



UNIVERSITY OF CRETE

Department of Computer Science

School of Sciences and Engineering

Study Guide



Organization of the Department

Establishment of the Department

The Department of Computer Science at the University of Crete offers a complete undergraduate and graduate program of studies since the academic year 1984-85. In this period, the Department has developed and applied a modern, coherent and strong curriculum of studies.

The latter is regularly updated to reflect current techno-

logical advancements and to encapsulate best emerging practices in teaching computer science. Today, it is broadly recognized for its significant impact at tertiary education in Greece in the general domain of information and communication technologies. At the same time, it is also internationally acknowledged for substantial educational and research contributions.

The Faculty of the Department consists of distinguished scientists holding and maintaining essential cooperation with top academic and research institutions, as well as the industry. The Department has achieved and maintained a strong competitive position mainly due to the high quality standards of its undergraduate and graduate program. Effectively, the latter constitutes a key factor to the successful careers of our graduates.

In Greece there is still a misconception that only the University departments related to Computer Engineering focus on hardware and electronics, while the departments in the domain of Computer Science or Information Technology and Telecommunications focus on information and software. However, the Department of Computer Science at the University of Crete, following the paradigm of similar or corresponding American and European Departments, is treating all the previous domains as an integrated thematic unit and technological topic. In this context, the Department curriculum aims to address the most important aspects in the development of systems and technologies supporting human needs and effectively changing the world. Along these lines, areas such as hardware design, operating systems, software engineering, computation theory, telecommunications, etc., are well balanced in the curriculum with the appropriate level of detail. Additionally, students are given specific assignments and laboratory projects, through which they learn how to combine demanding theoretical concepts with advanced programming methodologies and eventually develop all the necessary skills for real-life practicing of computer science.

The program also includes an obligatory Diploma Thesis, normally carried out during the final year of studies. The latter may be combined with Practical Training, as full-time occupation, in a Greek or international organization or company. Finally, several courses addressing pedagogical aspects are offered by faculty members from relevant departments. As a result, our students graduate with the necessary skills to cope with a wide variety of challenges in industrial, business, educational and research contexts.





Administration of the Department



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Cyprus	Univercity of Cyprus	www.ucy.ac.cy
Norway	NTNU, Trondheim	www.ntnu.no
The Netherlands	Universiteit van Amsterdam Vrije Universiteit Amsterdam	www.uva.nl www.vu.nl
Poland	Unwersytet Pedagogiczny im. Ken	www.wsp.krakow.pl
Turkey	Izmir Institute of Technology	www.iyte.edu.tr
Czech	Vysoke Uceni Technicke V BRNE (Brno University of Technology) Zapadoceska Univerzita v Prizni (University of West Bohemia)	www.vutbr.cz www.zcu.cz
Finland	Jyvaskylan Yliopisto (University of Jyvaskyla) Tampereen Yliopisto (University of Tampere)	www.jyu.fi www.uta.fi



Procedures for admission

Registration to the Department of Computer Science of the University of Crete is offered via the admission procedures provided by the Ministry of Education and Religious Affairs to Higher Education Institutions (State Examinations, Students belonging to special eligible family categories, foreigners, Greek citizens living abroad, people with severe illnesses, enrollment with examinations or with degree grade).

Specific arrangements for the recognition of previous studies

The courses that students attended successfully and the work they did as part of earlier studies in any Greek or foreign University can be recognized under certain conditions by the Department, for the fulfillment of graduation requirements. The same applies for courses and work as part of student exchange programs financed by the Socrates / Erasmus Programmes. The latter is responsibility of a special committee having three Faculty members: (a) the representative of the Department in the Committee of International Relations of the University, (b) his assistant, and (c) the chairman of the Committee for undergraduate studies of the Department.

The committee receives the relevant official documents including the courses, work, the course credits (CC), and grades, and judges: (i) which courses and laboratory work can be recognized; (ii) how they map to those of the Department curriculum; and (iii) how the grades are converted.

The committee maintains the right to change the prerequisite courses and relevant time constraints which are required for the recognition of a course or work.

The committee may consult any Faculty member of the Department, or other Departments of the University, that regularly teaches a related course in our Department.

