NEAPOLIS UNIVERSITY PAFOS
SCHOOL OF INFORMATION SCIENCES

UNDERGRADUATE PROGRAMME IN APPLIED INFORMATICS

(in short **BSCAI)**

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INTRODUCTION

This document contains details of the Undergraduate Programme in Applied Informatics (BScAI) that the University is submitting to the Evaluation Committee of Private Universities. The document contains information about the philosophy and structure of the programme, the aims, objectives and learning outcomes of the programme as well as detailed descriptions of every course taught on the Programme.

The educational philosophy that guides the BScAI at Neapolis University Pafos (NUP) can best be understood in light of the University's general mission which is the pursuit of excellence in teaching, research, and service to the community.

In support of its mission, the University**:**

Encourages and supports rigorous scholarship and innovative teaching in all academic areas offered by the University.
Creates an academic environment that values and promotes free, active and original intellectual inquiry among its faculty and students.
Fosters Programmes that respond to local and national needs and collaborates with other state and private stakeholders to promote economic development and to alleviate ignorance, poverty and injustice.
Strives continuously to promote activities that apply its intellectual and ethical heritage to work for the good of society as a whole.
Welcomes students, faculty and staff from all backgrounds and beliefs and creates a sense of community that facilitates their development and enhances their career aspirations.

The BScAI reflects the priorities of the mission and is designed to provide a course of studies that meets local and national needs, that promotes links with the local Information and Communications Technologies (ICT) communities, that is informed by rigorous scholarship and embraces modern pedagogy and learning technologies. At the same time, the Programme strengthens synergy with the other programs offered in NUP by including in its curriculum interdisciplinary courses from the areas of Economics, Finance, and Business. In fact, the Programme offers the possibility to its graduates to acquire, among other, a specialization in the area of what we call Operational Informatics. The Programme is offered by the School of Information Sciences, which is dedicated to the academic excellence through teaching and research in the areas of Computer Science, Communications and Signal Processing. The School is developing considerable strengths in the area of Informatics and offers a Bachelor of Science in Applied Informatics and a Master in Information Systems.

The School aspires to extend the range of taught Informatics programmes at graduate and undergraduate level and to launch a Doctoral Programme in Information Sciences as well. The programme will help to build the research capability of the school by attracting academics of international standing with a long experience both in teaching and in research acquired at universities in Europe, UK and Greece.

THE BScAI PROGRAMME

PROGRAMME AIMS AND OBJECTIVES

The aim of the BScAI Programme is to provide a course of study to those who aspire to become experts in the field of ICT applying them effectively in the public and the private sector. The programme's curriculum is designed to explore the essential elements of Applied Informatics and to prepare students for increasingly complex technical responsibilities in the public or the private sector, local government, and business organizations. The core curriculum emphasizes both the skills and knowledge required to effectively manage and develop technical Information resources and to understand the larger academic, industrial and business setting in which ICT, is developed, deployed and assessed in the field.

The programme provides up-to-date knowledge in a number of diverse areas that comprise the field of Informatics, such as Theory of Computation, Software development, Information Systems, and applications in the fields of Management, Finance, Economics and Business. In addition, the Programme aims to equip students with technical, analytical, ethical, accountability, and leadership skills to enhance their decision-making ability and to promote organisational well-being within the context of a continually changing and competitive technological and economic environment.

A fundamental philosophy of the programme is its empirical approach to the study of Applied Informatics, where the acquired new knowledge and skills are blended with the participants' experience and are applied from the beginning to real-life scenarios.

This approach broadens and deepens student understanding of applying techniques and processes from the area of Informatics; it fosters skills of research, analysis, synthesis and creativity; and it encourages innovation and awareness of the role of information and technology in innovation. Finally, it develops awareness of ethical, social, environmental and global issues affecting management decisions in relation to ICT.

LEARNING OUTCOMES

The overall learning outcome for students completing the BSc in Applied Informatics is to develop a broad conceptual understanding of the theory and practice of applying ICT in public or private organizations. At the end of the course students shall therefore have:

A sound theoretical and practical knowledge in most areas of Informatics and the way Informatics intersects and interacts with other scientific disciplines.
The ability to analyze and design Information Systems meant to cover needs in various sectors and environments.
The ability to deal with the operational side of Computing and Information systems and the way theses integrate with an organization.
The ability to think laterally, critically, innovatively, creatively, and to make connections among diverse fields of study in analysing real world problems and applying Informatics -based solutions
A global perspective based on an understanding of both the technical and the operational environments of an organization when applying ICT.
The ability to lead and to interact effectively in group situations and to manage in diverse technological and operational environments.
Gained experience in applying ICT methods and tools.
Achieved substantial competency in analysis and design, and in management techniques; and
understood the political, economic and social context of Informatics.
Developed skills related to critical thinking and autonomous learning.
Developed communication, and teamwork skills.

PROGRAMME STRUCTURE

Programme Foundations

The BScAI Programme is offering a modern undergraduate programme in Applied Informatics based on the latest recommendations given jointly by two top international scientific organizations, namely, the Association for Computing Machinery (ACM), and the IEEE Computer Society (CS), enriched with interdisciplinary courses from the areas of Economics, Management, Finance and Business. The end result is to produce graduates capable to respond to requirements of their professional endeavor in all sectors of economy including industry, commerce, education, health, and research.

The programme has as objective to offer a horizontal knowledge to all basic subjects of Informatics and interdisciplinary subjects through a carefully planed set of compulsory courses. In addition, the Programme offers as option to its students, specialization opportunities through compulsory per specialization courses and electives. Also, free electives complement the students' knowledge. In particular, the Programme offers:

- a degree that certifies besides basic knowledge in Informatics focused knowledge in four (4) specializations grouped into two sections;
- a Programme structure according to the European Credit Transfer and Accumulation System (ECTS);
- sound foundational knowledge through a carefully reduced set of core courses in comparison to similar BSc Programmes;
- reduced classroom hours per week by adopting a free lectures day for the first two years of study;
- an introductory course covering the broad area of Informatics that helps the student to formulate his own pathway through the Programme; and
- free electives in any discipline, including the case through the ECTS and Erasmus.

Programme Duration

The programme is implemented in 8 semesters and requires 240 ECTS units to be accumulated by a student for graduation.

Programme breakdown

The Programme is divided into two 2-years cycles; the **basic** cycle and the **focused** cycle of studies:

- **Basic** cycle (1st to 4th semesters): It is composed of,
    a. an **introductory** course in Informatics,
    b. 15 compulsory **core** courses in Informatics (including 3 courses in management, finance and economy) and
    c. 4 introductory **interdisciplinary** courses.

  This cycle actually corresponds to Tier 1 of the ACM/IEEE CS model curriculum.

- **Focused** cycle (5th to 8th semester): It is composed of,
    a. two additional compulsory **core** courses and **elective** courses. The electives are distinguished into the following three classes:
        i. **Basic specialization** courses for securing a specialization reflected in the graduation certificate.
        ii. Electives of a specialization.

iii. **Free electives** (from any other BSc course of NUP or outside institute).

b. **Thesis** (compulsory)**.**

The focused cycle effectively corresponds to Tier 2 and Electives of the ACM/IEEE CS model curriculum.

The Programme caters for four (4) specializations, namely,

- **E1** for a specialization in **Operational Informatics**
- **E2** for a specialization in **Information Systems**
- **E3** for a specialization in **Software development**
- **E4** for a specialization in **Computer Systems and Networks**

Groups E1 and E2 comprise the so-called **Orientation A** of the curriculum and groups E3 and E4 comprise the **Orientation B**. The orientation A conceptually indicates the application of Informatics in some domain (i.e., Operational Informatics and Information Systems), whereas orientation B conceptually refers to the S/W and H/W infrastructure needed (Software development and Computer Systems and Networks), to develop and support applications. The term *Operational Informatics* refers to the use of informatics methodologies, techniques and tools for any kind of applications for the purpose of optimizing them in terms of operations, management, outcomes, quality, cost and security.

Note that the Programme does not include currently explicitly a specialization in the area of the Theory of Informatics. However, a student may build up his/her theoretical knowledge in pure Computer Science by selecting appropriate electives. The tables below present the lists of courses comprising the Applied Informatics Programme.

The table below gives the **core courses** of the Program, showing also the prerequisites and semester.

Compulsory core courses							
Course ID	Course	Lecture hours	Tutor hours	Lab hours	ECTS	Prerequisite	Semester
AIINTR	Introduction to Computer Science and networks	3	1		6		1st
AIK01	Introduction to programming	3	1	2	7		1st
AIK02	Linear Algebra	3	2		7		1st
AIK03	Management Information Systems	3	1		6		2nd
AIK04	Discrete mathematics	4	2		6		2nd
AIK05	Calculus	4	2		7		2nd
AIK06	Data Structures and Programming techniques	3	1	1	7	AIKO1	2nd
AIK07	Computer Architecture I	3	1	1	6	AIK03	2nd
FINA200/AIK08	Financial Theory	3	1		6	ECON101	3rd
AIK09	Probability and Statistics	3	1		6	AIK05	3rd
AIK10	Object-oriented programming	3	1	2	7	AIK01	3rd
AIK15	Communication Networks I	3	1		7	AIK06	3rd
AIK12	Algorithms and Complexity	4	2		7	AIK04	4th
AIK13 / BUSN209	Operations Research	3	1		6	AIK05	4th
AIK14	Design and use of Databases	3	1	1	7	AIK07	4th
AIK11	Graphics I	3		1	6	AIK02	4th
AIK16	Operating Systems	4			6	AIK07	5th
AIK17	Software Engineering	3	1		6	AIK10	6th

The inclusion in the core courses of the course on Finance and that on Operations Research is something not met normally to traditional core sets of Informatics. Their inclusion in our core set shows our intention to educate students capable to deal, as early as possible, with real applications of Informatics in diverse areas. Finance, on one hand is the driving force of any human activity and Operations Research, on the other hand, is the basic tool for analyzing areas and problems in which Informatics may be applicable.

In line with the above argument, the Programme includes the four (4) compulsory courses listed in the table below. The first two of them are our interdisciplinary introductory courses, taken one (1) per semester and help the students to get a global view of the real world in Economy and Business. The course on Psychology is essential to let students deal and react properly in their public and customers' relations. These courses are to be delivered by staff of the relevant schools of NUP. The 4th course (i.e., PEPS104) will allow the students to develop language and communication skills for both oral and written presentations and reports.

Compulsory Interdisciplinary Courses							
Course ID	Course	Lecture hours	Tutor hours	Lab hours	ECTS	Prerequisite	Semester
ECON101	Introduction to Economics	3	1		4		1st
BUSN100	Introduction to Business	3	1		4		1st
PSYC100	Introduction to Psychology	3	1		4		3rd
PEPS104	Language and Communication Skills	3	1		4		4th

The table below gives the optional laboratory courses. These laboratory courses stand independently of the corresponding courses in order to provide better quality of training only to those students who are really interested in laboratory hands; on experience with the hardware aspects of Informatics. Those students who do not wish to enroll to these lab courses have to replace them by some other courses in order to fill the ECTS gap.

Elective Laboratories							
Course ID	Course	Lecture hours	Tutor hours	Lab hours	ECTS	Prerequisite	Semester
AIK03L	Laboratory of Logic Design and Architecture			2	2		2nd
AIK15L	Laboratory of Communications Networks I			2	2	AIK13	4th

The following table (as shown below) lists for each specialization the compulsory per specialization courses ("Y" denotes the compulsory per specialization courses). The Orient column shows the applicable orientation(s) A and/or B. The students who wish to get an orientation, which will be stated in their graduation certificate, have to state the desired orientation beforehand, **after** the 4th semester, and they are **obliged to** take all four (4) compulsory (Y) courses of that same orientation. In the opposite case, they have to have any four (4) compulsory (Y) courses from either orientations A and B.

Compulsory & Basic Courses of Specialization												
Course ID	Course	Lecture hours	Tutor hours	Lab hours	ECTS	Prerequisite	Semester	Orient	E1	E2	E3	E4
AIK18	Numerical Analysis	3		1	6	AIK02	5th	A	Y			
AIK19	Implementation of Data Base systems	3	1		6	AIK14	5th	AB		Ba	Y	
AIK20	Computer Architecture II	3		1	6	AIK08	5th	B				Y
AIK21	Analysis and Design of Information Systems	3		1	6	AIK10	5th	AB	Ba	Y	Ba	Ba
AIK22	Artificial Intelligence	3	1		6	AIK06	6th	AB		Ba	Y	
ECON 205	Macroeconomics	3	1		6	ECON101	6th	A	Y			
AIK24	Protection and Security of Information Systems	3	1		6	AIK16	6th	AB	Ba	Y	Ba	Ba
AIK25	Network Management	3	1		6	AIK15	6th	B	E			Y

In the table above and the 4 following ones per semester (semesters 5 to 8) are denoted with “Ba”: courses per specialization that are considered to be basic courses for that specialization. A student who wishes to secure a specialization has to select four (4) out of ten (10) of these courses. Also in these tables are noted with “E” recommended elective courses per specialization to complete the required ECTS for graduation.

Electives of 5th semester												
Course ID	Course	Lecture hours	Tutor hours	Lab hours	ECTS	Prerequisite	Semester	Orient	E1	E2	E3	E4
ACCN100/ AIOP01	Financial Accounting	3	1		6	AIK07	5th	A	Ba			
AIOP02	Digital Economy	3	1		6	ECON101	5th	AB	Ba	E	E	E
AICS01	Parallel Systems	3	1		6	AIK07	5th	AB		Ba	E	Ba
AICS02	Communication Networks II	3		1	6	AIK15	5th	B			E	Ba
AIAL01	Analysis and design of Business Applications	3	1		6	BUSN100	5th	AB	E	Ba	Ba	E
AIOP03	Algorithmic Operations Research	3	1		6	AIK05 AIK18	5th	AB	E	E	Ba	
AIOP04	Marketing Information Systems	3	1		6	BUSN100	5th	A	E	E		
AIAL02	Graphics II	3		1	6	AIK11	5th	B			E	E

Electives of 6th semester

Course ID	Course	Lecture hours	Tutor hours	Lab hours	ECTS	Prerequisite	Semester	Orient	E1	E2	E3	E4
AIAL03	Data Mining techniques	3	1		6	AIK19	6th	AB	Ba	Ba	Ba	E
AICS03	Systems Programming	3	1		6	AIK16	6th	B			Ba	Ba
AICS04	Logic Programming	3	1		6	AIK12	6th	AB	E	E	E	E
AIOP05	Strategy and Economics of Information Systems	3	1		6	AIK03	6th	AB	Ba	E		E
AICS05	Technology for web applications	2	1	1	6	AIK11	6th	AB	E	Ba	E	Ba
AICS06	Pattern recognition - Machine Learning	3	1		6	AIK06	6th	AB		E	E	
AIOP06	Scientific Computing	3	1		6	AIK18	6th	AB	E	E	E	
AIOP07	Electronic Commerce	3	1		6	BUSN 100	6th	AB	E	E	E	E

Electives of 7th semester												
Course ID	Course	Lecture hours	Tutor hours	Lab hours	ECTS	Prerequisite	Semester	Orient	E1	E2	E3	E4
AIAL04	Cryptography	3	1		6	AIK12	7th	AB	E	E	E	Ba
AIAL05	Design of Virtual Spaces	3		1	6	AIK11	7th	AB		E	E	E
AICS08	Human Computer Interaction	3	1		6	AIK07	7th	AB	E	Ba	Ba	E
AICS09	Compilers	3	1		6	AIK11	7th	B			E	E
AICS10	Digital Communications	3		1	6	AIK13	7th	AB	E			Ba
AIOP08	Decision Support systems	3	1		6	AIK22	7th	AB	Ba	Ba	Ba	
AICS11	Information theory and Coding	3	1		6	AIK06	7th	B				E
AIOP09	Linear and non Linear Optimization	3	1		6	AIOP02	7th	AB	Ba	E	E	E
AIOP10	Econometrics I	3	1		6	AIOP02	7th	A	E	E		

Electives of 8th semester												
Course ID	Course	Lecture hours	Tutor hours	Lab hours	ECTS	Prerequisite	Semester	Orient	E1	E2	E3	E4
AIAL06	Programming multicore architectures	3	1		6	AIK17	8th	B			E	Ba
AICS12	Constraint Satisfaction Problems	3	1		6	AIK22	8th	A B	E	Ba	Ba	E
AICS13	Speech and Natural Language processing	3		1	6	AIK10	8th	B		E	E	E
AICS14	Image processing	3		1	6	AIK11	8th	B			E	Ba
AIOP11	Time Series and Prediction	3	1		6	AIK06	8th	A	Ba	E		
AIOP12	Game Theory	3	1		6	AIK06	8th	A	Ba	Ba		
AIAL07	Theory of Computation	3	1		6	AIK12	8th	A B	E	E	Ba	E
AIOP13	Econometrics II	3	1		6	AIOP10	8th	A	E			
AIAL08	Graph Theory	3	1		6	AIK12	8th	A B	E	E	E	E
AIAL09	Computational Geometry	3	1		6	AIK12	8th	A B		E	E	

The table below lists the elective projects, one (1) of which is compulsory to complete studies. The student may select any of them irrespective of the taken specialization.

Elective Compulsory Project												
Course ID	Course	Lecture hours	Tutor hours	Lab hours	ECTS	Prere-quisite	Semester	Orient	E1	E2	E3	E4
AIECP1	Software development for *Algorithmic problems*	1		3	8	AIK11 AIK12	7th	A B				
AIECP2	Software development for I*nformation Systems*	1		3	8	AIK10 AIK14	7th	A B				
AIECP3	Software development for *Embedded Systems*	1		3	8	AIK07 AIK14	7th	A B				
AIECP4	Software Development for *Operational Information Systems*	1		3	8	AIK08 AIK14	7th	A B				

The *Thesis* is **compulsory** and is equivalent to two (2) semester courses with 16 ECTS in total. One of the semesters may be replaced with a project at an organization subject to prior approval of the study advisor. In any case, a thesis committee is foreseen to ensure and normalize the thesis quality both in terms of quality and effort required to completion

ECTS breakdown

Based on the above analysis the table below shows the ECTS structure of the Programme and the allowed number of free and other electives. Note that the table below lists the minimum requirements for completing the 240 ECTS requirement. A student in the course of securing a specialization may exceed the 240 ECTS barrier. In any case, all passed courses are taken into consideration for the calculation of the degree classification and are to be listed in the transcript of studies.

Course type	Number	ECTS
Introductory course	1	6
Core compulsory courses	17	110
Compulsory interdisciplinary courses	4	16
Compulsory orientation courses (Y)	4	24
Project	1	8
Basic per specialization electives (Ba)	4	24
Thesis	2	16
Electives	4 - 6	24 – 36
Free electives	0 - 3	0 – 12
Elective Labs	0 - 2	0 – 4
Total	39-41	240

Note that Electives, Free Electives and Elective Labs sum up to 36 ECTS and the student has the freedom to choose how to cover these ECTS, or even to exceed them.

Semester breakdown

1st Semester (30 ECTS)		ECTS
AIINTR	Introduction to Computer Science and Networks	6
AIK01	Introduction to programming	7
AIK02	Linear Algebra	7
BUSN100	Introduction to Business	4
ECON101	Introduction to Economics	4
	Total	28

2nd Semester (30 ECTS)		ECTS
AIK04	Discrete mathematics	6
AIK05	Calculus	7
AIK06	Data Structures and Programming Techniques	7
AIK07	Computer Architecture I	6
AIK03	Management Information Systems	6
	Total	32

3rd Semester (30 ECTS)		ECTS
FINA200	Finance	6
AIK09	Probability and Statistics	6
AIK10	Object-oriented Programming	7
AIK15	Communication Networks I	7
PSYC100	Introduction to Psychology	4
	Total	30

4th Semester (30 ECTS)		ECTS
AIK12	Algorithms and Complexity	7
AIK13	Operations Research	6
AIK14	Design and usage of Databases	7
AIK11	Graphics I	6 .
PEPS104	Language and Communication Skills	4
	Total	30

5th Semester - Orientation A (30 ECTS)		ECTS
AIK16	Operating Systems	6
AIK18	Numerical Analysis	6
AIK21	Analysis and Design of Information Systems	6
	Elective Courses	12
	Total	30

5th Semester - Orientation B (30 ECTS)		ECTS
AIK16	Operating Systems	6
AIK19	Implementation of Database Systems	6
AIK20	Computer Architecture II	6
	Elective Courses	12
	Total	30

6th Semester – Orientation A (30 ECTS)		ECTS
AIK17	Software Engineering	6
ECON205	Macroeconomics	6
AIK24	Protection and Security of Information Systems	6
	Elective courses	12
	Total	30

6th Semester – Orientation B (30 ECTS)		ECTS
AIK17	Software Engineering	6
AIK22	Artificial Intelligence	6
AIK25	Network Management	6
	Elective courses	12
	Total	30

7th Semester – Orientations A and B (30 ECTS)		ECTS
AIECP	Orientation A Project ECP2 or ECP4	8
AIECP	Orientation B Project ECP1 or ECP3	
AITHE1	Thesis	8
	Elective courses	14
	Total	30

8th Semester – Orientations A and B (30 ECTS)		ECTS
AITHE2	Thesis	8
	Elective courses	22
	Total	30

Programme Flexibility

The structure of the Programme is such that it allows the following options:

A. **In-depth knowledge of one specialization area:** Students who wish to secure one (1) specialization and gain in-depth knowledge of one specialization area (say Ex), first choose the orientation A or B that contains the specific desired specialization area and then they have to take four (4) of the compulsory courses (i.e., Y) of that Orientation (of which two (2) are compulsory courses of the specialization Ex), one (1) of the two (2) project orientations which may be associated with the specialization and four (4) of the ten (10) basic courses (i.e., Ba) of the specialization Ex.

B. **Knowledge of two specializations within the same orientation:** Students who wish to secure two (2) specializations of the same orientation and to gain knowledge of the contents of two specialization areas (say Ex and Ey), first choose the orientation that contains the two fields and then they have to take four (4) of the compulsory courses (i.e., Y) of that Orientation (covering compulsory subjects of both skills), one (1) of the two (2) project orientations, which may be related to one of the two fields, four (4) of the ten (10) optional courses that are basic of Ex and four (4) of the ten (10) optional courses are basic of Ey.

C. **Knowledge of two different specializations of different orientations**: Students who wish to secure two specializations of different Orientations and to gain knowledge of the contents of two (2) specializations (say Ex and Ey), first choose one (1) orientation and then they have to take four (4) of the compulsory courses (i.e., Y) of the orientation (of which two (2) are compulsory courses of specialization Ex and two (2) are compulsory courses of specialization Ey), 2 Elective courses other than these, belonging to the other orientation (instead of free courses), 1 of the 2 project orientations, which can associated with one of the two fields, four (4) of the ten (10) optional courses that are basic for Ex, and four (4) of the ten (10) optional courses are basic of Ey.

D. **Horizontal without specialized knowledge (partly focus on an orientation):** Students who wish to gain knowledge horizontally, without securing any of the offered specializations, initially choose the orientation and then they have to take four (4) of the compulsory courses of the orientations, one (1) of the two (2) project and the orientation, and all four (4) elective courses, which is basic of the two specializations of the orientation, focusing thus partly their studies at the level of an orientation.

In all the above cases the student has to take additional courses up to 240 ECTS.

Programme Pedagogy

The BScAI Programme is designed to provide an academic experience that transcends that of the traditional classroom in which the flow of information is primarily from the instructor to student. As the programme proceeds from semester to semester, the instructor of each course uses the up to that point built experience of the students to establish a vigorous dialogue in their BScAI classes. The intention in BScAI education is that each participant contributes to the education of the full class through sharing expertise and leading discussion when the participant's skills and background make this possible.

Study Teams and Collaborative Learning

Study teams are a key feature of the Programme, contributing to the learning process in the collaborative manner of a productive workplace environment. As the Programme proceeds from semester to semester, study teams composed of students that participate to the programme are created by the instructor. The aim is to provide diversity of background and breadth of expertise so that total team effectiveness is maximized. Each study team addresses team-based assignments and receives team-directed feedback and grades from faculty.

Learning by Doing

This model followed by the programme is one of learning facilitation instead of the traditional approach of instructor teaching. In every course students will be provided with several opportunities to apply concepts and techniques to "real-world like" scenarios.

Student-Centered Learning

This approach encourages students to develop their own context for learning. Meaning and relevancy of concepts can be highly enhanced when students are able to relate what is covered in the course to their own professional experience. Projects from a student's work environment or from an area of their interest are encouraged. Projects should reflect applications that demonstrate improvement over conventional methods and cover technological skills that are considered current.

Course Attendance

Students are required to attend all sessions of every course, including regular classes and residencies. Attendance at all class sessions is essential to maintain academic quality and to benefit from as well as contribute to the dynamic learning environment of the class.

Class Preparation

Preparation means that students read the materials, consider the critical issues raised in the cases and discussion questions, and carry out appropriate quantitative and qualitative analysis in order to arrive at and provide support for their thoughtful position concerning the options that face the firms and managers in the cases. In addition, preparation involves developing a personal position on the issues raised in the cases and readings and contributes to fruitful exchange of ideas. Unless students have thought about and developed a personal position, it is difficult to learn from others' contributions to the class.

Class Participation

For the learning process to be effective, students will need to participate actively during every class. Only by actively participating in class discussions will they sharpen their own insights and those of their classmates. They will learn the content of the course and, just as important, the process of analysis and implementation that is critical to successful strategic management. The expectations are that students analyze, comment, question, discuss, and build on others' contributions. Participation enables students to learn from their colleagues.

PRACTICAL / INDUSTRIAL COMPONENT

The practical components of the programme are expressed in nearly all courses of the programme through the method of case study that is employed as the main pedagogical device.

RESEARCH-RELATED ASPECTS OF PROGRAMME

The *Thesis* is the main element of the programme through which students develop their research skills. However, every course of the programme has a coursework requirement that is designed to make students learn how to work autonomously and use bibliographical and other resources.

LANGUAGE OF INSTRUCTION

The programme will be taught in Greek and English.

ASSESSMENT

The assessment for the Undergraduate Programme in Applied Informatics complies with the Study Regulations approved by Senate.

