


## SCHOOL OF INFORMATION SCIENCES AND TECHNOLOGY

## DEPARTMENT OF INFORMATICS

# MSC IN INFORMATION SYSTEMS DEVELOPMENT AND SECURITY

**ATHENS, NOVEMBER 2026**

## PART I: INFORMATION ABOUT THE INSTITUTION

### CONTACT DETAILS (Name & Address)

ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS (AUEB)

Address:76, Patission Str. GR-10434, Athens

Telephone number: +30-210-8203911

Website: https://www.aueb.gr e-mail: webmaster@aueb.gr

Facebook: https://www.facebook.com/auebgreece

Twitter: https://twitter.com/aueb

LinkedIn: https://www.linkedin.com/school/athens-university-of-economics-and-business/mycompany/

Youtube: https://www.youtube.com/channel/UCPncunqp3bMuAHHeCikhalg

Instagram: https://www.instagram.com/aueb.gr/

### ACADEMIC AUTHORITIES

The rectorate authorities consist of the Rector and the Vice Rectors, as per below:

**Rector:**

Professor Vasilios Vasdekis

**Vice Rectors:**

**Vice Rector of Academic Affairs and Personnel**
Professor Leonidas Doukakis

**Vice Rector of Research and Lifelong Learning**
Professor Georgia Siougle

**Vice Rector of Financial Planning and Infrastructure**
Associate Professor Eleanna Galanaki

**Vice Rector of International Cooperation and Development**
Professor Nancy Pouloudi

**School of Information Sciences and Technology**
Dean Professor Vana Kalogeraki
**Department of Informatics**
Chair Ion Androutsopoulos
**Master's Program in Information Systems Development and Security**
Director Professor George Xylomenos
**Contact details**
Address: 47A Evelpidon & 33 Lefkados Street, Athens, 113 62, Greece
Email: xgeorge@aueb.gr
Website: https://mscis.cs.aueb.gr/el/normal/home

### UNIVERSITY LEADERSHIP & STRUCTURE

The organization and operation of the Institution is defined by current legislation as in force. Athens University of Economics and Business is under the supervision of the Ministry of Education, Research and Religious Affairs. Its structure includes:

**THE SENATE**

The **Senate** consists of:

- the Rector,
- the Vice-Rectors,
- the Deans of the Schools
- the Heads of the Departments
- one representative of undergraduate students, postgraduate students and doctoral candidates each
- one representative per category of staff: Special Educational Staff (EEP), Laboratory Teaching Staff (EDIP), Special Technical Laboratory Staff (ETEP) and administrative staff.

The **Senate** is the highest collective decision-making body of the University. It is comprised of the Rector, the Vice-Rectors, the Deans of the Schools, the Chairmen/Chairwomen of the Departments, students, teaching staff and administrative staff delegates.

**SCHOOLS**

The Athens University of Economics and Business consists of three Schools:

1. **SCHOOL OF ECONOMIC SCIENCES**, which supervises and coordinates the operation of the Department of International and European Economic Studies and the Department of Economics.

2. **SCHOOL OF BUSINESS**, which supervises and coordinates the operation of the Department of Management Science and Technology, the Department of Business Administration, the Department of Accounting and Finance and the Department of Marketing and Communication**.**

3. **SCHOOL OF INFORMATION SCIENCE AND TECHNOLOGY**, which supervises and coordinates the operation of the Departments of Informatics and the Department of Statistics.

According to Law 4485/2017 (Government Gazette 114 / 4-8-2017), each School is governed by the Dean of the School, the Dean's Council and the School's General Assembly, while each Department is governed by the Department's Chairman and General Assembly.

**DEPARTMENTS**

The Department is the University's main educational and academic unit, which promotes science and knowledge development in the relevant academic field, organizes and delivers teaching and ensures continuous improvement in research and education. The Department consists of the Professors, Associate Professors, Assistant Professors, Lecturers, members of the Special Educational Staff (EEP), members of the Laboratory Teaching Staff (EDIP) and members of the Special Technical Laboratory Staff (ETEP).

The Departments of the Athens University of Economics and Business are:

1. International and European Economic Studies
2. Economics
3. Management Science and Technology
4. Business Administration
5. Accounting and Finance
6. Marketing and Communication

7. Informatics
8. Statistics

According to Law 4485/2017 (Government Gazette 114 / 4-8-2017), each Department is governed by the Department's Chairman and the General Assembly.

**UNIVERSITY STAFF**
The University staff consists of the following categories:

**- TEACHING STAFF:**

- The Faculty consisting of (a) Professors, (b) Associate Professors (c) Assistant Professors and (d) Lecturers.
- Special Educational Staff (E.E.P.).
- Laboratory Teaching Staff (E.DI.P.).
- Special Technical Laboratory Staff (E.T.E.P.).
- Auxiliary Teaching Staff (E.D.P.).
- Research Assistants.
- University Scholars.
- Special Assignment Teachers.

- **ADMINISTRATIVE STAFF**

**STUDENT SERVICES & FACILITIES**
The Athens University of Economics and Business provides both administrative and other services (meals, housing, library, sport facilities etc.) aiming at serving both its students and staff. More information on the organization and operation of the University's services can be found on the University's website (http://www.aueb.gr/en).

**GENERAL DESCRIPTION OF THE UNIVERSITY**
Athens University of Economics and Business (AUEB), as a Higher Educational Institution, is a legal entity governed by public law and supervised by the Ministry of Education, Research and Religious Affairs.
AUEB is, in order of seniority, the third Higher Education Institution of the country and the first in the fields of Economics and Business Administration. Later, the scientific fields of Informatics and Statistics were added. Since its founding, in 1920, AUEB has a rich and noteworthy tradition of significant academic achievements that define the present and create excellent prospects for the future.
The University as a center of excellence, in academic research and teaching, is rated as one of the leading universities in its subject areas in Greece and one of the best internationally. The high level of its scientific staff, the quality in teaching and research, the modern curriculum/courses, but also the high demand of its graduates enhance significantly the University's brand name and reputation, in Greece and abroad.

**LIST OF DEGREE PROGRAMMES**
Athens University of Economics and Business offers the following Degrees and streams:

| A/A | DEPARTMENTS | SPECIALIZATIONS |
|---|---|---|
| 1. | International and European Economic Studies | 1. International Economics and Finance<br>2. International and European Political Economy |

| | | |
|---|---|---|
| 2. | Economics | 1. Economic Theory and Policy<br>2. Business Economics and Finance<br>3. International and European Economics |
| 3. | Management Science and Technology | 1. Operations Research and Business Analytics<br>2. Operations and Supply Chain Management<br>3. Software and Data Analysis Technologies<br>4. Information Systems and Electronic Business<br>5. Strategy, Entrepreneurship and Human Resources |
| 4. | Business Administration | 1. Business Administration<br>2. Information Systems Management<br>3. Accounting and Financial Management<br>4. Marketing |
| 5. | Accounting and Finance | 1. Accounting<br>2. Finance |
| 6. | Marketing and Communication | 1. International Management, Innovation and Entrepreneurship<br>2. Human Resources Management<br>3. Business Analytics<br>4. Digital Marketing |
| 7. | Informatics | 1. Theoretical Computer Science<br>2. Computer Systems and Networks<br>3. Information Systems and Information Security<br>4. Databases and Knowledge Management<br>5. Operational Research and Economics of Information Technology<br>6. Computational Mathematics and Scientific Calculations |
| 8. | Statistics | No specializations are offered |

Detailed information about programs and curriculum is provided in each department's study guide and website.

**ADMISSION/REGISTRATION PROCEDURE**

Admission for undergraduate students to each department is accomplished through central University entrance exams (Pan-Hellenic examinations). The registration of the successful candidates of these exams, in the Schools and Departments of the University takes place in September on the platform of mandatory electronic registration, according to the guidelines of the Ministry of Education, Research and Religious Affairs.

**MAIN UNIVERSITY REGULATIONS**

The regulations include:

- The Internal Regulations for the Operation of the Institution
- The Organization of Administrative Services
- The Regulations for the Operation of Postgraduate and PhD Programs
- The Internal Regulation for postdoctoral research
- The Exam Guide

**ECTS COORDINATOR OF THE UNIVERSITY**

The University's ECTS Coordinator is the Quality Assurance Chairperson, who ensures the University's compliance with the principles and rules of the European credit accumulation and transfer systems,

supervises compliance and implementation and is responsible for the full recognition and transfer of credit units.

# MSC IN INFORMATION SYSTEMS DEVELOPMENT AND SECURITY

Director Professor Dimitrios Gritzalis

- **Aim of the Program**

The aim of the MSc program is the promotion of knowledge and the development of interdisciplinary approach and research in Information Systems, as well as the development of sophisticated IT applications. The MSc aims to train specialized professionals with strong theoretical and solid practical knowledge and skills, able to adequately meet the needs of enterprises and organizations of the public and private sector, in Greece and internationally, in the field of planning, implementation and management of Information Systems.

- **Qualification awarded.**

The Postgraduate Program awards a **Master Degree in Information Systems Development and Security.**

The program can offer specialization in either one of the two following areas:

**1st Specialization: Intelligent Large-Scale Information Systems Development**

**2nd Specialization: Cybersecurity & Digital Infrastructures Protection**

- **Admission requirements**

The Program is seeking applicants with a bachelor's degree from both domestic and foreign Universities/allied Institutions recognized by DOATAP. Candidates with an undergraduate degree in Computer Science, Computer Engineering, Mathematics and Management as well as graduates from Higher Military Educational Institutions and Police Academies and equivalent schools are particularly encouraged to apply.