The entire committee, any member, or a Faculty member of a relative domain, may also request for an interview with the interested student. A unanimous decision of the committee is always considered to be final. Otherwise, the subject is forwarded to the entire Department for final decision. The committee is permitted to recognize up to 40 CCs per student, otherwise a decision by the Department is required.



General description of learning objectives

Our curriculum follows the paradigm of similar or corresponding American and European Departments, considering computer science to be a distinct topic, and is also based on the indicative ACM Computer Science curriculum. Areas such as hardware design, operating systems, software engineering, computation theory, telecommunications, etc., are well balanced in the curriculum. Moreover, students are given comprehensive assignments and laboratory projects along with a Diploma Thesis through which they learn how to combine demanding theoretical concepts with advanced programming methodologies and eventually develop all the necessary skills for real-life practicing of computer science, either in industry, government or research organizations. Students may also join a Practical Training program. Moreover, a variety of pedagogically-oriented courses target to equip students with important teaching skills.

Learning objectives

The learning objectives of the curriculum are realized thanks to the high standards maintained by the Department members and the active participation of students and are the following:

- High quality studies following international standards.
- Conformity with recent advancements in information and communication technologies.
- Emphasis on applications and laboratories aiming to: (i) form a sound scientific and engineering basis for students; and (ii) promote critical and creative thinking through assimilation of basic research principles in the course of real practice.

- Courses are balanced regarding the breadth of scientific areas they consider and the depth in which each of these areas are elaborated. Specialization in areas of primary importance and hands-on research experience is offered in collaboration with the Foundation for Research and Technology, Hellas (FORTH).

Occupational profile of graduates

As mentioned before, the Department treats computer science as a distinct technological topic that requires strong foundations of theory, methodology and practice. The curriculum targets the construction of hardware and software systems, however, with a stronger emphasis on software topics, addressing key aspects of applications of information and communication technologies together with algorithmic theory and theory of computation. Along these lines, students are ready to uptake working tasks in the field of software development, either of complete systems or modules, and to architect real-life applications out of components, services or legacy systems. Additionally, they are also skilled in software processes related to integration, testing, operation, maintenance and evolution of actual systems. They have a strong background on specific topics involved in the context of system development such as database design, networking, distributed systems, compilers, signal processing, human-computer interaction, and web systems. In terms of hardware skills, they gain strong skills in digital design, micro-electronics, computer architecture, and embedded microsystems.



Access to further studies

Access to 2nd Cycle of studies (postgraduate studies leading to a Masters degree) or/ and to 3rd Cycle of studies (Doctoral Studies) is provided under certain conditions and eligibility criteria

Regulations and curriculum

The undergraduate studies program in Computer Science consists of: (a) core courses; (b) two groups of elective courses; and (c) optional courses. In order to obtain a Bachelor's degree, students are required to succeed in all core courses (i.e., they are mandatory), while they must succeed in a specific number of the available elective ones. Optional courses allow for further specialization in Computer Science in various areas. Essentially, core courses are designed to provide core knowledge and enable students to form a sound scientific background complemented with strong engineering skills. Then, elective and optional courses allow students to elaborate on thematically-focused topics.

The estimated workload of each course is measured in CTS Credits. The total workload per semester for students is the sum of the ECTS of the courses in which they enrol, while the recommended semester workload is approximately 30 ECTS. The maximum admissible workload per semester is 52 ECTS and per academic year is 97 ECTS. Additionally, a student is allowed to enrol in one extra course per semester for reassessment, normally for grade improvement,

provided they have already passed the particular course in an earlier term. In the latter case the rules for reassessment apply (see below).

Fluency in English language is required, since the vast majority of the computer science literature is written in it. Students are required to attend the relevant core classes during the first two years of their studies, unless they pass a corresponding English examination test. It should be noted that English bibliography is extensively used during the second half of the undergraduate program.



