devices, individual work |
| **Evaluation** | A final written examination. The optional individual course assignments contribute to the final grade. |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Hecht Eugene Hecht, Optics, C. DARDANOS - K. DARDANOS Ltd., 1st Edition/2018 (ed. Vess Sotiris).<br>[2 ]Giorgos Asimellis, Yannis Vamvakas, Panos Drakopoulos, Geometric Optics, 'Edition 1/2012. |

## TELETRAFIC THEORY

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| **Course unit code** | E37 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE301/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | (Adjunct Lecturer) |
| **Course content** | This course introduces communication systems analysis as a |

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| | key tool for evaluating performance and determining the dimensions of communication networks.<br>Students will learn analytical methods to calculate critical performance metrics such as blocking probability and capacity utilization, which define communication quality. These methods include:<br>• Markovian and Birth-Death processes<br>• Erlang and Engset models<br>• Kaufman-Roberts recursion<br>• Equivalent random theory<br>• Alternative routing modeling<br>• Reduced load approximation<br>Additionally, simulation techniques will be covered to assess network performance effectively. |
| **Expected learning outcomes**<br>**results and skills** | • **Communication Networks**: Analysis, performance evaluation, and optimization.<br>• **Statistical and Analytical Methods**: Application of probability, stochastic processes, and analytical techniques to assess network performance.<br>• **Simulation**: Use of simulation tools for network analysis.<br>**Competencies**<br>• Data analysis and synthesis with advanced technologies.<br>• Decision-making and independent work. |
| **Prerequisite courses** | Knowledge of probability theory is required to understand the course, while basic knowledge of telecommunication systems will help to easily understand the concepts of the course. |
| **Teaching methods** | Lectures and tutorial exercises |
| **Evaluation** | Assignments (30%), Final Examination (70%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Telecommunication Motion Theory and Applications, Logothetis Michael D., ISBN: 978-960-491-034-2<br>[2] Billys Euripides, *Telecommunication Systems*, S. ATHANASOPOULOS, Edition: 1/2012. |

## Cloud Computing

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| **Course unit code** | E39 |
| **Course unit type** | Compulsory/ Specialization |
| **Level course** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE297/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | A. Michalas (Professor) |
| **Course content** | **Distributed Systems Management**: Principles and techniques for managing shared distributed systems and cloud environments.<br>**Performance Measurement**: Methods for evaluating performance in distributed and cloud systems.<br>**Service-Oriented Applications and Infrastructure**: Implementation, quality of service, workflow, and monitoring.<br>**Forecasting and Modeling**: Techniques for execution design and service-oriented application modeling in distributed infrastructures.<br>**Resource Allocation**: Assigning and managing resources for applications in distributed systems.<br>**Cloud Integration**: Using, managing, comparing, and selecting multiple cloud platforms.<br>**Systems Mediation**: Coordinating and integrating systems across distributed environments. |

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| **Expected learning outcomes results and skills** | The course focuses on understanding the fundamental concepts and principles of **Cloud Computing**, enabling students to address technological challenges, analyze performance, manage, optimize, and design modern distributed systems.<br><br>Upon successful completion of the course, students will gain knowledge and understanding of:<br>• **Distributed Systems Management**: Core principles and techniques.<br>• **Cloud Computing Technologies and Models**: Architecture and functionality.<br>• **Cloud Computing Features**: Key characteristics and benefits.<br>• **Performance Measurement**: Evaluating shared distributed systems and cloud computing performance.<br>• **Service-Oriented Implementations**: Applications and infrastructure in distributed systems.<br>• **Workflow and Monitoring**: Techniques for distributed application management.<br>• **Load Forecasting in Cloud Systems**: Methods for system resource planning and optimization. |
| **Prerequisite courses** | None |
| **Teaching methods** | Lectures, Classroom Exercises and Laboratory |
| **Evaluation** | ● Written assignments (group and individual)<br>● Written Examination with Problem Solving<br>Laboratory Work |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Cloud computing: principles, technology architecture. Thomas Erl, 2015<br>[2] Cloud computing: a practical approach, A. T. Velte, T. J. Velte, R. Elsenpeter, 2010 |

## PHOTONICS - OPTICAL DEVICES

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| **Course unit code** | E46 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | http://eclass.uowm.gr/courses/ICTE320/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | (Adjunct lecturer lecturer) |
| **Course content** | • **Waveguide Components**: Optical fibres, integrated waveguides, and coupling mechanisms (directional couplers, tapers, Bragg gratings).<br>• **Optical Communication Mechanisms**: Attenuation, dispersion, and nonlinearity.<br>• **Passive and Tunable Components**: Mirrors, isolators, circulators, modulators, resonators, filters, switches, multiplexers, and AWGs.<br>• **Active Devices**: LASER diodes, LEDs, photodetectors, receiver noise, and amplifiers (erbium fibre and semiconductor).<br>• **Advanced Photonics**: Photonic integrated circuits and current research areas.<br>**Laboratory and Tools**<br>• **Hands-On Demonstration**: Training kit for optical communication systems (laser source, modulator, fibre, photodiode receiver).<br>• **Software Design**: ANSYS/Lumerical for CAE-based |

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| | analysis and design of photonic circuits. |
| **Expected learning outcomes results and skills** | Upon successful completion of the course, students will:<br>• Understand the fundamental concepts of **wave guidance** in optical systems.<br>• Analyze **complex photonic/optical devices** by breaking them into individual components.<br>• Design simple photonic components for **telecommunication applications**.<br>• Gain basic familiarity with **advanced device design methodologies**.<br>• Acquire foundational knowledge of **photonic and optical component manufacturing technologies** and their associated challenges.<br>• Identify key photonic components and their roles in **optical communication systems**.<br>Effectively explain the relationship between these technologies and their **human, societal, and economic impacts**, including their benefits and potential risks, to non-experts. |
| **Prerequisite courses** | Knowledge of the courses is required:<br>- Electromagnetic Waves |
| **Teaching methods** | Lectures and tutorial exercises. Demonstration of simulation software and simple scientific programming applications. Demonstration of a laboratory/educational fibre optic telecommunication system. |
| **Evaluation** | **Final Exam**: The final score is based on written exams assessing fundamental understanding and judgment (theory) as well as the ability to solve basic exercises or problems (analysis or design). Students can select questions from a broad set.<br>**Homework Projects**: Students may improve their final grade through optional projects, provided their combined score from exams and labs exceeds 5. Projects are only available during the teaching semester (spring). |

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| **Language of instruction/Exams** | Greek, English |
| **Bibliography** | [1] Optoelectronics, Alexandris A.<br>[2] Applied Optics, 3rd Edition, Zevgolis D.<br>[3] OPTICS AND LASER, M. Young<br>[4] Optoelectronics, New Improved, Singh Jasprit<br>[5] Optical Fibre Communication Systems, Agrawal G. P. |

## BIG DATA AND COGNITIVE INTERNET OF THINGS APPLICATIONS

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| **Course unit code** | ETH11 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY124/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | P. Sarigiannidis (Professor), P. Aggelidis(Professor) |
| **Course content** | This course covers cutting-edge topics in IoT, including **mobile and distributed computing systems**, architecture design, and integration with **cloud computing**.<br>Key areas include:<br>• **Big Data and IoT**: Data collection, processing, storage, interoperability, and analysis. |

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| | • **Machine Learning Applications**: Data management and analytics for IoT systems.<br>• **Security and Privacy**: Advanced topics in encryption, authentication, and security certificates.<br>• **Standards and Protocols**: Modern trends and synergies with wired and **5G networks**.<br>• **Case Studies**: Intelligent applications in **smart agriculture**, **smart cities**, **smart grids**, **smart homes**, and **healthcare services**. |
| **Expected learning outcomes results and skills** | Big Data in IoT: Understand and apply Big Data concepts within the Internet of Things.<br>Machine Learning in IoT: Explore applications of machine learning in IoT systems.<br>Distributed Computing in IoT: Comprehend and differentiate distributed computing systems within IoT architectures.<br>IoT Security: Design and implement integrated security solutions for IoT environments.<br>Intelligent Environments: Develop and support smart environments for various IoT implementation scenarios.<br>Energy and Performance Modeling: Assess energy consumption and model modern IoT applications.<br>Strategic Assessment: Evaluate the strategic impact and potential of advanced IoT applications. |
| **Prerequisite courses** | - |
| **Teaching methods** | Lectures, Laboratory, Exercises, Semester Work |
| **Evaluation** | Final Written Examination (60%), Laboratory Exercises (30%), Presentation of Semester Work (10%),<br>Oral Examination (20%) |
| **Language of instruction/Exams** | English |

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| **Bibliography** | [1] G. Hwaiyu, G., & J. McKeeth, 'Internet of things and data an-alytics handbook', Wiley Online Library, 2016.<br>[2] I. P. Žarko, A. Broering, S. Soursos, & M. Serrano, 'Interoperability and open-source solutions for the Internet of Things, 2015, Springer International Publishing. |

## 9th SEMESTER – DIVISION OF TELECOMMUNICATIONS & NETWORKS

### MICROWAVE COMMUNICATIONS

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| **Course unit code** | Y8 |
| **Course unit type** | Compulsory / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE213/ |
| **Teaching weekly hours** | 4 (Theory: 2 hours, Tutoring: 1 hour, Lab: 1 hour) |
| **Lecturer** | N. Nai (Adjunct lecturer) |
| **Course content** | **Transmission Line Principles**:<br>• **Electromagnetic Analysis**: Field equations and their relation to transmission lines.<br>• **Circuit Analysis**: Transmission line circuit analogs.<br>• **Characteristics**: Propagation constant, characteristic impedance, phase/group velocity.<br>• **Propagation Modes**: TEM, near TEM, TE, TM, and hybrid.<br>• **Examples**: Coaxial cables, waveguides, and planar |

transmission lines.

**Transmission Line Analysis**:

- **Key Elements**: Input impedance, reflection coefficient, standing wave ratio (SWR).
- **Matching**: Techniques and matching elements like taps.
- **Smith Chart**: Calculations for reflection coefficient, impedance, and SWR; device design applications.

**Waveguides**:

- **Types**: Rectangular, cylindrical, dielectric, and plasmonic.
- **Key Features**: Propagation rates, cutoff frequency, dispersion, impedance, and losses.

**Planar Transmission Lines**:

- **Microwave Circuits**: Advantages of planar circuits at microwave frequencies.
- **Line Types**:
    - **Stripline and Microstrip**: Characterization, dispersion, and losses.
    - **Alternatives**: Notch lines and coplanar waveguides.

**Transmission Line Parameters**:

- **Circuit Descriptions**: Scattering parameters, ABCD matrices, and their relationships.
- **Multi-Port Circuits**: Design and analysis of dividers and directional couplers.

**Expected learning outcomes**

**results and skills**

This course introduces **transmission lines**, **waveguides**, and **microwave networks**, focusing on analysis, design, and practical applications.

**Objectives**

1. Understand and analyze transmission line characteristics, waveguide devices, and matching techniques, including effective use of the **Smith chart**.
2. Design and analyze microwave networks and circuits using **Smith chart** and computational tools.
3. Gain hands-on experience with real microwave devices

through laboratory exercises.

**Learning Outcomes**

After completing the course, students will:

- Understand and calculate key parameters of transmission lines and waveguides.
- Categorize and study planar transmission lines.
- Utilize the **Smith chart** to extract design information.
- Apply adjustment methods specific to various applications.
- Analyze the response of microwave networks.
- Identify and measure real microwave components.
- Design simple wave-guiding devices.

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| **Prerequisite courses** | None |
| **Teaching methods** | Lectures, tutorials, workshops |
| **Evaluation** | A final written examination (80%) and the laboratory grade (20%). The optional individual coursework assignments contribute to the final grade. |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Gioultsi Traianos, Kriezis Emmanuel, Microwaves, A. TZIOLA & YIOI S.A., 1st Edition/2016.<br>[2] Collin Robert E., Microwaves, Ed. A. Giola & Sons, 2005.<br>[3] Pozar David M., Microwave technology, Stella Parikou & CO., 2004.<br>[4] Ouzounoglou Nikolaos K., Introduction to Microwaves, A. PAPASOTIRIOU & CO., 1999. |

## DESIGN AND ANALYSIS OF COMPUTER NETWORKS

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| **Course unit code** | YH2 |
| **Course unit type** | Compulsory / Specialization |

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| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE390/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | B. Lazaridis (Lecturer) |
| **Course content** | The course covers the design and features of transmission control protocols at the transport, session, presentation, and application levels, as defined by the OSI model. Topics include Wide Area Networks (WANs), Quality of Service (IntServ, DiffServ), and the TCP and UDP protocols. Students will explore sockets, connection management, flow control, and application-level protocols such as email, FTP, DNS, peer-to-peer networks, content delivery networks, and the World Wide Web. Practical skills are developed using simulation tools like OPNET and NS-2, enabling students to analyze and design network performance and behavior effectively. |
| **Expected learning outcomes**<br><br>**results and skills** | Upon successful completion of the course, students will:<br>• Gain a solid understanding of **modern techniques, protocols, and applications** in computer networks.<br>• Develop skills to **research, analyze, and document** key requirements for building efficient and reliable networks.<br>• Adapt their knowledge to **emerging technologies**, including MPLS networks, cloud computing, IPv6, the Internet of Things (IoT), and other modern Internet technologies, by understanding the underlying principles. |
| **Prerequisite courses** | None |

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| **Teaching methods** | Lectures, laboratory exercises. |
| **Evaluation** | Written Examination (70%)<br>Laboratory examination (30%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Andrew S. Tanenbaum, *Computer Networks*, 4th edition, Keydarithm Publishing.<br>[2] William Stallings, *Computer and Data Communications*, 6th edition, Giola Publications.<br>[3] Douglas Comer, *Networks and Computer Networks*, 4th edition, Keydarithm Publishing.<br>[4] Douglas Comer, *TCP/IP Networks (Volume A)*, 4th edition, Keydarithm Publishing.<br>[5] Jean Walrand, Communication Networks, Papasotiriou Publications |

## MANAGEMENT AND OPTIMISATION OF COMMUNICATION NETWORKS

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| **Course unit code** | E35 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE292/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | A. Michalas (Professor) |

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| **Course content** | The course has a dual objective: it first emphasizes techniques for managing and evaluating communication networks, focusing on methods and models for monitoring and optimizing network performance. It then delves into the theory of telecommunication network optimization, introducing methods and algorithms that address network constraints and meet the requirements of supported services. |
| **Expected learning outcomes results and skills** | The learning outcomes of the course are related to:<br>• Gain knowledge of fault management, performance monitoring, security, and configuration in telecommunication networks.<br>• Learn techniques for the management and evaluation of communication networks.<br>• Understand management methodologies through the study of network performance monitoring models and methods.<br>• Acquire and evaluate knowledge of network monitoring and management protocols.<br>• Understand graph theory and its application in solving optimization problems.<br>• Analyze and solve fundamental telecommunication network problems, such as minimum path, maximum flow, and minimum cost.<br>• Develop expertise in optimization methods, including the analysis and resolution of non-linear optimization problems in telecommunication networks. |
| **Prerequisite courses** | Telecommunication Networks and Computer Networks I |
| **Teaching methods** | Lectures, practical exercises and work. |
| **Evaluation** | 30% from the written theory exam. 30% from practical exercises.<br>40% from semester work. |
| **Language of instruction/Exams** | Greek, English |

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| **Bibliography** | [1] "Computer Networking Top-Down Approach with an Internet Focus" ,J. Kurose and K. Ross, M. Gourdas Publications, 7th edition, March 2018.<br>[2] "Computer Networks and Interconnections", Douglas E. Comer,<br>Sixth American edition, Keydarithmos Publications, 2014<br>[3] Computer Networks - a systems perspective approach", L.L. Peterson & B.S. Davie, 4th American edition, Keydarithm Publishing, 2009.<br>[4] Spyros D. Arsenis, Network Design and Implementation, Keydarithmos Publications, December 2008.<br>[5] Dimitri P. Bertsekas, Network Optimization: Continuous and Discrete Models, Athena Scientific, 1998. |

## NEW GENERATION NETWORKS AND SERVICES

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| **Course unit code** | E3 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **ECTS credits** | 5 |
| **Website** | http://eclass.uowm.gr/courses/ICTE173/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | M. Louta (Professor) |