- **Target Learning Outcomes**

The Postgraduate Program offers postgraduate level expertise in Information Systems. Instructors of the program include faculty from the Department of Informatics of AUEB with industrial experience in their field of expertise and a strong international research presence.

The carefully crafted curriculum offers a well-balanced program between theory and practice. The specialization in Intelligent Large-Scale Information Systems Development promotes the use of open-source tools, services, and cloud infrastructures. The available courses cover leading edge topics such as big data, intelligent systems development, machine learning and development of WWW and mobile applications. The specialization in Cybersecurity & Digital Infrastructures Protection emphasizes the design and operation of secure computer and network systems. The available courses cover state-of-the-art techniques for assessing security and identifying vulnerabilities and risks in Information Systems design and operation.
The program seeks to provide graduates with a strong theoretical foundation related to the development of intelligent and secure Information Systems, as well as practical training on modern systems and tools. Graduates of the program are eligible for admission to the PhD Program of the Department of Informatics

- **Program structure with courses and their ECTS:**

**The total number of ECTS credits offered by the program is 90.**

**It should be noted that an elective course may not be offered if a limited number of students have registered for it, if there is no availability of a full-time lecturer, if the available financial resources are not sufficient to cover it, etc.**

**The following table lists the available courses and their ECTS credits (CR).**

| **1st Semester** (all five **(5)** courses are mandatory) | | **CR** |
|---|---|---|
| Big Data Analysis & Management Systems | | 6 |
| Advanced Software Development Methods | | 6 |
| Cybersecurity Technologies & Management | | 6 |
| Digital Infrastructure Technologies | | 6 |
| Internet Technologies & Services | | 6 |
| **2nd Semester** (each student selects **(5)** courses. If a student wants to complete a Specialization, she/he can select two **(2) compulsory courses**, along with at least **two (2**) elective courses of the Specialization) | | **CR** |
| **Specialization Compulsory Courses** | | |
| 1st Specialization | Service Oriented Software Development in the Cloud | 6 |
| | Systems Modelling & Knowledge Organization | 6 |
| 2nd Specialization | Software and Network Security | 6 |
| | Applied Cryptography | 6 |
| **Specialization Elective Courses** | | |
| 1st Specialization | Deep Learning | 6 |
| | Web Applications Development | 6 |
| | Mobile Applications Development | |
| | Natural Language Processing | 6 |
| 2nd Specialization | Digital Forensics | 6 |
| | Penetration Testing – Ethical Hacking | 6 |
| | Information Systems Audit | 6 |
| | Blockchains & Smart Contracts | 6 |
| 1st & 2nd Specialization | Software Testing, Reliability & Quality Assurance | 6 |
| | Information Law | 6 |

| **3rd Semester** (each student takes both(2)) | **CR** |
|---|---|
| Digital Innovation & Entrepreneurship Seminar | 3 |
| Communication & Business Environment Seminar | 3 |
| MSc Thesis | 24 |

- **Examination and assessment regulations**

At the end of each semester, students are evaluated in all courses they attended. Evaluation may include exercises, team projects, mid-term and final written or oral examinations, according to the description of each course.

During his/her studies a graduate student is not allowed to fail more than two (2) courses per semester. Failure to participate in the final exam without proper justification results in an automatic failure. Failure on three (3) or more courses per semester will result in removal from the program following a decision of the Department's Assembly.

Each student is eligible to participate in one re-examination period held in September, for up to four (4) courses in total, from the two first semesters. If a student fails during the re-examination to exactly one (1) course, then the grade of this course can be offset by the grade of the master thesis and the student can be awarded a master degree following a decision of the Department's Assembly.

**ACADEMIC CALENDAR**

**FALL SEMESTER**

| | |
|---|---|
| Classes begin: | October 5, 2026 |
| Break before Christmas Holidays: | December 23, 2026 |
| Classes restart: | January 7, 2027 |
| Classes end: | January 15, 2027 |

**Exam period January-February 2027**

| | |
|---|---|
| Start of Exams: | January 25, 2027 |
| End of Exams: | February 5, 2027 |

**Holidays**

October 28 Holiday - The Anniversary of the "No", Wednesday, October 28, 2026
The Anniversary of Polytechneio, November 17, 2026
Theofania, January 6, 2027

**SPRING SEMESTER**

| | |
|---|---|
| Classes begin: | February 8, 2027 |
| Break before Easter Holidays: | April 26, 2027 |
| Classes restart: | May 10, 2027 |
| Classes end: | May 21, 2027 |

**Exam period June 2021**

| | |
|---|---|
| Start of Exams: | May 31, 2027 |
| End of Exams: | June 11, 2027 |

**Holidays**
Clean Monday, Monday, March 15, 2027
Greek Independence Day, March 25, 2027
Agiou Pneumatos, June 21, 2027

**DESCRIPTION OF COURSES**

## M31105- Big Data Analysis & Management Systems

**Core Course, 1st semester, 6 ECTS units**

**Instructor: Professor Ioannis Kotidis**

**Course level: Graduate (MSc)**

**Course Description**

Techniques, algorithms, and systems used for the efficient organization, analysis, and management of big data in centralized and distributed settings. Introduction to big data, horizontal and vertical scaling, modern applications. Handling data of different types, introduction to hashing (open, closed, consistent). Data Warehouses and Business Intelligence. The star schema and its variations. The Data cube operator, definition, and computation. View management, selection, computation, updates. Big Data Systems (Hadoop Map-Reduce, Hive, Apache Spark). Handling and analysing interconnected data, centrality metrics, graph databases (Neo4j, Pregel, Spark GraphX). Data stream processing systems (Storm, Flink, Spark Streaming). Approximate query answering on data streams (sampling, bloom filters, moments, sketches). Introduction to data mining (association rules).

**Learning Outcomes**

Upon completion of the course, students will be able to

1) describe and use techniques and systems for managing big data.

2) understand the benefits and shortcomings of different data systems that can be used to represent and store big data.

3) select and apply efficient techniques and algorithms for analyzing big data in modern applications.

**Prerequisites**

Students should have basic knowledge of databases (SQL), mathematical calculus, linear algebra, and probability theory. For the programming assignments of the course, programming experience is recommended (e.g., in Java, Scala, Python).

**Bibliography**

- Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeff Ullman, http://www.mmds.org/
- Database Systems the Complete Book, H. Garcia-Molina, J. Ullman, J. Widom, ISBN-13: 978-0131873254

**Teaching and Learning Activities**

One three-hour lecture per week, tutorials (2x3 hours), programming exercises as homework.

**Assessment criteria**

The final grade is the weighted average of the midterm (20%) and final examination grade (30%) and the grade of the programming exercises (50%).

**Language**

All lectures are delivered in Greek, with extensive use of English terminology.

## M31109- Advanced Software Development Methods

**Core Course, 1st semester, 6 ECTS units**

**Instructors: Dr.Nikolaos Diamantidis – Dr. Vasileios Zafeiris**

**Course level: Graduate (MSc)**

**Course Description**

Software process models. Agile processes. Software architecture and architectural patterns. Object-oriented design and design patterns. Software implementation and testing. Version control and strategies for team development. Software maintenance and software refactoring. Software deployment strategies (e.g. Continuous Delivery). Modern platforms for software development.

**Learning Outcomes**

After successfully completing the course, students will be able to:

- Understand and successfully participate in all activities of the software lifecycle,
- Understand and assess the architectural factors that shape the architecture of software systems.
- Specify, design, implement and test software to achieve high quality software products.
- Apply methods, techniques, and tools throughout all phases of the software development lifecycle.
- Participate in a software development team that applies modern patterns and practices.

**Prerequisites**

Students should have knowledge of Programming Languages (e.g., Java) and Software Engineering.

**Bibliography**


- Wiegers, K., Software Requirements, 3rd ed, Microsoft Press, 2013.
- Bass, L., Clements, P., Kazman, R., Software Architecture in Practice, 3rd ed, Addison-Wesley, 2012.
- Buschmann, F., Meunier, R., Rohnert, H., Sommerlad, P., Stal, M., Pattern-Oriented Software Architecture: A System of Patterns, vol 1, Wiley, 1996
- Clements P., Bachmann F., Bass L., Garlan D., Ivers J., Little R., Merson P., Nord R., Stafford J., Documenting Software Architectures: Views and Beyond, 2nd ed, Addison Wesley, 2010
- Martin, R., C., Agile Software Development: Principles, Patterns and Practices, Prentice Hall, 2003.
- Gamma, E., Helm R., Johnson, R., Vlissides, J., Design Patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley, 1995.
- Larman, C., Agile and Iterative Development: A Manager's Guide, Addison-Wesley, 2003.
- Beck, K., Andres, C., Extreme Programming Explained: Embrace Change, 2nd ed., Addison Wesley, 2004.
- Schwaber, K., Agile Project Management with Scrum, Microsoft Press, 2004.
- Buschmann F., Henney K., Schmidt D. C., Pattern-Oriented Software Architecture Volume 4: A Pattern Language for Distributed Computing, Wiley, 2007.
- Richardson L., Ruby S., RESTful Web Services, O 'Reilly, 2007.
- Γιακουμάκης Μ., Διαμαντίδης Ν. Τεχνολογία Λογισμικού, Εκδόσεις UniBook, 2021


**Teaching and Learning Activities**

One three-hour lecture per week, tutoring lectures (9 hours in total), student project on analysis of software requirements, software design and implementation.