THE UNIVERSITY ASSESSMENT FRAMEWORK

The University allows a range of methods to be used for the assessment of a course (coursework, presentation, written or oral examination) provided they are appropriate to the course. All types of assessment are considered equally valuable.
The Assessment methods employed enable a student to demonstrate that the Learning Outcomes for a course, or the programme, and therefore the required standard for the award, have been achieved. Each assessment component is weighted appropriately in accordance with its content and importance.

REQUIREMENTS TO PASS A COURSE

The course assessment is according to the University's "Assessment Regulation for Taught Programmes". The course is assessed by the participation therein, by exam in the middle of the semester, and by a final exam on all content in the end. Participation in the course is graded with 25% of the final grade, the exam in the middle of the semester with 25% of the final score, and the final exam with the remaining 50% of the final score.

In order to pass a course, a student must achieve a course mark of at least 50% and must in addition satisfy any component requirement of the course as is set out in the Course Specification.

RESITS

Where a student fails to participate in an assessment or where the student participates and fails, the student may be allowed to retake the assessment if the Assessment Board of the Programme so decides. A student who successfully completes a resit shall be awarded the credit for the course.

AWARDS OF DEGREE

In order to graduate from the Programme a student should achieve a mark of at least 50% in each of the courses and the dissertation.
Exceptionally, students who have achieved in no more than two courses a mark of not less than 40% will graduate provided that the overall (arithmetic) average mark of all the courses excluding the dissertation is at least 50%.

DEGREE CLASSIFICATION

The class of the Degree that will be awarded shall be decided upon the overall aggregate mark calculated as a weighted average of all marks for the courses and dissertation. The ECTS of each course and the dissertation are the weights. The following formula is used,

$$OverallAggregateMark = \frac{\sum_{i=1}^{n}(ECTS_i \times Mark_i)}{\sum_{i=1}^{n} ECTS_i}$$

where, *n* is the total number of courses which are needed for the Degree to be awarded (on average 39-41) the ECTS of each course and the Mark of each course.

The minimum overall aggregate percentage for recommending the award of the BSc Degree on Applied Informatics shall normally be:

Letter Grade	Grade Meaning	Grade Points	Percentage Grades
A	Excellent	4	85 – 100
B	Very Good	3	65 – 84
C	Good	1	50 – 64
F	Failed	0	

The course mark used in award calculations shall be calculated from the original marks for the component(s) that the student passed at first attempt and the minimum pass mark for the component(s) constituting the resit requirement.

ASSESSMENT BOARDS

Recommendations on student progression, degree award, and award of credit or withdrawal from the Programme as a result of academic failure are made by the Assessment Board of the Programme which comprises all the internal and external examiners of the programme. The Assessment Board makes such recommendations through their consideration of student results. It also considers recommendations from Extenuating Circumstances Panels and Academic Misconduct Panels and makes recommendations to Senate based on the performance of students.

INTERNAL EXAMINERS

For each programme the Internal Examiners are those who teach a course and who have been appointed as an Internal Examiners by the appropriate Board(s) of Studies. Internal Examiners are responsible for all the aspects of assessment of a course.

EXTERNAL EXAMINERS

The programme has an External Examiner appointed by Senate who provides an independent review of the programme. The External Examiner approves the assessments compiled by the Internal Examiners, and reviews assessment material agreed with the Board of Studies in advance. The External Examiner has a right to see all assessment material if they wish and attend meetings of the Assessment Board(s).

ADMISSIONS AND REGISTRATION

ADMISSION CRITERIA

The University admits students irrespective of nationality, race, religion, or gender, provided that they meet the admission criteria of the Programme. The admission criteria are based on the type and quality of previous studies, the grade obtained in previous studies, and the suitability of the candidate for the programme of study that has been applied for.

The University's admission policy is to make admission offers to applicants who on account of their background and abilities are likely to benefit from university study and to complete successfully the Programme.

In particular, ccandidates for the BSc in Applied Informatics should submit a school leaving certificate from a recognized six-form secondary school (high school) with an average grade of 75% (Greek Cypriot secondary schools) or a grade "C" or its equivalent (other secondary schools), or equivalent qualification. Candidates who submit a six-form secondary school leaving certificate but do not meet the above grade requirements may be admitted on a probationary status, if they show potential for educational advancement. The probationary status will be removed, subject to a satisfactory academic performance. Candidates admitted on probationary status may also be asked to enrol in foundation courses in order to improve their skills and/or to take reduced load.

Candidates who have graduated from a recognized six-form secondary school, and have completed university level work in an accredited program at an institution other than the Neapolis University Pafos, are eligible to apply for transfer admission. Such candidates should, along with their application form, submit the following documents:

- A six-form secondary school (high school) leaving certificate or equivalent qualification.
- Official transcripts (grade reports) and syllabi (course descriptions) for all University coursework taken to date.

Transcripts are evaluated by the relevant department to determine the number of credits to be transferred in accordance with the Neapolis University curriculum requirements and the candidate's academic performance.

Transfer students, regardless of the number of credits transferred must complete a minimum of two year full time study (120 ECTS) at the Neapolis University in order to be eligible to graduate.
Candidates who have Informal or Non-formal prior learning, such as professional examinations (i.e. LCCI, CISCO, etc), non University level examinations (i.e. A' Levels, GCSE, IELTS, TOEFL, etc), business or industrial training programs, or other achievements, are eligible to apply for transfer credits. Work experience can be granted transfer credits after evaluation and verification. According to the University's regulations these candidates can apply for up to 10% of the total ECTS credits which are required for the completion of each program of study.

ADMISSION OF STUDENTS WITH SPECIAL NEEDS

The University offers equal opportunities to all students regardless of their physical abilities. Candidates who have some form of disability, which is mentioned in their application, will be examined on equal terms as all other candidates. Should any University employee reject a candidate due to physical disability then this is considered to be a disciplinary matter.

The candidates should explain in their application form the nature of their disability and inform the admissions office concerning the special needs they will require during their studies.

APPLICATION FORMS

For a candidate to be considered for admission to the Programme he/she needs to complete an Application Form, obtainable from the Admissions Office. Once completed the application form should be returned directly to that Admissions Office together with any additional documentation required. An electronic version of the Application Form can be downloaded from the Admissions Office homepage or submitted on-line.

DOCUMENTS REQUIRED

A student who applies for the Programme should submit the following documents:

- Completed Application Form.
- Certified results for all examinations mentioned on the Application Form and/or confirmation of the award of the student's qualification(s).
- Evidence of English language proficiency.
- An official transcript of academic work completed to date.
- Two confidential recommendation letters one of which must be from an instructor familiar with the student's academic work.
- A personal statement of interest in pursuing undergraduate or graduate studies.

International students must provide to the Admissions Office, a Financial Statement attesting to their ability to meet the costs of their study at the University.

ENGLISH LANGUAGE REQUIREMENTS

For the English speaking programme, the minimum English language requirements are:

1. TOEFL - a minimum score of 550 (paper based) or 213 (computer-based) or 80 (internet based) in the TOEFL test.
2. IELTS - The British Council/University of Cambridge Local Syndicate's test of Academic English, International English Language Testing System (IELTS) with a composite score in the range of 6-6.5 and not less than 6 in any one component.
3. GCE O Level English Language at Grade C or above.
4. GCSE English language at Grade C or above.
5. CSE Grade 1 Pass in English.
6. Hong Kong Certificate of Education, English Language Syllabus B, Grade C or better.
7. A pass in the Use of English examinations administered by bodies as listed under GCE Examination Board.
8. A pass in the Oxford Examining Body's English as a Foreign Language (Higher Paper).
9. A pass in English in the Joint Matriculation Board (JMB) Test in English (Overseas) examination.
10. A matriculation examination from European countries where English is presented as a subject and an acceptable level is achieved.
11. A grade C or higher on a Certificate of Proficiency in English (CPE).
12. Grade A on a Certificate in Advanced English (CAE).

Applicants whose native language is not English and do not comply with the above, may be required to take the University's English Placement Test (EPT). Candidates whose English is below the required standard will be offered additional English-language classes.

ADMISSIONS PROCEDURES

The Admissions Office on reception of application forms and supporting documentation will record and forward applications to the Programme Director who chairs the Admissions Committee for a decision to be made.

THE DECISION TO ADMIT

Once a decision to admit is made, the Director of the Programme will send the Application Form and the decision to the respective Board of Studies of the School for ratification. In order to avoid any unnecessary delay, the ratification will normally be done by Chairman's action and it will be an agenda item under Chairman's business at the next meeting of the Board. The Admissions Office will officially inform the student of its decision only after the ratification of the Board. If an offer is made this offer is considered an agreement, which both the student and the school are expected to honor.

ADMISSIONS APPEAL PROCESS

Where an applicant is dissatisfied with a decision of the University relating to admission to the programme, the applicant may appeal to the relevant Admissions Office within ten (10) working days of notification of the decision. The appeal will be considered by the Admission Appeals Committee comprising of three faculty nominees of the Dean, of the respective School, who were not involved in the decision to which the appeal relates.

REGISTRATION

Students are required to register on the first day of arrival at the University and be issued with a Student Identification Card.

GRADUATE STUDENT ASSOCIATION

All students are entitled to join the Graduate Student Association and Student Union and become automatic members upon registration with the University.

TARGET AUDIENCE

The program targets new high school graduates passionate about the future of education in Informatics. Along with the underlying theory and foundations in economics, law and business, our students will develop practical skills, such as programming (in various languages, Java, C/C++, Prolog) and design of hardware systems.

STUDENT INTAKE

We plan to enroll up to 30 students on the programme.

MANAGEMENT & QUALITY ASSURANCE

THE UNIVERSITY MANAGEMENT AND QUALITY FRAMEWORK

The University has established a robust system of managing programmes as well as of monitoring quality in order to ensure that the academic standards of the degrees are retained at a high level and the performance is aligned to the mission of the University. The key personnel, bodies and procedures are described below.

THE PROGRAMME DIRECTOR

The Programme Director is the person responsible for ensuring that the Programme is aligned with the strategic direction and values of the School and is responsive to the changing needs of students, the market place, and the University. The Director is accountable to the Dean for planning, developing and administering the Programme. A major responsibility of the position is to oversee admissions and to enforce all the quality assurance procedures of the University.

THE PROGRAMME OFFICER

The Programme Officer is responsible for the daily administrative operations of the Programme. Reporting to the Programme Director, the Programme Officer provides administrative support to the Programme Director, and the Programme Team. The person in this position gives input and advice relating to programme administration and policy development, assists in the growth and promotion of the Programme, and ensures that all School and University policies are communicated to and followed by faculty, staff and students.

THE PROGRAMME TEAM

The Programme Team is made up of all the instructors of the Programme and meets regularly to coordinate activities related to the programme or to express views and recommend actions on aspects of the programme.

THE SCHOOL BOARD

This School Board of Studies is chaired by the Dean. Its purpose is to consider and make recommendations to the Senate on matters of policy and curriculum. The School Board of Studies comprises all the academic staff of the School and allows student representation.

GRADUATE BOARD

The Graduate Board of Studies is a standing committee of the Senate and oversees the development and implementation of all graduate policies, quality assurance and strategy. The Board is responsible on behalf of the Senate for all graduate programmes in the University and brings together key personnel to consider graduate admission, graduate teaching and assessment, amendments to existing programmes and the appointment of external examiners.

THE SENATE

This Senate is the highest academic body responsible for all the aspects of the academic provision of the University. Many of its functions are discharged through its committees.

THE UNIVERSITY QUALITY ASSURANCE COMMITTEE

The quality of the programmes in the University is monitored by the University Quality Assurance Committee of the Senate which is responsible for the annual and quadrennial review of each programme.

ANNUAL PROGRAMME EVALUATION

The Annual Programme Review is a report, written by the Programme Director, evaluating the performance of the degree against its objectives and assessing the quality of the education provided.

FOUR-YEAR COURSE EVALUATION

The four-year evaluation of a programme is carried out by a team which is appointed by the Senate. The members of the team include an external assessor and a graduate representative.

After receiving the comments from the Board of Studies, the Senate examines the evaluation report and decides on the measures that need to be taken. The decisions of the Senate are then forwarded to the relevant Board of Studies so that they may be implemented.

THE EXTERNAL ADVISORY PANEL

Each programme of the University has an External Advisory Panel which offers advice on the content and structure of the programme. The Panel also provides advice on other activities, such as progression, marketing, general strategy etc. The panel is chaired by the Dean of the Academic School which offers programme and consists of various experts, eminent academics and the Programme Director.

TEACHING AND LEARNING CENTRE

The Teaching and Learning Centre has two functions. The first is to help new lecturers to acquire skills that will help them become effective teachers. The Centre will be running every year a series of seminars for newly recruited staff using both internal senior staff as well as external experts. A peer observation scheme will be introduced to monitor progress. The second purpose of the Teaching and Learning Centre is to monitor developments in learning technologies and ways of incorporating into our teaching provision. In this respect the Centre will work closely with the Division of Learning and Information Services.

THE GRADUATE STUDENT ASSOCIATION (GSA)

Though not part of the formal governance and operation of the Programme, this association provides a mechanism by which students enrolled in the Programme collectively organise and interact with the programme's governance structure.

The primary objectives of the GSA are to encourage a community environment, facilitate communication both within its membership and between its membership and the School, and act as a unified voice representing the interests of the graduate students within the University community, specifically through participation in committees concerning graduate student curriculum and policy, and general graduate student issues.

THE STAFF-STUDENT LIAISON COMMITTEE

The Staff-Student Liaison Committee provides a formal forum where students and staff will be able to discuss problems that may have arisen regarding the programme and to address them. The minutes of the Staff –Student Liaison Committee will be tabled by the Programme Director as an item at the School Board of Studies first meeting, following the Staff – Student Liaison Committee meetings.

STUDENT EVALUATIONS

Every course of the University at its conclusion is evaluated by the students who take the course. The process is under the direction of the academic registrar.

ANNUAL STUDENT SURVEY

Every student completes the Annual Student Survey form which records the views of the students on a number of issues including quality of teaching, facilities etc.

STAFF

PROGRAMME DIRECTOR

The programme director is Associate Professor Savvas A. Chatzichristofis.

TEACHING STAFF

A list of the staff who will be teaching on the programme is given below. The university shall employ more faculty members as the Programme develops.

Name	Scientific Areas	Contact Details
Savvas Chatzichristofis (Associate Professor)	Computer Vision, Robotics, Computer Architecture, Artificial Intelligence, Operating Systems	s.chatzichristofis@nup.ac.cy +357 2684 3341
Klitos Christodoulou (Lecturer)	Programming, Databases, Big Data, Semantic Data, Data structures	k.christodoulou@nup.ac.cy +357 2684 3427
Zinon Zinonos (Lecturer)	Programming , Computer Networks	z.zinonos@nup.ac.cy +357 2684 3600
Christos Christodoulou-Volos (Professor)	Economics and Finance	c.volos@nup.ac.cy +357 2684 3508
Christos Papademetriou (Lecturer)	Computer Science and HRM	c.papademetriou@nup.ac.cy +357 2684 3412
Stelios Charalambides (Visiting Lecturer)	Probability, Statistics, Scientific Computing, Linear Algebra, Programming, Calculus, Discrete mathematics	s.charalambides@nup.ac.cy
Marios Kyriakou (Visiting Lecturer)	Graphics, Virtual reality, Multimedia	marios.kyriakou@nup.ac.cy
Panayiotis Christodoulou (Visiting Lecturer)	Software Engineering	p.christodoulou@nup.ac.cy
Lecturer Diotma Papadi (Tutor Maria Tsilaki)	Language and Communication	diotima.papadi@nup.ac.cy +357 2684 3371

FULL TIME STAFF

Savvas Chatzichristofis

Savvas A. Chatzichristofis pursued the Diploma and the Ph.D. degree (with honors) both from the Department of Electrical and Computer Engineering, Democritus University of Thrace, Greece.

Currently, he serves as an Associate Professor at the School of Informatics at the Neapolis University Pafos (NUP), Cyprus. In past years, he has served as Adjunct Lecturer at Cyprus University of Technology (CUT), as well as a senior researcher at the Centre for Research and Technology Hellas (CE.R.T.H.), Information Technologies Institute (I.T.I.). Moreover, he has served as a Visiting Professor for teaching and research cooperation at Institute for Information Technology (ITEC) at Klagenfurt University in Austria. During his career he has been involved in several EU FP6, FP7 and H2020 Research & Development projects as researcher, technical scientific manager and co-coordinator.

His research is mainly focused on Cybernetics and Artificial Intelligence together with their applications in the fields of Computer Vision, Multimedia/Multimodal Retrieval, Robotics, Optimization and Pattern Recognition (forensic and industrial applications). Savvas A. Chatzichristofis has over 10 years of solid experience on information technology, with emphasis on topics related to multimedia information retrieval systems and machine vision, reporting more than 70 publications in these fields. In total, these publications have accumulated more than 1900 citations as recorded by Google Scholar, giving an h-index of 19.

Furthermore, he has served as reviewer for scientific journals in the area of artificial intelligence, image processing and multimedia (e.g IEEE Transactions on Multimedia, IEEE Transactions on Evolutionary Computation, IEEE Transactions on Intelligent Transportation Systems, IEEE Transactions on Robotics etc.) as well as reviewer and member of program committees of several international conferences/workshops (e.g. IEEE IROS, IEEE ICRA etc.). Moreover, he has given numerous talks during conferences, at universities (as visiting professor), at schools and in the industry.

Over the course of his scholarly career, he received numerous grants and scholarships, including three best paper awards

Klitos Christodoulou

Klitos Christodoulou is a Lecturer in Informatics. Klitos joined the Department of Informatics at the Neapolis University in Cyprus since the Department's creation in September 2015. He holds a doctorate (PhD) in Computer Science from the University of Manchester, UK. In his doctoral research he worked under the supervision of Prof. Norman W. Paton and Dr. Alvaro A. A. Fernandes undertaking research in the area of Linked Data while exploring automated Data Integration techniques when these are applied on the Semantic Web.

During his doctoral studies he received a full scholarship from the Engineering and Physical Sciences Research Council (EPSRC), UK. Klitos holds an MSc in Advance Computer Science with Specialization on Advance Applications (with Distinction) and graduated with a BSc (Hons) in Computer Science (with First Class) from the School of Computer Science at the same University.
Being a member of the Information Management Group in the School of Computer Science, at the University of Manchester, he contributed in various research and teaching activities.

Klitos's research focuses mainly on exploring machine learning, probabilistic techniques for automating the integration processes of semantically heterogeneous sources from the Web of Data.

Zinon Zinonos

Zinon Zinonos received the diploma in Computer Engineering from the Computer Engineering and Informatics Department (CEID) of the University of Patras, Greece, in 2005, and the M.Sc and Ph.D degrees from Computer Science Department, University of Cyprus, in 2008 and 2013, respectively, all in computer science. Since 2013 he works, as a Post-Doctoral researcher at KIOS Center of Intelligent Systems and Networks. His research interests include wireless, ad hoc and sensor networks, mobility management in low power devices, adaptive topology control, computer communication networks, quality of service (QoS) provisioning, intelligent systems, statistical learning, pattern recognition, machine learning techniques, implementation of real-time monitoring and control systems and energy efficiency.

He has published articles to journals and presented his work at several conferences organized by the computer science and communication networks community. His research has been funded by the European Commission, by the University of Cyprus and the KIOS Research Center for Intelligent Systems and Networks. He is actively involved in various projects funded by the European Commission that involve intelligent systems and networks, energy efficiency and water management. He is member of IEEE and the Cyprus Scientific and Technical Chamber.

Christos Christodoulou-Volos

Dr. Christos Christodoulou-Volos is an Associate Professor of Economics and Finance. He received an MA in economics from the City College of the City University of New York (CUNY), an MPhil and a Ph.D. in economics in 1997 from the Graduate School of the CUNY. His areas of specialization are Macroeconometrics and Monetary and Financial Economics. His teaching interests are in the areas of Macroeconomics, Financial Economics, Finance, Statistics, and Econometrics and he has taught in many universities worldwide. He has published many scientific articles in leading academic journals and his current research interests are in the broad field of empirical macroeconomics and financial economics, including the problem of pricing and hedging of financial assets, decisions making under uncertainty, and the application of econometric models, such as, univariate and multivariate GARCH models, FIGARCH models, and correlated unobserved components model, and the effects of economic uncertainty on real estate. For a number of years, he held managerial positions in well- known companies in the United States, as a senior economist for a trade association and as Economist for a financial company dealing with litigation economics, in USA.

Christos Papademetriou

Dr. Christos Papademetriou a native of Pafos, teaches at the University of Neapolis in Pafos since 2010. He obtained a BA (Hons) in Accounting and Business (2001) and MA in International Management (2002) from the University of Sunderland and a BSc (Hons) in Computing from the University of Portsmouth. He holds a doctorate (PhD) in Social Science from the University of Leicester, UK. The title of his thesis is "Investigating the Impact of Sequential Cross-Cultural Training on the Level of Sociocultural and Psychological Adjustment of Expatriate Managers". He is interested in International Human Resource Management (IHRM) especially for the selection and training of employees (international assignment). Also, he is interested in Computer Science particularly in E-Commerce and Online Marketing.

Lecturer Diotima Papadi

Dr. Diotima PAPADA is Lecturer in Classics. She holds a PhD from the University of London (UCL), postgraduate (MPhil.) From the University of Cambridge, and a BA in Classics from the University of Cyprus, for which she received the Prize of the President of the Republic. She has teaching and research experience at the Universities of University College as Honorary Research Associate and King's College London as Language Coordinator. Her research interests and publications focus on the ancient Greek

tragedy and recruitment in Late Antiquity, Literature of the Hellenistic Period - notably Plutarch - and Biography. She is a member of the International Plutarch Society, and has presented her work at numerous conferences and seminars. She has several publications in composite volumes.

VISITING STAFF

Stelios Charalambides

His research area is Ring Theory but he is currently expanding his interests to the Theory of Lie Algebras.

He also has experience as a tutor, teaching assistant, teacher and lecturer at two universities, a secondary school, a college and a higher technical institute, covering a wide breadth of courses in mathematics and statistics aimed at the social, biological, health and engineering sciences as well as service courses for business and management as well as pure mathematics.

Specialties: His research interests lie in ring theory with particular emphasis on torsion theory (16S90) in conjunction with injectivity, $\\Sigma$-injectivity and injective hulls (16D50), extending (CS) modules, direct sum decompositions (16D70), Noetherian and semi-Noetherian (Max) modules and rings (16P40) and chain conditions on annihilators (16P60).

Marios Kyriakou

Marios Kyriakou is a visiting lecturer in the Department of Informatics of the Neapolis University and a post-doctoral researcher at the Computer Graphics Lab of the University of Cyprus. He holds a doctorate (PhD) in Computer Science from the University of Cyprus. In his PhD studies he worked under the supervision of Dr. Chrysanthou conducting research in the area of crowd simulation in Computer Graphics and in the area of immersive and semiimmersive virtual reality systems, focusing on immersed users' experience and their sense of presence. He received his BSc in Computer Engineering and Informatics at the University of Patras and his MSc in Advanced Information Technologies at the University of Cyprus.

During his PhD studies he was awarded with a full scholarship by the Foundation of National Scholarships of Cyprus (IKY of Cyprus). He was also awarded with a full scholarship by the Foundation of National Scholarships of Cyprus (IKY of Cyprus) for his MSc studies and with a full scholarship by the Foundation of National Scholarships of Greece (IKY of Greece) for his BSc studies.

Marios has more than ten years' experience as an Information Science instructor in has also been involved in important European projects. His research interests include crowd simulation, immersive and semi-immersive virtual reality systems, augmented reality systems, focusing on immersed users' experience and their sense of presence, and their applications in entertainment and training.

Panagiotis Christodoulou

Panayiotis Christodoulou holds a PhD in Computer Engineering and Informatics from the Cyprus University of Technology (CUT). He completed his undergraduate and postgraduate studies at the Manchester University, UK (MEng) and the Frederick University, Cyprus (MSc). He is a member of the Software Engineering and Intelligent Information Systems Research Lab (SEIIS) located at CUT and his interests are focused mainly in the area of Software Engineering and more particular, in Recommender Systems and in techniques and mechanisms of Artificial and Computational Intelligence. He has also a lot of experience in managing EU projects as he participated as a project manager in the INNOLABS project and as a member in various projects (DOSSIER-Coud, SmartGov).

COURSE SPECIFICATIONS

COMPULSORY CORE COURSES

AIINTR Introduction to Computer Science and Networks

ECTS: 6

Overview and Objectives:
This introductory course serves as a guide to the new student to find his/her way through the multi facet and vast area of Computer Science and Networks. Its main objectives are:
(a) To get familiar with the various branches of Computer Science and Networks;
(b) to get a feeling of the various courses that will be taught during his/her studies.

Learning Outcomes:
At the end of the module, successful students should be able to:

1. Describe the function of the basic components and peripherals of a computer and its uses in the modern world.
2. Examine and apply number and data conversion techniques and understand the importance of binary coding and the operations permitted on binary digits.
3. Describe and distinguish the different areas of Computer Science and appreciate the value and contribution of each area of CS.
4. Describe and understand the function of the basic components of computer networks and their uses in the modern world.
5. Explain how the various areas of computing complete the sphere of knowledge of Computer Science.

Topics:

Introduction. Turing model, von Neumann model, Computer components, Number System. Positional number systems, Nonpositional number systems, Storing Data. Data types, Storing numbers - text - audio - images – video, Operations on Data. Logic operations, Shift operations, Arithmetic operations, System organization. Central processing unit, memory, storing devices, peripherals, bus. Algorithms. Representation of Algorithms, Basic Algorithms, Recursion. Programming Languages. Historical Review, Compilers, Interpreters. Software Engineering. Life cycle of Software, Analysis Phase, Design Phase, Implementation Phase, Control Phase. Data Structures. Records, Lists, Stacks, Queues, Trees, Binary Trees, Graphs. Operation systems. Resource management. Files and databases. Relational databases. SQL. Computation theory. Abstract computation models. Turing machines. Artificial Intelligence. Search. Knowledge representation and reasoning. Machine learning. Robotics. Data compression. Lossless and lossy compression methods, Security. Security fundamentals - attacks - services - techniques

Indicative reading list and references:

1. Les and Andrew Lister, Goldschlager, *Computer Science A Modern Introduction. Second Edition,*1988
2. Forouzan Behrouz*, Foundations of Computer Science*, 2nd edition 2008
3. Η ΕΠΙΣΤΗΜΗ ΤΩΝ ΥΠΟΛΟΓΙΣΤΩΝ: ΜΙΑ ΟΛΟΚΛΗΡΩΜΕΝΗ ΠΑΡΟΥΣΙΑΣΗ, J. GLENN BROOKSHEAR , Έκδοση: 10η/2009, ISBN: 978-960-461-270-3, (Εκδότης): ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ

AIK01 Introduction to Programming

ECTS: 7

Overview and Objectives:

This is the course where the student comes in contact with programming. The main objectives of this course are described as follows:

- Introduce students to the syntax and semantics of a structured high-level programming language.
- Provide students with working knowledge of programming constructs such as expressions, selection statements, loops, functions and arrays.
- Provide practical experience in problem solving and coding.
- Guide the student in order to develop good programming practices.