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| **Course content** | The course covers the principles and challenges of **new-generation networks and services**, including architectural frameworks, protocols, and standards. Topics include modern heterogeneous networks, such as xDSL, FTTx, WiMAX, LTE, LTE-Advanced, small cell networks, ad-hoc networks, wireless sensor networks, and B3G/4G/5G technologies, with a focus on user mobility management and optimal connectivity. It explores platforms for service provisioning (IN, DPE, TINA, Parlay OSA, CAMEL, IMS, SIP) and technologies for network and service management. Emerging trends are addressed, including context-aware networks, autonomous and cognitive systems, collaborative and overlay networks, peer-to-peer networking, the Internet of Things (IoT), and future internet technologies. Additional topics include dynamic service definition, personalization, and ubiquitous services. |
| **Expected learning outcomes**<br><br>**results and skills** | **Course Objectives**<br><br>The course aims to deepen students' understanding of current and emerging technologies in **next-generation networks and services**. It explores a wide range of cutting-edge topics relevant to the international research community, fostering both research activity and active student participation in the educational process.<br><br>**Learning Outcomes**<br><br>Upon successful completion of the course, students will be able to:<br><br>• Explain, assess, classify, and evaluate technologies and methods for the **design, development, and management** of next-generation networks and services.<br>• Identify, analyze, and address challenges related to the **design, deployment, and management** of these networks.<br>• Synthesize and evaluate potential **solutions and directions** for addressing identified challenges in next-generation networks and services. |

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| **Prerequisite courses** | None |
| **Teaching methods** | The course is delivered through **lectures** that encourage discussion and active student participation. Teaching methods combine traditional lectures, presentations of **scientific articles** from the international research community, student presentations during the semester, and engagement with lecture notes and bibliography. A key component is a **semester-long individual project**, where students select a topic, develop their work, and present it at the end of the semester. Lectures are supported by **PowerPoint presentations**, accessible via the asynchronous e-learning platform, ensuring a comprehensive and interactive learning experience. |
| **Evaluation** | The assessment of students combines the final written examination (30%), oral presentations of scientific articles from the international literature during the semester (30%), as well as the semester project (deliverable text and presentation at the end of the semester) (40%). |
| **Language of instruction/Exams** | Greek, English |
| **Bibliography** | [1] X. Vassilopoulos, et al., *New Generation Access Networks*, Keydarithmos Publications, 2010.<br>[2] A. Jeffrey, G. Ghosh, A. Muhamed, K. Tsoukatos, *WiMAX Fundamentals*, Papasotiriou Publications, 2010.<br>[3] J. L. Salina, P. Salina, *Next Generation Networks: Perspectives and Potentials*, John Wiley & Sons, 2007.<br>[4] *Towards 4G Technologies: Services with Initiative*, Edited by H. Berndt, John Wiley & Sons, 2008.<br>*Next Generation Telecommunications Networks, Services, and Management*, Ed. by T. Plevyak, Veli Sahin, IEEE Press, |

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| | 2010. |

## Mobile Computing

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| **Course unit code** | E24 |
| **Course unit type** | Elective |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE238/ |
| **Teaching weekly hours** | 4 |
| **Teacher** | C. Stergiou (Adjunct lecturer) |
| **Course content** | The course **"Mobile Computing"** aims to equip students with comprehensive knowledge of mobile computing, focusing on:<br>a) **Protocols** for mobile networks (communication, routing, clustering),<br>b) **Data management and storage** methods in mobile networks,<br>c) **Mobile operating systems**,<br>d) **Mobile network services** relevant to mobile computing (e.g., location-based services, IoT),<br>e) **Design methods** for mobile computing applications,<br>f) **Mobile device programming**, and<br>g) The **design and development** of applications on the **Android platform**. |

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| **Expected learning outcomes**<br><br>**results and skills** | Upon successful completion of the course, students will:<br>● Understand the basic principles of mobile computing<br>● Have knowledge about communication protocols, clustering, routing in mobile networks<br>● Understand issues related to management data such as caching and data consistency in mobile networks<br>● Have knowledge about the operating systems and platforms of mobile devices<br>● Understand mobile computing services, systems and location services<br>● Understand the design principles of mobile computing applications<br>● Have knowledge about the programming of mobile devices<br>Have knowledge about implementing applications on the Android platform |
| **Prerequisite courses** | None |
| **Teaching methods** | Lectures, Laboratory, Assignments |
| **Evaluation** | Written Examination (70%), Laboratory exercises (30%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Theologou M., *Mobile and personal communications networks*, A. TZIOLA & YIOI S.A., 2nd ed./2010.<br>[2] Damianos Gavalas, Vlasis Kasapakis, Thomas Hatzidimitris, *Mobile Technologies*, NEON TECHNOLOGIES, 1/2015.<br>[3] Stallings W. - Beard C., *Wireless Communications, Networks and Systems*, A. JIOLA PUBLISHINGS, Edition: 1/2016.<br>Laura Thomson, Shane Conder, *App Development with Android*, X. GIOURDA, 2nd ed./2011. |

## REMOTE SENSING

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| **Course unit code** | E42 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **ECTS credits** | 5 |
| **Website** | http://eclass.uowm.gr/courses/ICTE310/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | (Adjunct Lecturer) |
| **Course content** | The course explores the principles, methods, and applications of **geometric and radiometric measurements** and **satellite remote sensing**, emphasizing data analysis and classification techniques. Key topics include:<br>1. **Foundations of Remote Sensing**: History, electromagnetic spectrum, satellite imagery structure, and radiometric capacities.<br>2. **Aerial Photography**: Photographic cameras, photogrammetry, orthophoto creation, and sources in Greece.<br>3. **Sensors and Satellites**: Passive/active sensors, spatial resolutions, and satellite systems (e.g., Landsat, SPOT, IKONOS).<br>4. **Preprocessing Satellite Data**: Geometric corrections, coordinate systems, and GPS-based positioning.<br>5. **Radiometric and Atmospheric Corrections**: Addressing radiometric errors and atmospheric distortions. |

6. **Image Histograms**: Histogram analysis, enhancement, and matching techniques.
7. **Multispectral Transformations**: Principal component analysis and Kauth-Thomas transformations.
8. **Spatial Enhancements**: Filters for statistical, edge, directional, and textural optimization.
9. **Image Fusion**: Spatial resolution merging, e.g., Pan sharpening.
10. **Spectral Signatures**: Analysis and interpretation of spectral signatures for land cover.
11. **Classification Techniques**: Supervised, unsupervised, and AI-based methods, including neural and object-oriented classifications.
12. **Accuracy Evaluation**: Sampling strategies, accuracy tables, and evaluation methods.
13. **Emerging Trends**: Advanced sensors, UAVs, and cutting-edge applications in remote sensing.

**Expected learning outcomes**

**results and skills**

Remote sensing is a multidisciplinary scientific field that combines **theoretical knowledge** with **practical laboratory work**, focusing on the **processing of multispectral satellite images** using specialized software. The course aims to provide students with a comprehensive understanding of multispectral satellite imagery and its applications.

Upon completion, students will:

- Understand the **structure and methodology** of multispectral image processing.
- Create and analyze **color combinations of spectral channels** for visual identification of natural and technical features, such as disaster assessment or filter optimization.
- Perform **radiometric and geometric corrections** on satellite images.
- Extract **spectral signatures** of land cover using appropriate sampling techniques.
- Conduct both **unsupervised** and **supervised**

**classifications** of satellite images.

- Evaluate classification accuracy using technical tools like **coincidence tables** and the **KHAT index**.
- Be prepared to explore advanced remote sensing topics, including **temporal variations** and more specialized applications.

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| **Prerequisite courses** | |
| **Teaching methods** | Lectures, exercises |
| **Evaluation** | Written examination (60%), Assessment of assignments (40%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Brandt Tso and Paul M. Mather 2001, *Classification methods for remotely sensed data*, Taylor & Francis.<br>[2] Paul J. Gibson and Clare H. Power, 2000, *Introductory remote sensing: digital image processing and applications*.<br>[3] D. Wilkie, J. Finn, 1996, *Remote sensing imagery for natural resources monitoring: a guide for first-time users*, Columbia University Press.<br>[4] Paul M. Mather, 1989, *Computer processing of remotely sensed images: an introduction*, John Wiley & Sons.<br>[5] A. Cracknell, L. Hayes, 1993, *Introduction to remote sensing*. |

# 7th SEMESTER – DIVISION OF COMPUTERS

## AUTOMATIC CONTROL SYSTEMS II

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| **Course unit code** | YYH1 |
| **Course unit type** | Compulsory / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE367/ |
| **Teaching weekly hours** | 5 |
| **Lecturer** | C. Korkas (Adjunct lecturer) |
| **Course content** | The course, building on the foundation of Automatic Control Systems I, focuses on the practical applications and value of control systems theory. It equips students with knowledge directly applicable to solving automatic control problems, incorporating the use of specialized software tools. Key topics include frequency domain system analysis, stability assessment, and closed-loop system design using root locus and Bode diagrams, including PID controllers. The course also covers input filters and state-variable model-based control design, addressing concepts such as controllability, observability, state feedback, observer design, optimal control systems, and internal control model design. |

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| **Expected learning outcomes and skills** | This course provides a comprehensive introduction to the theory and applications of **Control Systems**, with a strong focus on design. Students will engage in the **simulation of physical systems**, developing appropriate controllers through assignments and problem-solving exercises. Additionally, a series of laboratory exercises will cover various types of compensators in control systems.<br>Upon successful completion of the course, students will be able to:<br>1. Identify and describe different types of compensators.<br>2. Understand and explain their operation in closed-loop systems.<br>3. Analyze and design control systems using **transfer functions** and **state equations**.<br>4. Evaluate and compare control systems based on specific design criteria.<br>5. Implement compensator circuits and experimental devices in the laboratory.<br>6. Simulate and analyze the operation of control systems using specialized software. |
| **Prerequisite courses** | Knowledge of the courses is required:<br>• Applied Mathematics I<br>• Automatic Control Systems I |
| **Teaching methods** | Traditions, exercises, laboratory. |
| **Evaluation** | • Written examination at the end of the semester (60%).<br>• Homeworking (10%).<br>• Laboratory examination (30%). |
| **Language of instruction/Exams** | Greek |

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| **Bibliography** | [1] Modern Automatic Control Systems, 13th Edition, Dorf Richard C., Bishop Robert H., A. JIOLA & SONS, 2017.<br>[2] Automatic Control Systems, Ogata K., C. Fountas, 2011.<br>[3] Automatic Control Systems, 2nd Edition, Malatestas Pantelis, Editions A. Tziolas & Sons, 2017. |

## Operating Systems

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| **Course unit code** | MK22 |
| **Course unit type** | Compulsory / Specialization |
| **Level course** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | http://eclass.uowm.gr/courses/ICTE189/ & http://arch.icte.uowm.gr/courses/os/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | (Adjunct lecturer) |
| **Course content** | This course covers the fundamental principles of operating systems, including their evolution, process management, synchronization, inter-process communication, and handling concurrent processes with mutual exclusion. Topics also include CPU scheduling, memory management, paging, virtual memory, file system management, system security, deadlocks, and input/output management. The course provides insights into widely used operating systems like Windows and Unix, complemented by hands-on laboratory exercises involving Windows and Linux scripting |

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| | as well as POSIX-based operating system programming. |
| **Expected learning outcomes and skills** | **Theory Objectives:**<br>By the end of the course, students will:<br>• Understand the advantages of operating systems (OS).<br>• Comprehend the core functionalities of modern OS subsystems.<br>• Learn time-sharing algorithms, file handling functions, and memory management techniques like paging and segmentation.<br>• Grasp task execution techniques provided by the OS.<br>• Analyze the interaction between hardware and operating systems.<br>**Workshop Objectives:**<br>By the end of the workshop, students will:<br>• Understand fundamental and advanced concepts of OS interfaces.<br>• Use UNIX as a development platform for programming.<br>• Develop skills in:<br>o Using popular operating systems (Windows, UNIX).<br>o Writing and debugging shell scripts.<br>o Programming in UNIX and POSIX environments.<br>o OS programming with system calls.<br>o Multithreading and process-based programming.<br>o Establishing remote SSH connections to FreeBSD OS.<br>o Transferring files to and from a remote FreeBSD server. |

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| **Prerequisite courses** | Computer Architecture |
| **Teaching methods** | Lectures, powerpoint slides, lecturer notes, in-class quizzes, automated multiple-choice I-exams, taped opencourses lectures, laboratory exercises, semester-long group work. |
| **Evaluation** | 50% theory final exam, 10% laboratory final exam, 10%, three short exams 15%, 12 laboratory exams exercises 10%, 1 group project 15%. |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Andrew S. Tanenbaum, *Modern Operating Systems*, Publications Klidarithmos Epe, 2009.<br>[2] Stallings W., *Functional Systems*, Ed. Giola & Walsallings, Wallace Walsallings, Wallace & Walsallings, Jola & Walsallings, Publishers. Sons, 2009.<br>[3] M. Rochkind, *Programming On Unix*, Ed. Klidarithmos, 2007.<br>[4] Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, *Operating Systems*, X. Gourda, Edition. |

## ARTIFICIAL INTELLIGENCE

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| **Course unit code** | Y1 |
| **Course unit type** | Compulsory / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |

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| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE107/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | K. Stergiou(Professor) |
| **Course content** | The course introduces **Artificial Intelligence (AI)**, covering foundational concepts and techniques. Topics include **intelligent agents**, **search algorithms** (blind, heuristic, and local search), and **constraint satisfaction problems**. Logic principles are explored through **propositional logic** (syntax, semantics, logical inference, and proof methods) and **categorical logic** (syntax, semantics, and logical convolution). The course also introduces **action planning**, focusing on key principles and algorithms, and delves into **machine learning**, covering inductive learning and decision tree methods. |
| **Expected learning outcomes**<br><br>**results and skills** | By the end of the course, students will:<br>• Understand the fundamental concepts of **Artificial Intelligence (AI)** and **Intelligent Systems**.<br>• Learn and apply methods for solving **search problems** in AI.<br>• Gain experience in implementing **search algorithms** (uninformed and informed) and **logical inference** techniques.<br>• Understand the basics of **Knowledge Representation** and **constraint satisfaction** theory.<br>• Develop creative thinking and **problem-solving skills** through hands-on implementation.<br>• Acquire foundational knowledge of **action planning** and the basics of **machine learning**.<br>• Build collaborative skills by engaging in team-based problem solving and project management. |

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| **Prerequisite courses** | None |
| **Teaching methods** | Lectures, exercises, assignments |
| **Evaluation** | Written examination (80%), Assignments (20%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | ιorvig, Artificial Intelligence: a Modern Approach, 2004<br>alas, Vassiliadis, Kokkoras, Sakellariou, Artificial ıartaganis Publications, 2005 |

## Robotics

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| **Course unit code** | E4 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE348/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | G. Fragoulis (Professor) |

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| **Course content** | The course introduces the fundamentals of robotics, focusing on the structural and geometric features of robots and the principles of solid kinematics. Key topics include the direct and inverse kinematic problems, the Denavit-Hartenberg method, tool orientation, and the computation of the Jacobian matrix. It also covers velocity and acceleration kinematics, robot position and velocity control, the implementation of PID controllers, automatic control systems for robots, precise position control, and track design. |
| **Expected learning outcomes results and skills** | The course aims to familiarize students with the fundamental concepts of robotics, with a focus on solving the core kinematic problems of robotic arms, including position, velocity, and acceleration analysis. By the end of the course, students will be able to understand essential robotics principles, perform kinematic analysis, design controllers for introductory robotic arm control techniques, and develop robotic arm trajectory plans. |
| **Prerequisite courses** | - |
| **Teaching methods** | Traditions, exercises, laboratory exercises. |
| **Evaluation** | Written final examination (80%), Assessment of work (20%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Introduction to Robotics, 4th Edition, Craig John<br>[2] Robotics, 4th Edition, Emiris Dimitrios, Koulouriotis D.<br>[3] Robotics, Ioannis Boutalis<br>[4] ROBOTICS, SICILIANO,SCIAVICCO,VILLANI,ORIOLO |

## INDUSTRIAL COMMUNICATIONS

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| **Course unit code** | EYH1 |
| **Course unit type** | Elective / Specialization |

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| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY110/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | C. Korkas (Adjunct lecturer) |
| **Course content** | Part 1 General principles of local area networks<br><br>1. Evolution of industrial automation<br>2. Advantages of communication networks in industry<br>3. Hierarchical control and communication networks<br>4. Data traffic on industrial LANs<br>5. Topologies of LANs<br>6. Data transmission media on LANs<br>7. Data transmission modes on LANs<br>8. Methods of access to the LAN bus<br>9. ISO/OSI open communications model<br>10. Components of network architecture<br><br>Part 2 Industrial networks<br>1. Modbus network<br>2. Ethernet network<br>3. Network can open |

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| **Expected learning outcomes results and skills** | Upon successful completion of the course, students will be able to:<br>• Identify and describe the components of industrial networks.<br>• Understand and explain the principles governing industrial network operations.<br>• Analyze and detail the core functions of network devices.<br>• Perform laboratory experiments and interpret their outcomes.<br>• Design and simulate simple industrial networks using computer-based tools.<br>• Collaborate effectively with peers on projects. |
| **Prerequisite courses** | - |
| **Teaching methods** | • Classroom teaching using a projector and tutorial exercises<br>• Selected laboratory exercises in student groups |
| **Evaluation** | I. Written final examination (30%) including:<br>• Multiple choice or true-false questions<br>• Analysis of theoretical issues requiring the student's judgment<br>• Problem solving II.<br>Individual Assignments<br>(50%):<br>• Solving selected problems<br>• Network simulation<br>• Modelling-design-control of systems<br>III. Group work on the laboratory experiments<br>(20%) |
| **anguage of instruction/Exams** | Greek |

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| **Bibliography** | [1] Industrial Networks and Advanced Programming Plc H. Papazacharias, Ed. Vrettos<br>[2] Industrial Networks of Programmable Logic Controllers Stam. A. Manesis Patras 2003<br>[3] Data Communications And Networking Behrouz A. Forouzan Fourth Edition McGraw-Hill |

## DIGITAL ELECTRONICS

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| **Course unit code** | E47 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY139/ |
| **Teaching weekly hours** | 4 (Theory: 2 hours, Tutoring: 1 hour, Laboratory: 1 hour) |
| **Lecturer** | M. Dasygenis (Associate Professor) |
| **Course content** | The course aims to familiarize students with **digital logic**, the synthesis and analysis of combinational circuits, the fundamentals of sequential circuits, and the principles of digital circuit design and implementation techniques. |
| **Expected learning outcomes results and skills** | By the end of the course, students will:<br>• Be familiar with the theory and operation of sequential digital circuits.<br>• Understand the principles of designing and studying sequential digital electronic circuits.<br>• Gain hands-on experience through laboratory exercises, reinforcing theoretical knowledge and essential implementation techniques.<br>• Develop skills to identify, analyze, and troubleshoot circuit operations.<br>• Apply course knowledge to design and create their own |

digital circuits.

