

UNIVERSITY OF CRETE



Department of Materials Science and Technology

Faculty of Sciences and Engineering

Study Guide



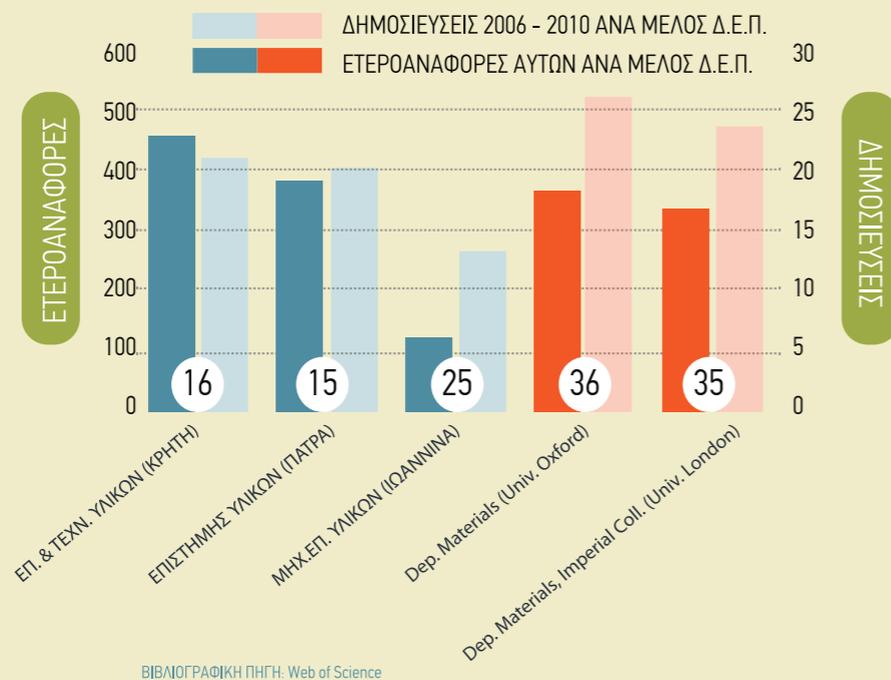
Organization of the Department

Establishment of the Department

The Department of Materials Science & Technology (MST) was established in 1999 and started its undergraduate programme in the academic year 2001-2002, when it accepted its first 50 students. Its master's degree program started in the academic year 2003-2004. The Department is located at the University Campus at Bassilika Vouton, and

has a close connection with the adjacent Foundation for Research and Technology, Hellas, where its students can carry out research projects and theses.