Learning Outcomes:

At the end of the course the student will be able to:

- Create, compile and run a program in C;
- recognize the data types supported by the programming language C;
- declare variables and assigns values to them;
- write commands in C using arithmetic and other types of operators;
- control the flow of a program;
- create and perform iterative loops;
- create and manipulate one-dimensional and two-dimensional tables;
- handle the various data types;
- use the popular ready function of the C library;
- perform basic implements and use search algorithms in tables;
- use functions for dynamic memory management commitment, and;
- define and manipulate structures and compounds;
- create their own data types;
- open and close files, read from files, write to files.

Topics:

Software and programming languages. Requirements of a procedural programming language. Executable programs. Compiling and linking. The programming language C. Programming environments for C. The C compiler gcc. Examples of simple programs in C. Features and capabilities of C. Variables, constants, types, and declarations. Replacement commands, operators and performances. The control flow. Program structure, functions and external variables. Scope and lifetime of variables. Recursion. Address of memory locations, indicators and tables. Dynamic memory allocation. Strings. Table indexes ,indexes of indexes and multidimensional tables. Pointers to functions. Command arguments. Enumerations, structures, self referential structures (lists, binary trees), unions, bit fields and creation of new types of names. Input and output. File Handling. C pre-processor and macros. Algorithms for classification tables and query tables. guidelines for proper programming. Often programming mistakes in C.

Laboratory Introduction to Programming:

Laboratory exercises: (1) Introduction, useful applications. (2) Unix tutorial. (3) programming environment and the first program C. (4) variables, control structures and iteration. (5) Input/output symbols. (6) Functions and recursion. (7) Indices and tables. (8) Multidimensional arrays and dynamic memory allocation. (9) Strings and command line arguments. (10) Structures and self-referential structures. (11) Input / output - files. (12) General roundup laboratory material.

Indicative reading list and references:

- Brian W. Kernighan, Dennis M. Ritchie. "The C Programming Language", Prentice-Hall
- Herbert Schildt. "Οδηγός της C", 3η έκδοση, McGraw-Hill (Ελληνική μετάφραση, εκδόσεις Γκιούρδας), 2004.
- Γ. Σ. Τσελίκης, Ν. Δ. Τσελίκας. "C: Από τη Θεωρία στην Εφαρμογή", 2010
- Νικόλαος Μισυρλής. "Εισαγωγή στον Προγραμματισμό με την C", 2003. (Ύλη: Σημειώσεις του μαθήματος και όλο το βιβλίο πλην των παραρτημάτων Δ και Ε)
- Νίκος Χατζηγιαννάκης. "Η Γλώσσα C σε Βάθος", 3η έκδοση, εκδόσεις Κλειδάριθμος, 2009. (Ύλη: Σημειώσεις του μαθήματος και όλο το βιβλίο πλην του κεφαλαίου 19)

AIK02 Linear Algebra

ECTS: 7

Overview and Objectives:

The main objectives of the course are to:

- Provide students with the theory of linear systems of equations.
- Cover in detail the theory of Matrices, and develop the necessary skills in order for the students to be able to apply Matrices to Linear Systems.
- Introduce students to eigenvalues, eigenvectors, and diagonalization of square matrices.
- Cover the elementary concepts from the theory of linear transformations and utilize their main applications.
- Provide the necessary skills, in order the students be capable of comprehending abstract algebraic notions, related to vector space theory.
- Discuss the fundamental concepts and the elementary theory of finite dimensional vector spaces in detail.

Learning Outcomes:

After completion of the course students are expected to be able to:

- Solve linear systems using the general theory of linear systems as well as matrix theory.
- Apply the basic concepts of vectors and their representation
- Define linear transformations and apply them.
- Utilize and handle abstract vector spaces; prove basic theorems related to the notions of linear independence, span, basis, and dimension of the vector space.
- Compute the eigenvalues and eigenvectors of square matrices.

Topics:

Basic concepts: sets, relations and mappings, composition. Basics on algebraic structures. Groups, rings, fields. Polynomials. Linear Spaces (base, dimension, Euclidean). Determinants and matrices. Linear systems: basic concepts and proposals, methods of solution. Eigenvalues and eigenvectors of matrices (SVD, canonical form Jordan). Linear and transformations. Bilinear quadratic. Conics.

Indicative reading list and references:

- LINEAR ALGEBRA, Jim Hefferon, Third edition
- ΜΙΑ ΕΙΣΑΓΩΓΗ ΣΤΗ ΓΡΑΜΜΙΚΗ ΑΛΓΕΒΡΑ, ΒΑΡΣΟΣ ΔΗΜΗΤΡΗΣ, ΔΕΡΙΖΙΩΤΗΣ ΔΗΜΗΤΡΗΣ, ΕΜΜΑΝΟΥΗΛ ΓΙΑΝΝΗΣ, ΜΑΛΙΑΚΑΣ ΜΗΧΑΛΗΣ, ΜΕΛΑΣ ΑΝΤΩΝΗΣ, ΤΑΛΕΛΛΗ ΟΛΥΜΠΙΑ, ISBN: 978-960-6706-36-3, Διαθέτης (Εκδότης): "σοφία" Ανώνυμη Εκδοτική & Εμπορική Εταιρεία
- ΓΡΑΜΜΙΚΗ ΑΛΓΕΒΡΑ ΚΑΙ ΕΦΑΡΜΟΓΕΣ, STRANG GILBERT, ISBN: 978-960-524-7309-70-9, Διαθέτης (Εκδότης): ΙΔΡΥΜΑ ΤΕΧΝΟΛΟΓΙΑΣ & ΕΡΕΥΝΑΣ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ

AIK03 Management Information Systems

ECTS: 6

Overview and Objectives:

The main objective of this course is the investigation of the role and impact of information systems in the business functions, through the examination of major models of strategy and management information systems used in today's business environment. Additionally, is a conceptual approach through the use of case studies, of a series of information systems applied in the "extended" or "digital enterprise", such as Enterprise Resource Planning Systems (ERP), Customer Relationship Management Systems (CRM), Supply Chain Management Systems (SCM), and Decision Support Systems.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Explain the role of different types of information systems for different business settings.
- Clarify the relationship between organizations, information systems, and business processes.
- Analyze existing business processes and design new ones using business process reengineering principles.
- Identify project risks and utilize ways of managing those through project management principles.
- Distinguish the key principles of e-commerce & m-commerce.

Topics:

- Introduction to Information Systems (Explain the new role of information systems in organizations).
- Key information systems in organizations (Define key information systems in organizations according to Functional areas, Management levels and clarify key challenges to Information Systems)
- Enterprise Applications (Explain the key characteristics of Enterprise Applications, ERP; SCM, CRM systems, Identify new opportunities and challenges)
- Data Management & Business Intelligence (Discuss Data management, Business Intelligence)
- Building Information Systems (Business process reengineering, IT development, IT Implementation).
- Process Improvement Exercise (Identify and analyze the information requirements for a new student registration system, Design new processes).
- Managing IT projects (Explain key steps in information systems project management).
- E-commerce & m-commerce (Discuss the key principles of E-commerce, M-commerce).
- The Business of New Online Social Media (What are online social media? How do businesses utilize online social media to their benefit?)

Indicative reading list and references:

- Laudon, Kenneth C., and Jane P. Laudon. *Management information system*. Pearson Education India, 2016.
- ΠΛΗΡΟΦΟΡΙΑΚΑ ΣΥΣΤΗΜΑΤΑ ΔΙΟΙΚΗΣΗΣ, KENNETH C. LAUDON, JANE P. LAUDON, Έκδοση: 11η Αμερικανική/2014., ISBN: 978-960-461-623-7, ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ
- Πληροφοριακά συστήματα διοίκησης, Έκδοση: 1η έκδ./2014, Συγγραφείς: Wallace Patricia, ISBN: 978-960-218-886-6, ΕΚΔΟΣΕΙΣ ΚΡΙΤΙΚΗ ΑΕ

AIK04 Discrete mathematics

ECTS: 6

Overview and Objectives:

The objective of this course is the study of discrete objects and the relationships among them. Additionally, is the study and implementation of computational methods in finite algebraic structures.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Apply formal methods of symbolic propositional and predicate logic.
- Outline the basic structure of proof techniques, with emphasis on mathematical induction
- Perform the operations associated with sets.
- Identify, describe and determine the properties of relations.
- Identify functions and determine their properties.
- Relate the concepts of graphs-digraphs-trees and model computing problems to programming algorithms.
- Compute combinations and permutations of a set

Topics:

Sets, propositions, induction, binary relations, functions, permutations, combinations, discrete probability, conditional probability, independent events, Bayes theorem, arithmetic functions, asymptotic behavior of numerical functions, generators of functions, graphs, Euler paths, Hamilton cycles, trees, trees with root, theory of numbers.

Indicative reading list and references:

- Rosen, Kenneth H., ed. *Handbook of discrete and combinatorial mathematics*. CRC press, 1999.
- ΣΤΟΙΧΕΙΑ ΔΙΑΚΡΙΤΩΝ ΜΑΘΗΜΑΤΙΚΩΝ, Έκδοση: 1η/2009, , LIU C.L., ISBN: 978-960-524-072-1, Διαθέτης (Εκδότης): ΙΔΡΥΜΑ ΤΕΧΝΟΛΟΓΙΑΣ & ΕΡΕΥΝΑΣ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ.
- Διακριτά μαθηματικά και εφαρμογές τους, 7η Έκδοση, Rosen Kenneth H., ISBN: 978-960-418-394-4, Διαθέτης (Εκδότης): ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε.

AIK05 Calculus

ECTS: 7

Overview and Objectives:

The main objectives of the course are to:

- Cover limits and continuity in depth.
- Discuss limits and continuity of functions in detail.
- Introduce students to derivatives and provide them with a deep knowledge of differentiation techniques.
- Discuss the basic calculus theorems such as the Intermediate Value theorem, the Mean Value theorem and Rolle's theorem.
- Provide students with the necessary knowledge to analyze functions and sketch their graphs.
- Introduce the students to the integral as a summation and evaluate indefinite and definite integrals.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Compute limits, including one-sided limits, and limits at infinity.
- Determine the intervals on which a function is continuous.
- Apply derivatives to find equations of tangent lines and rates of change.
- Use the derivative, analyze functions and sketch the graphs of polynomial and rational functions.
- Implement Rolle's theorem and the mean value theorem.
- Compute definite and indefinite integrals using their basic properties and techniques such as u-substitution.
- Calculate the derivatives and integrals of Logarithmic and exponential Functions.

Topics:

Basic topological concepts. Real numbers, Sequences, Series. Functions (limit, then elementary functions). Definite integral. Derivative. Indefinite integral. Power series, functions of several variables, partial derivatives, differential. Taylor Series. Implicit functions. Extrema of functions with several variables. Multiple integrals. Line integrals. Vector analysis (theorems of Stokes, Gauss, and Green).

Indicative reading list and references:

- Thomas, George B., et al. Thomas' calculus. Addison-Wesley, 2001
- Εφαρμοσμένος Απειροστικός Λογισμός, Τσίτσας Λ., Έκδοση: 2η έκδ./2003, ISBN: 978-960-266-152-9, Διαθέτης (Εκδότης): Σ.ΑΘΑΝΑΣΟΠΟΥΛΟΣ & ΣΙΑ Ο.Ε
- Γενικά Μαθηματικά - Απειροστικός Λογισμός τόμος Ι, Αθανασιάδης Χ. Ε., Γιαννακούλιας Ε., Γιωτόπουλος Σ.Χ Έκδοση: 1η έκδ./2009, ISBN: 978-960-266-248-9, Διαθέτης (Εκδότης): Σ.ΑΘΑΝΑΣΟΠΟΥΛΟΣ & ΣΙΑ Ο.Ε.
- ΑΠΕΙΡΟΣΤΙΚΟΣ ΛΟΓΙΣΜΟΣ (ΣΕ ΕΝΑΝ ΤΟΜΟ), FINNEY R.L., WEIR M.D., GIORDANO F.R. Έκδοση: 1Η/2012 , ISBN: 978-960-524-182-7, Διαθέτης (Εκδότης): ΙΔΡΥΜΑ ΤΕΧΝΟΛΟΓΙΑΣ & ΕΡΕΥΝΑΣ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ

AIK06 Data Structures and Programming Techniques

ECTS: 7

Overview and Objectives:
The course emphasizes the use of Abstract Data Types (ADT) with references from our daily lives (e.g., in a bank queue management, list of contacts in our mobile phone). The work has given four objectives:

a) consolidate and advance knowledge in C programming in general,
b) the use and development of ADT,
c) programming techniques (modules, tests, etc.), and
d) the connection of the course with real-world applications.

Learning Outcomes:

At the end of the module, successful candidates should be able to understand and use:

- Concepts and principles commonly found in IT, such as abstraction.
- Intermediate structures (level modeling) to display data in computer.
- Private queues, stacks, lists, trees and graphs as ADT and their implementation in C.
- Algorithms using these structures.
- Useful programming techniques (modular programming, modules, recursion).
- Complexity of Algorithms with the O notation.
- Checking (testing), debugging (debugging) and technical development programs.

Topics:

Introduction. The concept of abstract data types (ADT). The ADT Table, Structure, Sets, Strings (strings). Stacks, recursion, queues, lists, trees (binary trees, binary search trees), balanced trees (AVL). Graphs (implementation algorithms). Applications.

Indicative reading list and references:

- Data Structures, Algorithms & Software Principles in C, Thomas A. Standish, Addison Wesley.
- Data Structures and Algorithm Analysis in C. Mark Allen Weiss.

AIK07 Computer Architecture I

ECTS: 6

Overview and Objectives:

In the lectures of the course, the student is initially taught the basic concepts of organization and computer technology while learning about the challenges of modern computer architecture. Then the student is taught the instruction set architecture as the interface between the hardware and software using as a vehicle for systematic and in-depth teaching of the instruction set architecture of MIPS, and the RISC architecture. At this point, the student is taught the basics principles of low level programming in symbolic language (a.k.a. assembly language). In particular, the course reviews computer technology, commands and levels of representation, representation of numerical and non-numerical data, typical computer organization, instruction set architecture (ISA), microarchitecture, computers, RISC and CISC, MIPS ISA, registers, format and coding of instructions, addressing modes, arithmetic functions, logical and data transfer functions, program flow control, support processes by the hardware, using the stack, basic concepts of compilation, evaluation and understanding of the performance, performance measurement, factors affecting performance, performance evaluation, processor design, components of the data path, data path design, control unit design, implement a machine cycle, implementation of many cycles, microprogramming.

Learning Outcomes:

At the end of this module, successful candidates:

- Will have a detailed knowledge of the concepts related to the evaluation and understanding of the performance of a computer.
- Will know in depth the organization and design of the computer to carry out an instruction set architecture at the system level (no pipelined), starting from the basic hardware components (logic gates and status information) that is aware of the species of a course on Logic Design.
- Will know the fundamentals of pipelining and its significant benefits in terms of efficiency and difficulties of this technique.

Topics:

- Introduction, abstract concepts, and computer technology.
- Evaluation of the performance measures used.
- Instruction set architecture (Instruction Set Architectures) and the microprocessor MIPS.
- Symbolic language (assembly language) and machine language.
- The hardware interface and software. From the high-level programming languages to machine language of the computer
- Computer arithmetic for integers and real numbers (representations, acts, orders and material).
- Design of central processing unit (CPU) without pipelining. Data paths and control units.
- The basic design of the CPU with pipelining.

The course includes a laboratory part (using a PC Board) which covers the instruction set architecture and assembly language programming in microprocessor MIPS. The software tool used is the simulator and assembler SPIM.

Indicative reading list and references:

- Patterson, David A., and John L. Hennessy. "Computer organization and design." Morgan Kaufmann (2007): 474-476.
- «Οργάνωση και Σχεδίαση Υπολογιστών: η Διασύνδεση Υλικού και Λογισμικού» (Α & Β Τόμος), των D.A. Patterson, και J.L. Hennessy, (μετάφραση και επιστημονική επιμέλεια στα ελληνικά: Δ.Γκιζόπουλος), Κλειδάριθμος, 2010. (τίτλος πρωτοτύπου: "Computer Organization and Design: the Hardware/Software Interface", Elsevier/Morgan Kaufmann, 2010).
- Οργάνωση και αρχιτεκτονική ηλεκτρονικών υπολογιστών, Hammacher Carl,Vranesic Zvonko,Zaky Safwat, Έκδοση: 1η έκδ./2007, ISBN: 978-960-458-000-2, (Εκδότης): Εκδόσεις Επίκεντρο Α.Ε.

AIK08 Finance

ECTS: 7

Overview and Objectives:

Students are introduced to the following concepts and practices in Finance:

- Understanding the basic concepts in Financial Analysis and Management
- Ability to use these concepts as tools of analyzing the function of finance in firms.
- Decision making based on the results of the specific financial analysis.
- Competence in using spreadsheet type of software to solve problems in finance.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Understand the basic concepts and practices of Finance
- use these concepts as tools of analyzing the function of finance in firms.
- Make decisions based on the results of the specific financial analysis.
- Exhibit competence in using spreadsheet type of software to solve problems in finance.

Topics:

- Basic concepts in finance and the financial environment.
- Comparative analysis of financial statements.
- Sources and uses of funds.
- Working capital-revenue-cost planning and control.
- Time value of money and capital budgeting.
- Money and capital markets (sources of funds).
- Use of spreadsheets (MS Excel type) in solving problems in finance.
- Preparing and completing a case study (use of web based financial databases and presentation of a financial analysis for a specific enterprise.

Indicative reading list and references:

- «FINANCIAL MANAGEMENT AND POLICY», VAN HORNE J.C, Prentice Hall, New York, 1992.
- Βασικές αρχές της χρηματοοικονομικής διαχείρισης και πολιτικής, Brigham Eugene F.,Weston J. Fred, ISBN: 960-02-0302-4, Διαθέτης (Εκδότης): ΕΚΔΟΣΕΙΣ ΠΑΠΑΖΗΣΗ ΑΕΒΕ
- Χρηματοοικονομική ανάλυση επιχειρήσεων, Ξανθάκης Μανώλης, Αλεξάκης Χρήστος, Έκδοση: 1η έκδ./2007, ISBN: 978-960-351-679-8, Διαθέτης (Εκδότης): ΕΚΔΟΣΕΙΣ ΣΤΑΜΟΥΛΗ ΑΕ
- «ΛΟΓΙΣΤΙΚΗ Η ΒΑΣΗ ΤΩΝ ΕΠΙΧΕΙΡΗΜΑΤΙΚΩΝ ΑΠΟΦΑΣΕΩΝ»
  MEIGS, F.R., Εκδ. Παπαζήση, Αθήνα, 1988 (Μετάφραση από αγγλικά).
- Χρήση και Εφαρμογές του Excel στην Οικονομία και τη Διοίκηση», Α. Οικονομίδης, Β. Καρατζόγλου, Θ. Χατζιδάκη, Πανεπιστήμιο Μακεδονίας, Θεσσαλονίκη, 2011.

AIK09 Probability and Statistics

ECTS: 6

Overview and Objectives:

The main objectives of the course are to:

- Provide the students with in-depth knowledge of how to summarize and present univariate data.
- Cover probability concepts, random variables and their distributions in detail.
- Discuss the concept of expectation of functions of random variables.
- Make students aware of the importance of the central limit theorem and the laws of large numbers.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Produce summary statistics and present data.
- Use the laws and rules of probability to solve combinatorial problems.
- Explain the behavior of the most common probability distributions.
- Calculate expected values of functions of random variables.
- Handle moments and moment generating functions of random variables

Topics:

Axioms of probability. Conditional probability and stochastic independence. Terminology: population, sample, random variable, etc. Data collection: enumeration, sampling techniques. Graphical and numerical presentation of data. Frequency distribution. Measures of Central Tendency and Dispersion. Basic terminology of probabilities: trial, sample space, simple and complex events, etc. Conditional probability. Rule of Bayes. Probability functions. Discrete distribution: Binomial, Poisson, etc. Continuous distribution: Normal, Exponential, etc. Sampling distributions. Central limit theorem. Point estimation. Properties of estimators. Confidence interval estimation. Determining sample size. Hypothesis testing theory and applications. Testing for goodness of fit.

Indicative reading list and references:

- Hoel, Paul G., Sidney C. Port, and Charles J. Stone. Introduction to stochastic processes. Waveland Press, 1986.
- Εισαγωγή στις πιθανότητες με στοιχεία στατιστικής, Μπερτσεκάς Δ. - Τσιτσικλής Γ., Έκδοση: 1η/2013, ISBN: 978-960-418-398-2, (Εκδότης): ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε.
- Εισαγωγή στις Πιθανότητες και τη Στατιστική, Δαμιανού Χ., Χαραλαμπίδης Χ., Παπαδάτος Ν. , Α' ΕΚΔΟΣΗ/2010, ISBN: 978-960-266-308-0, (Εκδότης): Σ.ΑΘΑΝΑΣΟΠΟΥΛΟΣ & ΣΙΑ Ο.Ε.
- ΕΙΣΑΓΩΓΗ ΣΤΗ ΘΕΩΡΙΑ ΠΙΘΑΝΟΤΗΤΩΝ, HOEL P., PORT S., STONE C., Έκδοση: 1η/2009, ISBN: 978-960-524-156-8, Διαθέτης (Εκδότης): ΙΔΡΥΜΑ ΤΕΧΝΟΛΟΓΙΑΣ & ΕΡΕΥΝΑΣ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ
- Εισαγωγή στη στατιστική και τις πιθανότητες, Ζαφειρόπουλος Κώστας, Έκδοση: 1η έκδ./2013, ISBN: 978-960-218-879-8, Διαθέτης (Εκδότης): ΕΚΔΟΣΕΙΣ ΚΡΙΤΙΚΗ ΑΕ

- Στατιστική, Ψωινός Δημήτριος Π. Έκδοση: 1η έκδ./1999, ISBN: 960-431-561-7, (Εκδότης): Ζήτη Πελαγία & Σια Ο.Ε.

AIK10 Object Oriented Programming

ECTS: 7

Overview and Objectives:

The main objectives of the course are to:

- Discuss and acquire the knowledge and programming experience of basic principles of the object-oriented programming with specific reference to the C++ programming language.
- Demonstrate and analyze the basic object-oriented concepts for simple concepts as well as for more complex (private classes, objects, encapsulation, inheritance and polymorphism).
- Identify the key Object Oriented Concepts (OO Concepts) required to build an OO system
- Design, practice and develop using the C++ graphical user interfaces (GUI) applications with the associated API libraries.
- Critically assess, plan, and build simple applications using the concepts of OO programming in the C++ context.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Analyze problems and find abstract OO solutions.
- Identify basic principles of object-oriented program design advanced issues related to extrapolate manipulation of classes and methods-such as data, visibility, scope, method parameters, object references, and nested classes.
- Exploit object-oriented principles and advanced C++ language features in the design and implementation of object-oriented programs.
- Identify the basic ideas behind class hierarchies, polymorphism, and programming to interfaces.
- Explain the capabilities of several C++ API's and demonstrate appropriately the utilization of them.
- Identify the object-oriented, windows-based and event driven programming paradigms.
- Implement, test, maintain small to medium sized applications in C++ develop API applications consisting of multiple source files.
- Design, write and execute programs in C++.
- Demonstrate and analyze the basic concepts of object-oriented programming.
- Critically assess the abstractions of the Object Oriented design core language of C++.
- Design and develop (write/debug/correct) C++ source code and GUI programs with specified requirements.

Topics:

Overview of object-oriented programming and classes. The programming language C ++. Basic elements, namespaces, overloading, classes, objects, inheritance, composition, patterns, abstract classes, exception handling, description of the standard library, a description of the STL. Design and programming with C ++. General description of the Java language and the language C #. Other object-oriented programming languages. Theoretical issues related to the objects.

Indicative reading list and references:

- Coplien, James O. Advanced C++ programming styles and idioms. Vol. 201548550. Reading, MA: Addison-Wesley, 1992.
- Vohra, Deepak, et al. Beginning Java programming: the object-oriented approach. John Wiley & Sons, 2015.
- Weisfeld, M. (2008). The object-oriented thought process. Pearson Education.
- Τρόπος Σκέψης σε C++, 2η Έκδοση, Α' Τόμος, Eckel Bruce, Έκδοση: 2η έκδ./2009, ISBN: 978-960-512-526-4, Διαθέτης (Εκδότης): Χ. ΓΚΙΟΥΡΔΑ & ΣΙΑ ΕΕ
- Προγραμματισμός με τη C++, Stroustrup Bjarne, 1η εκδ./2009, ISBN: 978-960-7182-54-8, Διαθέτης (Εκδότης): Α. ΠΑΠΑΣΩΤΗΡΙΟΥ & ΣΙΑ ΟΕ
- Η ΓΛΩΣΣΑ ΠΡΟΓΡΑΜΜΑΤΙΣΜΟΥ C++, BJARNE STROUSTRUP**,** 3η/1999, ISBN: 960-332-142-7, (Εκδότης): ΙΩΑΝΝΗΣ ΦΑΛΔΑΜΗΣ ΚΑΙ ΣΙΑ ΕΕ

AIK11 Graphics I

ECTS: 6

Overview and Objectives:
This entry level course in computer graphics is focused on understanding the geometry of two and three dimensions and basic algorithms for coloring and lighting design two-and three-dimensional direct imaging. Students have the opportunity to learn the algorithms currently used to design graphics and real-time photorealistic graphics, learn about the related hardware and graphics to practice while in the corresponding laboratory course of three-dimensional graphics programming in OpenGL / C ++.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Understand the basic computer systems and models used in computer graphics.
- Understand Graphics Programming and the OpenGL API.
- Input and Interaction in Windowing Systems using OpenGL.
- Geometric Objects and Transformations.
- Viewing and Shading in computer graphics.
- Texture mapping and other advanced techniques.