**Assessment criteria**

The final grade is the weighted average of the final examination grade (60%) and the grade of the student project - exercises (40%).

**Language**

All lectures are delivered in Greek, with extensive use of English terminology.

## M31110- Cybersecurity Technologies & Management

**Core Course, 1st or 2nd semester, 6 ECTS units**

**Instructor: Professor Dimitris Gritzalis**

**Course level: Graduate (MSc)**

**Course Description**

Cybersecurity terminology. Cybersecurity paradigms. Selected cybersecurity technologies (e.g., risk assessment, digital identity management, anti-malware systems, cryptosystems, etc.). Critical infrastructure protection (e.g., Energy, Oil & Gas, Airports, Maritime, etc.). Cybersecurity in the (Industrial) Internet of Things ((I)IoT). Cybersecurity management: Social context and its role, hacking and hacktivism, cyber warfare, fake news, professional security certification. Privacy protection in the digital social networks. Cryptosystems and international relations (e.g., Enigma Machine, Purple Code, Clipper Chip, etc.). Human and civic rights, liberties, and cybersecurity: Limiting autocratic methods and social surveillance in the Information Age. Case studies.

**Learning Outcomes**

After successfully completing the course, students are expected to be able to: (a) know to use properly the cybersecurity terminology, (b) select and apply proper cybersecurity technologies, (c) perform a proper assessment of threats and vulnerabilities of an information system or a digital infrastructure, as well as of the impact a cyberattack may have of them, (d) assess the impact of using (or not using) cybersecurity technologies on the rights and liberties of a citizen in a democratic society, and (e) to select methods to properly manage and audit applied cybersecurity technologies.

**Prerequisites**

There is no typical prerequisite. However, if a student has successfully attended an undergraduate course on Information Systems Security or Computer Security or Cryptography, he/she is expected to feel more confident with the introductory course material.

**Bibliography**

The recommended bibliography is revised and updated on an annual basis. Some textbooks and other basic references that are usually suggested to the students include:

R. Anderson, *Security Engineering*, Wiley (2nd ed.), USA, 2001.

D. Gritzalis, *Autonomy and Civic Disobedience in Cyberspace*, New Technologies Publications (2nd ed.), Greece, 2019.

D. Gritzalis, *Secure Electronic Voting*, Springer (2nd ed.), USA, 2013.

S. Gritzalis, S. Katsikas, D. Gritzalis, *Computer Networks Security*, Papasotiriou Publ. (3rd ed.), Greece, 2015.

Ministry of Digital Governance, *National Cybersecurity Strategy*, Greece, 2020.

C. Pfleeger, *Security in Computing*, Prentice Hall (4th ed.), USA, 2016.

V. LeVeque, *Information Security: A Strategic Approach*, IEEE Computer Society, USA, 2006.

**Teaching and Learning Activities**

(a) One 3-hour lecture per week, (b) selected case studies originated from the national context or based upon the international literature, (c) invited lectures from distinguished experts from the Government, the Industry, and the Academia.

**Assessment criteria**

The final grade is the weighted average of the final (oral or written) examination grade (40-60%) and the grade of a take-home project (60-40%). A student should get a grade that is at least 5/10 in both examinations.

**Language**

All lectures are delivered in Greek, with extensive use of English terminology.

## M31111- Digital Infrastructure Technologies

**Core Course, 1st or 2nd semester, 6 ECTS units**

**Instructor: Professor Vasiliki Kalogeraki**

**Course level: Graduate (MSc)**

### Course Description

Advanced and current topics in modern, digital infrastructure systems. Fundamental theory and tradeoffs in digital systems, data-driven methods for urban-infrastructure design, cloud computing models, SaaS, IaaS, PaaS, FaaS, big data processing, computational data models, techniques for parallelism, data storage, assessment and management, monitoring techniques and novel sensing technologies, smart infrastructure technologies, Kafka, Flink, Hadoop, quantification and propagation of uncertainty, methods for systematic validation, cyberphysical issues, design and implementation of various digital infrastructure systems, and issues related to scalability, replication, consistency, load balancing and privacy. Study and understand the main parts of a digital infrastructure through the main definitions and approaches to the smart urban infrastructure (e.g., smart city, smart building).

### Learning Outcomes

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

- develop basic knowledge in theory, design and implementation of digial systems (basic concepts and principles, basic technologies, algorithms, design approaches, programmatic implementation problems),
- gain a very good understanding of the opportunities they offer, and the problems currently faced in digital infrastructures,
- get hands-on experience through carrying out a large-scale programming project,
- evaluate the effectiveness and efficiency of digital infrastructure methods and systems in particular applications.

### Prerequisites

Students are expected to be familiar with Computer Networks (ISO / OSI model, Internet protocols (IP, UDP, and TCP), Operating systems (Processes, inter process communication, threads, synchronization problems). For the programming assignments of the course, programming experience is required (e.g., in Java, C, C++, Python).

### Bibliography


- The Datacenter as a Computer, L.A. Barroso, U. Holzle, P. Ranganathan, 2nd edition
- Cloud Computing: Theory and Practice, Dan Marienscu, 2nd edition
- G. Coulouris, J. Dollimore, T. Kindberg and G. Blair, "Distributed Systems: Concepts and Design", 5th edition, Addison Wesley, 2011
- A.S. Tanenbaum and M. van Steen, "Distributed Systems: Principles and Paradigms", 2nd edition, Prentice Hall, 2007


### Teaching and Learning Activities

One three-hour lecture per week, programming project as homework (to be submitted).

**Assessment criteria**

The final grade is the average of the final examination grade (50%) and the grade of the programming project to be submitted (50%), provided that the final examination grade is at least 5/10. Otherwise, the final grade equals the final examination grade.

**Language**

All lectures are delivered in Greek, with extensive use of English terminology.

## M31112- Internet Technologies & Services

**Core Course, 1st semester, 6 ECTS units**

**Instructors: Professor Georgios Xylomenos**

**Course level: Graduate (MSc)**

**Course Description**

Overview of the technologies, architecture and protocol philosophy of the Internet. Network layer protocols, routing algorithms and hierarchical routing, high speed packet forwarding. Local area switching networks, VLANs, wide area switching networks (MPLS). Protocols and services of the application and transport layers, error, flow and congestion control schemes. Content Distribution Networks (CDN), Peer to Peer networks (P2P), adaptive video streaming (π.χ. Netflix). Data Center Networks (DCN). Multimedia transport. Software Defined Networks (SDN).

**Learning Outcomes**

Upon completion of the course, students will be able to

- design organizational networks at the physical and logical levels.
- understand how the TCP/IP protocols influence the performance of network applications.
- exploit network traffic analysis tools in order to pinpoint network problems.

**Prerequisites**

Students should have a basic of communication networks, programming in any language and probability theory.

**Bibliography**

- J. F. Kurose, K. W. Ross, "Computer Networking: A Top-Down Approach", 8th edition, 2021
- W. Stallings, "Data and Computer Communications", 10th edition, 2018.
- D. Comer, "Computer Networks and Internets", 5th edition, 2008

**Teaching and Learning Activities**

One three-hour lecture per week, tutorials (3x3 hours), traffic analysis project as homework

**Assessment criteria**

The final grade is the weighted average of the midterm (25%) and final examination grade (60%) and the project grade (15%).

**Language**

All lectures are delivered in Greek, with extensive use of English terminology.

## M31224- Service Oriented Software Development in the Cloud *(1st Specialization)*

**Core Specialization Course, 2nd semester, 6 ECTS units**

**Instructor: Dr Vasileios Zafeiris**

**Course level: Graduate (MSc)**

**Course Description**

Software Services and Service Oriented Architecture. Web Services. Web APIs and REST Services. Microservices Architecture. Design patterns for scalability and resiliency (Event Sourcing, CQRS, Circuit Breaker etc.). SOA monitoring and governance. Cloud native software. The Twelve-Factor App Methodology. Service implementation in modern open source platforms (eg. Quarkus). Cloud service models (IaaS, PaaS, SaaS). Technological platforms and infrastructure for software deployment in the cloud. Virtualization technologies. Application Containers – the Docker platform. Platform as a Service – the Kubernetes system. Continuous Integration and Continuous Deployment techniques. DevOps practices.

**Learning Outcomes**

After successfully completing the course, students will be able to:

- understand concepts related to software services, service oriented architectures, cloud platforms and technologies,
- evaluate the architectural factors that shape the alternative service oriented architectures,
- understand the features and constraints of common service-oriented architectures and evaluate their applicability to a given application domain,
- implement service-based software on modern platforms (eg. Quarkus),
- appreciate the capabilities offered by the cloud platform for application deployment and execution,
- evaluate the requirements and restrictions imposed by alternative cloud deployment platforms,
- understand the importance of methodological and organizational concerns for successful software deployment in the cloud platform,
- use the Docker platform for software packaging and deployment

**Prerequisites**

Students should have basic knowledge of Programming Languages, Software Engineering, Operating Systems and Computer Networks.