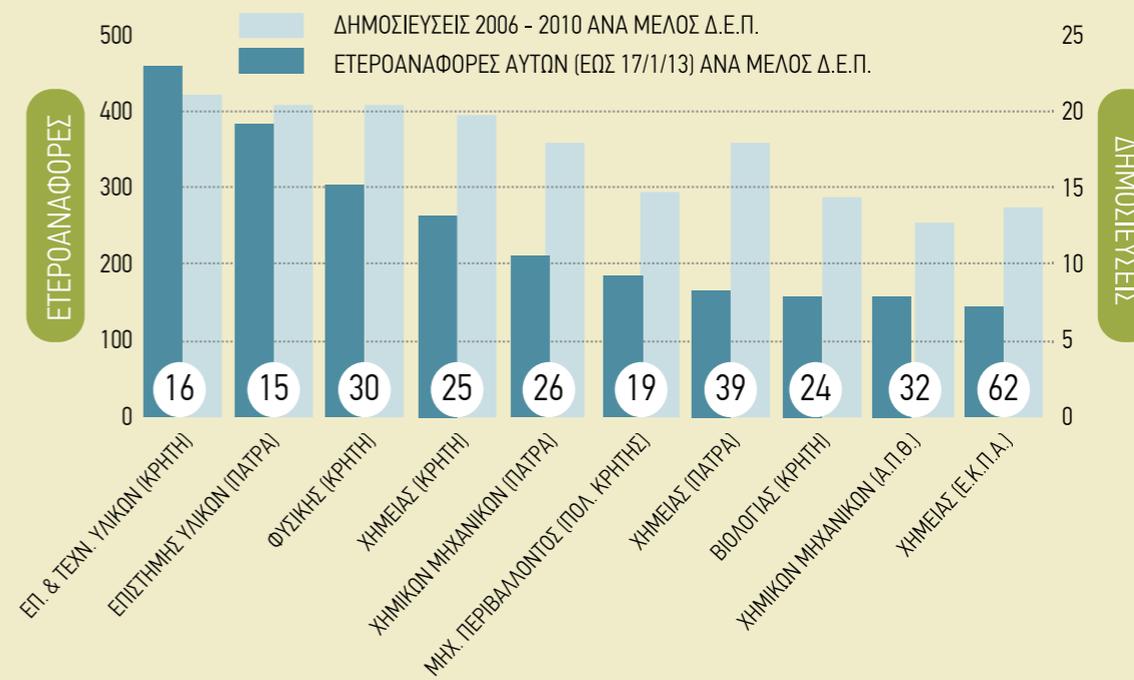
The aim of the MST Department is to constitute a modern, innovative and dynamic center of excellence in an area that meets the needs of modern industry and economy. It also aims to participate in the current and future scientific and technological developments in the continuously and rapidly grown area of Materials Science.



The research activities of the Department focus on the development of new materials by understanding the composition-structure- processing-properties relationship of a material. To enforce and empower its research activities the Department, soon after its establishment, developed a well-organized graduate programme in the field of Materials Science and Technology. The graduate program leads to both Master's and PhD Degrees and its development and structure was based on the corresponding programs of other, previously established, Departments of the University of Crete, as well as Materials Sci-

ence and Engineering international Departments worldwide.

Despite, its young age, the MST Department, has received already several distinctions, such as the highest number of papers and citations per member of faculty for the period 2006-2010 compared to the other Materials Science Departments in Greece (Figure 1), but also other well-known Departments in Greece (Figure 2); this classification was concluded in a recent research/survey on the scientific output of Greek universities, and the data were obtained from the most authoritative international scientific data-base (Thomson Reuters ISI Web of Science) (<http://www.materials.uoc.gr/el/general/awards.html>).



Administration of the Department

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Structure and operation

To The scientific field of the MST Department is the Science and Technology of Materials. Materials Science focuses on understanding the correlation between the composition, structure and properties of materials, whereas materials technology comprises the specialized design, synthesis, characterization and processing of the materials in order to fulfill specific needs of the society. Scientists in the MST field design, synthesize, characterize and develop a wide variety of materials appropriate for use in most of today's technological advances, from mechanical constructions and machinery, to consumer products, advanced electronics, new types of drugs, biotechnology, etc.

The Science and Technology of Materials requires both an understanding of the basic science of the materials' building blocks (atoms, molecules, etc.) and the technology of their application; therefore, it is a very broad and interdisciplinary field. Scientists working globally on the science, engineering and technology of materials should have a good knowledge of Physics, Chemistry, Biology, and Engineering.

The research in the MST Department focuses on the following fields (with the corresponding Labs):

- Biomaterials
- Polymers and Colloids
- Theoretical and Computational Materials Science
- Magnetic Materials
- Optoelectronic and Photonic Materials
- Chemistry of Materials

Faculty members of the Department Professors

Dimitrios Vlassopoulos:

He received his PhD in Chemical Engineering from Princeton University (1990). He has industrial experience (Metelco, Greece, 1983-4 and Mobil R&D, 1990-2). He is researcher in FORTH since 1992 and faculty at the University of Crete since 2002. His research focuses on molecular rheology and dynamics of complex fluids (polymers, colloids, interfaces).