Topics:

Introduction scenic line output, input and output graphics. Algorithms performance line segments, circles, conic sections and polygons, antialiasing. Affine transformations, transformations two-and three-dimensional homogeneous coordinates, composition transformations, transformations window to viewport. Algorithms for clipping line segments and polygons in two and three dimensions. Views. Concealment algorithm z- Graphics

Laboratory I:

Overview of OpenGL, description GLUT, management of messages, colors, views. Basic shapes with glBegin, 2D transformations, animation. Animation (complex motion), hierarchical 3D transformations, experimenting with transformations and movement. Combination regimens (blending), lighting, hide with Z-buffer, fonts.

Indicative reading list and references:

- Graphics: Principles & Algorithms - A. Boehm, Th. Theocharis, A.. Karabasis C.. Papaioannou, N.. Platis, 1999 (main textbook)
- Computer Graphics and Visualization: Principles & Algorithms, T. Theoharis, G. Papaioannou, N. Platis, NM Patrikalakis, AK Peters, 2008 (Newer, updated textbook - in English).
- Real-Time Rendering (3rd Ed.), T. Akenine-Möller, E. Haines, N. Hoffman, AK Peters Ltd (Brief coverage of many slightly more advanced real-time graphics issues - middle level).
- A. Watt, F. Policarpo: 3D Games - Real-time Rendering and Software Technology (Vol 1). Addison-Wesley (Reference to graphics techniques applied to three-dimensional game engine technology - introductory level).
- RS Wright jr., B. Lipchak: OpenGL Superbible (3rd edition), SAMS (Very good book for learning library OpenGL - introductory level).

- E. Lengyel: Mathematics for 3D Game Programming & Computer Graphics (2nd edition). Charles River Media.
- PJ Schneider, DH Eberly: Geometric Tools for Computer Graphics. Morgan-Kaufmann (Mathematics and approximate methods used in computer graphics - medium / advanced level).
- AS Glassner: Principles of Digital Image Synthesis (2-vol set). Morgan-Kaufmann (Theory lighting and digital image representation, photorealistic imaging theory - advanced level).

AIK12 Algorithms and Complexity

ECTS: 7

Overview and Objectives:

The course covers topics on:

- Fundamentals and technical analysis and runtime algorithms Asymptotic notation O, Z and I;
- some data structures (eg, heaps and priority queues);
- sorting and searching algorithms;
- three basic algorithm design techniques: Greedy approach, divide-and-conquer, dynamic programming;
- basic graph algorithms (search by width and depth, applications, coating trees, shortest paths, matching); and
- NP-completeness, reductions.

Learning Outcomes:

At the end of the course, the students should be able to:

- Discuss computability issues and need for axiomatic models of computations. Introduce the notion of an algorithm noting the existence of unsolvable problems.
- Discuss the notion of time and space complexity and classify functions by their growth rates.
- Analyze the running time of various algorithms; employ in particular, the Master Theorem for solving recurrences.
- Describe and use general techniques, such as the Divide and Conquer and the Dynamic Programming paradigms, for designing correct and effective algorithms
- Develop, evaluate and reason about the correctness and performance, of sorting algorithms (Insertion Sort, Merge Sort, Heapsort and Quick Sort), write programs to implement these and prove lower bounds for sorting by comparison keys.
- Analyze graph-traversing algorithms (BFS/DFS), compare Kruskall's and Prim's method for finding minimal spanning trees and explain Dijkstra's Single Source Shortest-path algorithm. Discuss the Maximum flow problem and Ford-Fulkerson algorithm.
- Explain the general notion of complexity classes, P and NP, completeness and hardness, and the relationships between classes by reduction. Compare a range of computational problems according to their classification. Consider approximation algorithms for solving hard problems.

Topics:

The concept of algorithms and complexity. Complexity average and worst-case complexity. Recursive algorithms and recursive equations. Priority Queues and Heaps, Heapsort. Search techniques: search trees, key transformation (hashing), union and find. Technical traversal in graphs: Breadth first (BFS), Depth first (DFS), connected components. Techniques for designing algorithms. Divide and conquer: selection and sorting algorithms, binary search, the master theorem. Greedy algorithms: resource allocation - the maximum independent set in interval graphs, minimum cost spanning tree, optimal paths, the knapsack problem, minimum set cover. Dynamic programming: minimal paths in graphs (algorithm Bellman), maximum common subsequence, 0-1 Knapsack. Tree algorithms: the problem of n-queens, the travelling salesman problem (TSP). Easy and difficult combinatorial optimization problems, decision problems, the classes P and NP, NP-complete problems and NP-hard, reductions.

Indicative reading list and references:

- Cormen, Leiserson, Rivest, and Stein, Introduction to Algorithms, The MIT Press, 2nd edition, 2001.
- Cormen, Leiserson, Rivest, Stein. Εισαγωγή στους αλγορίθμους, Τόμος Ι. Πανεπ. Εκδόσεις Κρήτης, 2006
- Π. Δ. Μποζάνης. Αλγόριθμοι: Σχεδιασμός και ανάλυση. Εκδόσεις Α. Τζιόλα, 2003 S. Dasgupta, C.H. Papadimitriou, and U.V. Vazirani, Algorithms, McGraw Hill, 2006.
- J. Kleinberg and E. Tardos, Algorithm Design, Addison Wesley, 2005. Μεταφρασμένο στα Ελληνικά με τίτλο Σχεδιασμός αλγορίθμων από τις εκδόσεις Κλειδάριθμος.

AIK13 Operations Research

ECTS: 6

Overview and Objectives:

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Outline the scope of Operations Research, the impact it has, and the core underlying technologies it involves.
- Formulate optimization problems in Mathematical Programming (linear and integer).
- Apply the Simplex method to solve small LP formulations.
- Use spreadsheet and other software packages to solve small to medium size MP problems and perform sensitivity analysis.
- Discuss the limitations of MP models and its application in real world settings.
- List and briefly describe alternative (non mathematical programming) approaches to optimization.

Topics:

Formulation of problems in operations research. Linear programming: formulation of problems, Simplex (phase I and phase II), introduction to the dual theory. Nonlinear programming: optimization without constraints, optimization with equality constraints (theory and algorithms), optimization with inequality restrictions (conditions Karush-Kuhn-Tucker), algorithmic implementation. Theory of inventories/stocks: deterministic models (order quantity), probabilistic models, policies (s, S). Dynamic programming: features, implementations, deterministic models, probabilistic models. Applications to dynamic inventory control models, the algorithm Wagner-Whitin.

Indicative reading list and references:

1. F.S. HILLIER and G.J. LIEBERMAN, *Introduction to Operations Research*, 8th ed., McGraw-Hill, New York, 2004
2. E. AARTS & J.-K. LENSTRA, *Local Search in Combinatorial Optimization*, John Wiley & Sons, 1997
3. Th. H. CORMEN, CH. E. LEISERSON, R.L. RIVEST, *Introduction to algorithms*, MIT-Press, 2000
4. R. K. MARTIN, *Large scale linear and integer optimization*, Kluwer Academic Publishers, 1999
5. ΓΡΑΜΜΙΚΟΣ ΠΡΟΓΡΑΜΜΑΤΙΣΜΟΣ, Μια Προσέγγιση με Matlab, ΠΑΠΑΡΡΙΖΟΣ ΚΩΝΣΤΑΝΤΙΝΟΣ, Έκδοση: Α/2009, ISBN: 978-960-8065-67-3, (Εκδότης): ΜΑΡΚΟΥ Ι. ΓΕΩΡΓΙΟΣ ΚΑΙ ΣΙΑ ΕΕ
6. ΕΠΙΧΕΙΡΗΣΙΑΚΗ ΕΡΕΥΝΑ ΓΙΑ ΤΗ ΛΗΨΗ ΔΙΟΙΚΗΤΙΚΩΝ ΑΠΟΦΑΣΕΩΝ, ΟΙΚΟΝΟΜΟΥ ΓΕΩΡΓΙΟΣ, ΓΕΩΡΓΙΟΥ ΑΝΔΡΕΑΣ , Έκδοση: Α/2011, ISBN: 978-960-8249-80-6, (Εκδότης): ΓΕΩΡΓΙΑ ΣΩΤ. ΜΠΕΝΟΥ

AIK14 Designing and Using Databases

ECTS: 7

Overview and Objectives:

The main objectives of the course are to:

- Analyze data models and data modeling techniques.
- Cover relational database design by converting a conceptual data model to a database schema.
- Explain normalization and use it to design normalized relational databases.
- Cover Structured Query Language's (SQL), data definition (DDL), data manipulation (DML), and data control (DCL) components.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Explain the role of databases and database management systems in managing organizational data and information.
- Distinguish between the basic approaches to data modeling techniques (i.e. object-oriented data modeling, semantic data modeling, etc.).
- Use at least one conceptual data modeling technique (such as entity-relationship modeling) to capture the information requirements for an enterprise domain.
- Design high-quality relational databases.
- Explain the purpose and principles of normalizing a relational database structure and design a normalized relational database.
- Implement a relational database design using an industrial database management system, including the principles of data type selection and indexing.
- Use the data definition, data manipulation, and data control language components of SQL in the context of one widely use implementation of the language.

Topics:

Entity-Relationship (E/R) model, design of bases schemes with the E/R model, relational data model, a translation of the E/R to the relational, study of relational schemas based on functional dependencies, normal forms of relational schemas, the language SQL, the language QBE, contact forms, report writing, system lists, views, constraints, developing applications with embedded SQL, application development over standard communication interfaces to databases (ODBC, JDBC), distributed databases, client-server architecture, databases and the Internet, object-oriented databases.

Indicative reading list and references:

- Garcia-Molina, Hector, Jeffrey D. Ullman, and Jennifer Widom. Database system implementation. Vol. 654. Upper Saddle River, NJ:: Prentice Hall, 2000.
- ΒΑΣΙΚΕΣ ΑΡΧΕΣ ΓΙΑ ΤΑ ΣΥΣΤΗΜΑΤΑ ΒΑΣΕΩΝ ΔΕΔΟΜΕΝΩΝ, JEFFREY D. ULLMAN, JENNIFER WIDOM, Έκδοση: 2η/2008, ISBN: 978-960-461-183-6, (Εκδότης): ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ.
- Θεμελιώδεις αρχές συστημάτων βάσεων δεδομένων, Elmasri Ramez,Navathe Shamkant B., 6η Έκδοση Αναθεωρημένη/2012, ISBN: 978-960-531-281-7 , (Εκδότης): ΔΙΑΥΛΟΣ Α.Ε. ΕΚΔΟΣΕΙΣ ΒΙΒΛΙΩΝ.

AIK15 Communication Networks I

ECTS: 6

Overview and Objectives:

Communication networks are one of the most interesting and important technological fields of our times. Internet connects billions of computers, providing a global communications, computing and storage infrastructure. A remarkable increase in new applications is imminent with the completion of Internet technologies with the mobile/wireless communications. Much has changed in our daily lives with the development of networks of fatal condition during the 60's until today. But this is only the beginning - a new generation of creative scientists and engineers and communications will lead to a future Internet bullets might not have even imagined. This course aims to give a good introduction to the background that one needs to travel and explore this interesting cognitive area.
The aim of the course is to understand the principles of operation and design choices of communication networks, as well as learning the basic characteristics of the prevailing network technologies. The main focus of the course is the Internet, covering issues related to the planning, implementation and operation of communication networks with emphasis on fundamental concepts and principles.
The course is organized into five main sections. Introduction to basic principles and technologies of Networks. Internet (Internet): architecture, addresses, routing and transport protocols. Local networks: multiple access algorithms access to common media, study efficiency technologies, Ethernet. Asynchronous Transfer Technology (Asynchronous Transfer Mode - ATM): architecture, routing, services from end to end. Function link layer protocols, retransmission, congestion control mechanisms and flow on the Internet. The lab on "Computer Networks" is optional and separate from this course.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Provide a clear identification of the physical and logical as well as the electrical characteristics of digital signals and the basic methods of data transmission.
- Critically assess the concepts and requirements hosted in communication protocols and provide an overview of Data Communication Standards.
- Understand and explain the basic protocols involved in wired/wireless communication process; Local Area Networks (MAC-CSMA-CD/Ethernet, Token Ring, FDDI, and others), and for Wide Area Networks using the TCP/IP, UDP/IP.
- Analyze the structural performance for some commonly used network architectures/identify the functions and architectures of LAN and WAN, analyze and design LAN architecture and the design and deployment requirements.
- Demonstrate and analyze the electrical interface and the basics of digital data transmission.
- Demonstrate and critically assess the need for data communication standards and the underlying technology used in wired and wireless communication models.
- Critically compare, evaluate and identify the principles of Open Systems as well as the Transport/Application protocols.
- Identify the utilized fundamentals and technologies of physical, data-link and network layers.
- Link different network performance concepts and traffic issues for Quality of Service (QoS) in broadband communication.

Topics:

Introduction to basic concepts and definitions of communication networks, basic design principles and technologies. Internet structure, Internet History. Application Layer (HTTP, FTP, e-mail). Modes of transport layer (TCP, UDP, reliable data transfer in TCP, flow control, congestion control). Network layer (Routing, Addressing, IP protocol, packet structure IP). Link layer (reliable transport of bits, retransmission protocols). Multiple access protocols for local area networks (Ethernet, IEEE 802.11), Local Peer Networks. ATM networking (objectives, principles, cells, quality of service, routing-switching).

Indicative reading list and references:

- "Computer Networks, An Open Source Approach – International Edition", Yin-Dar Lin, Ten-Hung Hwang, and Fred Baker, McGraw Hill, 2011
- Mathematical Foundations of Computer Networking - Srinivasan Keshav, Addison-Wesley, 2012
- Computer Networks. A systems Approach, 4th Edition, Larry Peterson and Bruce Davie, Morgan Kaufmann 2007
- Communication Networks: Fundamental Concepts and Key Architectures – 2nd International Edition, Alberto Leon-Garcia and Indra Widjaja, McGraw Hill, 2006.
- "Computer Networking -- A Top-Down Approach Featuring the Internet" – 6th Edition, James F. Kurose and Keith W. Ross, Addison-Wesley, 2016.
- ΔΙΚΤΥΑ ΕΠΙΚΟΙΝΩΝΙΩΝ, ΕΝΑ ΠΡΩΤΟ ΜΑΘΗΜΑ, JEAN WALRAND, 2/2003, ISBN: 960-6608-15-8, (Εκδότης): ΕΤΑΙΡΕΙΑ ΑΞΙΟΠΟΙΗΣΕΩΣ ΚΑΙ ΔΙΑΧΕΙΡΙΣΕΩΣ ΤΗΣ ΠΕΡΙΟΥΣΙΑΣ ΤΟΥ ΠΑΝΕΠΙΣΤΗΜΙΟΥ ΑΘΗΝΩΝ
- Δικτύωση Υπολογιστών, 6η Έκδοση , J.F. Kurose, K.W. Ross, 6η Εκδ./2013, ISBN: 978-960-512-6575, (Εκδότης): Χ. ΓΚΙΟΥΡΔΑ & ΣΙΑ ΕΕ

AIK16 Operating Systems

ECTS: 6

Overview and Objectives:

The main objectives of the course are to:

- Introduce Operating System (OS) structuring methods like monolithic, layered, modular, micro-kernel models.
- Provide deep knowledge of abstractions, processes, and resources.
- Make aware the concept of protection through the transition between user and system (kernel) mode.
- Thoroughly discuss OS structures e.g., ready list, process control block etc.
- Provide deep knowledge of the concept of processes and threads.
- Thoroughly discuss dispatching, context switching, pre-emptive, and non-preemptive scheduling
- Cover in detail the "mutual exclusion" problem with some of its solutions.
- Provide knowledge of deadlock including: causes, conditions, and prevention.
- Provide knowledge of synchronization models and mechanisms (semaphores, monitors, condition variables, rendezvous).
- Explain in detail: physical memory, memory management hardware, paging, and virtual memory.

Learning Outcomes:

At the end of this module, successful candidates should be able to:

- Compare and contrast the various ways of structuring an operating system such as object-oriented, modular, micro-kernel, and layered.
- Contrast kernel and user mode in an operating system.
- Describe the difference between processes and threads.
- Compare and contrast the common algorithms used for both pre-emptive and non-preemptive scheduling of tasks in operating systems, such as priority, shortest job first, round robin, and multi-layer schemes.
- Describe reasons for using interrupts, dispatching, and context switching to support concurrency in an operating system.
- Describe the need for concurrency within the framework of an operating system.
- Demonstrate the potential run-time problems arising from the concurrent operation of many separate tasks.
- Compare the various approaches to solving the problem of mutual exclusion in an operating system.
- Explain memory hierarchy and cost-performance trade-offs.
- Explain the concept of virtual memory and how it is realized in hardware and software.

Topics:

Introduction to Operating Systems and Structures of Computer Systems. Basic Structures of Operating Systems. Processes and main methods of process communication. Scheduling and scheduling techniques. Process synchronization, critical sections, semaphores, monitors. Deadlocks, recovering and methods of avoiding deadlocks. Memory management, paging, segmentation, swapping. Virtual Memory and

implementation methods. Methods for page swapping and metrics for monitoring them. File systems, directories, file system implementation, security and protection. Input-Output units, disks, CD-ROMs, peripherals, I/O interfaces, tapes, scheduling functions in the memory hierarchy. Using the Unix operating system to implement programming assignments.

Indicative reading list and references:

- Tanenbaum, Andrew S., and Albert S. Woodhull. Operating systems: design and implementation. Vol. 2. Englewood Cliffs, NJ: Prentice-Hall, 1987.
- Tanenbaum, Andrew S. Modern operating system. Pearson Education, Inc, 2009.
- Λειτουργικά Συστήματα, 9η Εκδ., Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 9η Εκδ./2013, ISBN: 978-960-512-6513, Διαθέτης (Εκδότης): Χ. ΓΚΙΟΥΡΔΑ & ΣΙΑ ΕΕ
- ΣΥΓΧΡΟΝΑ ΛΕΙΤΟΥΡΓΙΚΑ ΣΥΣΤΗΜΑΤΑ, ANDREW S. TANENBAUM, 3η/2009, ISBN: 978-960-461-200-0, (Εκδότης): ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ
- Ι. Κ. Κάβουρας, «Λειτουργικά Συστήματα», 7η έκδοση, Κλειδάριθμος, 2009.

AIK17 Software Engineering

ECTS: 6

Overview and Objectives:

Familiarization with and assimilation of the approaches, methodologies, models and tools used to develop quality software systems. Understanding of software architectures, software modeling and testing. Understanding of software testing process and of software architecture design patterns. Applications of software creation methodologies on the construction of a real software system. Understanding of software testing procedures. Use and application of architecture design patterns.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Explain the concept of a software life-cycle and provide examples illustrating its phases including the deliverables that are produced.
- Select, with justification the software development models and process elements most appropriate for the development and maintenance of a diverse range of software products.
- Explain the role of process maturity models. Develop a medium-size software product using a software requirement specification, an accepted program design methodology (e.g., structured or object-oriented), and appropriate design notation.
- Use CASE tools and design appropriate UML diagrams for a medium-sized software system.
- Discuss the properties of good software design including the nature and the role of associated documentation.
- Evaluate the quality of multiple software designs based on key design principles and concepts.

Topics:

Methods, tools, and procedures for the development and maintenance of large-scale software systems. Existing life-cycle models (e.g. waterfall model). Introduction to Agile development. Requirements analysis and specification techniques. Software development methodologies. Unified Modelling Language (UML) and supported static and dynamic diagrams. Code transformation. Practical experience with CASE tools for modeling data and procedures (ArgoUML, StarUML). Prototyping for Web applications (HTML, CSS). Architectural Design patterns (Model View Controller etc.). Software verification and validation. Unit testing and frameworks (JUnit etc.). CASE tools. Project planning and management. Agile software development. Model driven engineering. Legacy systems. Sociotechnical systems. Software reuse. Component Based systems. Distributed software engineering. Service oriented architectures. Embedded software. Aspect oriented software engineering.

Indicative reading list and references:

- R. Pressman, *Software Engineering: A Practitioner's Approach*, 7th Edition, Mc Graw Hill, 2010.
- Τεχνολογία Λογισμικού - Θεωρία καί Πράξη, Bhari Lawrence Pfleeger, μετάφραση: Κώστας Φρυσήρας, εκδόσεις Κλειδάριθμος, 2012, (δύο τόμοι).
- H. Van Vliet, *Software Engineering: Principles and Practice*, 3rd Edition, John Wiley & Sons, 2008.
- I. Sommerville, *Software Engineering*, 9th Edition, Addison-Wesley, 2011.

- E. J. Baude, M. E. Bernstein, *Software Engineering – Modern approaches*, John Wiley & Sons, 2nd edition, 2011.
- Αντικειμενοστρεφής Σχεδίαση: UML, Αρχές, Πρότυπα και Ευρετικοί Κανόνες Α. Χατζηγεωργίου, Εκδόσεις Κλειδάριθμος 2005, ISBN: 960-209-882-1
- Αντικειμενοστρεφής ανάπτυξη λογισμικού με τη UML, Β. Γερογιάννης,Γ. Κακαρόντζας, Α. Καμέας, Γ. Σταμέλος, Π. Φιτσιλής, Εκδόσεις Κλειδάριθμος 2006, ISBN: 960-209-913-5
- Εισαγωγη στη UML, : συνοπτικος οδηγος της προτυπης γλωσσας μοντελοποιησης αντικειμενων, martin fowler, έκδοση: 3η/2006, είς: martin fowler, isbn: 960-209-957-7, εκδοσεις κλειδαριθμος επε

COMPULSORY INTERDISCIPLINARY INTRODUCTORY COURSES

ECON101 Introduction to Economics

ECTS: 4

Learning Outcomes:

At the end of the module, successful candidates should be able to:

(a) Understand the basic principles of Economics.
(b) Identify the main theories of Economics.
(c) Apply the methodologies of Economics on real cases.
(d) Use the tools of Economics in decision - making.

Topics:

Fundamental concepts and methodological approaches, economic failure and social choice, the framework and the operation of the market mechanism, the role of the state - national product, unemployment, inflation, consumption, savings and investment, the determination of income, balance income - Monetary Policy, Outside area, economic policy, theory choice and consumer demand, production and cost - market structure

Indicative reading list and references:

- Begg, David, Stanley FISCHER, and Rudiger DORNBUSCH. "Economics, England." (1994).
- Εισαγωγή στην οικονομική, David Begg, Stanley Fisher, Rudiger Dornbusch, Έκδοση: 2η έκδ./2006, ISBN: 978-960-218-735-7, (Εκδότης): ΕΚΔΟΣΕΙΣ ΚΡΙΤΙΚΗ ΑΕ
- Βιβλίο [12589597]: Αρχές οικονομικής θεωρίας - Ενιαίο, Mankiw N. Gregory, Taylor P. Mark, Έκδοση: 1η έκδ./2011, ISBN: 978-960-01-1435-5, (Εκδότης): Γ. ΔΑΡΔΑΝΟΣ - Κ. ΔΑΡΔΑΝΟΣ Ο.Ε.

BUSN100 Introduction to Innovation and Entrepreneurship

ECTS: 4

Learning Outcomes:

At the end of the module, successful candidates should be able to:

Topics:

Introduction to the concept of entrepreneurship. Development and innovation management. Patent, copyright. Uncertainty, risk and performance. Get business - investment decisions. S.W.O.T. Analysis. Strategic planning business. Preparation of business plan. Sustainability and competitiveness. Harnessing ICT businesses. Internet and entrepreneurship. Management and quality certification, Benchmarking. Administration and management of resources (material and human). Organizational culture. Business skills. Social Entrepreneurship - Corporate social responsibility and ethics. Entrepreneurship and sustainable development. National policies for entrepreneurship - Community actions. Case Studies.

Indicative reading list and references:

- Drucker, Peter. *Innovation and entrepreneurship*. Routledge, 2014.
- Καινοτομία, Στρατηγική Ανάπτυξη και Πληροφοριακά Συστήματα, Δουκίδης, Γ., εκδ. Σιδέρης, 2010, ISBN 978-960-08-0528-4
- Καινοτομία και αλλαγή στο επιχειρείν, Ελένη Ε. Σαλαβού, Έκδοση: 1/2013, ISBN: 978-960-7745-31-6, (Εκδότης): ROSILI ΕΜΠΟΡΙΚΗ - ΕΚΔΟΤΙΚΗ Μ.ΕΠΕ
- ΚΑΙΝΟΤΟΜΙΑ & ΕΠΙΧΕΙΡΗΜΑΤΙΚΟΤΗΤΑ , ΚΑΡΑΓΙΑΝΝΗΣ ΗΛΙΑΣ, ΜΠΑΚΟΥΡΟΣ ΙΩΑΝΝΗΣ Έκδοση: 1η έκδοση/2010, ISBN: 978-960-6706-33-2, (Εκδότης): "σοφία" Ανώνυμη Εκδοτική & Εμπορική Εταιρεία

PSYC100 Introduction to Psychology

ECTS: 4

Overview and Objectives:

To understand some of the basic principles and processes that govern how individuals behave in social situations, how we develop, what happens when people go wrong, and the application of psychology in some applied settings. To become familiar with and be able to describe some of the most important methods that are used to gather evidence about these issues, and how that evidence can be interpreted.
Be able to analyze and interpret actual data related to these issues, and present your findings according to scientific convention. To be able to apply your knowledge of basic psychological processes to understanding human behavior in everyday real-world settings.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Understand the vocabulary and concepts of psychology.
- Understand the research upon which the knowledge of human thought and behavior is based.
- Understand how critical thinking skills are developed.
- Be a cautious and analytical consumer of information that is proclaimed to be scientific or based on research.
- Have a greater understanding and accepting of him/herself and others.
- Describe the critical developments that led to the present discipline of psychology.
- Contrast and compare the three major
- Describe and apply psychological theory in some areas of their lives.

Topics:

Survey the major principles of psychology. History of psychology and scientific thought, biological basis of behavior, research methodology, statistics, sensation and perception, states of conscious, memory, language and intelligence, developmental psychology, personality, and learning.