**Bibliography**


- Bass, L., Clements, P., Kazman, R., Software Architecture in Practice, 3rd ed, Addison-Wesley, 2012.
- Josuttis M. N., SOA in Practice: The Art of Distributed System Design, O 'Reilly , 2007.
- Daigneau R., Service Design Patterns: Fundamental Design Solutions for SOAP/WSDL and RESTful Web Services, Addison-Wesley Professional, 2011.
- Richardson L., Ruby S., RESTful Web Services, O 'Reilly, 2007.
- Chris Richardson, Microservices Patterns, Manning Publications, 2018
- J. Humble and D. Farley, Continuous Delivery: Reliable Software Releases Through Build, Test, and Deployment Automation, Addison-Wesley Professional, 1st edition, 2010
- G. Kim, P. Debois, J. Willis, and J. Humble, The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, IT Revolution Press, 2016

- Cornelia Davis, Cloud Native Patterns: Designing change-tolerant software, Manning Publications, 2019

**Teaching and Learning Activities**

One three-hour lecture per week, student exercises on development of service-oriented software.

**Assessment criteria**

The final grade is the average of the final examination grade (50%) and the grade of the student exercises (50%).

**Language**

All lectures are delivered in Greek, with extensive use of English terminology.

## M31225- Systems Modelling & Knowledge Organization *(1st Specialization)*

**Core Specialization Course, 1st semester, 6 ECTS units**

**Instructors: Dr. Vasiliki Dritsou**

**Course level: Graduate (MSc)**

**Course Description**

Information representation. Views and lifecycle of systems development. Dialogical, infological and ontological levels of operation. Conceptual models. Structuring mechanisms, inheritance, meta-models. Rules, derived types, integrity constraints. Modelling practices. Modelling environments and modelling languages. Analysis and management of business processes, BPM environments. Ontologies, ontology types, ontology structure. Enterprise ontology. Model patterns. Knowledge organization systems. Thematic terms, thematic languages, authorities. Taxonomies, taxonomical systems. Facetted classification. Term thesauri, ISO 25964 standard. Elements of knowledge representation and management in the Web. Metadata, encoding in XML, Dublin Core metadata element set, application profiles. RDF/RDFS, OWL knowledge representation languages. Thesauri encoding with SKOS. Querying and reasoning.

**Learning Outcomes**

The course offers a systematic study of the methods and techniques of conceptual modelling and knowledge organization, as well as their application in the analysis and design of information systems, process management, and knowledge representation.

After successfully completing the course, students will be able to:

- Build models and use them for the analysis of enterprise systems.
- Use modelling environments.
- Develop and use model patterns, knowledge organization systems and ontologies.

**Prerequisites**

Basic knowledge of information systems analysis and design, and familiarity with XML.

**Bibliography**


- Olive, A., *Conceptual Modeling of Information Systems*, Springer, 2007
- Κωνσταντόπουλος, Π., *Εννοιολογικά μοντέλα και οργάνωση πληροφοριών, Σημειώσεις*, Οικονομικό Πανεπιστήμιο Αθηνών, 2020.
- van der Aalst, W., Stahl, C., *Modeling Business Processes*, MIT Press, 2011.
- ter Hofstede, A.H.M., van der Aalst, W.M.P., Adams, M., Russell, N. (Eds.), *Modern Business Process Automation*, Springer, 2010.
- Hay, D. C., *Enterprise Model Patterns: Describing the World*, Technics Publications LLC, 2011.
- Riley, J., *Understanding Metadata: What is Metadata, and What is it For? : A Primer*, NISO Press, 2017.

Horridge, M., *Protégé OWL Tutorial*, http://owl.cs.manchester.ac.uk/publications/talks-and-tutorials/protg-owl-tutorial/


**Teaching and Learning Activities**

One three-hour lecture per week, modelling and analysis assignments.

**Assessment criteria**

The course grade, B, is derived from the final exam grade, T, and the average grade of assignments, E, as follows: if $T \geq 5$, then $B = 0{,}5T + 0{,}5E$; else $B=T$.

**Language**

All lectures are delivered in Greek, with extensive use of English terminology.

## M31226- Software & Network Security *(2nd Specialization)*

**Core Specialization Course, 2nd semester, 6 ECTS units**

**Instructor: Dr. Nikolaos Fotiou**

**Course level: Graduate (MSc)**

**Course Description**

Software and network security applications and technologies. Cryptosystems, symmetric and public key cryptography, secure hashing algorithms and their applications in security mechanisms and services. Confidentiality and integrity, digital time-stamping and e-notarization/commitment schemes. Wired and Wireless Network Security: Attacks, threats, and security protocols on computer networks. Firewalls, advanced and intelligent intrusion detection/response systems (IPS/IDS). Identification and authentication systems, attacks and vulnerabilities, best practices. Multi-factor authentication protocols and mechanisms, biometric systems, OTP/2FA protocols. Modern trends, architectures and authentication infrastructures. Software security: attacks and vulnerabilities, exploitation, software and protection, web and computers attacks, OWASP rules. Operating system security, authorization and access control, code reliability, attacks and countermeasures. DB security, anonymity and inference in DBs, application of the General Data Protection Regulation (GDPR), attacks and countermeasures. Privacy enhancement techniques, anonymization/pseudonymization. Operating principles of blockchains and cryptocurrencies.

**Learning Outcomes**

After successfully completing the course, students will be able to:

- Assess and map security needs into computer and network security countermeasures, mechanisms and protocols
- Understand the vulnerabilities and the attacks, at all levels of networking, as well as the appropriate countermeasures
- Be aware of the privacy needs of the web
- Have the background to evaluate, monitor and guide developments in contemporary issues, such as authentication, authentication and trust management architectures.
- Select and implement appropriate security mechanisms in the field of software and computer networks.

**Prerequisites**

Students should have basic knowledge of computer networks, databases, operating systems and code development.

**Bibliography**


- C. Pfleeger, S. Pfleeger, J. Margulies “Security in Computing”, 5th Ed., Prentice Hall, 2015 [Ελληνική μετάφραση: Ασφάλεια Πληροφοριακών Συστημάτων 5η έκδοση, εκδόσεις ΤΖΙΟΛΑ, ISBN-13: 978-960-418-600-6)
- W. Stallings and L. Brown, “Computer Security – Principles and Practice”, 4th Ed., Prentice Hall, ISBN-13: 978-0134794105
- C. Kaufman, R. Perlman and M. Speciner, “Network Security, Private Communication in a Public World” 2nd Ed., Prentice Hall, ISBN-13 : 978-0130460196


**Teaching and Learning Activities**

One three-hour lecture per week, study exercises and programming exercises as homework (some to be submitted).

**Assessment criteria**

The final grade is the average of the final examination grade (50%) and the grade of the study and programming exercises to be submitted (50%), provided that the final examination grade is at least 5/10. Otherwise, the final grade equals the final examination grade.

**Language**

All lectures are delivered in Greek, with extensive use of English terminology.

## M31227- Applied Cryptography *(2nd Specialization)*

**Core Specialization Course, 2nd semester, 6 ECTS units**

**Instructors: Professor Konstantinos Patsakis**

**Course level: Graduate (MSc)**

**Course Description**

Basic principles of operation and definitions of Cryptography and Cryptosystems. Mathematical background (Number Theory, Group Theory, Galois Fields, Modular Arithmetic). Classic cryptographic systems (Shift, Affine, Enigma, Vigenere Ciphers), permutations, substitutions and product ciphers. Cryptographic security, cryptanalysis, attacks and Shannon criteria. Symmetric block encryption (DES/ 3DES, AES-Rijndael) and stream ciphers. Public key cryptography (RSA, ElGamal, Elliptic Curves). Secure hasing mechanisms (SH2 / SHA3) and their applications. Digital signatures (DSA, Blind and Arbitrated Digital Signatures). Methods and cryptographic protocols for secret sharing, commitment schemes, zero knowledge proofs, oblivious transfer, multiparty computation, private-information-retrieval. Quantum cryptography. Cryptography and applications in PKIs/CAs, SSL/TLS, ToR networks, online gaming, block chains and cryptocurrencies.

**Learning Outcomes**

After successfully completing the course, students will be able to:

- understand the strengths and weaknesses of cryptographic methods
- evaluate and map security needs to cryptographic mechanisms
- have the background to evaluate and lead recent research and developments in modern cryptography and applications
- select and implement appropriate mechanisms in the field of software and computer networks.

**Prerequisites**

Students should have basic knowledge of linear algebra, and probability theory.

**Bibliography**


- Douglas R. Stinson, Maura Paterson, “Cryptography: Theory and Practice, Fourth Edition”, CRC Press, 4th Edition, ISBN9781138197015,
- Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, “Handbook of Applied Cryptography”, CRC Press, ISBN0849385237
- William Stallings, “Cryptography and Network Security Principles and Practices”, 7th Ed, Prentice Hall
- N. Ferguson and B. Schneier, “Practical Cryptography”, John Wiley & Sons, 1st edition


**Teaching and Learning Activities**

One three-hour lecture per week, study exercises and programming exercises as homework (some to be submitted).

**Assessment criteria**

The final grade is the average of the final examination grade (50%) and the grade of the study and programming exercises to be submitted (50%), provided that the final examination grade is at least 5/10. Otherwise, the final grade equals the final examination grade.