Graduation requirements

The requirements for graduation are as follows:

- Enrolment in the Department and course attendance for at least eight (8) semesters
- Successful score in all core courses and fulfilment of a Bachelor's Thesis as shown in Table 1
- Successful score in at least two (2) courses from the "Other Sciences" set of electives (E1) (see Table 2). Similar courses are grouped in a set with an "or" meaning only one course from each set can be recognized towards fulfilling this requirement
- Successful score in courses selected from sets E3 through E9 from the Computer Science Elective Courses, corresponding to at least 42 ECTS. At most three (3) courses can be selected from the same set in order to fulfil this requirement. Undergraduate students are further allowed to enrol in graduate courses offered by the Department following their request and a corresponding

approval by the Undergraduate Studies Committee. The enrolment in a graduate course is only accepted on the condition that at least one course from the relevant set has been successfully completed. The classification of graduate courses in Computer Science Elective Sets is undertaken by the Undergraduate Studies Committee after prior consultation with the Postgraduate Studies Committee

- Accumulation of at least a two hundred and forty (240 ECTS) in total

Finally, undergraduate students are allowed to enrol in graduate courses, after permission granted by the corresponding instructor. The credits gained from the successful completion of these courses do not fall in any of the previous categories, but are normally added to their ECTS sum.

Grade-Point Average

The maximum grade in a course is ten (10) and the passing grade is five (5). The grading system is characterized as follows:

EXCELLENT: from 8.50 to 10

VERY GOOD: from 6.50 to 8.49

GOOD: from 5 to 6.49

Grade less than 5 in the individual courses means failing to the course.

The grade point average (GPA) for graduation is computed using the weight factor of ECTS units for each course. Courses "English I, II, and III" (CS-108, 109, and 208) do not participate in the final grade of the degree, while the "English IV" (CS-209) course participates. The grade of the Bachelor's thesis also participates with 18 ECTS. Furthermore, if a student has earned more than 240 ECTS credits, then the extra courses with the lower grades are excluded from the calculation of the GPA.

Reassessment

Students who have succeeded in passing a particular course during the first examination period (usually during February and June) are allowed to participate in the second examination period (September of the same calendar year) to improve their grade. In this case, the maximum of the two grades is retained. Also, students may enrol again in a course they have succeeded in a previous semester aiming for grade improvement. In this case, it should be noted that the earlier grade is not retained.

The following pages contain tables (one for each course category) summarizing courses offered by the undergraduate studies program of the Computer Science Department at the University of Crete. Courses with code-names beginning with "MATH" or "PHYS" are taught by the Mathematics Department and Physics Department respectively at the University of Crete.

Βάσει του παραπάνω ετήσιου μέσου βαθμού, ο οποίος υπολογίζεται κάθε Σεπτέμβριο μετά την Β' εξεταστική περίοδο, οι φοιτητές κάθε έτους κατατάσσονται στην ``ετήσια σειρά επιτυχίας''. Σαν έτος φοίτησης κάθε φοιτητή θεωρείται το Α', Β', ή Γ', την πρώτη, δεύτερη, ή τρίτη αντίστοιχα Ακαδημαϊκή χρονιά, το Δ' δε την κάθε χρονιά από εκεί και πέρα. Οι παραπάνω μέσοι βαθμοί και σειρές επιτυχίας (ετήσιοι και πτυχίου) μπορούν να χρησιμοποιούνται σαν κριτήρια για απονομή τιμητικών διακρίσεων και υποτροφιών.

1. Core Courses

Code	Course Name	ECTS	Prerequisites
CS-100	Introduction to Computer Science	8	--
CS-108	English I	4	--
CS-109	English II	4	CS108
CS-110	Calculus I	8	-----
CS-111	Calculus II	6	CS-110 or MATH-102
CS-112	Physics I	8	--
CS-118	Discrete Mathematics	6	--
CS-119	Linear Algebra	6	--
CS-120	Digital Design	8	--
CS-150	Programming	8	--
CS-180	Logic	6	--
CS-208	English III	4	CS-109
CS-209	English IV	4	CS-208
CS-215	Applied Mathematics for Engineers	8	CS-110 or MATH-102
CS-217	Probability	6	CS-110 or MATH-102
CS-225	Computer Organization	8	CS-120
CS-240	Data Structures	8	CS-100, CS-150, (CS-118)
CS-252	Object-Oriented Programming	8	CS-150
CS-255	Software Technology Laboratory	6	6 CS-150
CS-280	Theory of Computation	6	-----
CS-335	Computer Networks	6	CS-118, (CS-217)
CS-340	Languages and Compilers	8	CS-280, CS-240, ή CS-255 (CS-225)
CS-345	Operating Systems	8	CS240, CS-255, (CS225)
CS-360	Files and Databases	8	CS-240, CS-118 (CS-180)
CS-380	Algorithms and Complexity	8	HY-240, HY-118
CS-499	Bachelor's Thesis	18	