Indicative reading list and references:

- Psychology: Core Concepts -- Zimbardo, Johnson, Weber Pearson: Allyn and Bacon, Fifth Edition; ISBN:0-205-42428-7
- Βοσνιάδου, Σ. (2003). *Εισαγωγή στην Ψυχολογία*. Αθήνα: Gutenberg.
- Schacter, D. L., Gilbert, D. T., W. D. M. (2011). *Ψυχολογία*. Σ. Βοσνιάδου (Επιμ.). Αθήνα: Gutenberg.

PEPS100 Language and Communication Skills

ECTS: 4

This course is composed of two (2) parts: one for the English language and another for the Greek language.

Part 1: English Language

Overview and Objectives:

As English is considered to be an international language, it is essential for every student to be able to communicate successfully in all aspects of the language. This course offers the students the opportunity to improve their English in general. Through a variety of topics they will be able to enrich their vocabulary and improve their speaking and listening skills. They will also have the opportunity to practice communication skills, through various activities and exercises.

The objectives of this course are to:

- Improve students' writing skills, so their assignments are very well written.
- Improve students speaking skills, so they are able to communicate successfully with the lecturers and future employers.
- Improve students' listening skills by using a lot of material from various speakers with different pronunciation-accent.
- Improve students' reading skills, so they are able to understand anything they read.

Learning Outcomes:

At the end of the course students should have mastered the English language to an Academic level.

Topics:

- Grammar
- Listening
- Reading
- Speaking

Indicative reading list and references:

- David Cotton, David Falvey, Simon Kent with John Rogers (2009), New Edition Market Leader Pre-Intermediate Business English Course Book, Pearson Longman.
- David Cotton, David Falvey, Simon Kent with John Rogers (2009), New Edition Market Leader Pre-Intermediate Business English Practice File, Pearson Longman.

Part 2: Greek Language

Overview and Objectives:

Το μάθημα αποσκοπεί:

- Να βοηθήσει τους φοιτητές να αναπτύξουν την ικανότητά τους στη συγγραφή ακαδημαϊκού δοκιμίου.
- Να επιτύχει την εξοικείωση των φοιτητών με βασικά θέματα της σύγχρονης ζωής, έτσι όπως αυτά αποτυπώνονται σε άρθρα και δοκίμια.
- Να αναπτύξει την κριτική σκέψη και την ικανότητα δημιουργικής σύνθεσης.
- Να εμπλουτίσει το λεξιλόγιο των φοιτητών.
- Να εξομαλύνει προβλήματα Γραμματικής, Συντακτικού και Ορθογραφίας.

Learning Outcomes:

At the end of the course students should have mastered the Greek language to an Academic level.

- Να κατανοήσουν τα διάφορα είδη επιστημονικής μελέτης και τις πληροφορίες που μπορούν να αντλήσουν από καθεμία από αυτές.
- Να υποβάλουν στο πλαίσιο των σπουδών τους επιστημονικές εργασίες, οι οποίες θα ακολουθούν τους επιστημονικούς κανόνες δομής και μεθοδολογίας, με σωστή χρήση και επεξεργασία της σχετικής βιβλιογραφίας
- Να κατανοούν καλύτερα και σε βάθος δοκίμια και άρθρα πάνω σε μεγάλο εύρος θεμάτων
- Να απαντούν δημιουργικά σε ερωτήματα κατανόησης κειμένων
- Να συνθέτουν ένα ακαδημαϊκό δοκίμιο κάνοντας σωστή χρήση της ελληνικής γλώσσας
- Να έχουν μια ολοκληρωμένη εικόνα πάνω σε θέματα Γραμματικής, Συντακτικού προχωρημένου επιπέδου

Topics:

Στο πλαίσιο του μαθήματος θα συζητηθούν:

- Τα είδη της επιστημονικής μελέτης
- Τα στάδια προετοιμασίας συγγραφής ενός ακαδημαϊκού δοκιμίου
- Οι κανόνες που διέπουν τη συγγραφή μιας πανεπιστημιακής επιστημονικής μελέτης
- Ο τρόπος παραπομπών σε σχετική βιβλιογραφία, η αξιολόγηση και επεξεργασία κύριας και δευτερεύουσας βιβλιογραφίας
- Η ορθή κατάρτιση βιβλιογραφικού οδηγού
- Άρθρα/δοκίμια πάνω στα εξής θέματα: γλώσσα, περιβάλλον-οικολογία, δημόσιος βίος-κοινωνία, πολιτισμός-τέχνες, ψυχολογία, επιστήμη- τεχνολογία, υγεία, εκπαίδευση, οικονομία-εργασία
- Η ορθή χρήση της γλώσσας
- Η συγγραφή ακαδημαϊκού δοκιμίου
- Γραμματική:
  - μετοχές ενεργητικής φωνής από την αρχαία ελληνική σε -ων, -ουσα, -ον (π.χ. γράφων, -ουσα, -ον), σε -ών, -ώσα, -ών (π.χ. δρων, -ώσα, -ων), και σε -ών, -ούσα, -ούν (π.χ. ομιλών, -ούσα, -ούν) ενεργητική παρελθοντική μετοχή σε -ας, -ασα, -αν (π.χ. διδάξας, -ασα, - αν)

- παθητική παρελθοντική μετοχή σε -είς, -είσα, -έν (π.χ. ερωτηθείς, -είσα, -έν)
- επίθετα σε -ής, -ής, -ές (π.χ. επιμελής, -ής, -ές)
- αρχαιόκλιτα επίθετα σε -ων, -ων, -ον (π.χ. νοήμων, -ων, -ον) και σε -ύς, -εία, -ύ π.χ. ευρύς, -εία, -ύ)
- συγκριτικός και υπερθετικός βαθμός επιθέτων
- τα ρήματα σε -ομαι
- τα ρήματα σε -ώμαι (π.χ. εξαρτώμαι) και -ούμαι (π.χ. δικαιούμαι)
- συνηρημένα ρήματα σε -ώ (αγαπάω, δημιουργώ, πληρώ)
- σύνθετα ρήματα (π.χ. διεξάγω)
- επιρρήματα σε -α και -ως (π.χ. τέλεια, τελείως)
- χρήση προθέσεων
- εκφράσεις/ιδιωματισμοί
- απόδοση ξένων λέξεων στη Νεοελληνική

Indicative reading list and references:

- Παναγοπούλου, Ε. & Χατζηπαναγιωτίδη, Ά. (1995), *Ελληνικά για Προχωρημένους* (*ομογενείς και αλλογενείς*), γ΄κύκλος, Θεσσαλονίκη: Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης, Ινστιτούτο Νεοελληνικών Σπουδών, Ίδρυμα Μανόλη Τριανταφυλλίδη.
- Γαβριηλίδου, Γωγώ (2010), *Τα Καλώς Κείμενα για Προχωρημένους. Για φοιτητές και σπουδαστές προχωρημένης ελληνομάθειας*, Θεσσαλονίκη: University Studio Press.
- Σπυροπούλου, Μαρία & Θεοδωρίδου, Θεοδώρα (2004), *Η γλώσσα που μιλάμε στην Ελλάδα*, Θεσσαλονίκη: University Studio Press.

COMPULSORY STANDALONE LABORATORIES

AIK03e Workshop Logic Design / Architecture

ECTS: 2

Topics:

The digital signal and its creation in the laboratory. The operational characteristics of integrated circuits (ICs), how to recognize them and use them on the board of implementation of laboratory exercises. Experimental verification of the operation of logic gates Design and implementation of combinational circuits using MSI integrated circuits (7442, 74151 and 74153). Exercises in the MIPS ISA and programming in assembly language using the simulator SPIM. Introduction to SPIM. Arithmetic and logic functions. Memory accesses. System calls and I / O in SPIM. Bifurcation. Comparisons. Loops. Tables. Calling procedures. Recursive procedures.

Indicative reading list and references:

See the books of the relevant course K07

AIK15e Communication Networks Laboratory

ECTS: 2

Topics:
Construction of Cable for Ethernet - Configuration and connectivity testing of a local computer network - Using the Wireshark tool for capture of data movement (tracking filters and display) - Remote access to H / PC (Remote Desktop, Telnet) - ARP protocol - IP, MAC addresses - Use the command ping, netstat - Static routing - Function / PC as a router - Cisco router Configuration - Application routing tables.

Indicative reading list and references:

See the books of the relevant course K15

COMPULSORY COURSES OF SPECIALIZATION

AIK18 Numerical Analysis

ECTS: 6

Overview and Objectives:

The course belongs to the area of Scientific Computing. It should be noted that Scientific Computing is an emerging area, which has applications in many disciplines. Recently they have been created, university departments in this area.
The numerical simulation is an important tool for the study of scientific problems arising from several disciplines such as Physics, Chemistry, Geology, Biology and Economics. Most of these problems result in solving a mathematical problem. For example, in solving a large system of linear algebraic equations, which can only be solved by numerical methods. The aim is to equip the student with the necessary knowledge to be able to develop software for the numerical solution of basic mathematical problems.

Learning Outcomes:

At the end of the module, successful candidates will know:

- The development and implementation of numerical algorithms for solving scientific problems.
- The current evaluation methodology and compare the performance of numerical algorithms.
- Current trends in the area of Scientific Computing.
- The development of modern scientific software simulation problems of our natural world.

Topics:

Elements of error analysis. Numerical solution of non-linear equations (the fixed point method, Newton-Raphson). Numerical methods for solving linear systems (direct and iterative). Numerical methods for calculating eigenvalues-eigenvectors. Interpolation. The least squares method. Numerical differentiation. Numerical integration. Introduction to the numerical solution of ordinary differential equations.

Laboratory

A series of Matrix computations using MATLAB.

Indicative reading list and references:

- Stoer, Josef, and Roland Bulirsch. *Introduction to numerical analysis*. Vol. 12. Springer Science & Business Media, 2013
- ΕΙΣΑΓΩΓΗ ΣΤΗΝ ΑΡΙΘΜΗΤΙΚΗ ΑΝΑΛΥΣΗ, ΑΚΡΙΒΗΣ Γ.Δ., ΔΟΥΓΑΛΗΣ Β.Α., Έκδοση: 4η /2009, ISBN: 978-960-524-022-6, (Εκδότης): ΙΔΡΥΜΑ ΤΕΧΝΟΛΟΓΙΑΣ & ΕΡΕΥΝΑΣ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ
- Αριθμητική Ανάλυση, Νικόλαος Μισυρλής, Έκδοση: 1/2009, ISBN: 978-960-92031-2-8, (Εκδότης): ΝΙΚΟΛΑΟΣ ΜΙΣΥΡΛΗΣ

AIK19 Implementation of Database systems

ECTS: 6

Overview and Objectives:

The course Implementation of Database Systems (DBs) will cover a number of key issues related to the organization and storage of data to external storage, basically drives. The specific topics to be discussed include the concept of file storage peripherals and physical characteristics, layout and sort files located on disks, primary file organization, secondary file organization, static and dynamic data structures, Indexed Sequential Access Method (ISAM), static and dynamic fragmentation (hashing), B+ trees and multidimensional data structures (e.g.,, R-trees). It will also cover issues of relational algebra, query processing and data operators of relational algebra, algorithms used, and the corresponding overhead, with or without the use of indexes. In addition, the course addresses the concept of transaction, concurrency control, concurrent access and disaster recovery.

Learning Outcomes:

At the end of the module, successful candidates will critically know:

- The difference of DBs from the file management system.
- The role of file management, of the static and dynamic data structures.
- ISAM, B+ trees, static and dynamic fragmentation
- To describe the mathematical foundation and internal mechanisms based on relational algebra.
- The cost associated to indexes.
- Query optimization using relational algebra.
- The role of concurrency control.
- Disaster recovery.

Topics:

Introduction to Database Systems, differences from the file management system, the physical characteristics of external storage devices (e.g., disks), organization of data on disks, the concept of file management, buffer, primary file organizations, secondary file organization, static and dynamic data structures, ISAM, B+ trees, static and dynamic fragmentation (hashing), sorting files located on disks, relational algebra, relational algebra operators processing and corresponding algorithms, cost/overhead depending on the available indexes, query optimization, the concept of transaction, concurrency control (concurrent access), recovery from damage.

Indicative reading list and references:

- Elmasri, Ramez, and Shamkant B. Navathe. Fundamentals of database systems. Pearson, 2015.
- Θεμελιώδεις αρχές συστημάτων βάσεων δεδομένων, Elmasri Ramez, Navathe Shamkant B., Έκδοση: 6η Έκδοση Αναθεωρημένη/2012, ISBN: 978-960-531-281-7, (Εκδότης): ΔΙΑΥΛΟΣ Α.Ε. ΕΚΔΟΣΕΙΣ ΒΙΒΛΙΩΝ
- Συστήματα Διαχείρισης Βάσεων Δεδομένων, 3η Έκδοση, Ramakrishnan Raghu, Gehrke Joahannes. 3η Έκδοση/2012, ISBN: 978-960-418-411-8, (Εκδότης): ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε.

AIK20 Computer Architecture II

ECTS: 6

Overview and Objectives:

This course belongs to the Basic subjects from Orientation B of the Undergraduate Program in Applied Informatics and is taught during the 5th semester. The course includes lectures as well as laboratory exercises. During the lectures students are taught the basic techniques to enhance the performance of a computer; the parallelism ILP (Instruction Level Parallelism, ILP) emphasizing Pipelining, speculation and the use of the memory hierarchy (Memory Hierarchy). The teaching of these techniques is based on the architecture of the microprocessor instruction set MIPS; a RISC architecture with which students are already familiar since been used for teaching the core course of Computer Architecture I.

The objective of this course is that, starting from the basic background of the organization and architecture of computers that students have learned during the Computer Architecture I course, to obtain the necessary knowledge with regards to basic techniques that enhance the performance of computers. More specifically, the parallelism level command, the caches and the system input and output.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Understand the benefits of ILP, speculative execution and Pipelining.
- Understand the benefits of cache, virtual memory and memory hierarchies.
- Understand the I/O interfaces.

Topics:

General principles of computer architecture, pipelined implementation, pipeline processor MIPS, data path design with forwarding, controller design, data hazards, control hazards, data forwarding (bypassing), delays, control/branch, static branch prediction, reducing branch delay, dynamic branch prediction, delayed branching, exceptions and exception handling in pipelines, basic concepts, advanced pipelines, instruction-level parallelism, static and dynamic multi-initiation, the concept of speculation, exploiting the memory hierarchy, the basics of caches, measuring and improving the performance of cache memory, virtual memory, a common framework for memory hierarchies, disk storage and reliability, channels and other connections between processors, memory and input / output interface of input / output processor, memory and operating system design input / output.

Computer Architecture II (Laboratory)

The laboratory course, Computer Architecture II, involves the use of simulators for the two main mechanisms to increase the performance of microprocessors that are taught in this course: the diversion (pipelining) and cache (cache memory). Makes use of the most updated academic simulators in computer architecture to study all technical hardware and software to better exploit the diversion and caches.

Indicative reading list and references:

- Patterson, David A., and John L. Hennessy. Computer Organization and Design RISC-V Edition: The Hardware Software Interface. Morgan kaufmann, 2017.
- «Οργάνωση και Σχεδίαση Υπολογιστών: η Διασύνδεση Υλικού και Λογισμικού» (Α & Β Τόμος), των D.A. Patterson, και J.L. Hennessy, (μετάφραση και επιστημονική επιμέλεια στα ελληνικά: Δ.Γκιζόπουλος), Κλειδάριθμος, 2010 (τίτλος πρωτοτύπου: "Computer Organization and Design: the Hardware/Software Interface", Elsevier/Morgan Kaufmann, 2010).
- Οργάνωση και Αρχιτεκτονική Υπολογιστών, Stallings William, Έκδοση: 8η, Έκδοση/2011, ISBN: 978-960-418-328-9, Διαθέτης (Εκδότης): ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε.

AIK21 Analysis and Design of Information Systems

ECTS: 6

Overview and Objectives:

The course will address the basic notions on IS, namely, basic development life cycle; analysis and design techniques; information systems planning and project identification and selection, requirements collection and structuring, process modeling, conceptual and logical data modeling, database implementation. Examine several development methodologies, which may be used to manage the software development process. Such methodologies include: Structured Systems Analysis and Design Methodology (SSADM) and the Systems Development Life Cycle (SDLC); agile and iterative methodologies including Prototyping, Rapid Application Development and other agile software development approaches; Object-Oriented Analysis and Design using UML and other methodologies.

Learning Outcomes:

At the end of the module, successful students should be able to analyze and design an IS using appropriate CASE tools and methodologies based on the Unified Modeling Language (UML), In particular, the student will be able to:

- Initiate, specify, and prioritize information systems.
- Understand and compare between different systems development methodologies.
- Use at least one specific methodology for analyzing an organizational situation (a problem or opportunity), modeling it using a formal technique, and specifying requirements for a system that enables a productive change in the way the organization operates.

Topics:

Basic concepts of General Systems Theory (structure, boundaries, entropy, etc.). Way of describing a system. Problems in the study of systems. The role of information in the system. Information Systems (IS) and organizations. Strategies to develop an IS. Lifecycle of ISs: determination problem, feasibility study, requirements analysis, conceptual design, technical design, organizational design, implementation, operation-maintenance. Technical description and analysis of the structure of an IS. Methods development of IS: Information Engineering, SSADM, Merise, Jackson System Development, ETHICS, Object-Oriented Analysis and Design, etc. Comparative annotation methods. The UML language. Examples and applications.

Laboratory

Learning of the Case tool, which is used for creating diagrams of using the UML language; a language used for the purpose of modeling requirements and designing information systems. From UML diagram to the automatic generation of Java or C++ code.

Indicative reading list and references:

- Dennis, Alan, Barbara Haley Wixom, and David Tegarden. Systems analysis and design: An object-oriented approach with UML. John Wiley & Sons, 2015.
- Ανάλυση & Σχεδιασμός συστημάτων με τη UML 2.0: μια Αντικειμενοστρεφής προσέγγιση, ALAN DENNIS, BARBARA HALEY WIXOM, DAVID TEGARDEN, Έκδοση: 3η/2010, ISBN: 978-960-461-389-2, (Εκδότης): ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ
- ΑΝΤΙΚΕΙΜΕΝΟΣΤΡΕΦΗΣ ΑΝΑΠΤΥΞΗ ΛΟΓΙΣΜΙΚΟΥ ΜΕ ΤΗ UML, ΒΑΣΙΛΗΣ ΓΕΡΟΓΙΑΝΝΗΣ, ΓΙΩΡΓΟΣ ΚΑΚΑΡΟΝΤΖΑΣ, ΑΧΙΛΛΕΑΣ ΚΑΜΕΑΣ, ΓΙΑΝΝΗΣ

ΣΤΑΜΕΛΟΣ, ΠΑΝΟΣ ΦΙΤΣΙΛΗΣ , Έκδοση: 1η/2006, ISBN: 960-209-913-5, (Εκδότης): ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ

AIK22 Artificial Intelligence

ECTS: 6

Overview and Objectives:

To provide an introduction to the theory and practice of Artificial Intelligence (AI). This course is designed to develop an understanding of the fundamental issues associated with the field such as: problems and search, knowledge representation and reasoning, game playing, rule-based systems. Advanced topic areas such as probabilistic reasoning and Bayesian networks are also introduced.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Examine various search techniques (both uniformed and informed) and apply them to solve various AI problems.
- Develop suitable heuristic functions for informed search.
- Implement a solution to a problem using searching.
- Explain the role of Knowledge Representation in AI.
- Use predicate logic to translate and prove sentences.
- Explain the fundamentals of rule-based systems.
- Examine the various approaches to uncertain reasoning and apply them to problems.
- Explain the fundamentals of game playing (both deterministic and stochastic games) and apply suitable algorithms for searching and pruning game trees.

Topics:

The purpose of Artificial Intelligence. Search Methods. Blind and heuristic search. First search and depth-first width. Iterative deepening and widening repetitive. Search the best first. Hill climbing and simulated annealing. Methods A * and IDA *. Two-player games. Methods minimax and alpha-beta. Knowledge representation and inference procedure through logic. Propositional logic and first-order logic. Suggestions and Horn normal form formulas. Skolemization. Inference rules. Modus ponens rule and resolved. Applications of generating new knowledge from existing knowledge. Check reasoning. Systems of conservation truth. Non-monotonic reasoning. Reasoning with uncertainty. Networks Bayes. Frames and semantic networks.

Indicative reading list and references:

- Russell, Stuart, Peter Norvig, and Artificial Intelligence. "A modern approach." Artificial Intelligence. Prentice-Hall, Egnlewood Cliffs 25 (1995): 27.
- Russel, S. και Norvig, P., Τεχνητή Νοημοσύνη - Μια Σύγχρονη Προσέγγιση, 2η αμερικανική έκδοση, Κλειδάριθμος 2005. Τίτλος αγγλικού πρωτοτύπου: Artificial Intelligence - A Modern Approach, 2nd edition, Prentice Hall, 2003. (Στα αγγλικά κυκλοφορεί και η 3η έκδοση, του 2009, με σχετικά μικρές αλλαγές.)
- Βλαχάβας, Ι., Κεφαλάς, Π, Βασιλειάδης, Ν., Κόκκορας, Φ., Σακελλαρίου, Η., Τεχνητή Νοημοσύνη, 3η έκδοση, Εκδόσεις Πανεπιστημίου Μακεδονίας, 2011.

ECON102/AIK23 Macroeconomic models and Policies

ECTS: 6

Overview and Objectives:

This course provides a comprehensive overview of macroeconomics. Students will understand principal macroeconomic concepts and comprehend the function of an open economy in a free market as well as in a gross economy. The aim of this course is to introduce the students with macroeconomic models given their forecasting influence, the exertion of economic policy and also the forecasting of future values in economic variables.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

Topics:

- SCOPE OF MACRO AND NATIONAL ACCOUNTS
- GROSS DOMESTIC Product (GDP, GDP)
- UNEMPLOYMENT, INFLATION, INTEREST
- THE MODEL OF TOTAL REQUEST
- CURVE OF TOTAL OFFER
- BALANCE BY THE SIDE OF REQUEST AND The IGNITION
- FINANCIAL POLICY AND PUBLIC DEFICIT
- THEORY
- Keynesianism & monetarism

Indicative reading list and references:

- Blanchard, Olivier J., and Stanley Fischer. *Lectures on macroeconomics*. MIT press, 1989
- Εισαγωγή στη Μακροοικονομική, Δημήτρης Π. Χατζηνικολάου, Πρωτη (Α΄)/2011, ISBN: 978-960-9587-00-6, (Εκδότης): Κιόρογλου Λαμπρινή
- ΜΑΚΡΟΟΙΚΟΝΟΜΙΚΑ ΜΕΓΕΘΗ ΚΑΙ ΑΝΑΠΤΥΞΗ ΤΗΣ ΕΛΛΗΝΙΚΗΣ ΟΙΚΟΝΟΜΙΑΣ, ΔΗΜΕΛΗ ΣΟΦΙΑ, Έκδοση: 1/2010, ISBN: 978-960-9443-04-3, (Εκδότης): ΕΤΑΙΡΕΙΑ ΑΞΙΟΠΟΙΗΣΗΣ ΚΑΙ ΔΙΑΧΕΙΡΙΣΗΣ ΤΗΣ ΠΕΡΙΟΥΣΙΑΣ ΤΟΥ ΟΙΚΟΝΟΜΙΚΟΥ ΠΑΝΕΠΙΣΤΗΜΙΟΥ ΑΘΗΝΑ
- Απέργης Νικόλαος (2005). Σύγχρονη Μακροοικονομική, Εκδόσεις Rosoli,
- Δημέλη Σοφία (2010). Μακροοικονομικά Μεγέθη και Ανάπτυξη της Ελληνικής Οικονομίας, Εκδόσεις ΟΠΑ, Αθήνα.
- Παναγιώτου Ευάγγελος (2004). Μακροοικονομική Ανάλυση, Εκδόσεις Τσαχουρίδης Ιωάννης (Εκδόσεις Γράφημα).
- Mankiw G. (2002). Μακροοικονομική Θεωρία, αναθεωρημένη έκδοση. Εκδόσεις Gutenberg.
- Stiglitz,J. & Walsh, C. (2009). Αρχές της Μακροοικονομίας, Εκδόσεις Παπαζήση, Αθήνα.
- Blanchard,O . (2006). Μακροοικονομική, Εκδόσεις Επίκεντρο, Θεσσαλονίκη.

AIK24 Protection and Security of Information Systems

ECTS: 6

Overview and Objectives:

- To provide students with deep knowledge on various concepts of classical computer and network security paradigms.
- To build foundations that assesses contemporary security policies and security mechanisms within organizations and illustrate the balance of the managerial and technical aspects of network security.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Explain and use the fundamentals of cryptography such as symmetric/asymmetric encryption, digital signatures, and hash functions.
- Discuss and explain current network authentication applications, PKI, Web security and their vulnerabilities that can be exploited by intentional and unintentional attacks.
- Identify network attacks (denial of service (DoS), flooding, sniffing and traffic redirection, inside attacks, etc.) and basic network defense tools.
- Differentiate between organizational security policies and security mechanisms.
- Analyze the security needs of a small enterprise, design a strategic plan to address those security requirements, and select the appropriate tools to implement the organizational policies.

Topics:

Introduction to security. Basic definitions, common security threats, requirements for specific network environments. Approaches to achieve security. Mechanisms of protection, identity verification, access control, security techniques. Protection of computational resources on the Web. Firewalls, wrappers and related techniques. Introduction to cryptography and key management. Cryptography, symmetric and asymmetric algorithms, validation of public keys, key management, digital signatures, references to cryptanalysis techniques. Security Internet users. Dangers from active content moving online and ways of protection. Security Framework for Languages Javascript and Java. The problem of viruses. What is a virus, viral species, ways of infection techniques used by viruses, software and methods for the treatment of viruses. Vulnerability detection tools. General definitions, their role, control methods, examples. Intrusion Detection Systems. Reasons of using them, the general model, system architecture, special features and techniques, ways of response.