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| **Prerequisite courses** | - |
| **Teaching methods** | Lectures, slide presentations in Power Point, presentation simulations of technological applications. Assignment of Themes<br>assignments to students in groups to better familiarize them with the concepts and basic principles of digital logic |
| **Evaluation** | Students will complete group assignments, contributing **20%** to the final grade, while the remaining **80%** will be determined by the written final exam.. |
| **Language of instruction/Exams** | Greek, English |
| **Bibliography** | [1] Digital Design, Mano Morris, Ciletti Michael<br>[2] Microelectronics, Jaeger Richard - Blalock Travis<br>[3] Microelectronic circuits Volume B ADEL. S. SEDRA & KENNETH C. SMITH<br>[4] KLEITZ, W., Digital Electronics, , Giola Publications, 2013. |

## Object Oriented Programming II

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| **Course unit code** | MK31 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |

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| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE195/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | S. Bibi (Associate Professor) |
| **Course content** | The course focuses on **Object-Oriented Programming (OOP)** with practical training in **C++**, emphasizing the OOP model and advanced programming concepts such as references, parameter passing, dynamic memory management, and friendly functions. Students will learn to implement OOP techniques, including classes, objects, encapsulation, abstraction, composition, hierarchies, inheritance, and polymorphism, using C++.<br>Key modules include:<br>• **Introduction to OOP**: Basics of OOP, comparison with Java, and C++ history and applications.<br>• **C++ Fundamentals**: Object and class implementation, initialization functions, destructors, and member data access.<br>• **Advanced Features**: Operator overloading, inheritance, abstract classes, pointers, dynamic memory, and object handling.<br>• **Special Topics**: File handling, templates, generic programming, and code reuse. |
| **Expected learning outcomes**<br><br>**results and skills** | Upon successful completion of the course, students will be able to:<br>• Classify and understand various programming models.<br>• Implement core class relationships in C++, including inheritance, polymorphism, and composition.<br>• Perform operator overloading for unary, arithmetic, comparison, input, and output operators.<br>• Utilize global, friendly, and class member functions, as well as effectively manage variables and functions using const, static, and final keywords.<br>• Store and retrieve data in both text and binary files. |

• Perform dynamic memory management using pointers.
Implement and utilize templates for generic programming.

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| **Prerequisite courses** | None |
| **Teaching Methods** | Lectures and workshops |
| **Evaluation** | 20% laboratory, 20% group work, 60% written examination |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Deitel Harvey M.,Deitel Paul J., C++ Programming, H. GIOURDA & CO.<br>[2] Savitch Walter, Complete C++, PUBLICATIONS A. JIOLA & S.A.<br>[3] B. Stroustrup, The C++ Programming Language, Addison Wesley.<br>[4] S. Al, W. Clayton, "The C++ Bible", A. Gourda & LTD. |

## COMPUTER GRAPHICS

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| **Course unit code** | E34 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |

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| **Website** | https://eclass.uowm.gr/courses/ICTE275/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | A. Protopsaltis (Laboratory Teaching Staff) |
| **Course content** | This course covers fundamental concepts and applications of computer graphics, including design algorithms, coordinate systems, and 2D/3D transformations. Key topics include viewing transformations, hidden surface removal, model representation and simplification, parametric curves and surfaces, scene management, color and visualization, lighting models, shadows, texture mapping, and basic animation techniques.<br>The laboratory component involves practical exercises using **OpenGL SDK/C++** or **DirectX SDK/C++** environments. |
| **Expected learning outcomes and skills** | This course focuses on understanding 2D and 3D geometry while learning the principles, algorithms, and techniques for designing, coloring, and lighting to create real-time photorealistic graphics. Through the laboratory component, students will develop interactive rendering and visualization software for 3D graphics using **OpenGL/C++**. |
| **Prerequisite courses** | None |
| **Teaching methods** | Lectures, laboratory exercises. |
| **Evaluation** | Written final examination, Laboratory Exercises |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Theocharis Th., Platis N., Papaioannou G., Patrikalakis N., Graphics and Visualization, S.ATHANASOPOULOS, 1st EDITION/2010.<br><br>Bakers H., Computer Graphics with Open GL, PUBLICATIONS |

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| A. JIOLA & S.A., 3rd edition, 2010. |

## E-HEALTH

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| **Course unit code** | E2 |
| **Course unit type** | Elective / Specialization |
| **Level course** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | http://eclass.uowm.gr/courses/ICTE128/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | P. Aggelidis(Professor) |
| **Course content** | This course introduces the concepts of eHealth, medical informatics, and technology-based knowledge management, emphasizing their significance in modern healthcare. Topics include health information systems, challenges and opportunities, electronic patient record systems, and decision support tools. Key principles of medical data management and computational statistics are covered, along with clinical quality development as part of clinical information systems. Students will explore online healthcare, including the supply and demand for medical services, internet-based interventions (e.g., teletherapy), peer-to-peer support in virtual communities, and the use of online resources to support clinical trials. Additional topics include health portals, telemedicine services, mobile and wireless healthcare communications, internet-based professional training for health practitioners, and communities of practice.<br>The course also addresses security in eHealth, focusing on |

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| | privacy, confidentiality, and ethical principles in healthcare applications. |
| **Expected learning outcomes**<br>**results and skills** | The course aims to introduce students to the evolving field of eHealth, which applies information and telecommunication technologies to address challenges in prevention, treatment, and healthcare quality. Due to its interdisciplinary nature, the course exposes students to diverse scientific domains such as biology, medicine, and the use of specialized devices and software for problem analysis and study. It also explores current trends, including eWellness, independent living, Health 2.0, and MedSocApps. |
| **Prerequisite courses** | None |
| **Teaching methods** | Lectures and laboratory exercises |
| **Evaluation** | 30% from the written theory exam.<br>30% by practical lab exam. 40% from term paper. |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Pantelis Angelidis, *Medical Informatics Volume A*, "wisdom," 2011.<br>[2] Athina Lazakidou, *Advanced Systems and Information Technology Services in the Health Sector*, Athina Lazakidou, 2009. |

## DATA ANALYSIS

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|---|---|
| **Course unit code** | EYH8 |
| **Course unit type** | Elective / Specialization |

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| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY121/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | (Adjunct lecturer) |
| **Course content** | This course covers statistical hypothesis testing, sampling methodologies (probability and directed sampling), and core sampling methods, including simple random sampling (S.R.S.), stratified random sampling, and systematic sampling. It delves into regression analysis, exploring linear, parabolic, exponential, and multiple regressions, including the calculation of regression coefficients, correlation coefficients, and ANOVA. Principal Component Analysis (PCA) is also studied, involving data standardization, correlation matrix analysis, eigenvalue computation, and inertia calculation on factorial axes. Clustering techniques are introduced, including hierarchical methods (e.g., nearest neighbor, Lance-Williams) and non-hierarchical methods (e.g., K-means clustering). Laboratory exercises and applications are conducted using statistical software such as SPSS, PSPP, or equivalent tools. |

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| **Expected learning outcomes results and skills** | Develop the ability to systematically record, analyze, and draw practical conclusions using a theoretical foundation in modern methodologies and recognized processing software, including:<br>• Directed and probability sampling techniques.<br>• Analyzing correlations between multiple variables.<br>• Reducing data dimensionality while preserving maximum variance.<br>• Applying hierarchical and non-hierarchical clustering methods. |
| **Prerequisite courses** | None |
| **Teaching Methods** | Lectures and tutorials |
| **Evaluation** | 70% theory exam.<br>30% from semester work. |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Book [94699890]: Statistical Processing and Analysis of Multivariate Data II, Christos Konstantinos Fragkos<br>[2] Data analysis, Papadimitriou Yannis |

## 8th SEMESTER – DIVISION OF COMPUTERS & ELECTRONICS

### PARALLEL AND DISTRIBUTED SYSTEMS

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| **Course unit code** | MK34 |
| **Course unit type** | Option/ Specialization |
| **Course level** | Undergraduate |

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| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE161/<br>https://arch.ece.uowm.gr/courses/parallel/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | M. Dasygenis (Associate Professor) |
| **Course content** | Introduction to parallel and distributed processing, including a historical overview. Overview of the von Neumann model and Flynn's taxonomy. Exploration of multi-processors, multi-computers, and distributed vs. shared memory systems. Memory architectures with single and non-single access. Performance metrics, scaling, and laws such as Grosch's, Amdahl's, and Gustafson-Barsis'. Parallel application design, program parallelization with MPI, synchronization, dependency graphs, and scheduling. Shared memory relevance, MESI protocol, and GPU-based parallel processing. Models and mechanisms for process communication, vector processing, computational arrays, and grid computing. Practical examples of parallelization applications and synchronization challenges. Laboratory exercises include programming parallel applications using OpenMPI, OpenMP, threads, and CUDA. |
| **Expected learning outcomes**<br><br>**results and skills** | Upon successful completion of the course, students will understand the need for parallel processing, its types, advantages, and limitations, processor interconnection methods, memory consistency issues and protocols, clock synchronization in distributed systems, and the strengths of parallel processing on multi-core systems or GPUs. They will also grasp techniques for achieving various levels of parallelism.<br><br>In the laboratory, students will gain hands-on experience in scaling parallel applications, writing and debugging parallel |

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| | programs, enhancing parallelism, and using tools like OpenMPI for distributed systems, OpenMP for multicore systems, CUDA for GPUs, and POSIX threads for multithreading. They will also learn to utilize grid and task submission tools, analyze applications to identify critical components, measure application performance, and select optimal architectures for parallelization. |
| **Prerequisite courses** | Operating Systems, C Programming (not compulsory). |
| **Teaching methods** | Lectures, powerpoint slides, lecturer notes, in-class quizzes, automated multiple-choice I-exams,<br>taped opencourses lectures, laboratory exercises, semester-long group work. |
| **Evaluation** | 50% theory final exam, 10% laboratory final exam, 10%, three short exams 15%, 12 laboratory exams<br>exercises 10%, 1 group project 15%. |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Andrew S. Tanenbaum, Maarten Van Steen, *Distributed Systems: Principles and Patterns*, Klidarithmos Publishers, 2006.<br>[2] David B. Kirk, Wen-Mei W. Hwu, Massively Parallel Processor Programming, Keydarithm, 2010.<br>[3] S. Papadakis, K. Diamantaras, Programming and Architecture of Parallel Processing Systems, Kleidarithmos. |

## Design and Analysis of Algorithms

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| **Course unit code** | MK37 |
| **Course unit type** | Compulsory / Specialization |

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| **Course level** | Undergraduate |
| **Year of study** | 4 |
| **Semester** | 8 |
| **ECTS credits** | 5 |
| **Website** | [https://eclass.uowm.gr/courses/ICTE332/](https://eclass.uowm.gr/courses/ICTE332/) |
| **Teaching weekly hours** | 4 |
| **Lecturer** | N. Ploskas (Associate Professor) |

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| **Course content** | The course covers fundamental concepts in algorithm analysis, including complexity and asymptotic analysis, along with techniques for designing efficient algorithms. It delves into recursive algorithms, the dominance theorem, divide-and-conquer strategies, dynamic programming, and greedy approaches. Probabilistic algorithms, as well as graph and network algorithms, are also explored. Additionally, the course introduces computational complexity, emphasizing the P and NP classes and the concept of NP-completeness. |
| **Expected learning outcomes results and skills** | Upon successful completion of the course, students will be able to:<br>• Analyze algorithms and evaluate their complexity.<br>• Perform asymptotic analysis.<br>• Design and implement recursive and greedy algorithms.<br>• Apply principles of dynamic programming to design and implement algorithms.<br>• Understand and utilize graph and network algorithms.<br>• Comprehend the concepts of P and NP classes. |

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| **Prerequisite courses** | None |

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| **Teaching methods** | Lectures, workshops |
| **Evaluation** | Exercises (30%), Written examination (70%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] T. Cormen, C. Leiserson, R. Rivest, C. Stein, *Introduction in algorithms*, University Publications of Crete, Edition 1/2016<br>[2] Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, *Algorithms*, Cleidarithmos publications, Edition: 1/2009<br>[3] P. Bozanis, *Algorithms*, Tziola Publications, Version 2/2017<br>[4] Jon Kleinberg, Eva Tardos, *Algorithm Design*, Kleidarithmos Publications, Version: 1/2009<br>[5] Anany Levitin, *Algorithm analysis and design*, Tziola Publications, Edition: 3rd/2018 |

## SOFTWARE ENGINEERING

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|---|---|
| **Course unit code** | MK33 |
| **Course unit type** | Compulsory / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE284/ |
| **Teaching weekly hours** | 4 |

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| **Lecturer** | S. Bibi (Associate Professor) |
| **Course content** | The course provides an overview of software development methodologies, life cycle processes, and best practices. Topics include software requirements analysis, design, coding, documentation, and testing, with a focus on object-oriented development and UML modeling. Key modules cover project management, architectural design, and software quality control, integrating tools like Gantt charts, version control systems (e.g., Git), and testing frameworks (e.g., JUnit). Emphasis is placed on practical applications of design patterns such as Adapter, Visitor, and Bridge, as well as cost estimation techniques like the COCOMO model. Laboratory work involves implementing UML diagrams (use case, class, interaction) into code and exploring tools for software project management and quality assurance. |
| **Expectedly learning outcomes and skills** | Students gain practical knowledge and experience in software development models, requirements analysis, and information system design. By working on prototype applications, they develop skills in managing small software development and testing teams. Upon successful completion, students will:<br>• Analyze and design software systems using UML.<br>• Manage software projects, estimate costs, and mitigate risks.<br>• Develop large object-oriented systems.<br>• Apply software testing techniques, including white-box and black-box testing.<br>• Design software using patterns like Adapter, Visitor, Composite, and Observer.<br>• Translate software designs (class and sequence diagrams) into functional and testable code.<br>• Calculate basic software metrics such as Halstead and McCabe metrics.<br>• Understand and apply software development models, including waterfall, RUP, component-based, and spiral models. |

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| **Prerequisite courses** | None |
| **Teaching methods** | Lectures and workshops |
| **Evaluation** | 40% term paper, 60% written examination |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] S. Pfleeger,Software Technology: Theory and Practice , Keydarithm.<br>[2] I. Sommerville, Fundamentals of Software Engineering, Keydarithm.<br>[3] M. Fowler, Introduction to UML: A concise guide to the standard object modeling language, Keydarithm.<br>[4] M. Giakoumakis, N. Diamantidis, Software Technology, Unibooks. |

## VLSI DESIGN

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| **Course unit code** | E30 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | |
| **Teaching weekly hours** | 4 |