E1. Elective Courses from Mathematics and Physics

Code	Course Name	ECTS	Prerequisites	
EM-181	Numerical Analysis			
EM-191	Introduction to Numerical Algorithms			
EM-211	Linear Algebra II			
EM-224	Multiple Variables Analysis		As in Mathematics and Applied Mathematics Dept.	
EM-231	Linear and Non-linear Programming			
EM-243	Common Differential Equations			
EM-271	Statistics			
EM-272	Applied Statistics			
EM-281	Mathematical Simulation I			
EM-291	Numerical Solution of Differential Equations			
CS-113	Physics II	6		-
CS-121	Electronic Circuits	6		-
CS-122	Introduction to Electronics	6		-
CS-305	Introduction to Economic Theory	6	-	
M-1222	Algebra			
M-2222	Number Theory			
M-2811	Euclid Geometry			
M-2113	Ordinary Differential Equations I			
M-2722	Partial Differential Equations I			
M-2213	Group Theory		As in Mathematics and Applied Mathematics Dept.	
M-2224	Theory of Rings & Modules			
M-1212	Linear Algebra II			
M-2413	Set Theory I			
M-292	Topics in Algebra			
M-2711	Introduction to Optimisation Theory			

M-2522	Introduction to Numerical Analysis		
M-2611	Parametrical Statistical Inference		
M-2524	Numerical Solution of Differential Equations		As in Mathematics and Applied Mathematics Dept.
M-2515	Numerical Linear Algebra		
M-2526	Approximation Theory and Applications		
M-2622	Introduction to Applied Statistics		
M-297-	Applied Math Theory (Graph Theory)		As in Mathematics and Applied Mathematics Dept.
M-2815	Symbolic Calculation		
PHYS-273	Introduction to Microelectronics		
PHYS-371	Introduction to Semiconductors		
PHYS-374	Electronics		As in Physics Dept.
PHYS-457	Mathematics of Finance I		

E2. Other Sciences Elective Courses

Code	Course Name	ECTS	Prerequisites
BIOL-207	Molecular Biology		
BIOL-205	Genetics I		
BIOL-405	Terrestrial Ecosystem Management		As in Biology Dept.
MAK0-111	Macroeconomic Theory I		
MIK0-101	Microeconomic Theory I		
XPM0-181	Finance I		As in Dept. of Economics
OMT0 132	Econometrics I		
TETY-141	Materials I: Introduction to Materials Science		
TETY-242	Materials III: Microelectronics		
	Optoelectronics Materials		As in Dept of Materials Science and Technology
TETY 302	Optics and Waves		

E3. Networks and Telecommunications

Code	Course Name	ECTS	Prerequisites
CS-330	Introduction to Telecommunication Theory	6	(CS-217, HY-215)
CS-370	Digital Signal Processing	6	CS-215, (CS-111 or MATH-103)
CS-431	Telecommunications Laboratory	6	CS-330
CS-435	Network Technology & Programming Lab	6	CS-335
CS-436	Wireless Networks and Mobile Calculations	6	CS-335
CS-439	Multimedia Technology	6	CS-335
CS-474	Applied Digital Signal Processing	6	CS-215 (CS-370, CS-217)
CS-490.30	Software Defined Networking (SDN)	6	CS-370, CS-225 or CS150

E4 Υλικό (Hardware)

Code	Course Name	ECTS	Prerequisites
CS-220	Digital Circuits Lab	6	CS-120
CS-428	Microprocessors and Peripherals Laboratory	6	CS-225
CS-422	Introduction to VLSI Systems	6	CS-225, (CS-121)
CS-425	Computer Systems Architecture	6	CS-225