Indicative reading list and references:

- Menezes, Alfred J., Paul C. Van Oorschot, and Scott A. Vanstone. Handbook of applied cryptography. CRC press, 1996.
- Κρυπτογραφία για Ασφάλεια Δικτύων Αρχές και Εφαρμογές, Stallings , Έκδοση: 1η/2011, ISBN: 9789604117307, (Εκδότης): ΜΑΡΙΑ ΠΑΡΙΚΟΥ & ΣΙΑ ΕΠΕ
- ΒΑΣΙΚΕΣ ΑΡΧΕΣ ΑΣΦΑΛΕΙΑΣ ΔΙΚΤΥΩΝ: ΕΦΑΡΜΟΓΕΣ ΚΑΙ ΠΡΟΤΥΠΑ, WILLIAM STALLINGS, Έκδοση: 3η/2008, ISBN: 978-960-461-117-1, (Εκδότης): ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ
- ΑΣΦΑΛΕΙΑ ΠΛΗΡΟΦΟΡΙΑΚΩΝ ΣΥΣΤΗΜΑΤΩΝ , ΠΑΓΚΑΛΟΣ ΓΕΩΡΓΙΟΣ,ΜΑΥΡΙΔΗΣ Ι., Έκδοση: Α' ΕΚΔΟΣΗ /2002, ISBN: 9605160188, (Εκδότης): Ε.&Δ.ΑΝΙΚΟΥΛΑ-Ι.ΑΛΕΞΙΚΟΣ ΟΕ

- Ασφάλεια Πληροφοριακών Συστημάτων , Σωκτ. Κάτσικας - Δ. Γκρίτζαλης - Στεφ. Γκρίτζαλης, Έκδοση: 1η/2004, ISBN: 960-8105-57-9, (Εκδότης): ΕΚΔΟΣΕΙΣ ΝΕΩΝ ΤΕΧΝΟΛΟΓΙΩΝ ΜΟΝ. ΕΠΕ

AIK25 Network Management

ECTS: 6

Topics:

Introduction to the management of computer networks, standardized management, organization of management systems and platform management, introduction and drafting of the ASN.1 standard. Structure of management information, managed object classes and tree management information. Design the classification of the object under management through GDMO and ASN.1. Management services and the protocol CMIP. Functional areas and network management functions. Design methodology of a network management system. New technologies for network management, distributed CORBA management, management via Web, and use of Java.

Indicative reading list and references:

- Stallings, William, and Moumita Mitra Manna. *Data and computer communications*. Vol. 6. Englewood Cliffs, NJ: Prentice hall, 1997.
- Διαχείριση δικτύων υπολογιστών, Μήλιου Αμαλία Ν.,Νικοπολιτίδης Πέτρος,Πομπόρτσης Ανδρέας Σ., Έκδοση: 1η έκδ./2007, ISBN: 978-960-418-133-9, (Εκδότης): ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε.
- Ασύρματες επικοινωνίες και δίκτυα, Stallings William , Έκδοση: 1η έκδ./2007, ISBN: 978-960-418-213-0, (Εκδότης): ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε.

COMPULSORY ELECTIVE PROJECTS

AICEP1 Software Development for Algorithmic problems

ECTS: 8

Topic:

Extended implementation of an algorithmic problem by using a main programming language, according to the material of other courses (mainly in the area of Algorithms and Scientific Computing) which takes place by one of the following ways: (a) Implementation of a simplified form of the algorithmic problem (b) Implementation in the context of an application.

AICEP2 Software Development for Information Systems

ECTS: 8

Topics:

Extended implementation of software systems using some main programming language, according to the material of other subjects (mainly in the area of Databases), which takes place by one of the following ways: (a) Implementation of a simplified form of the various levels of a system Database: organization and blocks to disk, static data structure to disk file (e.g., hash tables), dynamic data structure in disk file (e.g., B + tree) lists system, a naive query processing language databases, query optimization, user management, aspects and limitations, etc.. (b) an implementation over an industrial database system or internet software or other technology.

AICEP3 Software Development for Embedded Systems

ECTS: 8

Topics:

Embedded Systems (ES) are gaining momentum in the IT market. Progress of ES in Europe and the world. Building blocks of ES: Microcontrollers, components of intellectual property (IP cores), memory systems, bridges, peripherals. Implementation technologies of ES. Systems with low energy consumption.

Embedded Software development: processes, process scheduling, nucleus of real-time operating systems. Designing Embedded Systems, ES with processors of general and special purpose in the same integrated circuit (Systems on Chip). Co-design of software-hardware. ES prototyping technologies. Applications of embedded systems in telecommunications (Wireless sensor), signal processing (eg. Intelligent cameras), automatic control, automotive, biomedical, etc. Required skills: digital systems design with VHDL. Computer architectures. C Programming language.

Embedded Systems Laboratory

Stepwise design using hardware description language VHDL in an embedded system chip (System on Chip) that includes programmable and special purpose processors (IP cores). Output growth in card with FPGA.

AICEP4 Software Development for Operational information Systems

ECTS: 8

Topics:

Extended systems implementation of operational software using any major programming language, according to the material of other subjects (mainly from the areas of Economy, Management, Accounting and Entrepreneurship), which takes place by one or more of the following ways: (a) Implementation of a simplified form with various levels of an operational database system: block and record structure on disk, static data structure on disk file (e.g., hash tables), dynamic data structure to disk file (e.g., B + tree), system directories, query processing of a simple database language, query optimization, user management, aspects and limitations, etc. (b) an implementation over an industrial database system or internet software or other software of some other technology.

ELECTIVE COURSES (ALGORITHMS)

AIAL01 Analysis and Design of Business Applications

ECTS: 6

Overview and Objectives:

Modern analysis and design of business applications relies heavily on the use field models and tools. The purpose of this course is the systematic introduction to the concepts and methods of conceptual modeling, examining general operational models information and functions and develop capacity to analyze and design business applications.

Topics:

The environment of business applications. The role of modelling information in the development of computer applications and general business applications in particular. The natural language as a tool for representation of reality. Data conceptual modelling: objects, entities, attributes, abstraction mechanisms, integrity constraints and productive rules. Concepts of the model and condition. Events. The knowledge representation language Telos. Mechanisms of abstraction: classification, generalization - specialization. Inheritance. Using multiple channels classification. Meta-models. Constraints through attributes. General business models: personal and company structure, resources and products, processes and activities, transactions and contracts, accounting, planning, continuous processes, documents. Methodological issues, quality models. Ontologies and thesauri. Environments, languages, development tools and business applications.

Indicative reading list and references:

1. Conceptual Modeling of Information Systems [electronic resource] , Olivé, Antoni., ISBN: 9783540393900,

AIAL02 Graphics II

ECTS: 6

Topics:

Models and structures representation of objects and images. Transformations Observed in three dimensions. General concealment algorithms. Models and algorithms for illumination. Selections from the following topics: curves and Bezier surfaces and B-Spline, properties, and representation of terrain texture, shadow generation algorithms, ray tracing, game.

Indicative reading list and references:

- Graphics: Principles & Algorithms - A. Boehm, Th. Theocharis, A.. Karabasis C.. Papaioannou, N.. Platis, 1999 (main textbook)
- Computer Graphics and Visualization: Principles & Algorithms, T. Theoharis, G. Papaioannou, N. Platis, NM Patrikalakis, AK Peters, 2008 (Newer, updated textbook - in English).
- Real-Time Rendering (3rd Ed.), T. Akenine-Möller, E. Haines, N. Hoffman, AK Peters Ltd (Brief coverage of many slightly more advanced real-time graphics issues - middle level).
- A. Watt, F. Policarpo: 3D Games - Real-time Rendering and Software Technology (Vol 1). Addison-Wesley (Reference to graphics techniques applied to three-dimensional game engine technology - introductory level).
- RS Wright jr., B. Lipchak: OpenGL Superbible (3rd edition), SAMS (Very good book for learning library OpenGL - introductory level).
- E. Lengyel: Mathematics for 3D Game Programming & Computer Graphics (2nd edition). Charles River Media.
- PJ Schneider, DH Eberly: Geometric Tools for Computer Graphics. Morgan-Kaufmann (Mathematics and approximate methods used in computer graphics - medium / advanced level).
- AS Glassner: Principles of Digital Image Synthesis (2-vol set). Morgan-Kaufmann (Theory lighting and digital image representation, photorealistic imaging theory - advanced level).

AIAL03 Data Mining Techniques

ECTS: 6

Overview and Objectives:

Our ability to generate and collect data has been increasing rapidly. The widespread use of information technology in our lives has flooded us with a tremendous amount of data. This explosive growth of stored and transient data has generated an urgent need for new techniques and automated tools that can assist us in transforming this data into useful information and knowledge. Data Mining has emerged as a multidisciplinary field that addresses this issue.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Interpret the contribution of data warehousing and data mining to the decision support level of organizations;
- Evaluate different models used for online analytical processing (OLAP) and data pre-processing;
- Categorize and carefully differentiate between situations for applying different data mining techniques: mining frequent pattern, association, correlation, classification, prediction, and cluster analysis;
- Design and implement systems for data mining;
- Evaluate the performance of different data mining algorithms;
- Propose data mining solutions for different applications.

Topics:

Introduction to data mining techniques: data, problems, applications. General techniques of analysis and data processing. Data classification algorithms (decision trees, statistical techniques). Data classification algorithms for multidimensional data and time series. Techniques for data clustering. Techniques for finding correlations in multidimensional data and relational data. Applications of data mining to problems for searching on the internet and large databases of specific purpose (e.g., biomedical databases).

Indicative reading list and references:

- Principles of Data Mining , David Hand, Heikki Mannila, and Padhraic Smyth, MIT Press, August 2001.
- Learning from Data – Y. Abu-Mostafa, M. Magdon-Ismail, Hsuan-Tien Lin,
- Doing Data Science, Straight Talk from the Frontline, Cathy O'Neil, Rachel Schutt
- Pattern Recognition and Machine Learning (Information Science and Statistics) Hardcover – October 1, 2007, Christopher M. Bishop
- Hadoop: The Definitive Guide, 3rd Edition, T. WhiteSlides
- Jiawei Han, Micheline Kamber, and Jian Pei. *Data Mining: Concepts and Techniques* (3rd ed.). Morgan Kaufmann, 2012. ISBN 978-0-12-381479-1.
- Ian H. Witten, Eibe Frank, and Mark A. Hall. *Data Mining: Practical Machine Learning Tools and Techniques* (3rd ed.). Morgan Kaufmann, 2011. ISBN 978-0-12-374856-0

AIAL04 Cryptography

ECTS: 6

Topics:

Introduction: Data complexity theory, algebraic structures, number theory, probability algorithms. Concept of security, message hiding, privacy and accuracy. Random and pseudorandom bit sequences. Unidirectional (one-way) functions and functions Secrets reversible (trapdoor). How can cryptography based on factoring numbers, finding discrete logarithms, decoding codes, solving systems of polynomial equations, execution and other combinatorial optimization problems. Cryptographic tools including key exchange (Diffie Hellman) electronic signatures (RSA), public-key encryption (ElGamal, Cramer Shoup). The random oracle model as a way for the safety argument for cryptosystems. The methodology of simulation as a way of defining security cryptosystems. Applications in point-to-point secure communication channels, e-commerce and money, elections, transmitting digital content of various kinds etc.

Indicative reading list and references:

- "*Applied Cryptography: protocols, algorithms and source code in C (second edition)",* B. Schneier, Wiley, 1996.
- ΒΑΣΙΚΕΣ ΑΡΧΕΣ ΑΣΦΑΛΕΙΑΣ ΔΙΚΤΥΩΝ: ΕΦΑΡΜΟΓΕΣ ΚΑΙ ΠΡΟΤΥΠΑ, WILLIAM STALLINGS , Έκδοση: 3η/2008, ISBN: 978-960-461-117-1, (Εκδότης): ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ
- Σύγχρονη κρυπτογραφία, Γκρίτζαλης Στέφανος Έκδοση: 1η έκδ./2010, ISBN: 978-960-7182-76-0, (Εκδότης): Α. ΠΑΠΑΣΩΤΗΡΙΟΥ & ΣΙΑ ΟΕ
- *Handbook of Applied Cryptography*", A. J. Menezes, P. C. Van Oorschot και S. A. Vanstone, CRC Press, 1996
- *"Τεχνικές κρυπτογραφίας και κρυπτανάλυσης*", Β. Α. Κάτος, Γ. Χ. Στεφανίδης, Ζυγός, 2003. (διαθέσιμο στο σύνδεσμο: http://utopia.duth.gr/~vkatos/documents/publications_thebook.html)
- *"The Craft of System Security",* S. Smith and J. Marchesini*, Addison-Wesley, 2007 (διαθέσιμο ηλεκτρονικά μέσω του MyAthens)*

AIAL05 Design of Virtual Spaces

ECTS: 6

Topics:

Introduction to graphics and virtual reality, imaging process information input and output graphics. Algorithms performance, conic sections and polygons, antialiasing. Affine transformations, transformations two-and three-dimensional homogeneous coordinates, composition transformations, transformations imaging (viewport). Algorithms for clipping line segments and polygons in two and three dimensions. Views. Stereoscopic vision. Concealment algorithm z-buffer. Shadows, texture. Basic principles of lighting. Color systems. Ray tracing algorithms overall lighting, synthetic traffic, avatars, virtual reality simulations, simulation based natural nomov. Virtual augmented and mixed reality.

Indicative reading list and references:

- Virtual World Design, by Ann Latham Cudworth, 2014 by A K Peters/CRC Press
- Virtual Technologies: Concepts, Methodologies, Tools, and Applications (3 Volumes), Jerzy Kisielnicki (Warsaw University, Poland), Release Date: May, 2008. Copyright © 2008. 1842 pages.

AIAL06 Programming of multicore architectures

ECTS: 6

Overview and Objectives:

The aim of this course is to introduce and familiarize students with languages, libraries, methods and techniques of parallel programming systems based on multicore processors. Areas that study both the interface of these instruments, with the programmer, and their implementation in real systems.
The course focuses on new methods of parallel programming aimed at improving the system performance and improvement of the productivity of the programmer. It focuses on the characteristics of the organization of multicore architectures which differ substantially from the corresponding characteristics of conventional parallel architectures of shared or distributed memory.
Students understand the concepts of sharing and job scheduling between cores, of covert and explicit communication between cores, the locality of access to data, and synchronization, as revised and adapted to the new multicore processors with homogeneous and heterogeneous cores (GPUs, Cell, etc.). In addition, students become familiar with both the system interface and the implementation of new methods of parallel programming, such as scheduling transactions, programming with data streams and programming with explicit management of the memory hierarchy.
The course provides an overview of modern multicore architectures and classification based on the architecture and the homogeneity of the cores, the memory hierarchy and mechanisms for communication and synchronization feature. It follows a study of programming models for homogeneous architectures common (OpenMP, Intel STM, Intel TBB), heterogeneous architectures (Sequoia, StarSs, RapidMind, CUDA) and architecture-independent models (MapReduce, Merge). Finally, methods are studied for source code translation and implementation of systems runtime programming models.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Deal with multicore architectures and their programming.
- Program multicore setups using a variety of tools and programming methods.

Topics:

Overview of parallel architectures, multicore processors with homogeneous cores, multicore processors with heterogeneous cores, Graphics Processing Units, Memory system and interprocess communication, Synchronize core hardware and software, Functional parallelism, Vector parallelism, Parallelism offlows and data filters, Parallelism transactions, Parallel Programming with memory management hardware, Parallel Programming with memory management software , Technical processes and flow routing , Techniques to improve the locality of accesses to memory, alignment, dynamic replication and data movement , Technical channel management and interpricess communication networks , Translators issues, Issues of runtime systems , Performance analysis, Examples of applications implementation

Indicative reading list and references:

- *Multi-Core programming, by* Shameem Akhter and Jason Roberts, Intel Press, ISBN 0-9764832-4-6, available online
- Pofessional multicore Programming, Design and Implementation for C++ developers, by Tracey Hughes, Cameron Hughes, ISBN:978-0-470-28962-4, Wrox Publisher 2008

AIAL07 Theory of Computation

ECTS: 6

Overview and Objectives:

The main objectives of the course are to:

- Be familiar with the basic theoretical principles in Computer Science.
- Know various types of finite automata.
- Be familiar with formal definitions of programming languages and their connection with
- finite automata.
- Have learnt material on Turing machines and computability.
- Have a deeper theoretical understanding of algorithmic complexity classes.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Discuss the concept of finite state machines.
- Explain context-free grammars.
- Design a deterministic finite-state machine to accept a specified language.
- Explain how some problems have no algorithmic solution.
- Provide examples that illustrate the concept of uncomputability.
- Determine a language's location in the Chomsky hierarchy (regular sets, context-free, context-sensitive, and recursively enumerable languages).
- Prove that a language is in a specified class and that it is not in the next lower class.
- Convert among equivalently powerful notations for a language, including among DFAs, NFAs, and regular expressions, and between PDAs and CFGs.
- Explain at least one algorithm for both top-down and bottom-up parsing.
- Explain the Church-Turing thesis and its significance.
- Define the classes P and NP.
- Explain the significance of NP-completeness.
- Prove that a problem is NP-complete by reducing a classic known NP-complete problem to it.

Topics:

Regular grammars and languages - finite automata. Grammars and context-free languages- stack automata. Recursive languages –Turing machines. Decidability. Determinism. Reduction. Relationship Classes of deterministic polynomial time (P) and non-deterministic polynomial time (NP). Theory of NP-completeness (NP-completeness).

Indicative reading list and references:

- Kozen, Dexter C. *Theory of computation*. Springer Science & Business Media, 2006.
- H. Lewis, X. Παπαδημητρίου. Στοιχεία Θεωρίας Υπολογισμού, εκδόσεις Κριτική, 2005.
- M. Sipser, Εισαγωγή στη Θεωρία Υπολογισμού, Πανεπιστημιακές Εκδόσεις Κρήτης, 2007.

AIAL08 Gragh Theory

ECTS: 6

Topics:

Basic parameters of graphs, modeling problems using graphs. Special classes of graphs: complete, bilateral, planar graphs, interval graphs, chordal graphs. Isomorphism of graphs. Connected components, Euler cycles, Hamilton cycles: applications in telecommunications networks. Scheduling problems, critical paths. Flows in networks, maximum flow theorem, max flow - min cut, networks with upper and lower bounds of capacity. Maximum flow of minimum cost - applications in network design. Crossings of Euler, conditions of existence, directed and undirected case. The Chinese postman problem. Matching problems and transmission networks. The problem of the maximum independent set (stability graph) - applications: applications satisfaction networks. Problems coloring (chromatic number, chromatic index) - applications: parallel and distributed systems. Problems maximum clique and dense subgraph. Polynomial cases in special graph topologies (Chordal, interval, perfect graphs).

Indicative reading list and references:

- Th. H. Cormen, Ch. E. Leiserson, R. L. Rivest, C. Stein "Introduction to algoritmhs", 2nd Edition, MIT-Press, 2001.
- ΜΑΘΗΜΑΤΑ ΘΕΩΡΙΑΣ ΓΡΑΦΩΝ, Θεμελιώσεις-Αλγόριθμοι-Εφαρμογές ", Γ. Μανωλόπουλος, εκδόσεις Νέων Τεχνολογιών.

AIAL09 Computational Geometry

ECTS: 6

Topics:

Convex hull points two, three and more dimensions, wrapping algorithm, divide and conquer methods, incremental algorithm and computation volume polyhedron. Worst-case complexity and sensitive output, lower bounds, upper bound theorem sized convex hull geometric duality. Linear optimization algorithm Simplex, randomized algorithms and complexity expected. Graph Voronoi, scanning method, triangulation Delaunay, connection to the convex hull. Point set triangulation in two and more dimensions, simple polygon triangulation and museum surveillance, visibility problems in the plane. Vertical subdivision identification sign, nearest neighbour, geometric data structures and geometric searching. Provisions and straight-line segments. Implementation problems, degenerative disorder of the data entry. Applications to the design of mobile robots, in the study of the structure of macromolecules in geometric design with a computer (CAD) and graphics. Implementing geometric algorithms in geometric software library CGAL or Python.

Indicative reading list and references:

- De Berg, Mark, et al. *Computational Geometry: Introduction*. Springer Berlin Heidelberg, 2008.
- ΥΠΟΛΟΓΙΣΤΙΚΗ ΓΕΩΜΕΤΡΙΑ - ΑΛΓΟΡΙΘΜΟΙ ΚΑΙ ΕΦΑΡΜΟΓΕΣ, DE BERG MARK, CHEONG OTFRIED, VAN KREVELT MARC, , OVERMARS MARK, Έκδοση: 1η/2011, ISBN: 978-960-524-336-4, (Εκδότης): ΙΔΡΥΜΑ ΤΕΧΝΟΛΟΓΙΑΣ & ΕΡΕΥΝΑΣ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ
- ΥΠΟΛΟΓΙΣΤΙΚΗ ΓΕΩΜΕΤΡΙΑ: ΜΙΑ ΣΥΓΧΡΟΝΗ ΑΛΓΟΡΙΘΜΙΚΗ ΠΡΟΣΕΓΓΙΣΗ, ΓΙΑΝΝΗΣ Ζ. ΕΜΙΡΗΣ, Έκδοση: 1η/2008, ISBN: 978-960-461-141-6, Διαθέτης (Εκδότης): ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ

AIAL10 Special Topics in Software Development

ECTS: 6

Overview and Objectives:
The objective of this course is to present to the students recent developments in this area.

Learning Outcomes:
Depends on the subject

Topics:
The material will be adapted to the individual requirements and scientific developments in the area.

Indicative reading list and references:
Depends on the subject

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ELECTIVE COURSES (COMPUTER SYSTEMS AND NETWORKS)

AICS01 Parallel Systems

ECTS: 6

Topics:

Introduction: general, parallel programming, parallel architectures, performance measures. Overview of parallel architectures and deepening classes in SIMD, MIMD shared and distributed memory. Parallel programming - tools: MPI Programming and laboratory. Principles of programming parallel shared memory SIMD and case study BLITZEN. Parallel algorithms for processing matrices, lists, sorting, searching, etc. for different architectures. Calculation of the parallelism complexity (processing, communication).

Indicative reading list and references:

- Quinn, Michael Jay, and Michael Jay Quinn. *Parallel computing: theory and practice*. Vol. 2. New York: McGraw-Hill, 1994.
- MPI, Μάργαρης Αθ. , 1η έκδ./2008, ISBN: 978-960-418-145-2, (Εκδότης): ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε.
- Συστήματα Παράλληλης Επεξεργασίας, Παπακωνσταντίνου Γεώργιος Κ.,Τσανάκας Παναγιώτης Δ.,Θεοχάρης Θ., 1η έκδ./1994, ISBN: 978-960-266-204-5, (Εκδότης): Σ.ΑΘΑΝΑΣΟΠΟΥΛΟΣ & ΣΙΑ Ο.Ε.

AICS02 Communication Networks II

ECTS: 6

Overview and Objectives:

This course is aimed at those who have already completed a first course in the basic technologies of communication networks and the Internet. It aims to cover, at the undergraduate level, the following major themes: Analysis of the queuing delay in packet switched networks (queuing systems M / M / 1 and variants, M / G / 1, systems and priorities, queuing networks) , Wireless / Mobile Networks (WLANs, support mobility in the Internet, mobile networks 3G) , Networking and Multimedia, and Network Security.

Topics:

Queuing system (M / M / 1 and variants, M / G / 1, systems and priorities, queuing networks), Wireless / Mobile Networks (WLANs, support mobility in the Internet, mobile networks 3G), Networking and Multimedia, Network Security.

Indicative reading list and references:

- Kurose, James F.; Ross, Keith W.Computer networking : a top-down approach, 6. ed., International ed.: Boston, [Mass.]: Pearson Education, cop. 2013
- "Computer Networks, An Open Source Approach – International Edition", Yin-Dar Lin, Ten-Hung Hwang, and Fred Baker, McGraw Hill, 2011
- Mathematical Foundations of Computer Networking - Srinivasan Keshav, Addison-Wesley, 2012
- Computer Networks. A systems Approach, 4th Edition, Larry Peterson and Bruce Davie, Morgan Kaufmann 2007
- Communication Networks: Fundamental Concepts and Key Architectures – 2nd International Edition, Alberto Leon-Garcia and Indra Widjaja, McGraw Hill, 2006.

AICS03 Systems Programming

ECTS: 6

Topics:

Key features and user interaction with Unix. Programming in kernel and utilities. Management processes and system files. Creation and termination of processes, sending and receiving signals, input and output low-level communication between processes through pipes and sockets. Communication between processes via message queues, shared memory and semaphores. Creating, scheduling, synchronization and communication with thread mutexes and condition variables. Website programming and the client server model. Application interface with the communication protocols. API for sockets. Design considerations of client / server software. Servers with UDP and TCP. Servers of multiple services and servers concurrency. Creation of distributed programs with RPCgen customers and telnet.

Indicative reading list and references:

- W. Richard Stevens. "Advanced Programming in the Unix Environment", 2nd edition, Addison-Wesley, 2005.
- ΠΡΟΓΡΑΜΜΑΤΙΣΜΟΣ ΣΕ UNIX, MARC J. ROCHKIND, Έκδοση: 2η/2007, ISBN: 978-960-461-084-6, (Εκδότης): ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ
- Unix για προγραμματιστές και χρήστες, Glass Graham,Albes King, Έκδοση: 3η έκδ./2005, ISBN: 960-512-461-0, (Εκδότης): Χ. ΓΚΙΟΥΡΔΑ & ΣΙΑ ΕΕ
- Brian W. Kernighan, Rob Pike. "Το Περιβάλλον Προγραμματισμού Unix", Prentice-Hall (Ελληνική μετάφραση, εκδόσεις Κλειδάριθμος), 1989
- Stephen R. Bourne. "The Unix System V Environment", Addison-Wesley, 1987.
- Marc J. Rochkind. "Advanced Unix Programming", Addison-Wesley, 2004.