Anna Mitraki:

She obtained her PhD in 1986, from the Universiti Paris-Sud, Orsay, France. She has worked as post-doctoral researcher and then Research Scientist at the Massachusetts Institute of Technology, Cambridge, MA, U.S.A, and subsequently as Research Scientist at the Institut de Biologie Structurale in Grenoble, France (French National Research Center). She joined the Materials Science and Technology Department in 2004. She is also affiliated with the Institute of Electronic Structure and Laser (IESL) of FORTH. Her work is focused on the proteins as biomaterials; engineering and design of fibrous biomaterials; self-assembling peptides; protein folding and assembly; protein engineering and production.

Nikolaos Pelekanos:

He obtained his Ph.D in 1991 from Brown University, USA. After a number of post-doctoral stays in various European laboratories, including the France Telecom, research center in Lannion and the Max-Planck Institute in Stuttgart, he joined the Semiconductor Physics Laboratory of CEA-Grenoble (1995–2001). He joined the Microelectronics Research group at FORTH in 2001, and the

Associate Professors

Materials Science and Technology Department of the University of Crete in 2003. His research is on novel optoelectronic devices (e.g. polariton lasers), physics and applications of piezoelectric semiconductor quantum dots and solar cells based on semiconductor nanostructures.

Konstantinos Tokatlidis:

He received his PhD in 1993 from the Department of Chemical Engineering at the University of Delaware, USA . He worked as a postdoctoral researcher at the Institute Pasteur in Paris and the Biozentrum, University of Basel, Switzerland. Before joining the Department of Materials Science and Technology of the University of Crete he was faculty member at the University of Manchester, UK , and in the Department of Chemistry, University of Crete . His research focuses on cellular biochemistry, protein folding, sorting and assembly or protein molecular machines and the biogenesis of mitochondria. He is the head of the Mitochondria Biology Laboratory at IMBB – FORTH.

Georgios Fytas:

He obtained his Ph.D. in 1975, from the Chem. Engineering Department of Technical University of Hannover, Germany. He has worked as post-doctoral researcher in the Department of Chemistry SUNY at Stony Brook USA and received his Habilitation in 1984 from University of Bielefeld, Germany. He is external member of Max Planck Society, and associated researcher of FORTH. His mission is the basic understanding and prediction of the behavior and tunability of unconventional physical properties of structured soft materials with spatiotemporal complexity.

Maria Vamvakaki:

She holds a PhD in Polymer Chemistry from the University of Sussex, UK. She has worked as a post-doctoral fellow in the department of Chemistry, Physics and Environmental Science of the University of Sussex and in the Department of Chemistry of the University of Cyprus, and as a Visiting Professor in the Department of Natural Sciences of the University of Cyprus and the Department of Materials Science and Technology of the University of Crete. In 2004 she joined as the faculty member the Department of Materials Science and Technology of the University of Crete and became an affiliated researcher in IESL-FORTH. Her research interests include the synthesis of functional and stimuli-responsive polymeric materials and their self-assembly in solution and at a surface.

Maria Kafesaki:

She obtained her Ph.D. in 1997, from the Physics Department of the University of Crete, Greece. She has worked as post-doctoral researcher in the Consejo Superior de Investigaciones Cientificas (CSIC) in Madrid, Spain, and at the Institute of Electronic Structure and Laser (IESL) of the Foundation for Research and Technology Hellas (FORTH), as well as Researcher at FORTH-IESL. Her research is on the area of electromagnetic and elastic wave propagation in periodic and random media, with emphasis on photonic crystals and metamaterials.

Georgios Kiioseoglou:

He obtained his Ph.D in experimental solid state physics from the State University of New York at Buffalo in 1999. He has worked as a post-doctoral

researcher at Brookhaven National Lab (1999-2001) and at the Naval Research Laboratory (NRL)/George Washington University. In 2007 he was appointed at the Department of Materials Science and Technology of the University of Crete. His research interests are in the physics and applications of semiconductor nanostructures, semiconductor spintronics and optical properties of two dimensional materials.