E5. Software

Code	Course Name	ECTS	Prerequisites
CS-351	Information System Analysis and Design	6	CS-252 (CS-352, CS-360)
CS-352	Software Engineering	6	CS-252
CS-358	Computer Graphics	6	CS-240
CS-359	Web Programming	6	CS-252
CS-452	Introduction to Science and Technology of Services		
CS-453	Parallel Programming	6	CS-345, (CS-340)
CS-454	Software Engineering of Intelligent,		

CS-455	Mobile and Multimedia Interfaces	6	CS-255 (CS-358)
	Network Attacks and Defence Techniques Laboratory	6	HY-335, CS-345
CS-457	Introduction to Secure Systems	6	CS-150, (CS-345, CS-335)
CS-459	Internet Measurement and Monitoring	6	CS-345
CS-490.40	Type Theory and Static Program Analysis	6	CS-340 (S-180)

E6. Information Systems

Code	Course Name	ECTS	Prerequisites
CS-460	Database Management Systems	6	CS-360
CS-463	Information Retrieval Systems	6	CS-240
CS-464	Human-Computer Interaction	6	CS-240, CS-150
CS-465	Formal Methods for Information Systems	6	CS-180
CS-467	Knowledge Representation and Processing	6	CS-180

E7. Computer Vision and Robotics

Code	Course Name	ECTS	Prerequisites
CS-471	Digital Image Processing	6	CS-215, (CS-217, CS-119)
CS-472	Computer Vision	6	CS-471
CS-473	Pattern Recognition	6	CS-217, CS-119, (CS-215, CS-370)
CS-475	Autonomous Robotic Navigation	6	CS-217, CS-119, (CS-471)
CS-476	Networks of Neural Computations	6	CS-217, CS-119

E8. Algorithms and System Analysis

Code	Course Name	ECTS	Prerequisites
CS-317	Applied Stochastic Processes	6	CS-217
CS-368	System Optimization	6	CS-119
CS-387	Introduction to Artificial Intelligence	6	CS-240, CS-180
CS-383	Complex Network Dynamics	6	CS-118, CS-240
CS-390.50	Introduction in Bioinformatics Programming	6	CS-150
CS-438	Data and Signal Compression	6	CS-217, CS-215 (CS-370)

CS-482	Algorithms in Bioinformatics	6	CS-380, CS-217, CS-119
CS-490.81	Algebraic Algorithm Survey	3	CS-240
CS-490.82	Computational geometry Survey	3	CS-240

E9. Society and Informatics

Code	Course Name	ECTS	Prerequisites
CS-302	Teaching of Computer Science	4	CS-100, CS-120, CS-150
CS-402	Design, Development and Evaluation of Educational Software	6	CS-302, (CS-255)
CS-404	Small Business Management - Entrepreneurship	6	-
CS-405	Technology Economics	6	-
CS-406	Legal Aspects of Information Technology and Telecommunications	6	-
CS-407	Introduction to Entrepreneurship	6	CS-404
CS-490.05	Introduction to E-Business	3	CS-405
CS-490.91	CRM	3	Statistics, DBMS

2. Free Elective Courses

Code	Course Name	ECTS	Prerequisites
CS-202	Technology, Knowledge and Values	6	-
CS-203	Introduction to the Philosophy of Science	6	-
CS-EP-20	Scientist Citizen	4	-



Model Programme of Studies

The courses of the Computer Science Department are designated with the letters "CS" followed by three digits. The first digit denotes the year of study during which students are expected to enrol in the course. The second digit denotes the area of specialization in which the course belongs.

First Digit

1,2,3,4
5,6
7,8,9

Advised Year of Enrolment

first, second, third, fourth
Graduate courses
Special topics

Second Digit

0
1
2
3
4,5
6
7
8
9

Scientific Area

Introductory – General
Background (Maths – Physics)
Hardware Systems
Networks and Telecommunications
Software Systems
Information Systems
Computer Vision and Robotics
Algorithms and Theory of Computation
Special projects

1st semester

		ECTS
CS-100	Introduction to Computer Science	8
CS-120	Digital Design	8
CS-112	Physics I	8
CS-110	Calculus I	8
CS-108	English I	4
	ECTS Total:	36

2nd semester

		ECTS
CS-119	Linear Algebra	6
CS-150	Programming	8
CS-118	Discrete Mathematics	6
CS-111	Calculus II	6
CS-109	English II	4
ECTS Total:		30