**Language**

All lectures are delivered in Greek, with extensive use of English terminology.

## M31228- Deep Learning *(1st Specialization)*

**Elective Specialization Course, 2nd semester, 6 ECTS units**

**Instructor: Associate Professor Themos Stafylakis**

**Course level: Graduate (MSc)**

**Course Description**

Deep learning models and algorithms that allow computers to learn from complex data. Deep convolutional neural networks, recurrent neural networks, stochastic training algorithms that learn from large scale datasets. Unsupervised deep learning algorithms with variational autoencoders and generative adversarial networks. Text generation from images, object recognition, image segmentation.

**Learning Outcomes**

By the end of the course the students will be able to:

- Understand the basic theory of deep learning
- Describe a wide range of deep learning techniques (architectures, algorithms)
- Design and implement neural networks, suitable for a variety of machine learning problems
- Evaluate the effectiveness and performance of neural networks

**Prerequisites _**

**Bibliography**


- "Deep Learning (Adaptive Computation and Machine Learning)", I. Goodfellow, Y. Bengio, A. Courville, MIT Press, 2016. (http://www.deeplearningbook.org/)
- "Introduction to Deep Learning", E. Charniak, MIT Press, 2019.
- "Neural Networks and Deep Learning", M. Nielsen, 2015.
- (http://neuralnetworksanddeeplearning.com/).
- "Grokking Deep Learning", A. W. Trask, Manning Publications, 2018.


**Teaching and Learning Activities**

One three-hour lecture per week and student exercises.

**Assessment criteria**

The final grade is the average of the final examination grade and the grade of the student exercises.

**Language**

All lectures are delivered in Greek, with extensive use of English terminology.

## M31230- Web Applications Development *(1st Specialization)*

**Elective Specialization Course, 2nd semester, 6 ECTS units**

**Instructor: Dr. Christos Koutsikas**

**Course level: Graduate (MSc)**

**Course Description**

Web applications development: Customer and server, basic technologies and models. Appearance: HTML and CSS, adaptation to various devices, introduction to Javascript, introduction to DOM, DOM me Javascript managing, communication with user. Web servers, NodeJS, asynchronous input and output. Connection to data bases. Performance of Web development.

**Learning Outcomes**

After successfully completing the course, students will acquire certain capacities regarding web programming on behalf of the computer- client and the full stack developer. The students will develop capacities to design and create interacting secure and powerful applications, using latest technologies applied by companies of the area such as HTML5, CSS3, JavaScript, jQuery, AJAX, JSON, REST models, Model View Controller (MVC) and Web API.

**Prerequisites N/A**

**Bibliography**

- Web Development with Node and Express, 2nd Edition by Ethan Brown Released November 2019
- Node.js full guide: https://nodejs.dev/learn
- Angular full guide: https://angular.io/start
- JavaScript Secure coding practices: https://www.w3.org/wiki/JavaScript_best_practices

**Teaching and Learning Activities**

One three-hour lecture per week and student exercises of web applications development.

**Assessment criteria**

The final grade is the average of the final examination grade and the grade of the student exercises.

**Language**

All lectures are delivered in Greek, with extensive use of English terminology.

## M31231- Natural Language Processing *(1st Specialization)*

**Elective Specialization Course, 2nd semester, 6 ECTS units**

**Instructor: Professor Ion Androutsopoulos**

**Course level: Graduate (MSc)**

**Course Description**

N-gram language models. Entropy, cross-entropy, perplexity. Spelling correction. Bag-of-word text representations. Feature selection and extraction. Text classification with k nearest neighbors and Naive Bayes. Clustering words and texts with k-means. Logistic regression, stochastic gradient descent, multi-layer Perceptrons, backpropagation for text classification. Pre-trained word embeddings, Word2Vec, FastText. Recurrent neural networks (RNNs), GRU and LSTM cells, RNNs with self-attention, bidirectional, stacked, hierarchical RNNs and applications to language models, text classification and sequence labeling. Sequence-to-sequence RNN models, machine translation. Pre-trained RNN language models, ELMo. Convolutional neural networks and applications to text processing. Transformers, BERT. Syntactic dependency parsing and relation extraction with deep learning models. Question answering systems for document collections. Dialogue systems.

**Learning Outcomes**

After successfully completing the course, students will be able to:

- describe a wide range of possible applications of Natural Language Processing,
- describe Natural Language Processing algorithms that can be used in particular applications,
- select and implement appropriate Natural Language Processing algorithms for particular applications,
- evaluate the effectiveness and efficiency of Natural Language Processing methods and systems.

**Prerequisites**

Students should have basic knowledge of mathematical calculus, linear algebra, and probability theory. For the programming assignments of the course, programming experience in Python is required. Students are advised to also attend the course “Deep Learning”, but this is not required.

**Bibliography**


- Speech and Language Processing, Daniel Jurafsky and James H. Martin, Pearson Education, 2nd edition, 2009, ISBN-13: 978-0135041963.
- Neural Network Methods for Natural Language Processing, Yoav Goldberg, Morgan & Claypool Publishers, 2017, ISBN-13: 978-1627052986.
- Introduction to Natural Language Processing, Jacob Eisenstein, MIT Press, 2019, ISBN-13: 978-0262042840.
- Foundations of Statistical Natural Language Processing, Christopher D. Manning and Hinrich Schütze, MIT Press, 1999, ISBN-13: 978-0262133609.

- An Introduction to Information Retrieval, Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, Cambridge University Press, 2008, ISBN-13: 978-0521865715.

**Teaching and Learning Activities**

One three-hour lecture per week, study exercises and programming exercises as homework (some to be submitted).

**Assessment criteria**

The final grade is the average of the final examination grade (50%) and the grade of the study and programming exercises to be submitted (50%), provided that the final examination grade is at least 5/10. Otherwise, the final grade equals the final examination grade.

**Language**

All lectures are delivered in Greek, with extensive use of English terminology.

## M31230- Mobile Applications Development *(1nd Specialization)*

**Elective Specialization Course, 2st semester, 6 ECTS units**

**Instructor: Dr. CHARILAOS STAIS**

**Course level: Graduate (MSc)**

**Course Description**

Introduction to the fundamental concepts and principles of mobile application development for devices running the Android operating system. Familiarization with the Android Studio development environment and the Kotlin programming language. Design and implementation of graphical user interfaces (UIs). Utilization of Android operating system services and functionalities. Storage, retrieval, and management of data using local databases. Development of network communication and data exchange mechanisms. Implementation of notification systems and alerts. Integration and management of multimedia content. Utilization of mobile device sensors. Power consumption management and application performance optimization. Implementation of security mechanisms and data protection techniques. Application testing and validation. Creation, signing, packaging, and distribution of Android applications.

**Learning Outcomes**

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

1. Describe the architecture and fundamental functionalities of the Android operating system.
2. Use the Android Studio development environment and the Kotlin programming language to develop mobile applications.
3. Design and implement graphical user interfaces.
4. Utilize Android services, mobile device sensors, and multimedia capabilities.
5. Manage data using databases and network services.
6. Implement notification mechanisms and alerts.
7. Apply power management techniques and security mechanisms.
8. Test and validate application functionality.
9. Create, sign, package, and distribute complete Android applications.

**Prerequisites**

There are no mandatory prerequisite courses. However, prior familiarity with basic programming concepts and object-oriented software development is recommended.

**Bibliography**


- Phillips, B., Stewart, C., & Marsicano, K. *Android Programming: The Big Nerd Ranch Guide*. Big Nerd Ranch.
- Griffiths, D., & Griffiths, D. *Head First Android Development*. O'Reilly Media.
- Android Developers. *Develop Android Apps with Kotlin*. Google. Available at: Android Developers – Training .
- Jemerov, D., & Isakova, S. *Kotlin in Action*. Manning Publications.
- Android Developers. *Android Developer Documentation*. Google. Available at: Android Developers – Documentation.


**Teaching and Learning Activities**

One three-hour lecture per week, practical exercises, and individual and/or group assignments involving the development of mobile applications.

**Assessment Criteria**

The final grade is the weighted average of the final written examination grade (50%) and the grade of the laboratory assignments (50%).

**Language**

All lectures are delivered in Greek, with extensive use of English terminology.

## M31232- Digital Forensics *(2nd Specialization)*

**Elective Specialization Course, 1st semester, 6 ECTS units**

**Instructor: Dr. Theodoros Ntouskas**

**Course level: Graduate (MSc)**

**Course Description**

Electronic crime and digital evidence fundamentals. Security incident management procedures. Methodologies, procedures and tools of analysis and examination of digital evidences. Procedure for identifying, collecting and seizure of digital evidence. Methodologies and tools for analysis of digital evidence. Preparation of the final report of the investigation of digital evidence.

**Learning Outcomes**

Upon completion of the course, students will be able to

1. describe and use techniques of Incident Response Framework.
2. understand and follow and perform the appropriate actions for the collection and analysis of digital evidence (of live or turned of machines).
3. understand and perform the appropriate techniques for collecting evidence from an active computer (e.g. memory analysis, registry, etc.).
4. understand and perform the appropriate techniques of collecting evidence from a closed computer, analysis of digital evidence (eg registry analysis, files systems analysis, internet artifacts, etc).
5. Use appropriate tools for collecting and analyzing digital evidence (e.g. FTK Imager, Autopsy, DEFT, DumpIt, Volatility, dd, CAINE).
6. Properly prepare digital evidence investigation reports

**Prerequisites**

There are no mandatory prerequisite courses. However, good knowledge of Security & Critical Infrastructure Protection and Network Management courses is required.