AICS04 Logic programming

ECTS: 6

Overview and Objectives

The course is an introduction to the original idea of declarative programming, with emphasis on logic programming. To understand the students approach problem solving through logic programming, introduced gradually the programming language Prolog. Emphasis on technology logic programming with constraints, which is ideal for troubleshooting search in which the phenomenon of the combinatorial explosion in the number of solutions might be. At the same time, and given programming assignments, which must be handed in by the students at regular periods during the semester. Then topics presented in the lectures on the theory of logic programming, technical implementation logic programming systems and parallel logic programming. Finally, following a chapter on the use of logic programming for knowledge representation, expert systems, the deductive databases and the application of logic programming on topics related to the Web.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Describe the differences between the declarative and procedural programming paradigms, discuss the potential applications of the Prolog programming language and identify its strengths and weaknesses.
- Define and interpret the syntax and semantics of Prolog's core concepts, develop basic Prolog programs and queries, and devise and employ compound terms to represent complex information.
- Recognise, analyse, explain, develop and illustrate the execution of, recursive predicates and predicates that manipulate lists, arithmetic and structures.
- Employ Prolog's built-in predicates for obtaining input from the keyboard or a file and for producing output to the screen or a file, explain the outcome that backtracking has for predicates with side effects and use the repeat predicate to achieve repeated execution of input/output predicates.
- Employ Prolog's built-in predicates for testing the type of terms, constructing and decomposing terms, adding and deleting clauses to/from a program, and collecting all the objects that satisfy some goal into a list (bagof, setof, findall).
- Demonstrate backtracking, employ Prolog's control facilities (cut and not), identify green and red cuts and explain their difference, illustrate the execution of predicates that contain cuts and analyse the issues associated with negation in goals.
- Develop and illustrate the execution of a non-trivial Prolog program.

Topics:

Generally about procedural and declarative programming. The logic programming as a version of declarative programming. The programming language Prolog. Writing programs. Lists. Operators. Arithmetic. Check regression. Refusal to Prolog. Built-in predicates. Handling data structures. Simple applications of Prolog in search problems, symbolic processing, understanding natural language and meta-programming. Expert systems and logic programming. Theory of logic programming. Interpretations and models. Montheltheoretic semantics. Semantics of fixed point. Unification. SLD-resolution. Functional semantics. Constraint Logic Programming. Technical implementation of logic programming systems. Parallel logic programming. Logic programming for knowledge representation. Knowledge Representation

- methodologies and implementations using Prolog. Systems based on knowledge - the case of expert systems. Deductive databases - the case of Datalog. Logic programming and Web.

Indicative reading list and references:

- I. Bratko, "Prolog Programming for Artficial Intelligence", Third Edition, Addison-Wesley, 2000.
- L. Sterling, E. Shapiro, "The Art of Prolog", The MIT Press, 1994.
- C. F. Mellish, W. F. Clocksin, "Programming in Prolog: Using the ISO Standard", Springer Verlag, 2003.
- J. W. Lloyd, "Foundations of Logic Programming", Springer Verlag, 1993.
- K. R. Apt, M. G. Wallace, "Constraint Logic Programming Using ECLiPSe", Cambridge University Press, 2007.
- P. Deransart, A. Ed-Dbali, L. Cervoni, "Prolog: The Standard - Reference Manual", Springer Verlag, 1996.

AICS05 Web Applications technologies

ECTS: 6

Overview and Objectives:

Internet technologies are playing an increasingly crucial role in the development of information systems, setting new standards in user interface and supporting new functions and business models. The objective of this course is to give the student a complete picture in relation to the development of information systems in general and web applications in particular, the technologies used for this purpose, as well as applications that can be supported. The course will cover theoretical and practical issues in relation to design, development and software testing, modern environments and development tools, as well as the Internet technologies. Emphasis will be given to the consideration of specific applications in the architectural design of these and how to implement them. Also, this course aims to complete the knowledge acquired by students in previous lessons databases, systems analysis and design and programming in a single module to support the development of Web applications, e.g., a functional web-site, which will also be the practical part of the course.

Objectives of the course:

- Provide students with deep knowledge for sockets and Client/Server structures, socket programming, N-tier architecture of the global Internet. Servers and State management.
- Thoroughly discuss the potential of web based applications with the utilized protocols and provide students with deep knowledge for developing web applications and critically assess the Web usability, server configuration and server based executable and scripts.
- Explore the basic concepts of thin and thick client scripting.
- Determine and demonstrate the HTTP Protocol, demonstrate and analyze the basic conceptual model for HTTP servers' and clients' communication with regards to the Hypertext Reference Model.
- Demonstrate and analyze the basic conceptual model RFC2965 – HTTP State Management Mechanism.
- Make students aware of the TCP/IP stack and protocols (TCP/IP Tutorial, RFC 1180) and application interface.
- Provide students with deep knowledge of the architecture and structure according to certain requirements of the World Wide Web (WWW), explore the basic concepts of using a Uniform Resource Identifier (URI) to access a resource, representation management, URI persistence, Linking and data access control.
- Provide students with deep knowledge for concepts about the Web caching and the utilizing state-of-the-art notation currently used.
- Critically assess and acquire a deep knowledge on client site caching control, Web Proxies, Web caching includes additional configuration and administration of Squid Cache.
- Discuss and provide students with deep knowledge for XML & Web Technologies, and cover in detail all aspects of the Web Programming: HTML, XHTML, Object Models, Styles, Dynamic content, DHTML.
- Make students aware of how to program the Web using Client scripting, JavaScript, Jscript, VB Script and demonstrate to students the Perl and ASP scripting.
- Demonstrate and analyze the basic conceptual model of the Socket Programming (Unix, Winsock, .NET)
- Provide students with deep knowledge for the Semantic Web and introduce state of the art research in the area of the WWW.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Recognize communication protocols used in Web technologies.
- Characterize the Internet technology and the underlying protocols that are supported by the Internet technology. Internet Services and Protocols. WWW.
- Review of TCP/IP and application interface.
- Critically compare and evaluate HTTP Protocol, HTTP servers and clients, SSL, thorough coverage of the HTTP Protocol. HTTP servers and clients, Hypertext Reference Model. RFC2965 - HTTP State Management Mechanism.
- Introduce state-of-the art research in the area of Web caching, Client site caching control, and Web Proxies.
- Cover in detail and gain experience of the Web Programming and the technologies currently being used for programming: HTML, XHTML, Object Models, Styles, Dynamic content, DHTML and .NET programming aspects.
- Provide students with deep knowledge for developing Web-applications: N-tier applications, Usability Principles, Methodologies & Evaluation, Unicode.
- Introduce state-of-the art research in the area of Internet Technologies.
- Make students aware of the technical requirements in order to effectively construct basic professional skills for the WWW, including hands-on experience with TCP/IP and web-based programming using up-to-date tools.
- Research in state-of-the art areas regarding the Semantic Web and provide students with experience in developing client-based, resource constrained applications on the WWW.

Topics:

Architecture Client / Server and its correlation with the WWW, several architectural layers (n-tier), the role of WEB Server, Application Servers, middleware (middleware - corba, activeX, transaction servers, message passing, message queues). Design and modeling, protocols and programming (Client Side Programming: HTML, DHTML, XML, scripting languages, Server Side Programming: JSP, ASP, contact databases), design and development of relevant application.

Application Technology Laboratory

Using the object-oriented Jana language with a focus on Web applications (introduction, servlets, XML, JSF).

Indicative reading list and references:

- Welling, Luke, and Laura Thomson. PHP and MySQL Web development. Sams Publishing, 2003.
- Βασικές Αρχές Τεχνολογίας Λογισμικού, Ian Sommerville (8η αγγλική έκδοση), Εκδόσεις Κλειδάριθμος
- Τεχνολογία Λογισμικού, Θεωρία και Πράξη, Τόμος ΙΙ. Εκδόσεις Κλειδάριθμος. P. Fleeger. Ελληνική Επιμέλεια: Γιάννης Σταμέλος.
- Servlets και Σελίδες Διακομιστή Java, Marty Hall, Larry Brown, Εκδόσεις Κλειδάριθμος.
- Java Προχωρημένες Τεχνικές, Κερκίρη, Εκδόσεις Κλειδάριθμος.
- Χ. Δουληγέρης, Ε. Κοπανάκη & Ρ. Μαυροπόδη (2004), Τεχνολογίες Διαδικτύου - Αρχές Λειτουργίας και Προγραμματισμός Εφαρμογών στο Διαδίκτυο, Νηρηίδες

- L. Welling & L. Thomson (2005), Ανάπτυξη Web Εφαρμογών με PHP Και MySQL, 3η Έκδοση, Γκιούρδας
- Α. Καράκος (2007), Διαδίκτυο Παγκόσμιος Ιστός & Τεχνικές Προγραμματισμού, Γκιούρδας
- T. Berners – Lee (2007), Το Πλαίσιο της Επιστήμης του Web
- Sebesta, W.R Programming the World Wide Web, Addison Wesley 2007 4th ed. ISBN-13: 9780321489692

AICS06 Pattern Recognition – Machine Learning

ECTS: 6

Overview and Objectives:

Pattern Recognition is the scientific area that aims automation with the help of a computer and categorize entities in specific categories. For example, such entities can be an image or a signal derived from recording voice or music, or any other mark that needs to be categorized. An example of such classifications is the classification of a medical image, corresponding to a medical finding, in the class of benign or malignant finding. The aim of this application is to assist the physician in diagnosis. In the case of voice, one goal is to recognize the words corresponding to the recording. In the case of music, one goal may be to identify the type of music, shuffling, etc. Other scientific areas which Pattern Recognition finds direct application is Computer Vision, Information Search in Multimedia Databases based content etc. Objective of this course is to present the basic concepts and methodologies of the area and standard methodologies from statistics, to the latest technical methodologies neural networks. Apart from familiarity with the methodologies of pattern recognition in the context of this course is attempted a systematic presentation of statistical concepts, covering subjects beyond the narrow confines of the course.

Topics:

Pattern recognition systems. Classifiers Bayes, nearest neighbor classifiers. Parametric probability density estimation (Maximum Likelihood, Maximum Aposteriori), nonparametric probability estimation methods (windows Parzen). Linear classifiers: algorithm perceptron, classifiers least squares Support Vector Machines (SVM). Non-linear classifiers: multilayer neural networks, kernel trick and SVMs. Birth characteristics: shape representation and description forms, contours, shapes representation and description of contour chain code, polygons, signatures, transformations Fourier, description schemes interior image area, moments, texture.

Indicative reading list and references:

- Bishop, Christopher M. Pattern recognition and machine learning. springer, 2006.
- Αναγνώριση Προτύπων, Theodoridis S. ,Έκδοση: 1η έκδ./2011, ISBN: 9789604891450, Διαθέτης (Εκδότης): BROKEN HILL PUBLISHERS LTD
- Εισαγωγή στην αναγνώριση προτύπων με Matlab, THEODORIDIS S., PIKRAKIS A., KOUTROUMBAS K., CAVOURAS D, Έκδοση: 1η έκδ./2011, ISBN: 9789604890231, Διαθέτης (Εκδότης): BROKEN HILL PUBLISHERS LTD

AICS08 Human Computer Interaction

ECTS: 6

Overview and Objectives:

The course focuses on the analysis, design, implementation and evaluation of user-friendly interactive systems, which allow users to perform tasks successfully and efficiently, in a way that satisfies them. The course covers introductory concepts of computer vision, natural language processing and other technologies used in modern natural user interfaces.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Discuss the Computer and Human-Computer Interaction.
- Have an insight to Human Capabilities and research topics in HCI.
- Participate in an Interactive Systems Design project.
- Build some Interfaces Design and Prototyping.
- Understand and design Windows Concepts and Interfaces.
- Perform a Quantitative Analysis – Evaluation – Redesign.
- Research Topics in HCI.

Topics:

Introduction to Human-Computer Interaction (HCI), human characteristics relating to communication with computers, senses and sense organs, vision and visual perception, hearing, movement, human memory, consciousness and working memory, long term memory functions, transport , characteristics of computer related communication with people, topics of people communicate with machines, ergonomics, design box, screen design, usability principles that affect learning ability, flexibility, and robustness, development and life cycle software man-machine communication, iterative design and prototyping, design methodologies (information systems based on analysis design space), requirements analysis and reporting standards, guidelines and standards, usability engineering, systems design SCM user modeling (model GOMS and KLM model), design type interfaces Windows-Icons-Mouse-selectors (PEPE) and the Global Information Grid, HTML elements and Javascript, evaluation systems, data visualization, future trends.

Indicative reading list and references:

Smith-Atakan, Serengul. *Human-computer interaction*. Cengage Learning EMEA, 2006.

Ν. Αβούρη, «Εισαγωγή στην Επικοινωνία Ανθρώπου - Υπολογιστή», Δίαυλος, 2000.

Δ. Ακουμιανάκη, «Διεπαφή Χρήστη-Υπολογιστή: Μια Σύγχρονη Προσέγγιση», Κλειδάριθμος, 2006.

Α. Dix, J. Finlay, G.D. Abowd, R. Beale, «Επικοινωνία Ανθρώπου-Υπολογιστή», 3η έκδοση, ελληνική μετάφραση, Εκδόσεις Α, Γκιούρδα, 2007.

Y. Rogers, H. Sharp, J. Preece, «Σχεδίαση Διαδραστικότητας – Επεκτείνοντας την Αλληλεπίδραση Ανθρώπου-Υπολογιστή», 3η έκδοση, ελληνική μετάφραση, Εκδόσεις Μ. Γκιούρδα, 2011.

AICS09 Compilers

ECTS: 6

Overview and Objectives:

In this course we explore the fundamental concepts and techniques behind a compiler: (1) Formal languages: regular languages, context-free languages, attribute grammars; (2) Meta-tools to create lexical analyzers; (3) Parsing: top-down and bottom-up, error recovery, meta-tools to use and create syntax analyzers; (4) Symbol tables. Semantic analysis: kinds of semantic checking, static type systems, dynamic type checking; (5) Generation of intermediate code; (6) Optimization, register allocation; (7) Generation of object code.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Implement a simple compiler in Java with object-oriented techniques.
- Know how parsing, regular expressions and languages, implementation of lexical analyzers are working.
- To explain Syntax analysis, top-down and bottom-up parsing, implementation of syntax analyzers.
- To understand how Semantic analysis and intermediate code generation are functioning.
- Explain issues concerning Memory organization and execution environment (run-time environment), Register allocation., and Generation and optimization of final code.

Topics:

Basic structure of a compiler. Formal languages: regular languages, context-free languages, attribute grammars. Verbal analysis compilers use to create word analysts. Parsing: parser from top to bottom (top-down) and bottom-up (bottom-up), recovery from errors, use compilers to create syntactic analyzers. Table of symbols. Semantic analysis: types of semantic verification, type systems, dynamic type checking. Production of intermediate code. Code optimization. Production of the final code. Compiling non-conventional programming languages.

Indicative reading list and references:

- Alfred V. Aho, Monica S. Lam, Ravi Sethi and Jeffrey D. Ullman Compilers: Principles, Techniques, and Tools. **2nd edition.** Addison-Wesley, 2007.
- Nikolaos S. Papaspyrou and Emmanuel St. Skordalakis, Compilers, Symmetria, Athens, 2002. (Νικόλαος Παπασπύρου και Εμμανουήλ Σκορδαλάκης. Μεταγλωττιστές, Εκδόσεις Συμμετρία.)
- K. Lazos, P. Katsaros, Z. Karaiskos, Compilers of Programming Languages: Theory and Practice, Thesaloniki 2004
- Κ. Λάζος, Π. Κατσαρός, Ζ. Καραΐσκος. Μεταγλωττιστές Γλωσσών Προγραμματισμού: θεωρία και πράξη. Εκδόσεις Θεσαλλονίκη 2004.

AICS10 Digital communications

ECTS: 6

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Understand basic components of digital communication systems
- Design optimum receivers for digital modulation techniques.
- Analyze the error performance of digital modulation techniques.
- Design digital communication systems under given power, spectral and error performance constrains.

Topics:

Quantitative and qualitative analysis of the transmission of analog signals from digital communications systems, practice problems and sample reconstitution of signal quantization techniques and quantization noise, PCM, bandwidth requirements, noise systems PCM, PCM systems and differential effect of channel noise in systems PCM, Delta modulation systems, bandwidth requirements and signal-to-noise ratio (S / N) of the Transmitted Signal, introduction to communication dispersed spectrum (CDM), comparison of PCM and DM systems with TDM, AM, and FM and the ideal system, coding for error control, linear block codes, Binary cyclic codes, burst error codes, convolutional codes, performance of the correction codes and error detection.

Lab on Digital Communications

Instrumentation and Learning Institutions - Measurements. Practical sampling and reconstruction of low frequency signals. Systems Configuration Delta and Delta demodulation systems. Adaptive delta modulation systems. Multiplexing of signals with time division (Transmitters TDM-PAM, sync generators, sync word detection circuits, etc.). Systems PCM (Shapers PCM, generators tiered voltage modulator timing PCM, Demodulators PCM, timing circuits, etc.). Simulation telecommunications system with H / Y (Asynchronous, Contemporary coupling Odds Digital - Analog modulation, coding, data compression, etc.). Simulation of digital data transmission channel (Add noise, bandwidth, channel codes, etc.).

Indicative reading list and references:

- J. Proakis, Digital Communications, McGraw-Hill Prentice-Hall, 4th edition, 2001.
- Ψηφιακές Επικοινωνίες & CD, Bernard Sklar, Νικόλαος Μήτρου , Έκδοση: 2η Έκδ./2011, ISBN: 978-960-491-019-9, (Εκδότης): Α. ΠΑΠΑΣΩΤΗΡΙΟΥ & ΣΙΑ ΟΕ
- ΨΗΦΙΑΚΑ ΚΑΙ ΑΝΑΛΟΓΙΚΑ ΣΥΣΤΗΜΑΤΑ ΕΠΙΚΟΙΝΩΝΙΑΣ, K.SAM SHANMUGAM , Έκδοση: 1/1979, , ISBN: 960-7258-30-4, (Εκδότης): ΕΠΙΣΤΗΜΟΝΙΚΕΣ ΚΑΙ ΤΕΧΝΟΛΟΓΙΚΕΣ ΕΚΔΟΣΕΙΣ Α.Γ.ΠΝΕΥΜΑΤΙΚΟΣ

AICS11 Information Theory and Coding

Topics:

Overview. First concepts. Define and measure the amount of information. Useful sizes and functions. Study sources distinct messages (entropy, redundancy, source codes, flow rate information). Sources and memoryless sources Markov. Channel capacity of discrete messages. Sources consecutive messages and reduction in discrete. Sampling theorem. Fantastic canal Ideal system, noisy channel, channel continuous message. Compare communication systems. Data error control coding.

Indicative reading list and references:

- Proakis, John G., et al. Communication systems engineering. Vol. 2. New Jersey: Prentice Hall, 1994.
- ΨΗΦΙΑΚΑ ΚΑΙ ΑΝΑΛΟΓΙΚΑ ΣΥΣΤΗΜΑΤΑ ΕΠΙΚΟΙΝΩΝΙΑΣ, K.SAM SHANMUGAM , Έκδοση: 1/1979, ISBN: 960-7258-30-4, Διαθέτης (Εκδότης): ΕΠΙΣΤΗΜΟΝΙΚΕΣ ΚΑΙ ΤΕΧΝΟΛΟΓΙΚΕΣ ΕΚΔΟΣΕΙΣ Α.Γ.ΠΝΕΥΜΑΤΙΚΟΣ
- ΣΥΣΤΗΜΑΤΑ ΤΗΛΕΠΙΚΟΙΝΩΝΙΩΝ, J. PROAKIS, M. SALEHI, Έκδοση: 1/2003, ISBN: 960-8313-04-X, (Εκδότης): ΕΤΑΙΡΕΙΑ ΑΞΙΟΠΟΙΗΣΕΩΣ ΚΑΙ ΔΙΑΧΕΙΡΙΣΕΩΣ ΤΗΣ ΠΕΡΙΟΥΣΙΑΣ ΤΟΥ ΠΑΝΕΠΙΣΤΗΜΙΟΥ ΑΘΗΝΩΝ
- Εισαγωγή στη θεωρία της πληροφορίας, Αφράτη Φώτω, Έκδοση: 1η εκδ./1994, , ISBN: 978-960-266-291-5, (Εκδότης): Σ.ΑΘΑΝΑΣΟΠΟΥΛΟΣ & ΣΙΑ Ο.Ε.

AICS12 Constraint satisfaction problems

ECTS: 6

Overview and Objectives:

A significant number of problems in Computer Science, covering a wide range of applications of Computer Vision and Artificial Intelligence to Computer Network Management and Scheduling configuration (configuration) of industrial products and processes, are special cases of constraint satisfaction problems. This course introduces approaches for solving these problems and associated software. Students will be able to understand the structure and behavior of constraint satisfaction problems and are familiar with basic algorithms solving them. You are aware of the usefulness of the tools and programming limitations of the range of problems they can solve, and some experience with problem solving tools.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- State what is a Constraint Satisfaction Problem (CSP).
- Formulate a CSP.
- Use a CSP S/W package for solving real-world problems using CSP techniques.

Topics:

Definition of constraint satisfaction problems. Representing constraints. Complexity. Various forms of consistency. Regression techniques and look-ahead. Smart setback and conditions for finding solutions. Description of the available commercial software. Study of problems of different applications, the modeling and behavior of different algorithms of solving.

Indicative reading list and references:

- Dechter, *Constraint Processing*, Morgan Keufmann, 2003.
- E. Tsang, *Foundations of Constraint Satisfaction*, Academic Press, 1993.
- Prolog: Προγραμματισμός σε Λογική για Τεχνητή Νοημοσύνη, Μανόλης Μαρακάκης, Έκδοση: 1η/2014, ISBN: 978-960-6759-98-7, (Εκδότης): ΕΚΔΟΣΕΙΣ ΝΕΩΝ ΤΕΧΝΟΛΟΓΙΩΝ ΜΟΝ. ΕΠΕ
- ΠΡΟΓΡΑΜΜΑΤΙΖΟΝΤΑΣ ΣΤΗ ΛΟΓΙΚΗ - PROLOG , ΝΟΤΟΠΟΥΛΟΣ ΠΑΝΑΓΙΩΤΗΣ, Έκδοση: Α' ΕΚΔΟΣΗ /2008, ISBN: 9789608729384, (Εκδότης): Ε.&Δ.ΑΝΙΚΟΥΛΑ-Ι.ΑΛΕΞΙΚΟΣ ΟΕ

AICS13 Speech and Natural Language Processing

ECTS:

Topics:

Key features of speech signals. Mechanisms and patterns of speech production. Hearing and speech perception. Methods of digital analysis of speech signals. The method of linear prediction. Digital speech coding. Methods for synthesizing speech. Convert text to speech. Methods for Speech Recognition. Talking to Human - Computer Interaction. Applications in information systems and communications.

Indicative reading list and references:

- Pereira, Fernando CN, and Barbara J. Gross. *Natural language processing*. MIT Press, 1994.
- Ψηφιακή Επεξεργασία Φωνής: Θεωρία και Εφαρμογές, Rabiner L, Έκδοση: 1η έκδ./2011, ISBN: 9789604891535, (Εκδότης): BROKEN HILL PUBLISHERS LTD

AICS14 Image Processing

ECTS: 6

Topics:

Elements of digital image processing and basic concepts. Basic two-dimensional image representations and transformations (Fourier, Walsh Hadamard, KL discrete cosine transform (DCT), fast implementations, image representation in MATLAB, basic image manipulation commands in MATLAB. Improving image (intensity transformations, histogram equalization, spatial filters, frequency selection, homomorphic filters). editing image color (basic color models, pseudocoloring, full color processing, basic commands in MATLAB). Restoring image (model deformations, conversely filters and filter Wiener, adaptive filter Wiener, basic commands in MATLAB). Compression and Encoding (Forms IT surplus and conformity criteria, design quantization Max Loyd, Designs compression and coding (predictive coding, DPCM, Ms, compression / lossless, standards basic commands in MATLAB). Partition Image (discontinuity detection point straight edges, transform Hough, thresholding, segmentation with regions encoding chain, boundary descriptors, texture, morphological processing).

Indicative reading list and references:

- R. Gonzalez and R. Woods, "Digital Image Processing", 3rd edition, Prentice Hall, 2008.
- R. Gonzalez, R. Woods, S. Eddins, "Digital Image Processing using MATLAB", Prentice Hall 2004.

AICS15 Special Topics in Computer Systems and Networks

ECTS: 6

Overview and Objectives:
The objective of this course is to present to the students recent developments in this area.

Learning Outcomes:
Depends on the subject

Topics:
The material will be adapted to the individual requirements and scientific developments in the area.

Indicative reading list and references:
Depends on the subject.

ELECTIVE COURSES OPERATIONAL INFORMATICS (OP)

ACCN100/AIOP01 Financial Accounting

ECTS: 6

Overview and Objectives:

This course aims to:

- Enable students familiarization with the students with essential knowledge on accounting.
- Make students capable of posting entries belonged to the general or financial accounting (Journal, general ledger, balance sheets).
- Enable students aware of posting entries in the accounting books of a company which is classified in the second class (B' class) of book keeping using the manuscript method, and at the time capable for the accounting estimation of the value added tax (VAT).
- Enable students capable of posting entries in accounting books of a company which is classified in the second class of book keeping (B' class) by the use of computer' software.

Topics:

Essentials of accounting, general accepted accounting principles (G.A.A.P), Objective and accounting branches. Accounting recording methods: "Aplografiko" and Double entry system. Analysis of the Greek general chart of accounts. Valuation of inventories. Fixed assets and their depreciation. Development and analysis of the financial statements (Journal entries, general ledger, trial balance, balance sheet, profit and losses statement). Adjustments. Accounting process for the measuring, reporting and announcement of the financial annual results. Book keeping of the first and second classes of accounting classification, using manuscript method and by the use of software. Exercises related to the different classes of book keeping (mainly B' and C'). Questions and answers related to the subject of code for books and records as well as value added tax and intersection of tax records.

Indicative reading list and references:

1) Financial & Managerial Accounting (Needles B, Powers M, Crosson S), 20081) Χρηματοοικονομική Λογιστική Λογιστικό Σχέδιο (Βαζακίδης Α, Σταυρόπουλος Α,Τσόπογλου Σ), 2η έκδοση, 2010, Θεσσαλονίκη
2) Παραδείγματα εφαρμογής και ανάλυσης του γενικού λογιστικού σχεδίου στην πράξη (Καραγιάννης Δ, Καραγιάννης Ι, Καραγιάννη Α) 8η έκδοση, 2011, Θεσσαλονίκη.

AIOP02 Digital Economy

ECTS: 6

Overview and Objectives:

- Investigate the characteristics of the digital economy.
- An understanding of how these features are connected to each other, contribute to the improvement of micro and macro-economic aggregate.
- Understanding the points that differ from digital conventional economy.
- The acquisition of knowledge on specific applications of ICT in the modern economy.