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| **Lecturer** | (Adjunct Lecturer) |
| **Course content** | The course covers NMOS and PMOS transistor properties and their use as switches, with a focus on physical design, latency, and optimization of logic gates. Topics include energy consumption and power optimization techniques, transistor-based gate design, combinational and sequential circuits, timing in digital circuits, and clock distribution. Memory design, input/output circuits, and power distribution networks in integrated circuits are explored alongside methodologies for design automation and the use of CAD tools. CMOS design is emphasized, including static and dynamic CMOS logic structures, floorplanning, and layout. The course also includes VLSI simulation and verification, with laboratory exercises on modeling, designing, and simulating circuits at the transistor level. |
| **Expected learning outcomes results and skills** | Upon completing the VLSI course, students will understand the complete VLSI design flow, from schematics to silicon fabrication. They will be able to simulate and analyze CMOS circuits using mathematical models, design CMOS electronic circuits with transistors, apply IC design rules, and create layouts and interconnections for small-scale circuits. Students will gain proficiency in using tools for extracting VLSI floorplans for manufacturing and will develop the ability to evaluate trade-offs to optimize circuit performance, cost, and energy efficiency. |
| **Prerequisite courses** | Knowledge of the courses is required:<br>• Digital Design<br>• Electronics I, II |
| **Teaching methods** | Deliveries, laboratory exercises. |
| **Evaluation** | Theory (50%), laboratory (50%). |
| **Language of instruction/Exams** | Greek |

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| **Bibliography** | [1] CMOS Digital Integrated Circuits: Analysis and Design, KANG; LEBLEBICI, Epikentro Publications, 2014.<br>[2] Design of Digital Systems on FPGAs, Wayne Wolf, NEW TECHNOLOGIES PUBLISHING, 2013.<br>[3] Digital Integrated Circuits: A Design Approach, J. M. Rabaey, A. Chandrakasan, Keydarithmos, 2006. |

## MECHATRONICS

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| **Course unit code** | EYH7 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY131/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | (Adjunct Lecturer) |
| **Course content** | The course covers the following modules: Introduction to Mechatronics; components of mechatronic systems (mechanical, electronic, computational); system interconnection and interfaces; electronic/digital systems, sensors, transducers, and actuators; electrical power management; automatic control systems, embedded systems, and controllers; PLC programming for mechatronics; mechatronic system design methodology (technology selection, modeling, simulation, integration, troubleshooting); applications of mechatronics; and elements of Artificial Intelligence in mechatronic systems. Laboratory exercises complement the theory with hands-on applications, experimental setups, and test structure development. |

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| **Expected learning outcomes**<br>**results and skills** | The course aims to provide students with an understanding of the basic principles, design, operation, limitations, and evolution of mechatronic systems, as well as their applications in various industries. Upon successful completion, students will be able to: comprehend the design and functionality of mechatronic systems; identify and analyze their mechanical, electronic, and computational components; correlate and evaluate subsystems and their interactions; design structural diagrams with functional and informational links; understand and analyze control functions; and address common synthesis and programming challenges, proposing effective solutions. |
| **Prerequisite courses** | None |
| **Methods teaching** | • Classroom teaching with projector and tutorial exercises<br>• Support for the learning process through the e-class platform |
| **Evaluation** | • Written examinations at the end of the semester, covering the theory and the solution of practical problems-exercises of the course (70%)<br>• Practical exercises on experimental devices and development of test structures for a better understanding of the concepts developed in the theoretical part (30%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Nesculescu D. "Mechatronics", 2011, Giola Publications<br>[2] Auslander, David M. and Kempf, Carl J., "Mechatronics", 1998, University Publications H.M.P.<br>[3] W. Bolton. "Mechatronics: Electronic Control Systems", 2003.<br>[4] R. H. Bishop, "The mechatronics handbook", 2002, CRC Press. |

## SCADA SYSTEMS

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| **Course unit code** | EYH3 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | |
| **Teaching weekly hours** | 4 (Theory: 2 hours, Laboratory: 2 hours) |
| **Lecturer** | (Will not be offered) |
| **Course content** | • Brief introduction to SCADA systems<br>• LabVIEW and Virtual Instruments.<br>• Data acquisition: measurement of single analog signal and multiple analog voltage signals. Measurement of single and multiple current signals, 4-20mA transducers<br>• Use of Instruments in Data Acquisition (RS-232, GPIB, Ethernet communication protocols)<br>• Receiving and exchanging data between remote units connected via a TCP network using DataSocket technology.<br>• Connection to industrial control devices (PLC) and transfer of data and information to user applications using OPC Server. |
| **Expected learning outcomes**<br><br>**results and skills** | Upon successful completion of the course the student will be able to:<br>• creates basic applications to receive data, transmit it and display it on HMI screens (Human - Machine Interfaces) using the LabVIEW graphical programming language,<br>• knows the connection techniques of analogue sensors (0 - 10V) and transmitters (4 - 20 mA), |

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| | • be familiar with the most basic protocols for communication with measuring instruments and be able to develop applications for taking and processing measurements from instruments,<br>• uses the basic options of the Lab VIEW language as well as the capabilities of the http and TCP/IP communication protocols for monitoring remote measurement and control units,<br>• can record and control the parameters of industrial PLC devices using OPC Server. |
| **Prerequisite courses** | None |
| **Teaching methods** | Theory lectures (2 hours/week)<br>Laboratory exercises (2 hours/week) |
| **Evaluation** | Individual work (50%)<br>Final exams (50%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] "Industrial automation with SCADA - Concepts, communication, and security", K.S. Manoj, Notionpress.com<br>[2] Konstantinos Kalovrektis, "LabVIEW for engineers", 3rd edition/2013, ISBN: 978-960-418-448-4, A. TZIOLA PUBLISHINGS. |

## EMBEDDED SYSTEMS

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| **Course unit code** | E33 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |

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| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | http://eclass.uowm.gr/courses/ICTE192/ http://arch.ece.uowm.gr/courses/embedded/ – |
| **Teaching weekly hours** | 4 |
| **Lecturer** | M. Dasygenis (Associate Professor) |
| **Course content** | Principles of embedded computing, including CPU instruction sets, digital system design, and programming for embedded devices. Topics cover design requirements, hardware-software challenges, memory hierarchy, algorithmic transformations, and performance/energy optimization. It explores real-time operating systems, implementation levels (VLSI, FPGA, ASIC, ASIP), modeling with VHDL and UML, multicore systems, accelerators, and I/O mechanisms, including interrupts and exceptions. Practical focus includes ARM architecture, symbolic language, C programming for embedded processors/microcontrollers, and VHDL-based system-on-chip design. |
| **Expected learning outcomes results and skills** | Upon completing the course, students will understand the fundamentals of embedded systems, including their design, economic aspects, communication networks, hardware-software integration, hardware accelerators, popular processor architectures, real-time operating systems, and performance optimization. They will also grasp key topics like I/O techniques, hard and soft constraints, and system performance.<br><br>In the laboratory, students will gain hands-on experience in programming embedded systems, microcontrollers (e.g., Arduino), and FPGAs. They will learn to optimize programs for performance and energy efficiency, use ARM and TI development environments, and apply VHDL for module design. Additionally, they will create embedded systems with soft cores, develop systems-on-chip (SoCs), implement the DTSE methodology, work with intellectual property cores, and link embedded software |

in C with hardware in VHDL..

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| **Prerequisite courses** | Computer Architecture, Digital Design |
| **Teaching methods** | Lectures, powerpoint slides, lecturer notes, in-class quizzes, automated multiple-choice I-exams, taped opencourses lectures, laboratory exercises, semester-long group work. |
| **Evaluation** | Final theory and laboratory exams 40%, 13 laboratory exercises 30%, 1 group project 30%. |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Design of embedded systems, Sudris, Demetrios, Dasigenis, Minas<br>[2] Embedded Systems, Minas Dasygenis, D. Sudris |

## Digital Games Development

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| **Course unit code** | E43 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE336/ |

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| **Teaching weekly hours** | 4 |
| **Lecturer** | A. Protopsaltis (Laboratory Teaching Staff) |
| **Course content** | The course aims to equip students with the skills to create and develop digital games, focusing on modeling, animation, photorealistic rendering, and visual style. It combines step-by-step programming with expertise in visual development tools and reusable software components. Emphasis is also placed on artistic creation, including narrative design, pre-visualization, imagery, sound, scriptwriting, story development, the hero's journey, and imaginative world-building. |
| **Expected learning outcomes**<br><br>**results and skills** | Upon successful completion of the course, students will be able to:<br><br>Design digital game architecture by analyzing requirements, structuring game components, and allocating data effectively.<br><br>Utilize the Unity engine for game development, leveraging its internal structure, 2D/3D components, cameras, and physics, as well as integrating objects such as characters, 3D models, and sounds.<br><br>Develop 2D and 3D models, including design, texturing, rendering, and photorealistic effects.<br><br>Use the Unreal engine for game creation, understanding its features and structure, incorporating 2D/3D characters, designing immersive environments, adding sound, and applying physics to enhance gameplay. |
| **Prerequisite courses** | Structured Programming, Object Oriented Programming, Algorithms and Data Structures, Computer Graphics |
| **Teaching methods** | Practical exercises, lectures, semester-long group work. |
| **Evaluation** | Examination using computer (50%), assignments (50%) |

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| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Birn, J. (2000) *Digital Lighting and Rendering*, USA: Library of Congress.<br>[2] Boellstorff, T. (2010). coming of age in second life: an anthropologist explores the Virtually Human. princeton. press.<br>[3] Fuller, M. (ed.) (2008) Software Studies: A Lexicon.<br>Cambridge, Massachusetts: The MIT Press<br>[4] Luebke, D. (2003) Level of detail for 3D graphics, Morgan Kaufmann Publishers, USA.<br>[5] Meigs, T. (2003) Ultimate Game Design: Building Game Worlds, McCraw-lHill/Osborne Companies. |

## ADVANCED DATABASES

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| **Course unit code** | E40 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE206/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | A. Michalas (Professor) |

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| **Course content** | • Object-oriented, parallel, and distributed databases.<br>• Internet databases and databases for semi-structured data.<br>• Introduction to Big Data database concepts, including document-oriented and big table databases. Practical learning of MongoDB and Apache Cassandra.<br>• Design and development of database applications.<br>• Spatio-temporal databases: introduction, case studies, and application implementation. Overview of inductive and multimedia databases.<br>• Transactions, timing checks, and data recovery mechanisms.<br>• Hashing techniques: dynamic, expansive, exponential with limited lists, and linear hashing.<br>• Query optimization: algebraic transformations, heuristic approaches, operation implementation, cost estimation, and result extrapolation. |
| **Expected learning outcomes results and skills** | Upon successful completion of the course, the student will be able to:<br>• Comprehend the methods employed by database systems to support their core functionalities.<br>• Analyze and describe complex operations within relational database systems.<br>• Understand the principles and functionalities of distributed, parallel, and object-oriented databases.<br>• Grasp the operational concepts of document-oriented and NoSQL databases.<br>• Design and implement applications integrated with databases, optimize their performance, and effectively manage transactions.<br>• Design advanced types of questions, and applications supporting chronological, spatial, geographic and multimedia data. |
| **Prerequisite courses** | Knowledge of the courses is required:<br>Structured Programming, Object Oriented Programming, Databases |
| **Teaching methods** | Lectures, workshop |

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| **Evaluation** | Written final examination (60%), examination of laboratory exercises (40%). |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Database Systems 6th Edition, Abraham Silver Treasure,Henry F. Korth,S. Sudarshan<br>[2] Database Management Systems, 3rd Edition, Ramakrishnan Raghu, Gehrke Joahannes<br>[3] Fundamentals of database systems, Elmasri Ramez,Navathe Shamkant B. Details |

## HUMAN-COMPUTER INTERACTION

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| **Course unit code** | Y7-H |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE314/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | A. Protopsaltis (Laboratory Teaching Staff) |

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| **Course content** | The course introduces the cognitive domain of Human-Machine Communication, focusing on modeling humans as users of computer systems. Topics include cognitive models, perception, representation, attention, memory, knowledge organization, mental models, user mental and group models. Interaction technologies are explored, including input/output devices, interaction styles, direct manipulation, collaboration support systems, virtual reality, and assistive technologies for individuals with disabilities. Interactive system design methodologies cover human-centered design, usability requirements, task analysis, GOMS models, dialogue description, interface design, and web application usability and accessibility. The course also addresses evaluation techniques for interactive systems and introduces collaboration technologies, such as modern and asynchronous collaboration applications and usability evaluation of collaborative systems. Laboratory sessions include design and evaluation exercises using analytical and empirical usability techniques for interactive software systems. |
| **Expected learning outcomes results and skills** | Students will gain an understanding of theoretical models of human interaction with technology and acquire the skills to use technologies, methods, and tools for designing and developing interactive software systems. They will also learn to evaluate interactive systems based on human-computer interaction models. |
| **Prerequisite courses** | None |
| **Teaching methods** | Lectures, laboratory exercises. |
| **Evaluation** | Written final examination, Laboratory work, Semester work |
| **Language of instruction/Exams** | Greek |

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| **Bibliography** | [1] Dix Alan J., Finlay Janet E., Abowd Gregory D., Human-Computer Communication, X. Gurdas, 3rd edition 2007.<br>[2] Avouris N., Katsanos C., Celios N., Introduction to Human Computer Interaction, University of Patras 2016<br>[3] Shneiderman Ben, Plaisant Cathrerine, User Interface Design, A. Giola, 6th edition 2016. |

## Machine Learning

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| **Course unit code** | EYH6 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE393/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | G. Fragoulis (Professor) |
| **Course content** | The course aims to provide students with a comprehensive understanding of Pattern Recognition and Machine Learning, covering popular supervised and unsupervised learning models, their underlying theory, capabilities, and limitations. Applications in fields like Big Data, computer vision, image and voice analysis, face and character recognition, robotics, and bioinformatics are discussed. Practical exercises using tools like MATLAB and Python (with emphasis on open-source software) support hands-on learning in implementing models for various scenarios.<br>The curriculum includes: |

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| | • **Supervised Learning:** Linear and logistic regression, neural networks (Perceptron, ADALINE, Back Propagation), support vector machines, Bayesian classification, and model/feature selection.<br>• **Unsupervised Learning:** Probability distribution estimation, clustering (K-means), and self-organizing models.<br>• **Dimensionality Reduction:** Principal Component Analysis (PCA) and Independent Component Analysis (ICA).<br>• **Applications:** Prediction models, data mining, recommendation systems, and natural language processing (e.g., emotion analysis).<br>The course emphasizes real-world problem-solving, reinforcing theoretical knowledge with laboratory exercises and use case applications. |
| **Expected learning outcomes results and skills** | Upon successful completion of the course, students will be able to:<br>• Understand the foundational principles of Machine Learning, including its capabilities, limitations, and theoretical underpinnings.<br>• Identify and evaluate the most popular Machine Learning models and methods, understanding their applicability, strengths, and limitations for different scenarios.<br>• Recognize the importance of Pattern Recognition in data analysis and apply appropriate tools to solve related problems.<br>• Efficiently use software tools, with a focus on open-source platforms, to implement Machine Learning models and analyze their practical applications in real-world scenarios.<br>• Gain familiarity with key applications of Pattern Recognition and Machine Learning, particularly in the fields of Electrical and Computer Engineering. |
| **Prerequisite courses** | None |

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| **Teaching methods** | • Classroom and laboratory teaching |
| **Evaluation** | Written final examination (80%), presentation of Individual/Group Work (20%) |
| **Language of instruction/Exams** | Greek, English |
| **Bibliography** | [1] Pattern Recognition and Machine Learning, C.M. Bishop, Version: 1/2019.<br>[2] Mechanical Learning, Konstantinos Diamantaras, Dimitris Botsis, Version: 1/2019.<br>[3] Neural Networks and Machine Learning, Haykin Simon, Edition: 3rd ed./2010.<br>[4] Recognition of Standards, Theodoridis S. , Version: 1st ed./2011. |

## Geographic Information Systems

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| **Course unit code** | E44 |
| **Course unit type** | Elective / Specialization |
| **Level course** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE337/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | Temporary lecturer |
| **Course content** | Geographic Information Systems (GIS) are applied in the sciences that study the dynamics of space through the use |

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| | and analysis of geographic information databases, digital cartography and<br>spatial data visualisation. The main purpose of the course is to deepen the theory of GIS to a degree that allows understanding the potentials and limitations of GIS software.<br>The course is divided into the following sections:<br>Basic concepts of GIS. Vector -point, line polygon- and Raster data.<br>Introduction to free GIS software. Import of spatial data Vector - Raster<br>Introduction to cartography & Maps in GIS: Creating maps, at different scales. Basic concepts such as thematic map, scale, projections and coordinate systems.<br>Georeferencing in GIS. Georeferencing of raster data.<br>Digitization in GIS: Creation of new spatial backgrounds with free GIS software, based on thematic maps (raster data).<br>Data bases<br>Spatial analytical procedures. select by location, select by attributes<br>Proximity analyses (buffer zones)<br>Map overlay (map overlay)<br>Digital Terrain Model (DEM).<br>Three-dimensional Applications (3D-GIS)<br>Spatial analysis and GIS<br>Review - preparing for exams |
| **Expected learning outcomes results and skills** | Upon completion of the course, students will have the theoretical and technical basis for the use of GIS in a variety of applications. |
| **Prerequisite courses** | |