**Bibliography**


- Casey, E., (2000) Digital evidence and computer crime. London: Academic Press, ISBN: 978-0-12-374268-1
- Carvey H. and Hull D. (2011) Windows registry forensics. Elsevier, Inc, ISBN: 978-1-59749-580-6
- Lillard,V. T., Garrrison, C. P., Shiller, A. C. and Steel, J. (2010) Digital forensics for network, internet, and cloud computing. Oxford: Syngress, ISBN: 978-1-59749-537-0


**Teaching and Learning Activities**

One three-hour lecture per week, labs (6x3 hours), exercises as homework.

**Assessment criteria**

The final grade is the weighted average of the final assignment grade (80%) and the grade of the laboratory exercises (20%).

**Language**

All lectures are delivered in Greek, with extensive use of English terminology.

## M31233- Penetration Testing - Ethical Hacking *(2nd Specialization)*

**Elective Specialization Course, 2nd semester, 6 ECTS units**

**Instructors: Dr. Theodoros Ntouskas**

**Course level: Graduate (MSc)**

**Course Description**

Penetration Testing (a.k.a. Pentest) is an authorized attack or simulation of an attack against Information Systems (IS), carried out to assess the level and security characteristics of all procedures and data used by the PS.

The audit aims to identify vulnerabilities that can be used to breach the confidentiality, integrity and availability of an IS, including the ability of unauthorized entities to access computational resources, processes and data used by the IS. Penetration Testing shall, in principle, identify vulnerable technologies, systems and procedures, then examine the available information and select both technical and operational means to execute unauthorized actions. Types of Pentests include (i) a "white box pentest", in which access to the system is provided in advance in order to detect as many weaknesses as possible, or (ii) a “black box pentest”, in which only basic information is provided to the auditor and attacks are carried out without access to the IS. Pentests help determine the vulnerability level of an IS, its exposure to attacks, and whether its defenses are adequate or not. Pentests also suggest improvements that should be taken to protect the IS and mitigate current threats and vulnerabilities.

**Learning Outcomes**

Upon completion of the course, students will be able to

1. Pre-list the necessary steps to perform security checks.
2. Follow and execute appropriate actions to collect and analyse information on a target machine, as a step towards an effective penetration test.
3. Understand and execute appropriate techniques for identifying vulnerabilities on target machines.
4. Understand and execute appropriate techniques for exploiting identified vulnerabilities and understand how to gain unauthorized access to target systems.
5. Use appropriate tools to collect and analyze vulnerabilities and perform targeted attacks (e.g. nmap, Kali, Metasploit, MSFVenom, Armitage, nsfencodeetc.).

**Prerequisites**

There are no mandatory prerequisite courses. However, good knowledge of Security & Critical Infrastructure Protection and Network Management courses is required.

**Bibliography**

- Gilberto Najera-Gutierrez. 2018. Kali Linux Web Penetration Testing Cookbook: Identify, exploit, and prevent web application vulnerabilities with Kali Linux 2018.x (2nd. ed.). Packt Publishing.
- Violent Python: A Cookbook for Hackers, Forensic Analysts, Penetration Testers and Security Engineers Book by TJ O'Connor
- Erickson, Jon. Hacking: the art of exploitation. No starch press, 2008.

**Teaching and Learning Activities**

Six three-hour lecture per week, labs (6x3 hours), six technical three-hour lectures (6x3 hours), exercises as homework.

**Assessment criteria**

The final grade is the weighted average of the final assignment grade (70%) and the grade of the laboratory exercises (30%).

**Language**

All lectures are delivered in Greek, with extensive use of English terminology.

## M31235- Blockchains & Smart Contracts *(2nd Specialization)*

**Elective Specialization Course, 2nd semester, 6 ECTS units**

**Instructor:: Assistant Professor Spyridon Voulgaris**

**Course level: Graduate (MSc)**

**Course Description:**

Basic cryptographic principles and tools, cryptographic hash functions, blockchains, smart contracts, detailed Bitcoin operation, UTXO payment model, detailed Ethereum operation, consensus protocols, Proof-of-Work, Proof-of-Stake, the Solidity programming language, security issues in Solidity, oracles, next generation blockchains: Algorand, Cardano, Filecoin, atomic swaps, side-chains, lightning network, Inter-Ledger Communication, Distributed Identifiers (DIDs), Verifiable Credentials (VCs).

**Learning Outcomes**

After successfully completing the course, students will be able to:

- Fully understand how blockchains operate and how they provide cryptographic guarantees.
- Comprehend blockchain design challenges and the proposed solutions.
- Understand the interaction of smart contracts to the external world through oracles.
- Design blockchain-based applications.
- Implement smart contracts for Ethereum in Solidity.
- Assess when an application can benefit from integrating with blockchains and how.
- Have an outlook on upcoming blockchain systems features, way beyond cryptocurrencies.

**Prerequisites**

Students should have a basic understanding of data structures and the concepts of network applications and distributed systems obtained by completing undergraduate level courses.

**Bibliography**


- "Mastering Bitcoin", Andreas M. Antonopoulos, 2nd edition, ISBN-13: 978-1491954386.
- "Blockchain Science - Distributed Ledger Technology", Roger Wattenhofer, 3rd edition, 2019, ISBN-13: 978-1793471734.


**Teaching and Learning Activities**

One three-hour lecture per week, one term project.

**Assessment criteria**

The final grade is comprised by 75% on the final examination grade and by 25% on the term project grade. However, the final examination grade must be passing for the final grade to be passing.

**Language**

All lectures are delivered in Greek, with extensive use of English terminology.

## M31236- Software Testing, Reliability & Quality Assurance *(1st & 2nd Specialization)*

**Elective Course, 1st semester, 6 ECTS units**

**Instructor:**

**Course level: Graduate (MSc)**

**Course Description:**

Factors affecting the quality of software. Metrication of traditional and object oriented software. Aspects of software testing. Formal methods and Software testing methods. Importance of the systematic testing methods. Program analysis techniques, testing techniques. Comparison of software testing techniques. Test data generation tools. Testing automation. Software Reliability. Comparison between hardware and software reliability. Software Reliability models. Parameter estimation and reliability level achieved. Correlation between reliability and software testing techniques for when to stop testing and release the software for its use. Critical systems Object oriented software, Database systems, GUI testing, Internet applications (web testing). New methodologies eg UML and problems encountered.

**Learning Outcomes**

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

- Understand that when a piece of software delivers acceptable results upon running it with a data set, it is not necessarily implied that this will also be the case with all test data sets.
- Understand that if certain methodologies are used, the produced software will be of high quality and therefore its maintenance will be performed easier.
- Anticipate how the rules and quantitative criteria ought to be applied in order to establish high quality assurance.
- Be in the position to apply techniques for revealing software errors in a piece of software.
- Anticipate the need for testing critical applications. The importance of software reliability and its achievement.

**Prerequisites**

Students should have programming knowledge of any programming language. Completion of a Software engineering discipline is desirable.

**Bibliography**

- Journal and Conference papers.
- Software Testing and Analysis: Process, Principles and Techniques, M. Pezze, M. Young, Wiley, 2008.
- Software Testing: A Craftsman's Approach, P. C. Jorgensen, CRC Press, 2013.
- Software Engineering, I. Sommerville, 9th Edition, Pearson, 2010.

**Teaching and Learning Activities**

One 3 hour lecture per week; completion of a compulsory assignment as a partial fulfillment of the course.

**Assessment criteria**

The final grade is the product of the final written exam (60%) and the grade of the compulsory undertaken assessment - project (40%) during the course.

**Language**

All lectures are delivered in Greek, with extensive use of English terminology.

## M31237- Information Law *(1st & 2nd Specialization)*

**Elective Course, 1st semester, 6 ECTS units**

**Instructor: Professor Evangelia Mitrou**

**Course level: Graduate (MSc)**

**Course Description:**

Introduction in Law of Information Society. Context, Basic notions, principles and institutions. Privacy, Confidentiality/Secrecy and Data Security. Data Protection and Privacy Enhancing Technologies/ Freedom of speech, rights and powers in the Information Society. Cybercrime and Computer crime: ethical, social, legal and economic aspects. Penal law and Information and Communication Technologies. Computer/Internet Forensics Intellectual property in the Information Society: software and database protection, open source, licenses, issues relating to peer to peer. Electronic signatures.

**Learning Outcomes**

Upon completion of this course, students will be able to:

- Identify the key regulatory, legal and ethical issues related to information systems and in particular to the security and to deal with them from a legal point of view
- Understand the adequacy and relevance of the existing law and the regulatory frameworks in information technology and identify possible weaknesses and deficiencies
- To understand and integrate their computer and security background into a general social, economic and institutional context.