3rd semester

		ECTS
CS-217	Probability Theory	6
CS-240	Data Structures	8
CS-252	Object-oriented Programming	8
CS-280	Theory of Computation	6
CS-208	English III	4
ECTS Total:		32

4th semester

		ECTS
CS-180	Logic	6
CS-215	Applied Mathematics for Engineers	8
CS-225	Computer Organisation	8
CS-255	Software Technology Laboratory	6
CS-209	English IV	4
ECTS Total:		32

5th semester

		ECTS
CS-345	Operating Systems	8
CS-335	Computer Networks	6
CS-360	Files and Databases	8
CS-3..	Elective Course	6
ECTS Total:		28

6th semester

		ECTS
CS-340	Languages and Compilers	8
CS-380	Algorithms and Complexity Theory	8
CS-3...	Elective Course	6
CS-3...	Elective Course	6
CS-3..	Elective Course	6
ECTS Total:		34

7th semester

		ECTS
(E3-E9)	Elective Courses	24
CS-499.1	Bachelor's Thesis	9
ECTS Total:		33

8th semester

		ECTS
(E3-E9)	Elective Courses	18
CS-499.2	Bachelor's Thesis	9
ECTS Total:		27

Bachelor's Thesis Requirement

The bachelor's thesis (CS-499 - BThesis) is the cornerstone of the undergraduate studies program in the Computer Science Department, and emphasizes the strong project-oriented and applied nature of the Department. The purpose of the BThesis is to have the students of the Department apply the knowledge which they have gained throughout their studies to solving some specific, practical and realistic problem like the ones they will face during their professional careers.

The BThesis can be only initiated after the fifth semester of the studies. The duration of a BThesis can be either one or two consecutive semesters. The BThesis is defined to carry a workload of eighteen (18) ECTS, making it account for approximately half of the semester workload, or roughly two and one half courses. Each BThesis is carried out by only one student, except in special cases where a large project can serve as the BThesis for a group of two students. Also, the student is given the option to choose as the subject of a BThesis an extension of an advanced course project.

The subject of a BThesis may not be innovative. The supervisor of a BThesis can be a member of the Department faculty or a visiting professor who actually offers one or more BThesis topics and finally selects the students to be involved from the list of those who expressed interest. This selection process must be completed within the first six weeks of every semester. Then, during the seventh week, the students just starting their BThesis should also register with the special course code CS-499. After completion, the BThesis is examined by the supervisor and is either accepted or rejected. Once accepted, it is assessed and given a grade that is inserted in the student record.

Practical Training

Undergraduate students in the Computer Science Department may spend three to six months working full-time in a Greek or international organisation, public or private, for the purpose of acquiring work experience in areas related to information technology. The work is carried out under the supervision of a faculty member or a visiting professor and a corresponding supervisor in the cooperating organisation. This training period counts toward the graduation requirements as an elective course and is given either the code 499-3 (3-month period and 6 ECTS) or code 499-6 (6-month period and 12 ECTS). Students are eligible for practical training once they successfully complete 135 ECTS in core courses. Preferably, practical training should be conducted full-time during the summer period, which lasts from June 1st to September 30th. In case the practical training is undertaken on a part-time basis, with a simultaneous registration in semester courses, the limit for course credits per semester is 30 ECTS, including the ECTS of the practical training itself.

Fellowships

- **Fellowships "Stelios Orphanoudakis".**

The Institute of Computer Science of the Foundation for Research and Technology (FORTH - ICS), starting from the academic year 2007-2008 has established distinguished scholarships to undergraduate students of Computer Science Department of the University of Crete. The latter are awarded in memory of Stelios Orphanoudakis, Professor in the Department of Computer Science, University of Crete, Director of the Institute of Computer Science in the period 1994-2004, and Chairman of FORTH from 2004 until his death in March 2005.

- **Fellowship "Chrysanthos and Anastasia Karidis"**

awarded by the Endowment "Chrysanthou and Anastasia Karidis" managed by the University of Crete Property Development and Management Company given to the best student of the Department under the national exams.

- **"State Scholarships Foundation" Fellowships:**

Given to the best Department students (one from each year of studies) and in accordance with the current regulations for scholarships.

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