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| **Teaching methods** | The course consists of the theoretical background and the corresponding laboratory exercises of computer application. These exercises are implemented with free GIS software. (e.g. QGIS due to its reliability, portability and zero financial burden for the Department and the Foundation). |
| **Evaluation** | 70% theory final exam, 30% term paper |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Burrough. p.A. & R., A. McDonnell (1998) *Principles of geographical information systems*. oxford Unio. press, Oxford.<br>[2] Ian Heywood, Sarah Cornelius, Steve Carver: *An Introduction to Geographical Information Systems*, 4th Edition, Kindle Edition<br>[3] Kalogerou, S., 2015. Spatial analysis. [Athens: Link of Greek Academics.Libraries.<br>[4] Tsoilos, L., Skopeliti, A., Stamos, L. 2015.<br>[5] Cartographic composition and rendering in a digital environment. [electric book]<br>[6] Faraslis I. University of Thessaly, School of Engineering, 2012. Notes: Geographically Information systems and natural resource mapping |

## CONSTRAINT PROGRAMMING

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| **Course unit code** | EHY9 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |

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| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE394/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | K. Stergiou(Professor) |
| **Course content** | Introduction to constraint satisfaction problems, including binary and non-binary constraints.<br>Problem modeling and representation.<br>Concepts of local and global consistency, with a focus on arc consistency and its fundamental algorithms.<br>Methods for solving constraint problems, including backtracking, forward checking, and arc consistency algorithms.<br>Local search techniques and their application to constraint problems.<br>Characteristics of solvable constraints and universal constraints.<br>Programming using constraint solvers and addressing optimization problems.<br>Case studies and practical applications of real-world combinatorial problems. |
| **Expected learning outcomes**<br><br>**results and skills** | The expected learning outcomes are:<br>• Understand basic concepts of constraint satisfaction and constraint programming problems.<br>• Understanding of methods for solving constraint satisfaction problems.<br>• Gain experience in programming constraint solvers.<br>• Developing creative thinking.<br>• Developing problem-solving skills.<br>• Gain experience in collaborative management and problem solving.<br>Upon successful completion of the course, students will:<br>• understand the basics of constraint programming |

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| | • know how to implement the basic algorithms for solving constraint satisfaction problems<br>• have gained experience in programming constraint solvers<br>• have become proficient in the use of constraint programming to solve real combinatorial problems |
| **Prerequisite courses** | |
| **Teaching methods** | Lectures |
| **Evaluation** | The evaluation is carried out through:<br>• a written examination at the end of the semester in which includes short answer questions and exercises<br>• grading of the report and code of work carried out during the semester<br>• oral presentation of the work carried out during the semester |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | Russell & Norvig, Artificial Intelligence: a Modern Approach, Clidarithmos, 2004<br>Vlahavas, Kefalas, Vassiliadis, Kokkoras, Sakellariou, Artificial Intelligence, University Publications Macedonia, Third Edition. |

## 9th SEMESTER - – DIVISION OF COMPUTERS & ELECTRONICS

### DESIGN AND OPERATION OF COMPUTER NETWORKS

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| **Course unit code** | YH2 |
| **Course unit type** | Compulsory / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **ECTS credits** | 5 |
| **Website** | eclass.uowm.gr/courses/ICTE279/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | B. Lazaridis (Lecturer) |
| **Course content** | Network Management and Security, including Quality of Service (IntServ, DiffServ). Multimedia services and networking. Introduction to application protocols such as email (SMTP), FTP, and DNS. Overview of peer-to-peer networks, Content Delivery Networks (CDNs), and the World Wide Web. Fundamentals of SOCKET programming and implementation of communication protocols. Practical usage of simulation tools for network analysis and protocol implementation. |
| **Expected learning outcomes results and skills** | Upon successful completion of the course, students will be able to:<br>• understand modern techniques, protocols, and applications of computer networks,<br>• to research, analyse, and document the key issues and requirements for building effective computer networks, |

- to adapt their knowledge to new and different emerging technologies, such as MPLS networks, cloud computing, as well as modern Internet technologies, such as IPv6, the Internet of Things (IoT), etc., based on an understanding of their underlying principles.

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| **Prerequisite courses** | None |
| **Teaching methods** | Lectures, laboratory exercises. |
| **Evaluation** | Written Examination (70%)<br>Laboratory examination (30%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Andrew S. Tanenbaum, *Computer Networks*, 4th edition, Keydarithm Publishing.<br>[2] William Stallings, *Computer and Data Communications*, 6th edition, Giola Publications.<br>[3] Douglas Comer, *Networks and Computer Networks*, 4th edition, Keydarithm Publishing.<br>[4] Douglas Comer, *TCP/IP Networks (Volume A)*, 4th edition, Keydarithm Publishing.<br>[5] Jean Walrand, *Communication Networks*, Papasotiriou Publications. |

## WEB PROGRAMMING

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| **Course unit code** | MK35 |
| **Course unit type** | Compulsory / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 5th |

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| **Semester** | 9th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE315/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | B. Lazaridis (Lecturer) |
| **Course content** | XHTML documents, text formatting, images, links, forms, and Cascading Style Sheets (CSS). Document Object Model (DOM). Server-side scripting with PHP, including variables, functions, tables, and database integration. Client-side scripting with JavaScript, focusing on objects, events, and asynchronous programming with AJAX. Introduction to website security principles and practices. |
| **Expected learning outcomes results and skills** | This course explores Internet and World Wide Web technologies, emphasizing programming systems and applications on the web. It begins with an overview of foundational technologies, including computer networks, the Internet, the World Wide Web, browsers, and web servers. Students will learn to create static web pages using HTML and CSS. The course distinguishes between client-side and server-side web programming, introducing PHP, JavaScript, and AJAX for dynamic content generation. Additionally, database management systems commonly used in web environments (e.g., MySQL) are presented, with practical development of applications that integrate web-based database access. |
| **Prerequisite courses** | None |
| **Teaching methods** | Lectures, laboratory exercises |
| **Evaluation** | Final written examination, Laboratory work, Semester work |

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| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Kenterlis P., Development of Internet Applications, Theory and Practice, P.D. Kenterlis, 2009<br>[2] Welling Luke, Thomson Laura, Web Application Development with PHP and MySQL, 4th Edition, X. GIOURDA & CO., 2011. |

## ADVANCED TOPICS OF DIGITAL DESIGN

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| **Course unit code** | E23 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE378 |
| **Teaching weekly hours** | 4 |
| **Lecturer** | D. Ziouzios (Adjunct lecturer) |
| **Course Content** | The course covers hardware description languages with a focus on VHDL and SystemVerilog. Topics include behavioral and structural levels of VHDL, advanced design of combinational and sequential digital circuits, memory and processor design, logic and timing simulation, and synthesis. Students will learn to program reprogrammable hardware (FPGAs and CPLDs), utilize IP cores, and design systems on a chip (SoC), including embedded core programming. SystemVerilog is introduced for SoC design. Laboratory exercises involve VHDL-based circuit design, programming, |

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| | and communication with reprogrammable hardware. |
| **Expected learning outcomes results and skills** | Upon successful completion of the course, students will gain knowledge and understanding of the following:<br>• The significance and productivity benefits of hardware description languages (HDLs) in digital design.<br>• The design workflow for reprogrammable logic structures.<br>• Effective use of the VHDL language for digital circuit design.<br>• The concept and implementation of Systems-on-Chip (SoC).<br>• Programming internal processor cores in FPGAs.<br>• Applications and modern uses of the SystemVerilog language.<br>Additionally, through the laboratory component, students will:<br>• Understand the advantages of VHDL over schematic descriptions.<br>• Develop skills in writing and debugging VHDL code.<br>• Master the use of VHDL commands for digital design.<br>• Perform logical simulations of digital circuits.<br>• Learn synthesis techniques for FPGAs and CPLDs.<br>• Estimate timing delays in hardware.<br>• Transfer designs to FPGAs and CPLDs and establish communication with reprogrammable hardware. |
| **Prerequisite courses** | Digital Design. |
| **Teaching methods** | Lectures and workshop. |
| **Evaluation** | Final exams 50%, Design projects 50% |
| **Language of instruction/Exams** | Greek |

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| **Bibliography** | [1] POGARIDIS DEMETRIOS, DIGITAL DESIGN WITH THE VHDL LANGUAGE, Murgos Ioannis, Version: 2/2010.<br>[2] Peter J Ashenden, *Digital Design with VHDL*, Version: 1/2010, NEW TECHNOLOGIES PUBLISHING LTD. ISBN: 978-960-6759-505, Book Code in Eudoxos: 64314<br>[3] VOLNEI A. PEDRONI, *Circuit design with the VHDL*, Version: 1/2008, KEIDARITHMOS PUBLISHINGS LTD, ISBN: 978-960-461-118-8, Book Code in Eudoxos: 13901.<br>[4] Brown, Vranesic , *Design of Digital Systems with the VHDL Language*, Version: 3rd Edition/2011, A. TZIOLA & SONS S.A.<br>[5] BROWN, FUNDAMENTALS OF DIGITAL LOGIC WITH VERILOG DESIGN, Epikentro Publications, Edition: 3/2013. |

## Microtechnology and Nanotechnology

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| **Course unit code** | E5 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **ECTS credits** | 5 |
| **Website** | [https://eclass.uowm.gr/courses/ICTE335/](https://eclass.uowm.gr/courses/ICTE335/) |
| **Teaching weekly hours** | 4 |
| **Lecturer** | (Adjunct Lecturer) |
| **Course content** | • Introduction to Microtechnology and Nanotechnology.<br>• Historical review of the micro and dwarf scales.<br>• The special contribution of the nanoscale to the evolution of science.<br>• Machines, tools and instruments used in Nano-sciences.<br>• Integrated circuit manufacturing technology and processes in clean, high-quality laboratories.<br>• Advanced applications of Microtechnology and Nanotechnology (Biology, Medicine, BioMEMS, Space, Environment, Communications, Electronics and Sensors, Energy and Materials).<br>• Examples of Nanoelectronics applications and reference to the latest research developments such as organic electronics, graphene.<br>• Legislation in Nanotechnology (Nanotoxicity/Public Policy).<br>• Reference to future developments and applications of |

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| | nanotechnology |
| **Expected learning outcomes results and skills** | The student acquires a thorough knowledge of the basic principles and the main principles of the applications of micro- and nanotechnology. Students become familiar with the terms, concepts and basic tools used in modern processes of development and manufacturing of relevant products and research efforts in the field of nanoscience/nanotechnology in applications for engineers. Describing some of the findings may change the students' understanding of the mode of operation at the micro-nano scale and lead them to focus their own creative energy on tackling major challenges i n engineering sciences by understanding and presenting answers to existing questions. Students acquire a theoretical background that is useful when continuing their studies at postgraduate level. |
| **Prerequisite courses** | None |
| **Teaching methods** | Lectures, Preparation of three assignments with PowerPoint presentations in class and Delivery of a written assignment (minimum 2,500 words for each assignment). |
| **Evaluation** | ● Presentation (20-25 slides and delivery of a written text (2500 words) of three papers on different topics.<br>● Final Course Grade (100%): final written theory exam = 40% and final grade of the Operations (average) = 60% |
| **Language teaching** | Greek and English |
| **Bibliography** | [1] Hanson George W., Principles of Nanoelectronics, A. JIOLA & SONS S.R.O., 2009.<br>[2] Williams Linda and Adams Wade, Nanotechnology Demystified, Epikentro Publications, 2006.<br>[3] Papaspyridis K, Pavlidou S, Nanotechnology and advanced polymeric materials, ARIS SYMEON, |

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| | 2012.<br>Jeremy Rasden, Nanotechnology: an Introduction, published by Elsevier Inc. in 2011. |

## FUZZY SYSTEMS

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| **Course unit code** | EYH4 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE388/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | G. Fragoulis (Professor) |
| **Course content** | The course covers the following modules:<br>• Introduction to Fuzzy Logic Systems<br>• Fuzzy Sets and Their Properties<br>• Principle of Extension and Fuzzy Relationships<br>• Fuzzy Logic and Inference Mechanisms<br>• Uncertain Reasoning Techniques<br>• Fuzzy Logic Systems: Fuzzifiers and Defuzzifiers<br>• Mathematical Representations of Fuzzy Logic Systems<br>• Optimization Techniques for Fuzzy Logic Systems<br>• Designing Knowledge Bases for Fuzzy Controllers<br>• Fuzzy PID Controllers<br>• Fuzzy Arithmetic Concepts |

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| | • Introduction to Neural Networks<br>• Data-Driven Knowledge Extraction<br>• Chaotic Systems and Their Applications |
| **Expected learning outcomes results and skills** | The course aims to equip students with a solid understanding of the fundamental principles and models of fuzzy logic and its application in system operation. Fuzzy logic provides an alternative approach to addressing real-world problems without relying on traditional mathematical standardization, enabling the study of complex systems that are challenging to formalize mathematically. In the laboratory component, students are introduced to intelligent technique development within the MATLAB environment, fostering familiarity with intelligent control methods and enhancing their ability to design and implement control systems. |
| **Prerequisite courses** | - |
| **Teaching methods** | ● Teaching with lectures-presentations and examples on the computer.<br>● Use of Matlab & Simulink Programming Language |
| **Evaluation** | Written examination (80%), Presentation of work (20%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Basic principles of fuzzy logic with applications in technology, Code in Eudoxos: 18549098, Theodorou Yannis<br>[2] Fuzzy Compendia, Applications in Design - Engineering Project Management, Book Code In Eudox:<br>50661849, Authors: Papadopoulos Vassilis,<br>Bodjoris Georgios<br>[3] Fuzzy logic with applications in engineering sciences, Tzimopoulos Christos, Papadopoulos |

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| | Vasilis<br>[4] Gang Feng - Analysis and Synthesis of Fuzzy Control Systems_ A Model-Based Approach (2010, CRC Press)<br><br>Zhong Li - Fuzzy Chaotic Systems_ Modeling, Control, and Applications (2006, Springer) |

## COMPILERS

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| **Course unit code** | MK39 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE345/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | S. Bibi (Associate Professor) |
| **Course content** | The course introduces the phases of program compilation, including lexical structure, analysis, and code generation. Topics covered include regular expressions, finite automata, syntactic and semantic analysis, and the generation of intermediate and machine code. Type systems and memory representation are also explored.<br><br>1. **Introduction to Compilers**: Overview of compilation phases, programming language types, and compiler technologies (e.g., symbol translators, preprocessors, interpreters). |

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| | 2. **Lexical Analysis**: Regular expressions, finite automata, and tools like Flex.<br>3. **Syntactic Analysis**: Descending and ascending methods, grammars, parsing techniques (LL(1), LR(1)), and tools like BYACC.<br>4. **Semantic Analysis**: Properties of grammars, translation schemes, and symbol table design.<br>5. **Intermediate Code Representation**: Syntax trees, stack machines, and three-address code.<br>6. **Code Optimization**: Techniques for improving code performance.<br>7. **Machine Code Generation**: Mapping types and structures to memory and generating executable machine code. |
| **Expected learning outcomes**<br><br>**results and skills** | During the course, students are expected to:<br><br>• Develop a critical understanding of programming languages through comparative analysis of their features.<br>• Grasp the trade-offs in language design decisions and their impact on language adoption.<br>• Recognize trends in programming language usage to prepare for emerging programming paradigms, patterns, and tools.<br>• Learn the design cycle of programming languages.<br>• Gain practical experience in compiler implementation. |
| **Prerequisite courses** | None |
| **Teaching methods** | Lectures and workshops |
| **Evaluation** | 10% lab, 20% progress grade, 70% written exam |

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| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Papaspyrou Nikolaos S., Skordalakis Emmanuel S., Compilers, S.ATHANASOPOULOS.<br>[2] K. Lazos, P. Katsaros, Z. Karaiskos, Programming Language Compilers: Theory & Theory, Theory and Practice,<br>ISBN:960-87723-4-6<br>[3] M. L. Scott, Pragmatology of Languages Programming, 2η edition/2009, Keydarithm, ISBN: 978-960-461-230-7.<br>[4] J. C. Mitchell, Concepts in Programming Languages, 1st edition/2002, Cambridge University Press, ISBN: 978-0521780988<br>[5] A. V. Aho, et al, Compilers: Principles,Techniques, and Tools, 2nd edition/2006, Addison Wesley, ISBN:978-0321486813 |