**Prerequisites -**

**Bibliography (in Greek)**


- Λαμπρινουδάκης Κ. & Μήτρου Λ. & Γκρίτζαλης Σ. & Κάτσικας Σ. (2010): Προστασία της Ιδιωτικότητας και Τεχνολογίες Πληροφορικής και Επικοινωνιών: Τεχνικά και Νομικά Θέματα
- Ι. Ιγγλεζάκης (2021), Δίκαιο Πληροφορικής, Αθήνα -Θεσσαλονίκη
- Μήτρου Λ. (2017): Ο Γενικός Κανονισμός Προστασίας Δεδομένων, Αθήνα -Θεσσαλονίκη
- Μήτρου Λ. (2002): Το δίκαιο στην Κοινωνία της Πληροφορίας. Αθήνα -Θεσσαλονίκη
- Παπαχρίστου Θ., Βιδάλης Τ., Μήτρου Λ., Τάκης, Α. (2006): Το δικαίωμα συμμετοχής στην Κοινωνία της Πληροφορίας, Αθήνα -Θεσσαλονίκη


**Teaching and Learning Activities**

a) lectures, b) case studies, c) students' presentations, d) Invited lectures

**Assessment criteria**

Written Exams 60 (%)

Group assignments with documentation and oral presentation 40%

**Language**

All lectures are delivered in Greek, with extensive use of English terminology.

**M31113- Digital Innovation & Entrepreneurship Seminar**

**Core Course (Seminar), 3rd semester, 6 ECTS units**

**Coordinators: Dr. Aggeliki Karagiannaki**

**Course level: Graduate (MSc)**

**Course Description**

The aim of the seminar is to develop entrepreneurial thinking for students who have a good background in information technology. The seminar covers key modules: design of innovative products and services; creativity techniques; market and competition analysis; design and evaluation of the business model canvas; presentation of innovative applications and case studies; mockup and customer-centric design; presentation skills (Pitching); financial analysis; managing innovation teams; digital marketing, sales and online promotion; legal guide to an innovative idea; funding opportunities; technology transfer models. The teaching method is interactive and makes extensive use of experiential learning (learning by doing) which includes the development of an innovative idea with incremental implementation of the above modules.

**Learning Outcomes**

The main objective of the seminar is to evolve the business ideas and future entrepreneurs by providing the participants with the knowledge, skill set, tools and the confidence required in order to:

- apply creativity techniques
- delve into the target market and conduct market research and competition analysis
- analyze how to design and evaluate alternative business models
- understand key areas of business planning (digital marketing and sales, legal issues, finance issues, etc.)
- understand how to build an innovation team and gain a better understanding of themselves as entrepreneurs, including motives, roles and basic responsibilities

**Prerequisites**

No prior knowledge is required for students to meet the needs of the course.

**Bibliography**


- Bessant, J. and Tidd, J. (2016). "Καινοτομία & Επιχειρηματικότητα", 3η Έκδοση, Εκδόσεις: Τζιόλα, Επιστ. Επιμέλεια: Κουλουριώτης Δημήτρης
- Murray L. Emma (2020). "Καινοτομία και επιχειρηματικότητα", Εκδότης: Κριτική, Μετάφραση: Νικολάου Ηρώ, Παπαδοπούλου Παρασκευή, Επιστ. Επιμέλεια: Γεώργιος Σταμπουλής, Έφη Τσίτσκαρη
- Osterwalder, A. and Pigneur, Y. (2010). "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers", Wiley
- Ries, E. (2011). "The Lean Startup: How Constant Innovation Creates Radically Successful Businesses", Penguin Books Limited
- Keeley, L., Walters, H. and Pikkel, R. and Quinn, B. (2013). "Ten Types of Innovation: The Discipline of Building Breakthroughs", John Wiley & Sons

**Teaching and Learning Activities**

One three-hour lecture per week. Creating groups (3-5 people) with the aim of developing an innovative idea that includes individual deliverables and a final presentation. Support of each group in the form of specialized feedback and systematic guidance (coaching) in 1-1 meetings that are open to all students.

**Assessment criteria**

The final grade is the weighted average of the grade of the project's deliverables (80%) and the final presentation (pitching) grade (20%).

**Language**

All lectures are delivered in Greek, with extensive use of English terminology.

## M31115- Communication and Business Environment Seminar

**Core Course (Seminar), 3 ECTS units**

**Coordinators: Assistant Professor Alkmini Gritzali**

**Course level: Graduate (MSc)**

**Course Description**

The main objective of the seminar is to help and guide the students of the MSc to develop their communication and business skills, in order to be able to effectively cope with the challenges of the modern business environment and to become more competitive in the business market. Overall, the seminar analyses techniques of written, oral and interpersonal communication, which aim at the professional and personal development of the students.

The seminar includes the introduction of the students to the writing of scientific works (e.g. structure, presentation and description and use of bibliographic systems (e.g. e.g. Harvard system), the writing of reports/business reports (e.g. structure, presentation and use of business language), but also the formation of personal narratives (e.g. CV preparation and writing of cover letters). The seminar also focuses on the presentation of ideas, designs and concepts using technical media (e.g. preparation, style, illustration, story development and practice). A key pillar of the seminar is group/teamworking and an introduction to the basic concepts of practice, leadership and team roles (e.g. Belbin roles).

The seminar refers to a set of business analyses (e.g. SWOT and PEST analysis), which help to understand the internal and external business environment and to develop personal business skills. In addition, the seminar focuses on the development of basic communication skills, such as interviewing skills in the work environment, business communication techniques (e.g. peers), professional management and negotiation, net-working techniques and social media and reflective practices in the work environment and beyond (e.g. managing pressure, criticism, failure, etc.). Finally, the seminar introduces students to the rules of ethical and professional ethics and practice.

**Learning Outcomes**

- Personal skills development, such as CV preparation and cover letter writing.

- Developing social skills, such as participating and working in groups, which are essential in the work environment.

- Development of written and oral communication techniques, such as writing and presenting essays and reports, conducting interviews and negotiating.

- Development of intra-organisational communication, such as analysis, net-working, reflective practices and understanding of ethical and professional standards.

- Providing techniques and practices for developing and expressing ideas in the workplace and beyond.

- A broader understanding of the importance of communication as a means of personal and professional development.

- Development of personal skills such as CV preparation and cover letter writing.

- Developing social skills, such as participation and working in teams, which are essential in the work environment.

- Development of written and oral communication techniques, such as writing and presenting essays and reports, conducting interviews and negotiating.

- Development of intra-organisational communication, such as analysis, net-working, reflective practices and understanding of ethical and professional standards.

- Providing techniques and practices for developing and expressing ideas in the workplace and beyond.

- A broader understanding of the importance of communication as a means of personal and professional development.

**Prerequisites**

No prior knowledge is required for students to meet the needs of the course.

**Bibliography**

**Teaching and Learning Activities**

Three three-hour lectures per week for a period of 2 -3 weeks.

**Assessment criteria**

The final grade is the weighted average of the grade of the project's deliverables (80%) and the final presentation (pitching) grade (20%).

**Language**

All lectures are delivered in Greek, with extensive use of English terminology.

## M31114- MSc Thesis

**Core Course, 24 ECTS units**

**Course level: Graduate (MSc)**

**Course Description**

The dissertation thesis (DT) consists of the writing by the student of a research essay where the existing bibliography is studied, methodologies are studied and if needed they adopt to the current problem, research hypotheses are formulated, relevant data are collected and processed, empirical results are recorded and conclusions are drawn.

The content of the DT includes, indicatively, some of the following sections: Summary, Introduction, Literature review, Research Hypotheses Development, Description of the data, Empirical results, Simulations to support the findings, Summary and conclusions, Bibliography, Appendices.

**Prerequisites**

For the preparation of the DT, it is required that the courses of the Msc Program have been completed.

**Learning Outcomes**

The DT aims to give the opportunity to the student to develop and apply research methodologies in real data to topics of scientific interest related to the studies of the Msc program. The goal is for the student to delve deeper into the topic under consideration, study the existing literature, develop his critical thinking by formulating appropriate research hypotheses, collect and analyze appropriate empirical data and acquire skills of investigation and derivation of substantiated conclusions.

**Recommended Bibliography**

The bibliography is determined by the Supervising Professor according to the topic of the thesis

**Assessment and Grading Methods**

The DE is evaluated by a **three-member examination committee** made up of the supervisor and two other faculty members or lecturers at the program as the valid regulations describe.

**Use of Information and Communications technology**

Yes

**Teaching Methods**

For each thesis there is one supervisor that has to guide the student for any problem that may occur, provide additional help on the bibliography but also supports the student during all the period.

**Language**: Greek or English

## M31239 – Internship

**Elective course, 6 ECTS units**

**Course level:** Graduate (MSc)

**Course Description**

Internship has the duration of 4 months in institutions of the students' choice, which are related to the scientific subject of the program. The full-time employment of each student is equivalent to 20 hours/week. The students undertake tasks and responsibilities assigned to them by their supervisor in the organisation.

During the internship the students:

- Get in touch with the modern working environment

- Apply their scientific knowledge in a real working environment

- Reinforce their scientific training with professional skills and qualifications

- Gain professional experience.

**Prerequisites**

Internship is addressed exclusively to full time students of the Program.

**Learning Outcoumes**

It is expected that upon completion of the internship, students will be able to:

1. Apply knowledge and skills developed during their studies in the workplace.
2. Judge whether the subject of their internship is a possible career choice.
3. Evaluate their knowledge and skills and their general scientific training in relation to the professional field in which they practised.