Topics:

Introduction to the Digital Economy (From industrial economics to digital economic, differences between old and new economy, rules and characteristics of the new economy), Productivity and new technologies (Measuring productivity change, the "productivity paradox" Integration of digital goods measurement productivity), pricing policies on the Internet (Factors that affect pricing on the Internet, Forms pricing on the Internet, Online auctions, Pricing Web services), Information and Communication Technologies and Digital Divide (determinants of the digital divide, forms the digital divide, Measurement the digital divide), Economic impact of digital technologies on the environment (analysis of the economic impact of e-waste, Environmental pollution by dumping or recycling of electronic waste, Methods of estimating the quantity produced electronic waste).

Indicative reading list and references:

- Digital Economics: How Information Technology Has Transformed Business Thinking, by Richard McKenzie, published by Praeger Publishers, 2003, ISBN: 1-56720-644-1
- Νέα Οικονομία, Διαδίκτυο και Ηλεκτρονικό Εμπόριο, του Ιωάννη Κατσουλάκου, έκδοση από Κέρκυρα, 2001, ISBN: 960-86003-8-3,

AIOP03 Algorithmic Operations Research

ECTS: 6

Overview and Objectives:

The objective is to provide the students with solid knowledge on:

- **Theory:** What is Operations Research (OR)? Modeling the OR as a problem solving Linear Programming (LP)., Geometric solution of LP problems. Different forms of LP, Theory primary - dual. Farkas lemmas. Integer Linear Programming (ILP). Integrality Gap.
- **Algorithms**: LP--Simplex – Ellipsoid - interior points.
  Transportation problem (Totally Unimodular matrix) - Reduced Costs – Vogel method. ILP: Branch - and - bound, Dynamic Programming, Approximation Algorithms.
- **Applications**: Graph-theoretic problems (min VC, max IS).

Topics:

Operations research models, algorithms, complexity, problems NP-hard. Linear programming: algorithm simplex, dual theory, the transportation problem. Integer programming: branch and bound - the problem of partitioning, the problem of minimum total coating (minimum set covering), dynamic programming - the knapsack problem (knapsack problem), generalized knapsack, heuristic algorithms and performance measurement techniques, the problem of vertex covering, maximum independent subset of upper and lower bounds, empirical evaluation heuristic methods. Local Search Method: neighborhood structure, neighborhood search techniques, PLS-completeness, the travelling salesman problem (k-OPT), partitioning graphs. Simulated annealing: the algorithm of Metropolis, applications, the problem of intersection of the maximum (max cut).

Indicative reading list and references:

- *Combinatorial Optimization: Algorithms and Complexity*. Prentice-Halll, Inc., 1982.
- Αλγοριθμική Επιχειρησιακή Έρευνα, Σημειώσεις Β. Ζησιμόπουλος
- *Operations Research Applications and Algorithms* 3 edition Wayne L. Winston,
- *Introduction to Algorithms,* 2nd ed. CLRS,
- *Linear and Nonlinear Programming,* S. G. Nash , A. Sofer, McGRWA-Hill International Editions 1996,

AIOP04 Marketing Information Systems

ECTS: 6

Topics:

Conceptual approaches. E-marketing, Internet marketing, Online Marketing, digital marketing, differences traditional and Internet Marketing scopes. Typology management information systems marketing. Management Systems Customer / Partner CRM / PRM (Customer / Partners Relationship Management) and knowledge management marketing. The use of GIS in marketing. Electronic identification and marketing intelligence. ON E / online marketing plan, online marketing mix strategy and e-marketing. Research based on innovative marketing tools and internet, electronics buyer behavior, segmentation strategy and targeting customers strategic differentiation and positioning, online invoicing, sales, advertising, politics brand on the internet, viral marketing, Social media / networks and marketing. Marketing management website. Measuring effectiveness email marketing actions. Practical applications.

Indicative reading list and references:

- Armstrong, Gary, et al. *Principles of marketing*. Pearson Australia, 2014.
- Ηλεκτρονικό Επιχειρείν και Μάρκετινγκ, Βλαχοπούλου Μάρω ,Δημητριάδης Σέργιος, Έκδοση: 1/2013, ISBN: 978-960-7745-32-3, (Εκδότης): ROSILI ΕΜΠΟΡΙΚΗ - ΕΚΔΟΤΙΚΗ Μ.ΕΠΕ
- ΚΑΙΝΟΤΟΜΙΑ, ΣΤΡΑΤΗΓΙΚΗ, ΑΝΑΠΤΥΞΗ ΚΑ ΠΛΗΡΟΦΟΡΙΑΚΑ ΣΥΣΤΗΜΑΤΑ, Γεώργιος Δουκίδης, Έκδοση: Α΄/2010, ISBN: 978-960-08-0528-4, (Εκδότης): ΑΝΔΡΕΑΣ ΣΙΔΕΡΗΣ-ΙΩΑΝΝΗΣ ΣΙΔΕΡΗΣ & ΣΙΑ Ο.Ε.
- Εισαγωγή στο Marketing, Armstrong Gary,Kotler Philip, Έκδοση: 1η έκδ./2009, ISBN: 978-960-458-204-4, (Εκδότης): Εκδόσεις Επίκεντρο Α.Ε.
- e-Marketing, Μάρω Βλαχοπούλου, Έκδοση: 1/2003
- Συγγραφείς: Μάρω Βλαχοπούλου, ISBN: 960-7745-04-3, (Εκδότης): ROSILI ΕΜΠΟΡΙΚΗ - ΕΚΔΟΤΙΚΗ Μ.ΕΠΕ

AIOP05 Strategy and Economics of Information Systems

ECTS: 6

Overview and Objectives:

The course aims to provide students administrative and organizational skills required for effective development strategy (strategy formulation) and administration (management) if information systems (IS) in modern businesses and organizations. The course is intended to cover the need to develop IS strategy in line with the business strategy, the need for management in an integrated way all the components of IS, the need to align business processes (business processes) of the used IS, the need for the use of workflow management technology in business processes (e.g., workflow and business process management, etc.) and the need to study the role of the Information Society in business processes (e.g, e-commerce). The course focuses on the systematic, methodical and effective administration and management of information technology in modern business. The focus is on the identification and analysis of methods and techniques, by which private and public organizations can design, use and manage information technology in order to exploit the technological possibilities and opportunities and achieve their goals. The course is interdisciplinary, drawing on disciplines such as administrative (management science), operational research (operations research), economics (economics) and the analysis and design of information systems (information systems analysis and design). The systematic management of information systems in an organization requires the knowledge of a range of basic techniques and methods. The main topics of the course under this perspective are:

- The hybrid role of IT manager.
- Technical management information systems (IT project management, process PRINCE, computer center organization).
- IT investment evaluation methods (Information Economics, application portfolio, etc.) and analysis of the costs and benefits of Information Systems.
- Technical measurement software (e.g., function point analysis).

Topics:

Business strategy. The strategic importance of Information Systems (IS). Methods of assessment strategies PS The strategic role of IS in-house Linking business strategy and PS Methodologies design strategies IS Redefining business functions and IS Evaluation of proposals and tenders for new projects IS Methods for replacement and maintenance of IS Accounting and cost accounting services handled by IS.

Indicative reading list and references:

- Scott Morton, M.S., ed. (1994) The Corporation of the 1990s, Information Technology and Organizational Transformation: Research Studies, Oxford University Press.
- Cash, J., F.W. McFarlan, J. McKenney and L. Applegate (1993) Corporate Information Systems Management, Harvard Business School Press.
- Robson, W (1995) Strategic Management and Information Systems, Pitman Publishing

AIOP06 Scientific Computing

ECTS: 6

Overview and Objectives:

The design and analysis of algorithms, of the basic numerical methods for matrix computations, which are the core problems in Computational Science and Engineering.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

Topics:

Introduction. Elements of error analysis. Direct methods of solution of linear systems (elimination, factorization). Iterative methods for solution of linear systems, semi-iterative methods. The conjugate gradient method. Numerical computation of eigenvalues and eigenvectors: iterative methods (power method), transformation methods (Jacobi, Givens, Householder, LR and QR). Introduction to the numerical solution of partial differential equations.

Indicative reading list and references:

- Strang, Gilbert, et al. *Introduction to linear algebra*. Vol. 3. Wellesley, MA: Wellesley-Cambridge Press, 1993.
- ΜΙΑ ΕΙΣΑΓΩΓΗ ΣΤΗ ΓΡΑΜΜΙΚΗ ΑΛΓΕΒΡΑ, ΒΑΡΣΟΣ ΔΗΜΗΤΡΗΣ, ΔΕΡΙΖΙΩΤΗΣ ΔΗΜΗΤΡΗΣ, ΕΜΜΑΝΟΥΗΛ ΓΙΑΝΝΗΣ, ΜΑΛΙΑΚΑΣ ΜΗΧΑΛΗΣ, ΜΕΛΑΣ ΑΝΤΩΝΗΣ, ΤΑΛΕΛΛΗ ΟΛΥΜΠΙΑ, ISBN: 978-960-6706-36-3, Διαθέτης (Εκδότης): "σοφία" Ανώνυμη Εκδοτική & Εμπορική Εταιρεία
- ΓΡΑΜΜΙΚΗ ΑΛΓΕΒΡΑ ΚΑΙ ΕΦΑΡΜΟΓΕΣ, STRANG GILBERT, ISBN: 978-960-524-7309-70-9, Διαθέτης (Εκδότης): ΙΔΡΥΜΑ ΤΕΧΝΟΛΟΓΙΑΣ & ΕΡΕΥΝΑΣ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ
- ΕΙΣΑΓΩΓΗ ΣΤΗΝ ΑΡΙΘΜΗΤΙΚΗ ΑΝΑΛΥΣΗ, ΑΚΡΙΒΗΣ Γ.Δ., ΔΟΥΓΑΛΗΣ Β.Α., Έκδοση: 4η /2009, ISBN: 978-960-524-022-6, (Εκδότης): ΙΔΡΥΜΑ ΤΕΧΝΟΛΟΓΙΑΣ & ΕΡΕΥΝΑΣ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ
- Αριθμητική Ανάλυση, Νικόλαος Μισυρλής, Έκδοση: 1/2009, ISBN: 978-960-92031-2-8, (Εκδότης): ΝΙΚΟΛΑΟΣ ΜΙΣΥΡΛΗΣ

AIOP07 Electronic Commerce (e-C)

ECTS: 6

Overview and Objectives:

Understanding and familiarization of students with:

- The strategy and implementation of e-Commerce and e-Business in terms of operational, technological and market conditions and environment.
- The operational applications of Electronic / Mobile Commerce and Electronic / Mobile Business through the presentation and analysis of best practices and case studies in various business sectors.

Topics:

It involves the study of the infrastructure, activities, and programming techniques involved in sound design, development and support of distributed Internet applications e-C. It covers current topics of advanced technologies, including specifics on mobile commerce applications, the issues of effective presence - usability of Web services on the WWW and concerns relating to the security of the transactions e-C and digital payment systems.

The internet as a technological infrastructure of Electronic Commerce (e-C), mobile commerce (m-Commerce) and transactions through mobile / wireless devices, e-C Security transactions and digital payment systems, creating an effective presence in the PI: personalization systems (personalization) and production recommendations (recommendations).

Laboratory

Environment Visual Studio to develop applications & sites of e-C on the Web (Visual Basic, ADO.NET, ASP.NET, C #), Introduction to visual programming. Using optical instruments / mechanisms and object-driven events programming to develop Web applications. Developing ecommerce sites: analysis, design and implementation of indicative case study.

Indicative reading list and references:

- Ince, Darrel. *Dictionary of the Internet: Book and CD-ROM with Cdrom*. Oxford University Press, Inc., 2001.
- Τεχνολογίες Διαδικτύου και Ηλεκτρονικό Εμπόριο, Ν. Καρανικόλας, Έκδοση: 1η/2006, ISBN: 960-8105-94-3, (Εκδότης): ΕΚΔΟΣΕΙΣ ΝΕΩΝ ΤΕΧΝΟΛΟΓΙΩΝ ΜΟΝ. ΕΠΕ
- Βιβλίο [4621]: ΚΑΤΑΝΕΜΗΜΕΝΕΣ ΕΦΑΡΜΟΓΕΣ ΚΑΙ ΗΛΕΚΤΡΟΝΙΚΟ ΕΜΠΟΡΙΟ (ΠΕΡΙΕΧΕΙ CD), INCE DARREL, Έκδοση: 1η/2007, ISBN: 978-960-8396-34-0, (Εκδότης): ΕΤΑΙΡΙΑ ΑΞΙΟΠΟΙΗΣΗΣ ΚΑΙ ΔΙΑΧΕΙΡΙΣΗΣ ΠΕΡΙΟΥΣΙΑΣ ΤΟΥ ΠΑΝΕΠΙΣΤΗΜΙΟΥ ΜΑΚΕΔΟΝΙΑΣ
- ΗΛΕΚΤΡΟΝΙΚΟ ΕΠΙΧΕΙΡΕΙΝ ΚΑΙ ΗΛΕΚΤΡΟΝΙΚΟ ΕΜΠΟΡΙΟ, DAVE CHAFFEY, Έκδοση: 3η/2008, ISBN: 978-960-461-171-3, ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ
- Ηλεκτρονικό Επιχειρείν και Μάρκετινγκ, Βλαχοπούλου Μάρω ,Δημητριάδης Σέργιος, Έκδοση: 1/2013, ISBN: 978-960-7745-32-3, (Εκδότης): ROSILI ΕΜΠΟΡΙΚΗ - ΕΚΔΟΤΙΚΗ Μ.ΕΠΕ

- Ηλεκτρονικό εμπόριο 2010, Turban Efraim,King David,,Lee Jae,Ting-Peng Liang, Turban Deborah, Έκδοση: 1η εκδ./2011, ISBN: 978-960-512-605-6, (Εκδότης): Χ. ΓΚΙΟΥΡΔΑ & ΣΙΑ ΕΕ
- e - Οικονομία-Εμπόριο-Μάρκετιγκ-Διακυβέρνηση, Γεωργιάδου Ε., Τριανταφύλλο Ευ., Οικονομίδης Αν. , Έκδοση: 1η έκδ./2010, ISBN: 978-960-418-242-8, (Εκδότης): ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε.

AIOP08 Decision Support Systems

ECTS: 6

Overview and Objectives:

The Decision Support Systems are information systems, in modern form, that provide to all management levels of an organization or a company the ability to make decisions taking into account a large number of parameters and volumes of information. The current size of the markets combined with the intensely competitive environment make use of such systems an essential tool.
The course aims to familiarize students with technologies as well as methodologies used in decision support systems. Individual topics will include: multi-criteria methodologies, decision analysis data (classification trees, association rules, clustering), knowledge systems, combination of decisions, decision making under uncertainty, risk, competition, optimization and decision trees, etc.

Learning Outcomes:

At the end of the module, successful candidates should be able to:

- Be able to describe different kinds of decision support systems and explain their function.
- Be able to describe and explain how decision support systems can be used in different kinds of organizations.
- Be able to analyze a typical decision situation in the finance market or estate management, and to apply relevant theory in order to evaluate different alternatives.
- Be able to evaluate the impact decision support systems have on organizations and their operation.

Topics:

Decision making, systems, models and support. Overview of a Decision Support System, its basic subsystems and their classification. Methods and tools for building DDS, repeat and adapt to these methods. Designs and applications of DSS (e.g., simulation, multi-criteria analysis). Construction and management models.. Data management subsystem, User interface and build models with visual interaction. The technical analysis of "what-if" (what-if). Decision support systems for groups. Implementation and integration of a DSS with other technologies and information systems.

Indicative reading list and references:

- Introduction to operations research, Frederick S Hillier, Gerald J Lieberman, Έκδοση: 8/2005,
- ISBN: 0073017795, (Εκδότης): Εκδόσεις Επίκεντρο Α.Ε.
- Εισαγωγή στην επιχειρησιακή έρευνα, Φράγκος Χρήστος Κ. , Έκδοση: 1η έκδ./2006, ISBN: 960-351-655-4, Διαθέτης (Εκδότης): ΕΚΔΟΣΕΙΣ ΣΤΑΜΟΥΛΗ ΑΕ
- Διοικητική επιστήμη - Λήψη επιχειρηματικών αποφάσεων στην κοινωνία της πληροφορίας, Πραστάκος Γρηγόρης Π., Έκδοση: 2η έκδ./2006, ISBN: 960-351-501-9, (Εκδότης): ΕΚΔΟΣΕΙΣ ΣΤΑΜΟΥΛΗ ΑΕ
- Making Hard Decisions: An Introduction to Decision Analysis, 2nd Edition, Robert T. Clemen, Duxbury Press, 1996.
- Essentials of Management Information Systems, 4th Edition, J. Laudon, Prentice Hall, 2001.
- Τεχνητή Νοημοσύνη, Γ' Έκδοση, Ι.Βλαχάβας, Π.Κεφαλάς, Ν. Βασιλειάδης, Φ.Κόκκορας και Η. Σακελλαρίου. Εκδόσεις Β.Γκιούρδας, 2006

AIOP09 Linear and Nonlinear Optimization

ECTS: 6

Overview and Objectives:

The course introduces the student to Optimization theory and modelling. It elaborates on the role of prices, duality, optimality conditions, and algorithms in finding and recognizing solutions. More specifically the course covers:

- Perspectives: problem formulation, analytical theory, computational methods, and recent applications in engineering, finance, and economics.
- Theories: finite dimensional derivatives, convexity, optimality, duality, and sensitivity.
- Methods: simplex and interior-point, gradient, Newton, and barrier.

Topics:

Optimization models: linear equations, non-linear programming. Feasibility and optimization. Derivative and curvature. The overall optimization algorithm. Speeds convergence. Optimization without constraints: method Newton. Ensuring convergence: linear search methods, methods Quasi-Newton. Conditions optimization for linear and non-linear constraints. Multipliers Lagrange, methods feasible point. Methods of penalty and barrier.

Indicative reading list and references:

- Linear and Nonlinear programming, S. Nash, A. Sofer.
- Convex Optimization, Stphen Boyd, Lieven Vandeberghe.
- Linear complementarity, Linear and Nonlinear programming, Katta G. Murty.
- Introduction to Algorithms, CRLS.
- Approximation Algorithms, Vazirani.

AIOP10 Econometrics I

ECTS: 6

Overview and Objectives:

Topics:

- SIMPLE regression (Introduction, regression function, the method of least squares regression line properties underlying assumptions of the model regression, sampling distributions of least squares estimators, properties of least squares estimators, Statistical inference: the regression coefficients, statistical inference: The regression line, Estimates)
- Multiple regression: (Introduction, regression function, the method of least squares regression plane Properties, The basic assumptions of the model of multiple regression, sampling distributions of least squares estimators, properties of least squares estimators, Statistical inference: The coefficients regression Statistical inference: the regression line, Investigation of the function regression, Statistical inference: Special occasions, Statistical inference: Sensitivity of the regression line, forecasts)
- VIOLATION three key assumptions: NON sphericity errors: (Introduction, The generalized method of least squares, generalized method of maximum likelihood, generalized attainability assessment methods, Heteroskedasticity, Autocorrelation, Normality)
  Four violations of basic assumptions:
- Problems of Sample: (e.g., Introduction, Errors Specialization).

Indicative reading list and references:

- ΕΙΣΑΓΩΓΗ ΣΤΗΝ ΟΙΚΟΝΟΜΕΤΡΙΑ ΜΕ ΤΗ ΧΡΗΣΗ ΤΟΥ ΛΟΓΙΣΜΙΚΟΥ EVIEWS, ΧΑΪΔΩ Ν. ΔΡΙΤΣΑΚΗ, ΜΕΛΙΝΑ Ν. ΔΡΙΤΣΑΚΗ, Έκδοση: 1η/2013, ISBN: 978-960-461-544-5, (Εκδότης): ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ
- ΟΙΚΟΝΟΜΕΤΡΙΑ, ΤΖΑΒΑΛΗΣ ΗΛΙΑΣ, Έκδοση: 1/2008, ISBN: 978-960-98566-0-7, (Εκδότης): ΕΤΑΙΡΕΙΑ ΑΞΙΟΠΟΙΗΣΗΣ ΚΑΙ ΔΙΑΧΕΙΡΙΣΗΣ ΤΗΣ ΠΕΡΙΟΥΣΙΑΣ ΤΟΥ ΟΙΚΟΝΟΜΙΚΟΥ ΠΑΝΕΠΙΣΤΗΜΙΟΥ ΑΘΗΝΩΝ ΑΕ

AIOP11 Time series and forecasting

ECTS: 6

Topics:

Purpose and use of the analysis of time series and forecasting methods. Statistical techniques for time series analysis and forecasting. Linear and nonlinear models of trend. Stochastic time series. Autoregressive model (AR), moving averages Designs (MA) and mixed (ARMA). The Box-Jenkins methodology in time series analysis (models ARIMA). Forecasting methods with ARIMA models and evaluation criteria of predictions. Unit Root Tests and applications. Vectors auto regression (VAR) and causality tests. Examples of time series analysis. Internship computers and experiential exercises.

Indicative reading list and references:

- Bowerman, Bruce L., and Richard T. O'Connell. *Time series and forecasting*. North Scituate, MA: Duxbury Press, 1979.
- Εφαρμοσμένη στατιστική, Μπόρα - Σέντα Ε., Μωυσιάδης Χρόνης Θ. , Έκδοση: 2η έκδ./1990, ISBN: 960-431-184-0, (Εκδότης): Ζήτη Πελαγία & Σια Ο.Ε.
- ΣΥΓΧΡΟΝΕΣ ΜΕΘΟΔΟΙ ΑΝΑΛΥΣΗΣ ΧΡΟΝΟΛΟΓΙΚΩΝ ΣΕΙΡΩΝ, ΔΗΜΕΛΗ ΣΟΦΙΑ, Έκδοση: 1η /2013, ISBN: 978-960-9443-17-3. Διαθέτης (Εκδότης): ΕΤΑΙΡΕΙΑ ΑΞΙΟΠΟΙΗΣΗΣ ΚΑΙ ΔΙΑΧΕΙΡΙΣΗΣ ΤΗΣ ΠΕΡΙΟΥΣΙΑΣ ΤΟΥ ΟΙΚΟΝΟΜΙΚΟΥ ΠΑΝΕΠΙΣΤΗΜΙΟΥ ΑΘΗΝΩΝ ΑΕ

AIOP12 Game theory

ECTS: 6

Overview and Objectives:

Familiarization with algorithmic problems in game theory. Emphasis will be placed on three axes: familiarity with techniques for designing algorithms in game theory, familiarity with basic complexity results for difficult problems in game theory and familiarity with techniques for analysis of computer systems with selfish components. Familiarity with the various costs that are set in the literature and techniques for their analysis.

Topics:

Strategic games: Original and mixed strategies, benefits, best responses. Balances: Genuine and mixed equilibrium Nash, the refinements and generalizations thereof. Classic equilibrium existence theorems and algorithmic aspects. Algorithms and complexity for finding equilibriums. The computational classes PLS and PPAD and their relation to the problem of calculating balances, and algorithms for the calculation of approximate equilibrium. The cost of anarchy and their variants. Analysis of the cost of anarchy for general and specific games (e.g., games for selfish routing, congestion games, gaming security). Applications to realistic situations (e.g., social networks, selfish formation Internet).
Bibliography:

Indicative reading list and references:

- M. Mavronicolas and P. Spirakis, Algorithmic Game Theory, Springer, 2011
- Selected research papers from the literature.

ECON815/AIOP13 Econometrics II

ECTS: 6

Overview and Objectives:

Topics:

- Models with dummies (Shift function, Rotate function, simultaneous translation and rotation function, simultaneous use of several qualitative explanatory variables, Seasonal dummies).
- Combination of laminar and longitudinal data (Stratified heteroskedasticity, layered and timeless ytosyschetisi independence, Stratified heteroskedasticity, temporal correlation and cross sectional autocorrelation).
- Models distributed lags (KCHY) (Assessment models KCHY, Evaluation models KCHY restricted to finite or infinite number of lags, Empirical models KCHY Methods of assessment models KCHY infinite number of lags, Diagnostics, Applications).
- Designs systems of equations (Error dependence, Identification, estimation methods (Indirect method, method in two steps), Models seemingly uncorrelated equations Diagnostics Analysis models).

Indicative reading list and references:

- ΣΥΓΧΡΟΝΗ ΟΙΚΟΝΟΜΕΤΡΙΑ, ΒΑΜΒΟΥΚΑΣ ΓΕΩΡΓΙΟΣ , Έκδοση: 1/2007, ISBN: 978-960-86157-9-3, (Εκδότης): ΕΤΑΙΡΕΙΑ ΑΞΙΟΠΟΙΗΣΗΣ ΚΑΙ ΔΙΑΧΕΙΡΙΣΗΣ ΤΗΣ ΠΕΡΙΟΥΣΙΑΣ ΤΟΥ ΟΙΚΟΝΟΜΙΚΟΥ ΠΑΝΕΠΙΣΤΗΜΙΟΥ ΑΘΗΝΩΝ ΑΕ
- Οικονομετρία, Χάλκος Γεώργιος, Έκδοση: 1η έκδ./2011, ISBN: 978-960-01-1394-5, Εκδότης): Γ. ΔΑΡΔΑΝΟΣ - Κ. ΔΑΡΔΑΝΟΣ Ο.Ε.
- ΟΙΚΟΝΟΜΕΤΡΙΚΑ ΥΠΟΔΕΙΓΜΑΤΑ ΚΑΙ ΕΦΑΡΜΟΓΕΣ ΜΕ ΤΟ EVIEWS, ΣΥΡΙΟΠΟΥΛΟΣ ΚΩΣΤΑΣ, Διονύσης Θ. Φίλιππας, , Έκδοση: Α' ΕΚΔΟΣΗ /2010, ISBN: 9789605160463, (Εκδότης): Ε.&Δ.ΑΝΙΚΟΥΛΑ-Ι.ΑΛΕΞΙΚΟΣ ΟΕ,

AIOP14 Special Topics in Operational Informatics

ECTS: 6

Overview and Objectives:
The objective of this course is to present to the students recent developments in this area.

Learning Outcomes:
Depends on the subject

Topics:
The material will be adapted to the individual requirements and scientific developments in the area.

Indicative reading list and references:
Depends on the subject