## DATA EXTRACTION

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| **Course unit code** | E11 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE293/ |
| **Teaching weekly hours** | 4 (Theory: 2 hours, Laboratory: 2 hours) |

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| **Lecturer** | M. Tsipouras (Professor) |
| **Course content** | Introduction to Data Mining Techniques: data, problems, applications. Data pre-processing: cleaning, transformation, dimensionality reduction techniques. Clustering: insertion, distances, k-means, hierarchical clustering. Correlation rules:<br>problem definition, the a-priori algorithm, the FP-Growth algorithm, evaluation of association rules. Classification: input, decision trees, overfitting, missing values, rule classifiers, k-nearest neighbours. |
| **Expectedly learning outcomes and skills** | This introductory course in Data Mining aims to familiarize students with fundamental concepts and techniques, including data, problems, and applications. It covers key topics such as data preprocessing, classification, clustering, and association rules, providing a comprehensive foundation for understanding data mining processes and methodologies. The course serves as a basis for advanced methodologies and techniques applicable at the postgraduate level. It also emphasizes the significance of data mining in diverse applications and its impact across various scientific fields.<br>Upon successful completion, students will be able to:<br>• Understand the basic principles and approaches of data mining (e.g., supervised and unsupervised learning).<br>• Apply data preprocessing techniques.<br>• Differentiate and utilize methods for data classification, categorization, and clustering.<br>• Extract knowledge from large data warehouses.<br>• Design and implement clustering and classification algorithms.<br>• Formulate association rules.<br>• Address multidimensional data mining challenges using dimensional reduction techniques.<br>• Evaluate, compare, and select suitable data mining algorithms for specific problems. |
| **Prerequisite courses** | None |

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| **Teaching methods** | Lectures and workshops |
| **Evaluation** | Compulsory work (40% of the grade)<br>Examinations (60% of the grade) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Vazirgiannis Michalis, Chalkidi M., *Knowledge extraction from databases and the web*, K. DARDANOS, 2005.<br>[2] Tan Pang - Ning, Steinbach Michael, Kumar Vipin, *Introduction to data mining*, PUBLISHINGS A. JIOLA & SONS, 2010.<br>[3] Margaret H. Dunham, *DATA MINING*, NEON TECHNOLOGIES PUBLISHINGS MON. LTD, 2004. |

## BIOINFORMATICS

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| **Course unit code** | Y9 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **ECTS credits** | 5 |
| **Website** | http://eclass.uowm.gr/courses/ICTE162/ |
| **Teaching weekly hours** | 4 |

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| **Lecturer** | P. Aggelidis(Professor) |
| **Course content** | Introduction to the basic concepts of biology. Biological macromolecules DNA and RNA. Structural elements of proteins. Biological databases. Replacement tables. Dynamic programming algorithms. Alignment pairwise sequences. Multiple sequence alignment. Patterns and patterns in the sequences of biological macromolecules. Basic principles of evolution. Phylogenetics Analysis. Construction of phylogenetic trees with the UPMGA, Fitch-Margoliash & Neighbor-joining. DNA microarrays. The heuristic algorithms FASTA & BLAST. Medical informatics and bioinformatics. |
| **Expected learning outcomes results and skills** | Bioinformatics aims to apply computational technologies for managing and analyzing biological data. The course focuses on equipping students with the skills to compute, store, analyze, visualize, and simulate/model biological information effectively. |
| **Prerequisite courses** | None |
| **Teaching methods** | Lectures and workshop |
| **Evaluation** | 60% of the written theory exam.<br>20% from the practical lab exam. 20% from term paper. |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Sophia Kossiada, *BIOLINFORMATION*, NEON TECHNOLOGY PUBLISHINGS MON. LTD, 2009.<br>[2] NEIL C. JONES, PAVEL A. PEVZNER, *INTRODUCTION TO BIOINFORMATICS ALGORITHMS*, EDS. KEYNOTE, 2010.<br>[3] PANTELIS ANGELIDIS, *Medical Informatics Volume A*, "wisdom", 1st edition/2011. |

## DIGITAL IMAGE PROCESSING

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| **Course unit code** | E17 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **ECTS credits** | 5 |
| **Website** | http://eclass.uowm.gr/courses/ICTE338/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | D. Tsalikakis (Assistant Professor) |
| **Course content** | Introduction to image processing, including binary images and color models. Binary algorithms, image rotation, and two-dimensional transformations such as Walsh, Hadamard, and Haar are covered. Image optimization techniques address noise types and filters, including mean, median, Gaussian, high-pass, and sharpness filters. Histogram modification techniques, image segmentation, contour and boundary detection, Fourier descriptors, and the Hough transform are explored. Feature extraction and edge detection methods, such as the Kirsch method, Laplace operator, and Marr-Hildreth method, are also discussed. Practical applications are implemented using MATLAB. |
| **Expected learning outcomes results and skills** | The course aims to familiarize students with applied digital image processing technology through a practical approach. Topics covered include the mathematical foundations of image analysis, two-dimensional transformations, digital filter design, and image restoration and coding. These fundamentals are complemented by advanced applications, such as wavelet decomposition. Special |

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| | emphasis is placed on Digital Medical Image processing. Using MATLAB for medical image processing, students will engage with real-world challenges in medical imaging and explore advanced filtering and object detection techniques, aligning with the lecturer's research focus. Upon completing the course, students will gain essential knowledge and skills to understand digital medical image representation, apply spatial and frequency domain processing methods, and implement basic algorithms for medical image restoration. |
| **Prerequisite courses** | None. |
| **Teaching methods** | Deliveries, laboratory exercises. |
| **Evaluation** | I. Written Final Theory Examination (50%)<br>II. II. Laboratory Final Examination (50%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Papamarkos Nikolaos, *Digital Image Processing and Analysis*, NIKOLAOS PAPAMARKOS, 2010.<br>[2] JOHN PETA, *DIGITAL IMAGE PROCESSING*, JOHN PETA, 2010.<br>[3] Gonzales, *Digital Image Processing*, Publications A. JIOLA & SONS, 2010. |

## COMPLEXITY THEORY

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| **Course unit code** | E10 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |

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| **Year of study** | 5 |
| **Semester** | 9 |
| **ECTS credits** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE266/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | K. Stergiou(Professor) |
| **Course content** | Problems. Algorithms and Computational Complexity. Turing Machines. Recursive and Recursively Numerical Languages. Special Types and Combinations of Turing Machines. Non-Deterministic Turing Machines. Universal Turing Machines. The Church's Thesis. Non-Decidability. The Problem of Termination. Rice's Theorem. Complexity Classes and their Relationships. The Classes L, NL, P, NP, PSPACE and EXPTIME. Reductions. The Concept of Completeness. The Cook-Levin Theorem. NP-completeness. The Complement of the NP-Class. |
| **Expected learning outcomes**<br><br>**results and skills** | Students who successfully complete the course should be able to:<br>● fully understand the design and operation of Turing machines<br>● understand termination problems<br>● know the complexity classes and how to classify problems into classes<br>● understand the concept of completeness and will be able to solve problems<br>● understand the concepts of NP completeness and the NP class complement<br>● implement algorithms to solve computationally difficult problems<br><br>synthesise algorithmic ideas for the implementation of applications |

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| **Prerequisite courses** | None |
| **Teaching methods** | Lectures, workshops |
| **Evaluation** | Written examination (70%), Assignments (30%) |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Harry Lewis, Christos Papadimitriou, *Elements of Computation Theory*, Kritiki Publications, Edition: 1/2005<br>[2] Michael Sipser, *Introduction to Computation Theory*, University Publications of Crete, Publication: 1/2009 |

## COMBINATORIAL OPTIMIZATION

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| **Course unit code** | EVH10 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **ECTS credits** | 5 |
| **Website** | |
| **Teaching weekly hours** | 4 |
| **Lecturer** | N. Ploskas (Associate Professor) |

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| **Course content** | • Mathematical modelling of combinatorial optimization problems<br>• Techniques for solving combinatorial optimization problems<br>• Mathematical programming<br>• Constraint programming<br>• Branch and boundary algorithms<br>• Branching and intersection algorithms<br>• Approximate algorithms<br>• Heuristic algorithms<br>• Verifying algorithms<br>• Local search methods<br>• Modelling and application of algorithms to practical problems<br>• scheduling, production unit placement, routing, resource management, telecommunications |
| **Expected learning outcomes results and skills** | Students who successfully complete the course should be able to:<br>• model combinatorial optimization problems<br>• recognise the difficulty of solving combinatorial optimisation problems<br>• know the basic algorithmic techniques for solving combinatorial problems optimization<br>• implement exact, approximate and heuristic algorithms for combinatorial problems optimization<br>• evaluate the performance of algorithms<br>• are aware of recent research developments in the field of Combinatorial Optimisation |
| **Prerequisite courses** | None. |
| **Teaching methods** | • Extensive use of IT in both teaching and communication with students |

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| **Evaluation** | The assessment method is through three assignments (50%) and a final written examination (50%). The final examination will include multiple-choice, short-answer and problem-solving questions. The three tasks are programmatic and involve the implementation of algorithms. |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | - Suggested Bibliography:<br>1. Ioannis Marinakis, Athanasios Migdalas, Combinatorial Optimization, Neon Publications Technologies, Version: 1/2016<br>2. Ding Zhu Du, Panos Pardalos, Xiaodong Hu, Weili Wu, Introduction to Combinatorial Optimization, New Technologies Publishing, Version: 1/2023<br>- Related scientific journals:<br>• Journal of Combinatorial Optimization<br>• discrete optimization<br>• Mathematical Programming Computation |

# COMMON ELECTIVE COURSE (ALL SEMESTERS)

## SPECIAL ASSIGNEMENT

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| **Course unit code** | E27 |
| **Course unit type** | Elective / Specialization |
| **Course level** | Undergraduate |
| **Year of study** | 4th , 5th |
| **Semester** | 7th , 8th , 9th |
| **Credit units** | 5 |
| **Website** | eclass.uowm.gr/courses/ICTE246/ |
| **Teaching weekly hours** | - |
| **Lecturer** | Faculty members and adjunct faculty (responsible: Th. Zygiridis) |
| **Course content** | A research project, based on a combination of knowledge from previous semesters. |
| **Expected learning outcomes results and skills** | Upon successful completion of the Special Project, the student will:<br>• Be familiar with the research process and gain experience in searching and analyzing relevant literature.<br>• Develop skills in integrating knowledge from different disciplines and applying theoretical concepts.<br>• Cultivate the ability to critically analyze research outcomes.<br>• Acquire experience in managing tasks and delivering results within specific deadlines.<br>• Enhance proficiency in writing structured technical reports. |

- Gain insight into the working methods required for thesis preparation.

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| **Prerequisites** | None |
| **Teaching methods** | - |
| **Evaluation** | Writing the final paper |
| **Language of instruction/Exams** | Greek, English |
| **Bibliography** | Depending on the task assigned. |

# 7th SEMESTER - – FREE ELECTIVE COURSES

## RESEARCH, TECHNOLOGY AND INNOVATION POLICY

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| **Course unit code** | E7 |
| **Course unit type** | Free Elective |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **Credit units** | 5 |
| **Website** | https://ece.uowm.gr/courses.php?view_course=76 |
| **Teaching weekly hours** | 4 |
| **Lecturer** | It will not be offered |
| **Course Content** | The content of the course includes: |

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| | • Innovation and competitiveness<br>• Innovation as a management process<br>• Innovation Systems<br>• Technological entrepreneurship<br>• Entrepreneurship and innovation practices<br>• Research, Technology and Innovation Policies in America, Europe and Greece<br>• Indicators for measuring innovation<br>• Development of the Business Canvas<br>• Financial Tools<br>• Compilation and Development of Business Plan |
| **Expected learning outcomes results and skills** | This course aims to contribute to meeting the needs of education in modern innovation and entrepreneurship techniques and places particular emphasis on the detailed presentation of successful entrepreneurial Practical. The syllabus of this course is divided into two parts as follows: The first deals with the process of innovation and its relationship with knowledge, learning and creativity, while the second part deals with entrepreneurship and its interdependencies with innovation and the various systems, innovation policies, with particular emphasis on the drafting and development of a business plan.<br>At the end of the course the student will be able to:<br>• List the types of innovation.<br>• Describe the concepts of attitude, momentum and innovation performance.<br>• Name the difference between innovation and invention.<br>• Describe the types and characteristics of innovation.<br>• Apply the standards of the innovation process.<br>• Identify innovation systems.<br>• Identify the types of entrepreneurship.<br>• Select appropriate financial instruments for entrepreneurship. |

- Compare innovation policies.
- Draw up a business plan.

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| **Prerequisites** | None |
| **Teaching methods** | Oral presentations (13 weeks x 4 hours of theory) and two compulsory homework assignments |
| **Evaluation** | 30% final oral examination, 70% homework |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] INNOVATION & ENTREPRENEURSHIP, 2016, OVERVIEW. REVIEW: Koulouriotis Dimitris, "Bessant J." "Tidd J."<br>[2] Entrepreneurship and Social Economy, Edition: 1/2017, Authors: 1.1.1. Anna, |

## ENGLISH III (ACADEMIC WRITING)

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| **Course unit code** | EH2 |
| **Course unit type** | Free Elective |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **Credit units** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE391/ |
| **Teaching weekly hours** | 4 |

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| **Lecturer** | S. Tavoultzidou (Assistant Professor) |
| **Course content** | • Paraphrasing techniques to avoid plagiarism.<br>• Establishing cause-and-effect relationships in academic writing.<br>• Employing comparison and contrast in academic texts.<br>• Drawing conclusions effectively in academic writing.<br>• Developing paragraphs through various methods, including definition, generalization/specification, clarification, examples, classification, and description.<br>• Structuring texts with exercises focusing on coherence of expression, content clarity, and addressing common writing mistakes.<br>• Writing summaries and crafting proper references. |
| **Expected learning outcomes results and skills** | Upon successful completion of the course, the student will:<br>• Be familiar with the characteristics and style of academic discourse and key academic text genres (e.g., scientific articles, reports, theses).<br>• Develop essential language skills for writing and editing, including paragraph structure, coherence, syntax, specialized vocabulary, and proper punctuation.<br>• Apply effective writing strategies for producing scientific and technical texts relevant to their field of study, such as reports, descriptions, instructions, and dissertations. |
| **Prerequisites** | • Good knowledge of English language (level<br>B2 language proficiency, according to the CommonEuropean Framework of Reference for Modern Languages) |
| **Teaching methods** | Lectures |

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| **Evaluation** | • Written final examination (60%)<br>• Interim evaluation (Progress) (40%) |
| **Language of instruction/Exams** | English-Greek |
| **Bibliography** | [1] Integrating Technical & Academic Writing into your English Course - Theory and Practice - Κωδ. Book Code: 86199178<br>Edition: 1/2019, Authors: E. Panourgia<br>[2] University Writing Course Student's Book with answers, Ref. Book on Eudoxos: 10686, Edition: 1st ed./2007, Morley John,Doyle Peter,Pople Ian<br>[3] Academic Writing, Ref. Book Code in Eudoxos: 68391268, Publication: 3rd/2017, Evdoridou Elsa - Karakasidis Thodoros |

# COURSES IN THE DEPARTMENT OF MECHANICAL ENGINEERING

## HEATING

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| **Course code** | **208** |
| **Website** | http://eclass.uowm.gr/courses/MECH271/ |
| **Type of lesson** | Free Elective |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **Credit units** | 5 |
| **Teaching weekly hours** | 4 |
| **Proposed prerequisites** | Heat Transfer<br>Thermodynamics I |
| **Course content** | **Introduction:** Objectives of thermal environment regulation. Fundamentals of heat transfer and thermodynamics.<br>**Heating Systems:**<br>• Insulating properties of materials and thermal insulation.<br>• Calculation of thermal loads.<br>• Components and typologies of heating installations.<br>• Sizing of essential boiler room elements: circulators, expansion vessels, burners, flues, and auxiliary components (e.g., safety valves, automatic filling valves, triple and quadruple valves).<br>• Heat transfer components and terminal units. |

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| | • Relevant legislative elements and regulations.<br>• Methods for allocating heating costs. |
| **Expected learning outcomes results and skills** | The course introduces students to the fundamental principles of designing and analyzing heating systems and building installations. Upon successful completion, students will be able to:<br><br>Understand the core principles underlying the methods covered, connecting them to prior knowledge (e.g., Fluid Mechanics, Heat Transfer).<br><br>Apply methods accurately, such as calculating thermal loads and assessing a building's thermal insulation capacity.<br><br>Evaluate the reliability and complexity of each method, considering potential simplifications when appropriate.<br><br>Utilize these methods in designing heating systems and installations.<br>To reinforce these skills, students will complete a project involving the heating system design for a specific building. |
| **Teaching** | Oral deliveries, implementation guidance "workshops" |