**Assessment criteria**

Upon completion of the Internship, the following are submitted electronically to the Secretariat: (a) an evaluation form of the student's performance, submitted by the host institution and (b) an evaluation form, submitted by the student.

The Secretariat forwards the above forms to the Supervisor of each Internship, who evaluates the student's performance ("Successfully" or "Unsuccessfully") by completing a Evaluation Form and submitting it to the Secretariat.

## PART III: INFORMATION FOR THE STUDENTS

### GENERAL INFORMATION FOR THE STUDENTS

Athens University of Economics and Business provides not only high-quality education but also high quality student services. The adoption of the Presidential Decree 387/83 and Law 1404/83 defines the operation, organization and administration of Student Clubs at Universities, which aim at improving the living conditions of the students and enhance their social and intellectual wellbeing through engagement and socialization initiatives.

To fulfill this objective the University ensures the required infrastructure for housing, meals and sports activities through the operation of a student restaurant, reading rooms, library, organization of lectures, concerts, theatrical performances and excursions in Greece and abroad. Further in this context, the University supports the development of international student relations, organizes foreign language classes, computer/software literacy classes, and courses in modern Greek as a foreign language for foreign students and expatriated Greek students.

**Meals**

In the main building of the University there is a restaurant where all members of the university community can enjoy meals for free or by paying a minimum fee. Free meals are granted to those who meet special conditions (by contacting the Student Club).

**Medical Services, Insurance / Healthcare**

Undergraduate, postgraduate and PhD students of the University who have no other medical and hospital care are entitled to full medical and hospital care in the National Health System with coverage of the relevant costs by the National Health Service Provider. The doctor´s office is located in the main building and operates on some working days as announced. A psychiatric counseling service also operates at the University, staffed with a physician specializing in the treatment of mental health issues. More information can be found here https://www.aueb.gr/en/content/health-care .

**Services/Facilities to Students with Special Needs**

Athens University of Economics and Business ensures the facilitation of students with special needs for access to the university buildings through ramps, lifts and other equipment. There are also specific exam regulations for students with special needs.

In addition, the Library provides students with visual impairment with aids to access online the proposed reading lists of the courses taught at the University. In this context, the Association of Greek Academic Libraries has developed a multimodal electronic library called AMELIB. Entry to this service requires user authentication as well as username and password. More information can be found on the Library website https://www.aueb.gr/en/lib/content/users-additional-needs .

**Student Financial Aid – Scholarships and Awards**

Athens University of Economics and Business offers scholarships to undergraduate and graduate students in order to support them and to award and encourage excellence. The resources for these scholarships come from the Institution itself or from partnering organizations. More information about scholarships, according to the level of studies, can be found here https://www.aueb.gr/en/content/scholarships .

**Studies Advisor** (fill accordingly)

**Library and Study Rooms**

The Library & Information Center of the University was established in 1920 and operates on the first and second floor of the University's main building. The AUEB Library is a member of the Hellenic Academic

Libraries Association (Heal-LINK), the European Documentation Centers Europe Direct and the Economic Libraries Cooperation Network (DIOB).
Three Documentation Centers operate within the Library:

- The European Documentation Center (KET) since 1992,
- The Organization for Economic Cooperation and Development (OECD) Documentation Center since 1997,
- The Delegation Center of the World Tourism Organization (WHO) hosting publications since 2004.

The Library contributes substantially both to meeting the needs for scientific information of the academic community and to supporting studying and research of students. This objective is achieved through the unified organization of collections and the coordination of the services provided. The Library provides access to:

- Its printed collection of books and scientific journals,
- Course books used in classes,
- Its collection of electronic scientific journals
- Its collection of e-books
- Postgraduate theses and doctoral theses that are produced in Athens University of Economics and Business and deposited in digital form at the PYXIDA institutional repository
- Sectoral studies
- Statistical series by national and international organizations
- Audiovisual material
- Information material (encyclopedias, dictionaries)
- Collection of official government publications of the European Union, the OECD and the WCO
- Databases on the issues adopted by the University
- Printed collections of other academic libraries

The Library lends all its printed collections, except for magazines and statistical series, in accordance with its internal rules of operation. The Library and Information Center offers reading rooms, computer workstations for visitors, photocopiers and printing machines, and interlibrary loan of books and journal articles from other academic libraries that are members of its network. More information can be found here https://www.aueb.gr/en/library .

**International Programmes and Information on International Student Mobility**

Athens University of Economics and Business is actively involved in the Erasmus+ Program by promoting cooperation with universities, businesses and international organizations of the European Union (EU) as well as in the mobility of students, teaching and administrative staff. Within the framework of this Program, the University collaborates with more than 220 European Institutions on the subjects that its Departments encompass. It is worth mentioning that more than 7,000 students have participated in the "Erasmus" Program to date. Of these, approximately 4,000 AUEB students have attended courses at Associate Universities in Europe and about 3,000 foreign students who have completed a period of study at AUEB ensure accreditation through the Credit Transfer and Accumulation System (ECTS).
Finally, AUEB, adopting the internationalization and extroversion strategy, has been successfully participating in the International Credit Mobility Program with the aim of developing international collaborations in education and research with Partner Universities in countries outside the EU via:
a) student mobility b) short-term teaching staff mobility and c) teaching / administrative staff training mobility. The Program was first implemented in the academic year 2015-2016, and since then a total of 52 students and staff members moved from and to 8 Partner Institutions in countries outside the EU (USA, Canada, Singapore, Russia, South Korea, Armenia). More information can be found in the here https://www.aueb.gr/en/content/erasmus-programme

**Foreign Language Courses**

Knowledge of foreign languages is a necessity in today's educational and professional context. The Student Club offers opportunities of attending foreign language classes. Classes are held in English, French, German, Spanish, Italian and Russian, and new language seminars are available upon request. More information can be found here https://www.aueb.gr/en/content/foreign-languages-university-student-club .

**Connections with the Job Market and Entrepreneurship**

DASTA AUEB is the University's Employment and Career Unit that plans, coordinates and implements actions related to:

a) Entrepreneurship and innovation
b) Connecting students and graduates with the labor market
c) Connecting the academic community with businesses
d) Offering internships, and
e) Supporting dissemination of research output.

DASTA is structured in three units:

a) the Internship and Career Unit, that focuses on supporting our students and graduates in their professional development. The Unit also offers consulting services to students and graduates regarding work and educational future.
b) the ACEin Unit (Athens Center for Entrepreneurship and Innovation). Its goal is to support business ventures focused on implementing an innovative idea, develop a sustainable business effort or exploit the results of their research. At the same time, the Unit organizes actions that are part of a wider network between the Unit and the market in specific productive sectors.

More information can be found here https://www.aueb.gr/en/dasta

**Athletic Activities**

Students can participate in individual and team sports activities through the Department of Physical Education, which is staffed by University personnel, as well as a number of part-time instructors specialized in various sports. The University cooperates with the City of Athens Culture, Sports and Youth Organization and uses public and private sports facilities. More information can be found here https://www.aueb.gr/en/content/athletic-activities

**Cultural Activities**

To fulfill its purpose of providing a multidimensional study experience at AUEB, the Student Club organizes various cultural activities, such as theater, traditional dance, choir, photography, cinema, rhetorical club and Model Of United Nations (MUN). More information can be found here https://www.aueb.gr/en/content/cultural-activities

**Student Organizations and Clubs**

Various student organizations and clubs are active within the AUEB community, including AIESEC, Erasmus Club, Investment Club, Entrepreneurship Club ThinkBiz, and other. More information can be found here https://www.aueb.gr/en/content/student-clubs

**Alumni Network**

Adhering to a long tradition of educating future top executives in the economic, social and political life of the country, AUEB is proud of the fact that thousands of its graduates hold leading positions in companies, organizations, research institutes and universities in Greece and abroad. Understanding the importance of developing and strengthening the bond with its graduates, AUEB created its Alumni

Network including a platform where all graduates of the University can register. The main goals of the Network are the connection of the graduates with their colleagues and former fellow students, and diffusion of information about activities, services and events in and around the University that concern them. More information can be found here https://alumni.aueb.gr/en

**Volunteer Program**

AUEB's Volunteer Program was launched in September 2017 and since then has brought more than 450 volunteers to for-impact organizations around Athens, implementing more than 50 volunteer activities. The aim of "AUEB Volunteers" is to give the chance to the members of university's community, i.e. students, faculty and administrative staff, to experience volunteering so as to highlight the value of participation and contribution to society and the university, as well as to sensitize more citizens about crucial social issues. More information can be found here https://auebvolunteers.gr/english-intro/

**Quality Assurance**

Athens University of Economics & Business implements a quality assurance policy in order to continuously improve the quality of its educational programs, research activities and administrative services, and upgrade the academic and administrative processes and the University's overall operations. The Quality Assurance Unit (MODIP) coordinates and supports all related activities including the administration of the University-wide teaching and course evaluation process by students across all programs. More information can be found here https://aueb.gr/modip .

**Education and Lifelong Learning Center**

The Center for Education and Lifelong Learning (KEDIVIM / AUEB) ensures the coordination and interdisciplinary cooperation among all University entities in the development of continuous education programs, which complement and upgrade the skills and competences of the program participants. These programs build on participants earlier formal education, vocational training and professional experience. The aim is to facilitate job market integration, career and personal development. More information can be found here https://www.aueb.gr/en/content/kedivim-opa