## COMPUTATIONAL ENGINEERING

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| **Course code** | **228** |
| **Website** | https://eclass.uowm.gr/courses/MECH327/ |
| **Type of lesson** | Free Elective |
| **Course level** | Undergraduate |
| **Year of study** | 4th |

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| **Semester** | 7th |
| **Credit units** | 5 |
| **Teaching weekly hours** | 4 |
| **Proposed prerequisites** | Introduction to computers<br>· Mathematics I<br>· Mathematics II<br>· Fluid Mechanics I<br>· Numerical Analysis |
| **Course content** | The course covers conservation principles and their mathematical foundation, focusing on partial differential equations, boundary conditions, and boundary value problems. It introduces finite difference methods, basic equation forms, spatial discretization, and higher-order approaches. Topics include the basic laws governing gases, liquids, and particles, as well as gaseous, liquid, and particulate pollutants. Core fluid flow equations are explored, along with Euler-Lagrange methods for turbulent pollutant dispersion. The transport and diffusion of pollutants in turbulent flow and particle motion are modeled, with a focus on atmospheric pollutant diffusion and Gaussian dispersion models. The course includes practical applications using computational tools in a UNIX environment, WRF computing standards, and case studies under real topographic and environmental conditions. |

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| **Expected learning outcomes and skills** | Upon completing the course, students will gain the following skills:<br>• Solving technical problems using computational techniques.<br>• Evaluating logical solutions and selecting appropriate processing levels.<br>• Understanding critical physical phenomena necessary for system problem formulation.<br>• Developing equations and computational models tailored to specific systems.<br>• Solving computer models for various processes and simulating the involved systems effectively. |
| **Teaching** | Lectures, laboratory exercises |

## QUALITY CONTROL

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| **Course code** | **230** |
| **Website** | http://eclass.uowm.gr/courses/MECH167/ |
| **Type of lesson** | Free Elective |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **Credit units** | 5 |
| **Teaching weekly hours** | 4 |
| **Lecturer** | P. Kapetanopoulou (Assistant Professor) |
| **Proposed prerequisites** | Statistics |

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| **Course content** | Introduction to basic statistical concepts and the fundamentals of quality. Overview of quality control methods, including acceptance control through screening and measurement. Analysis of production process capabilities and the principles of control charts. Examination of control charts for screening and measurement characteristics, along with specialized charts. Methods for creating control charts and an introduction to Quality Management Systems. |
| **Expected learning outcomes results and skills** | This course serves as a critical extension of statistics, focusing on practical techniques for product and process quality control that can be applied across various production units. It emphasizes bridging theory with the industrial world by addressing realistic problems using quantitative methods. Upon completion, students will:<br>• Understand the significance of quality in business operations.<br>• Recognize the economic and operational impacts of quality on businesses.<br>• Develop models for real-world quality control systems.<br>• Solve practical quality control problems.<br>• Optimize quality-related decisions using various criteria. |
| **Teaching** | Oral presentations (2 hours theory and 2 hours exercises). |

## ADVANCED MATERIALS-NANOMATERIALS

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| **Course code** | **262** |
| **Website** | |
| **Type of lesson** | Free Elective |

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| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **Credit units** | 5 |
| **Teaching weekly hours** | 4 |
| **Lecturer** | A.Krestou (Assistant Professor) |
| **Proposed prerequisites** | · Materials Technology I<br>· Materials Technology II |
| **Course content** | Introductory elements - basic principles, size, scale - units, nanoscale phenomena. Definition - Need to produce advanced materials. Shape memory alloys. Advanced ceramics. Biomaterials. Smart materials. Structure - Properties - Applications relationship. Categories of nanomaterials; nanostructures of zeros<br><br>dimensional - one-dimensional nanostructures - two-dimensional nanostructures. Properties of nanomaterials - Optical - Mechanical/Tribological . Size dependence of properties. Nanomaterials synthesis techniques - Sol-Gel technique -<br><br>Micromachining techniques - Chemical vapour deposition techniques. Methods of characterization of advanced materials/nanomaterials - Microscopy - Scanning Microscopy (Scanning<br><br>Probe Microscopy-SPM) - Scanning Tunneling Microscopy-STM - Atomic Force Microscopy-AFM - Raman Spectroscopy - Nanoindentation of surfaces & Surface and Thin Films. Applications - Case study: ceramic nanomaterials for catalysts - catalyst substrates. Social - environmental impact of |

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| | nanotechnology. |
| **Expected learning outcomes results and skills** | Upon successful completion of the course, students will be able to:<br>-understand the importance of advanced materials - nanomaterials,<br>-study the different categories of advanced materials with an emphasis on nanomaterials,<br>-contextualise the structure, properties and applications of advanced materials - nanomaterials<br>-search for appropriate scientific sources, combine data and present their scientific work |
| **Teaching** | Lectures and laboratory exercises and/or demonstrations |

## Decision Theory and Data Analysis

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| **Course code** | **260** |
| **Website** | |
| **Type of lesson** | Free Elective |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 7th |
| **Credit units** | 5 |
| **Teaching weekly hours** | 4 |

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| **Lecturer** | K. Tasias (Assistant Professor) |
| **Proposed prerequisites** | Statistical Operational Research |
| **Course content** | Introduction to decision theory and game theory, decision criteria and trees, utility functions and probability, zero and nonzero sum games, applications of game theory to management science,dynamic programming, analysis and statistical processing of data for decision making, decision making using machine learning. |
| **Expectedly learning outcomes and skills** | Upon successful completion of the course, students will be able to:<br>Apply fundamental tools for decision-making.<br>Utilize Bayes' theorem to solve decision-making problems.<br>Construct and analyze decision trees.<br>Calculate and interpret utility functions.<br>Model operational problems using decision-making frameworks.<br>Solve problems involving risk and uncertainty.<br>Develop strategies for addressing complex decision-making scenarios.<br>Apply dynamic programming to manage interrelated decisions.<br>Leverage data analysis techniques for informed decision-making.<br>Integrate machine learning approaches to enhance decision processes. |
| **Teaching** | Oral lectures (Teaching hours: 52, Theory: 26, Exercises: 26). |

# COURSES FROM THE DEPARTMENT OF ACCOUNTING AND FINANCE

## ECONOMETRICS I

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| Course code | **AF505** |
| Website | |
| Type of lesson | Free Elective |
| Course level | Undergraduate |
| Year of study | 4th |
| Semester | 7th |
| CREDIT units | 5 |
| Teaching weekly hours | 4 |
| PROPOSED prerequisites | Mathematics and Statistics |
| Course CONTENT | 1. Object of Econometrics - Purposes of Econometrics Econometrics. Using the EViews Econometric Package.<br>2. Steps to Solve an Econometric Problem - Categories of Statistics - Data Sources. (Applications with the Eviews Econometric Package).<br>3. Simple Linear Regression Models - Deterministic and Stochastic Relationships. (Applications with the Eviews Econometric Package).<br>4. The Least Squares Method - Properties of the |

Regression Line - Assumptions of the Simple Linear Model - Gauss-Markov Theorem. (Applications with the Eviews Econometric Package).

5. Statistical Induction - Confidence intervals of Regression Coefficients - Checking cases of Regression Coefficients. (Applications with the Eviews Econometric Package).

6. Control with the F Distribution - Analysis of the Variance, Determination Coefficients, Coefficient of variation, Coefficient of Correlation, Regression Coefficients and Elasticity. (Applications with the Eviews Econometric Package).

7. Multiple Linear Regression Model - The Basic Assumptions of Multiple Linear Regression Model. (Applications with the Eviews Econometric Package).

8. Confidence Intervals and Case-Control of the Multiple Linear Regression Model Coefficients. (Applications with the Eviews Econometric Package).

9. Analysis of Variance in Multiple Linear Model, Multiple Determination Coefficient, Relationship between F statistic and Multiple Determination Coefficient, Some Correlation Coefficients. (Applications with the Eviews Econometric Package).

10. Some Correlation Coefficients, Criteria for Selection of Regression Models. (Applications with the Eviews Econometric Package).

11. Checking Linear Relationships Between Regression Coefficients. (Applications with the Econometric Eviews package).

12. Violation of Regression Model Cases - Normality (Applications with the Eviews Econometric Package).

Multilinearity - Types of Multilinearity - Consequences (Applications with the Eviews Econometric Package).

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| **Expected learning outcomes results AND skills** | Upon successful completion of the course the student is expected to know:<br>1. Specialise an econometric model.<br>2. Estimate a classical linear model.<br>3. Check and evaluate an econometric model.<br>4. Estimate - check time series models and make forecasts. |
| **Teaching** | Lectures, Computer-assisted learning of E-Views software in a laboratory, Independent Study |

## 8th SEMESTER - FREE ELECTIVE COURSES

### PROJECT MANAGEMENT

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| **Course unit code** | E38-H |
| **Course unit type** | Free Elective |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **Credit units** | 5 |
| **Website** | https://ece.uowm.gr/courses.php?view_course=219 |
| **Teaching weekly hours** | 4 |
| **Lecturer** | S.Ganatsios (Professor) |

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| **Course content** | Concept, characteristics, and types of projects. Key factors and variables influencing project operation, implementation, and success. Impact of environment and teams on project execution. Project life cycle and its phases. Integration of cost, quality, value-added, and life cycle considerations. Criteria and techniques for project selection and evaluation. Project organization, administration, and management. Breakdown structures: Work, Product, Cost, and Organization. Project resources, activities, milestones, and scheduling. Network analysis techniques: AOA, AON, CPM, and PERT. Time, cost management, and project compression. Budget preparation and monitoring. Key performance indicators for tracking project progress: CPI (Cost Performance Index) and SPI (Schedule Performance Index). |
| **Expected learning outcomes**<br><br>**results and skills** | Upon completing the course, students will be able to:<br><br>Understand what a project is, its key characteristics, and its significance for businesses and organizations.<br><br>Recognize the complexity and variability of the project implementation environment and the role of stakeholders in ensuring successful initiation, execution, and delivery.<br><br>Grasp the relationship between cost, time, and quality in project management.<br><br>Identify critical factors and variables influencing successful project completion.<br><br>Apply techniques and methodologies for project evaluation, selection, and rejection.<br><br>Comprehend the importance of the project life cycle and its role in effective monitoring and implementation.<br><br>Utilize tools and methods for organizing, scheduling, monitoring, and managing projects.<br><br>Draft, monitor, and manage project budgets, as well as understand their broader financial dimensions.<br><br>Identify and interpret CPI (Cost Performance Index) and SPI (Schedule Performance Index) indicators to make informed decisions regarding project implementation. |
| **Prerequisites** | None |

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| **Method. teaching** | Lectures |
| **Evaluation** | 100% final examination |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Larson, E.W., and Gray C.F., (2018), "Project Management : The Management Process", 7ⁿ Edition, Publishers Keyword<br>[2] Kerzner, H., (2017), "Project Management", JIOLA Publications<br>[3] Wysocki, R. K., (2014), Effective Project Management: Traditional, Agile, Extreme", 7th ed., WILEY, UK.<br>[4] Burke, R. (2014), "Project Management - Principles and Techniques", Kritiki Publications, Athens<br>[5] Burke, R. (2013), "Project management: planning and control techniques", 5th ed., WILEY, UK. |

## OPERATIONAL RESEARCH

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| **Course unit code** | E36 |
| **Course unit type** | Free Elective |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **Credit units** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ICTE318/ |
| **Teaching weekly hours** | 4 |

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| **Lecturer** | T. Kyriakidis (Laboratory Teaching Staff) |
| **Course content** | • Introduction<br>• Applications of Operational Research (EU)<br>• Mathematical modelling of Linear Programming (LP) problems<br>• Graphical solution of GM problems<br>• The Simplex method<br>• Interpretation, sensitivity analysis, Special cases<br>• Solving GM problems with the help of computer packages<br>• The Western problem<br>• Integer programming<br>• The Branch-and-Bound algorithm<br>• Transport problems<br>• Network problems<br>• Project scheduling<br>• Decision Theory<br>• Stock control<br>• Case studies |
| **Expected learning outcomes results and skills** | This course introduces students to the fundamentals of Quantitative Analysis, emphasizing optimization techniques for organizing, designing, and synthesizing production processes and systems. Through case studies, students gain a deeper understanding of theoretical concepts and practical experience in modeling process optimization problems.<br>Upon completing the course, students will:<br>• Understand the basic functions and decision-making tools within production systems, such as inventory management, equipment maintenance, quality control, demand forecasting, and production scheduling, along with their interactions with external environments.<br>• Grasp the relationship between real-world problems and mathematical modeling. |

- Recognize and apply essential tools of operations research.
- Model real-life problems using mathematical programming.
- Solve engineering problems and provide optimal solutions.
- Analyze and interpret mathematical programming solutions to engineering challenges.

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| **Prerequisites** | Probability and Statistics |
| **Teaching methods** | Lectures and workshop |
| **Evaluation** | Written final examination, optional progress examination |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] Business Research Case Studies, Volume A, A. K. Georgiou, C. S. Economou, G. D. Tsiotras. Ed. Benou, 2006.<br>[2] Quantitative Analysis, Volumes A and B, D. P. Psoinos. Ziti,1993.<br>[3] Operational Research, P. C. Ypsilantis. Proposer, 2007.<br>[4] Quantitative Analysis for Administrative Decision Making, Volumes A and B, C. S. Economou, A. K. Georgiou. Ed. Benou, 2000.<br>[5] Introduction to Operations Research, Hamdy A. Taha, translation by Athanasios I. Margaris. Tziola Publications, 2011 |

## PRINCIPLES OF ADMINISTRATION AND ADMINISTRATION DECISION MAKING

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| **Course unit code** | EH4 |
| **Course unit type** | Free Elective |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **Credit units** | 5 |
| **Website** | https://eclass.uowm.gr/courses/HMMY130/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | A. Tsalikakis (Assistant Professor) |
| **Course content** | The concept of Enterprise and Organization, their purpose, and significance. Operating environments and the resources (physical, financial, and human) that support enterprises. Fundamental principles and functions of management, including Planning, Organization, Leadership, and Control. Goal-setting: identification, evaluation, prioritization, and success criteria. The relationship between planning and control, programming, and decision-making. Decision-making processes and stages, addressing risk and uncertainty. Decision-making environments, types of decisions, and factors influencing and affecting the decision-making process. |
| **Expected learning outcomes results and skills** | The course introduces students to the concepts of firms, organizations, and the principles of their operation, highlighting the significance of both internal and external environments in shaping decisions and performance. Through lectures and case studies, students will grasp essential |

concepts and tools relevant to their academic and professional lives. Upon completion, students will:

- Understand the concepts of planning and organization and their importance in personal and professional contexts.
- Recognize the complexity and variability of organizational environments and their impact on business operations and decision-making.
- Apply the basic functions of management effectively.
- Appreciate the importance of objectives, understand their prioritization and evaluation, and identify factors that influence successful implementation.
- Comprehend the role of decision-making, including the associated risks and processes, and evaluate the factors influencing decision outcomes.

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| **Prerequisites** | None |
| **Teaching methods** | Oral traditions |
| **Evaluation** | Written final examination |
| **Language of instruction/Exams** | Greek |
| **Bibliography** | [1] BUSINESS ORGANIZATION AND MANAGEMENT, MANTZARIS IOANNIS<br>[2] MANAGEMENT, Bourantas Dimitris<br>[3] MANAGEMENT PRINCIPLES OF BUSINESS MANAGEMENT, S. L. HOUTIRIS, S. L.<br>[4] Decisions - Decision Making, Dimitropoulos Efstathios<br>[5] RATIONAL DECISION MAKING, GOLUB ANDREW |

# COURSES FROM THE DEPARTMENT OF MECHANICAL ENGINEERING

## TOTAL QUALITY MANAGEMENT

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| **Course code** | **395** |
| **Website** | |
| **Type of lesson** | Free Elective |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **Credit units** | 5 |
| **Teaching weekly hours** | 4 |
| **Lecturer** | - |
| **Proposed prerequisites** | · Statistics<br>· Operational Research I<br>· Quality Control |
| **Course content** | The concept of quality, its objectives, the reasons for adopting Total Quality Management (TQM), and the barriers to its successful implementation. Principles of TQM, including quality planning, the economic model of quality management, and the differences between TQM and traditional management approaches. Tools and techniques for quality measurement, control, and improvement, as well as production process capability analysis. Overview of quality assurance systems, the Common Framework for Evaluation, and quality awards. |

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| | Introduction to the Taguchi approach, including the Taguchi loss function, the Six Sigma (6σ) methodology, and the DMAIC framework. Integration of TQM with Business Process Reengineering (BPR) and its role in organizational redesign. |
| **Expected learning outcomes results and skills** | Upon successful completion of the course, students will be able to:<br>• understand basic concepts of quality,<br>• use quality measurement and control tools<br>• calculate the cost of quality,<br>• apply the basic tools of Total Quality Management,<br>• develop programs Management Total Quality Programmes,<br>• acknowledge the requirements of Quality Standards.<br>• prepare a company for the implementation of Quality Standards. |
| **Teaching** | Oral lectures (Teaching hours: 52, Theory: 26, Exercises: 26). |

## BIOMEDICAL ENGINEERING

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| **Course code** | **258** |
| **Website** | http://eclass.uowm.gr/courses/MECH258 |
| **Type of lesson** | Free Elective |
| **Course level** | Undergraduate |

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| **Year of study** | 4th |
| **Semester** | 8th |
| **Credit units** | 5 |
| **Teaching weekly hours** | 4 |
| **Lecturer** | A.Tsamis - A. Tsouknis (Assistant and Associate Professor) |
| **Proposed prerequisites** | · Materials Technology I<br>· Materials Technology II<br>· Numerical Methods of Design of Mechanical Structures<br>· Static<br>· Dynamic |
| **Course content** | Basic principles of biology, biological materials and their properties (tissues, cells, proteins, amino acids, blood, etc.). Understanding of biological systems and interactions between them.<br><br>Mechanical signal transmission mechanisms and its conversion into a biochemical. Evolutionary mechanics and the effect of daily loads on tissue morphogenesis. Technical materials, biocompatibility, biodegradation and principles governing implants. Species implants and their peculiarities based on the intended use. Smart/biomimetic materials and nanomaterials. Implant design, material selection, clinical trials, optimisation and regulatory framework for implantation.<br><br>Examples of orthopaedic and dental engineering and interdisciplinary benefits. |

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| **Expectedly learning outcomes and skills** | · Upon successful completion of the course, the student will:<br><br>· Acquire a solid theoretical foundation in various areas of biomedical technology and understand the application of engineering principles in medicine.<br><br>· Understand, describe, and categorize fundamental technologies used in biomedicine using diagrams and data.<br><br>· Evaluate and compare the advantages and disadvantages of different technological approaches and solutions, providing evidence-based documentation.<br><br>· Select the most appropriate digital system description to address specific biomedical problems.<br><br>· Gain familiarity with the basic principles of materials technology relevant to biomedical devices.<br><br>· Understand the core principles of biomaterials, their properties, and the characteristics of prosthetic limbs. |
| **Teaching** | Oral lectures (Teaching hours: 52, Theory: 26, Exercises: 26). |

## STRATEGIC MANAGEMENT

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| **Code course** | **224** |
| **Website** | |

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| **Type of lesson** | Free Elective |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **Credit units** | 5 |
| **Teaching weekly hours** | 4 |
| **Lecturer** | - |
| **Expected learning outcomes and skills** | The aim of the course is to give the student the opportunity to:<br>• understand in a simple way the basic principles that govern Strategy in business,<br>• analyse the contribution of each aspect of the Strategy to the development of the business project,<br>• analyse the internal environment of the company,<br>• analyse the intra-business environment of the company,<br>• may choose a strategy at market or industry level,<br>• evaluates strategies,<br>• implements strategies |

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| **Teaching** | Oral presentations (13 weeks x 5 hours of theory) and one major homework assignment. |

## REFRIGERATION-AIR CONDITIONING

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| **Course code** | **209** |
| **Website** | |
| **Type of lesson** | Free Elective |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |
| **Credit units** | 5 |
| **Teaching weekly hours** | 4 |
| **Lecturer** | N. Taousanidis (Professor) |
| **Proposed prerequisites** | Heat Transfer<br>Thermodynamics I |
| **Course content** | **Air Conditioning and Refrigeration**: Understanding comfort conditions and climatological data. Analysis of solar and air conditioning loads, including walls, glazing, lighting, occupants, appliances, and air infiltration. Calculation of cooling loads. Overview of air conditioning systems and components, including sizing of key elements and duct networks.<br><br>**Refrigeration**: Principles of mechanical vapor compression, elementary refrigeration cycles, and advanced cycles with subcooling and superheating. Analysis of real refrigeration cycles and multi-stage vapor compression systems. |

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| | Introduction to refrigerants and alternative cooling methods, including absorption systems (NH3/H2nd, H2nd/LiBr) and adsorption cooling. Overview of refrigeration systems for cooling chambers and the preservation, storage, and catering of foodstuffs. |
| **Expected learning outcomes results and skills** | Upon successful completion of the course, students will be able to:<br><br>Calculate refrigeration loads for air-conditioned spaces.<br>Plan air conditioning processes using the psychrometric diagram.<br>Design and size duct networks.<br>Select and size chillers, fans, and other cooling components.<br>Utilize technical instructions, standards, and manuals effectively.<br>Perform mass and energy balances for cooling systems.<br>Analyze refrigeration cycles on T-s diagrams, identifying energy losses in individual processes (e.g., compression, expansion, heat exchangers).<br>Perform basic psychrometric calculations with confidence. |
| **Teaching** | Lectures, tutorial exercises |

## INDUSTRIAL MANAGEMENT

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| **Course code** | **123** |
| **Website** | http://eclass.uowm.gr/courses/MECH177/ |
| **Type of lesson** | Free Elective |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |

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| **Credit units** | 6 |
| **Teaching weekly hours** | 5 |
| **Lecturer** | K. Tasias (Assistant Professor) |
| **Proposed prerequisites** | Statistics<br>Operational Research |
| **Course content** | Introduction to production processes. Forecasting techniques:<br>Time series models, causal models, linear trend models and seasonal models. Production system design: product design, production process selection and capacity design, spatial layout. Planning and control production systems: overall production planning, work scheduling, inventory management,<br><br>quality control, maintenance and replacement of equipment. |
| **Expected learning outcomes results and skills** | The course aims to address challenges related to the design and operation of production units. It presents and analyzes methods for making critical decisions in both the design phase (e.g., location selection, organization of production methods, and management structure) and the operational phase (e.g., production planning, line balancing, work organization, and procurement strategies).<br><br>Upon successful completion of the course, students will be able to:<br><br>Analyze problems associated with factory design and operation.<br><br>Use forecasting techniques effectively.<br><br>Apply methods for selecting optimal installation locations.<br><br>Calculate the required capacity and equipment for |

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| | production units.<br>Choose appropriate work methods.<br>Utilize production scheduling tools.<br>Optimize the timing of production operations.<br>Allocate resources efficiently for task execution.<br>Apply techniques for balancing and smoothing production lines.<br>Organize and manage procurement systems effectively. |
| **Teaching** | Oral lectures (Teaching hours: 65, Theory: 39, Exercises: 26). |

# COURSES FROM THE DEPARTMENT OF MANAGEMENT SCIENCE AND TECHNOLOGY

## BLOCKCHAIN AND CRYPTOCURRENCIES

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| **Code course** | **DET 806** |
| **Website** | https://eclass.uowm.gr/courses/MST148/ |
| **Type of lesson** | Free Elective |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | 8th |

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| **Credit units** | 2 |
| **Teaching weekly hours** | 3 |
| **Featured prerequisites** | - |
| **Course content** | The transition to Web 3.0 is characterized by a series of changes in the way we use the internet for our daily communication and the way businesses and organizations operate. New technologies and terms are entering our lives every day such as artificial intelligence, machine learning and of course what everyone is talking about Bitcoin and cryptocurrencies.<br><br>But behind bitcoin there is a whole technology that will radically change the way not only businesses and organisations but also societies are organised, managed and run. In this course we look at the characteristics of this technology and its main uses (use cases), which as we will see are not limited to cryptocurrencies.<br><br>Introduction to Blockchain<br><br>2. Features and mode of operation<br><br>3. Blockchain 1.0 (Bitcoin and cryptocurrencies)<br><br>4. Blockchain 2.0 (Ethereum 1.0 and Ethereum 2.0 - Serenity)<br><br>5. Smart Contracts - Decentralised Autonomous Organisations (DAOs) and apps (DApps)<br><br>6. Technology applications (use cases)<br><br>a. Financial sector - DeFi<br><br>b. Supply Chain and Marketing<br><br>c. Public Sector and Governance<br><br>7. Challenges and problems for the implementation and |

adoption of technology

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| **Expected learning outcomes and skills** | Upon successful completion of the course the student is able to know:<br>● Understands the basic concepts and importance of BlockChain technology and cryptocurrencies<br>● Recognize and analyze the characteristics of blockchain technology and its limitations.<br>● Knows the basics of practical application and blockchain creation<br>● It analyses the factors that lead to the adoption and implementation of BlockChain technology by companies and organisations in different industries. |
| **Teaching** | Lectures<br><br>Possibility of remote lectures and practical applications using a modern education platform and web platforms (APIs) |

## 9th SEMESTER - COURSES OF FREE ELECTIVE

### NON-DESTRUCTIVE TESTING

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| **Course unit code** | EH6 |
| **Course unit type** | Free Elective |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **Credit units** | 5 |
| **Website** | https://ece.uowm.gr/courses.php?view_course=190 |

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| **Teaching weekly hours** | 4 |
| **Lecturer** | It will not be offered |
| **Course content** | Non-destructive testing of materials and structures. Radiography method, ultrasonic method, electromagnetic methods (leakage, magnetic leakage), magnetic particle and liquid penetrant methods, optical inspection, method thermography and other methods. International standards and specifications |
| **Expected learning outcomes results and skills** | Upon successful completion of the course, the student will:<br>• has understood the phenomenon of each recognized method of Non-Destructive Control,<br>• may carry out simple laboratory tests using at least 4 methods (Magnetic, Penetrant, Intrusive, Dyno, Ultrasonic),<br>• can interpret industrial radiographs,<br>• can evaluate the application and the expected errors in the test specimen,<br>• can choose the appropriate method of Non-Destructive Control,<br>• can interpret specifications,<br>• prepare simple non-destructive testing reports,<br>• develop the ability to solve problems and through the evaluation of his/her numerical skills calculations will consolidate the concept of order of magnitude. |
| **Prerequisites** | None |
| **Teaching methods** | Lectures, laboratory exercises |
| **Evaluation** | 100% final examination |

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| **Language teaching** | Greek |
| **Bibliography** | [1] Book in Eudoxos [320267]: NON-DESTRUCTIVE CONTROLS, THEODOROS MATIKAS, DEMETRIOS ANGELIS |

## INFORMATION TECHNOLOGY AND EDUCATION

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| **Course unit code** | E41 |
| **Course unit type** | Free Elective |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **Credit units** | 5 |
| **Website** | https://eclass.uowm.gr/courses/ECE389/ |
| **Teaching weekly hours** | 4 |
| **Lecturer** | B. Lazaridis (Lecturer) |
| **Course content** | The course aims to establish a research infrastructure for analyzing the various types of interactions that computers facilitate in the classroom, with a focus on fostering deeper and more meaningful pedagogical solutions. It explores the key technological and pedagogical parameters involved in integrating new technologies into teaching. The dynamic field of educational applications of information and communication technologies significantly impacts the teaching framework, learning activities, and all participants in the pedagogical process. Consequently, understanding the multifaceted and complex teaching reality, the overall organization of the educational system, and the interactions |

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| | between its parameters is essential. |
| **xpected learning outcomes results and skills** | Upon completion of the course, students are expected to be able to:<br>• Identify Educational Technology and describe the past and present of the region and the factors that influence it<br>• Make arguments in favour of the use of technology in education<br>• Identify the general categories of technological resources (hardware and software) that can be used in education<br>• Identify teaching practices and strategies technology integration reflecting instructional and constructivist approaches to teaching and learning<br>• Design strategies to integrate the technology in education, implement them and design action research to assess the impact of these strategies<br>• Develop learning activities that make use of: (a) modern technological tools (educational software, general-purpose and special-purpose software tools, multimedia/transmedia tools), (b) Internet and World Wide Web services, tools and applications, and (c) mobile technologies and related applications<br>• Evaluate pedagogical/teaching methods.<br>Can evaluate a system interface<br>- user of educational applications, and the student-learning outcome assessment (teaching effectiveness) |
| **Prerequisites** | None |
| **Teaching methods** | Preparation and presentation of papers, Written examination |
| **Evaluation** | 100% final examination |
| **Language of instruction/Exams** | Greek |

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| **Bibliography** | [1] Grigoriadou, M., etc. (2009) Teaching Approaches and Tools for the Teaching of Computer Science. Ed. Keyword<br>[2] Komis, V. (2005) Introduction to the Teaching of Computer Science. Athens: Klidarithmos Publications. |

# COURSES FROM THE DEPARTMENT OF MECHANICAL ENGINEERING

## ENERGY DESIGN OF BUILDINGS

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| **Code course** | **251** |
| **Website** | http://eclass.uowm.gr/courses/MECH227/ |
| **Type of lesson** | Free Elective |
| **Course level** | Undergraduate |
| **Year of study** | 5th |
| **Semester** | 9th |
| **Credit Units** | 5 |
| **Teaching weekly hours** | 4 |
| **Lecturer** | G. Panaras (Assistant Professor) |
| **Proposed prerequisites** | Heating - Cooling - Air Conditioning |

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| **Course content** | Objectives & content of energy design of buildings. Building uses. Building comfort requirements: Thermal comfort, ventilation, visual comfort. Estimation of heating & cooling loads. Dimensioning Systems. Bioclimatic design of buildings. Passive solar systems for heating buildings.<br><br>Natural cooling of buildings: solar protection, passive and hybrid natural cooling techniques. Natural and artificial ventilation of buildings. Conventional active systems. Solar thermal systems. Solar air conditioning systems. Renewable energy systems in buildings. Energy performance analysis of a building:<br><br>Energy load modelling, semi-steady state method of monthly step, systems modelling. Application to optimal building design. |
| **Expected learning outcomes results and skills** | The course presents the basic principles of design to achieve the lowest possible energy consumption in buildings. Upon successful completion of the course, students will have:<br><br>• understand the difference between sizing a building installation and assessing its behaviour and efficiency,<br>• understand the influence of the environment and comfort requirements on his/her choices energy design of buildings,<br>  • understand the technical, environmental and economic objectives of energy planning,<br>  • gain knowledge of passive and active systems that can be implemented in a building,<br>  • in the direction of energy saving and maximum exploitation of renewable energy systems,<br>  • synthesize existing methods, tools and technologies towards optimal |

design,

- apply the acquired knowledge to a Energy Design problem, according to the low/near-zero energy building design project (of their choice) assigned to them.

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| **Teaching** | Lectures and homework. |

# OPTIONAL COURSES

## METHODOLOGIES FOR CARRYING OUT A RESEARCH PROJECT

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| **Course unit code** | EH5 |
| **Course unit type** | Optional/General Knowledge |
| **Course level** | Undergraduate |
| **Year of study** | 4th |
| **Semester** | Spring |
| **Credit units** | 2 |
| **Website** | https://eclass.uowm.gr/courses/HMMY111/ |
| **Teaching weekly hours** | 2 |
| **Lecturer** | (Adjunct Lecturer) |

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| **Course content** | Proper research planning and preparation are essential for students. This course introduces key concepts of scientific research, emphasizing organization, planning, and preparation. Topics include data collection techniques, statistical data processing, knowledge extraction, bibliographic material organization, scientific writing, and presentation. Areas covered include primary, quantitative, and qualitative research, research ethics, objectivity, validity, and data collection methods like observation, interviews, and questionnaires. Students also explore bibliographic searches, research structure, writing rules, and presentation techniques. Practical teaching units address the research process, experimental design, hypothesis formulation, ethical considerations, and effective time management during presentations. |
| **Expected learning outcomes results and skills** | Upon successful completion of the course, the student will be able to:<br>• Identify the nature of a scientific problem and propose appropriate solutions.<br>• Comprehend the fundamental principles of scientific research.<br>• Gather and organize the necessary data and literature to conduct effective research.<br>• Write a scientific paper adhering to proper structure, including result analysis and conclusion formulation.<br>• Present research findings effectively, following established specifications and guidelines. |
| **Prerequisites** | None |
| **Teaching methods** | - Classroom teaching using a projector<br>- Support the learning process through e-class |
| **Evaluation** | - Individual work (80 %)<br>- Final examination (20 %) |
| **Language of instruction/Exams** | Greek |

**Bibliography**

[1] A. Sachini-Kardasi, "Research Methodology", Ed. Veta, 2007

[2] P.G. Kyriazopoulos, "Research methodology for the preparation of theses", Synchronic Editions, 2011

[3] I. Mantzaris, "Scientific research: writing-formulation - presentation of scientific papers", Ed. Entypes, 2007

[4] P. Latinopoulos, "The first steps in research: a useful guide for young researchers", Ed. Kritiki, 2010.

[5] Z. Ayoutantis, "A practical guide to the writing technical texts", Ion Publications, Athens, Greece, 2003