Georgios Kopidakis:

He obtained his Ph.D. in Condensed Matter Physics from Iowa State University in 1995. He has worked at the Technical University of Denmark (DTU) as a research assistant professor, at Laboratoire Leon Brillouin (CEA-CNRS), Saclay, France, initially with an individual Marie Curie EC post-doctoral fellowship and later as a CNRS research associate, and at the Physics Dept., University of Crete, as a research associate. His research focuses on atomistic simulations with quantum and classical models for the structural, vibrational, mechanical, electronic, optical properties of amorphous and nanostructured materials, fundamentals and applications of localization and transfer of nonlinear excitations.

Andreas Lyberatos:

He received his PhD in 1986 from Imperial College of the University of London. He worked as post-doctoral researcher at the Universities of Central Lancashire, Manchester and Keele (1989-96) and as visiting Lecturer at the University of Crete. He has industrial experience as Research Consultant at Seagate Technology (2000-9), Hitachi Global Storage Technologies (2011-3) and HGST a Western Digital Co. (2013-). In 2014 he was appointed at the Department of Materials Science and Technology of the University of Crete. His research focuses

on theoretical modeling of magnetic materials with application in magnetic and thermomagnetic recording with emphasis on the use of simulations and optimization methods for the study of static and dynamic properties.

Georgios Petekidis:

He received his PhD in Polymer Physics from the Physics Department of University of Crete (1997). He has worked as post-doc at the Department of Physics and Astronomy of the University of Edinburgh and at IESL-FORTH, and as researcher at IESL-FORTH. In 2006 he joined the Department of Materials Science and Technology of University of Crete. He is also associated researcher at IESL-FORTH. His research interests are in the field of Experimental Soft Matter currently focus in the Dynamics and Rheology of colloidal systems.

Pavlos Savvidis:

He obtained his PhD from the University of Southampton, UK in 2001. He has worked as postdoctoral researcher at the Univ. of California, Santa Barbara. Since 2004 he is in the Department of Materials Science and Technology of the University of Crete and holds associated researcher position at the Institute of Electronic Structure and Laser (IESL) of FORTH. His research is in the development of polariton based devices, such as polariton LED and transistor.

Stylianos Tzortzakis:

He received his PhD from the Ecole Polytechnique (France, 2001) in Nonlinear Optics. In 2003 he was elected in a permanent CNRS position at the Ecole Polytechnique. In 2006 he founded and leads since then the UNIS research group at IESL-FORTH in Greece, where he has been a Principal Researcher. His research experience and expertise is around



the topics of: Nonlinear interactions of intense femtosecond laser pulses with matter – Nonlinear laser propagation phenomena – Ultrafast spectroscopy – Hot/warm and dense plasma physics – Photonic structuring in transparent solid materials– Dynamical Metamaterials and Photonic lattices – Strong field THz science.

Nikolaos Chronis:

He obtained his Ph.D. in 2004 from the department of Mechanical Engineering at the University of California at Berkeley, USA. He worked as a post-doctoral researcher at Cornelia's Bargmann lab at Rockefeller University (New York, USA). In 2006, he joined the department of Mechanical Engineering at the University of Michigan (Ann Arbor, USA) as an Assistant Professor and in 2012, he was appointed Associate Professor. His research interests include the design and fabrication of Bio-MicroElectroMechanical Systems (Bio-MEMS), implantable micro-sensors and microfluidics devices. roMechanical Systems (Bio-MEMS), implantable microsensors and microfluidics devices.

Assistant Professors

Gerasimos Armatas:

He obtained his Ph.D. in Chemistry in 2003 from the Chemistry Department of the University of Ioannina, Greece. He has worked as post-doctoral researcher at the Chemistry Department of Michigan State University (MSU), MI, USA and at the Chemistry Department of Northwestern University (NU), IL, USA. In 2008 he was appointed at the Materials Science and Technology Department of the University of Crete. His research activities are focused on the design and synthesis of nanostruc-

tured mesoporous materials for specific applications, especially in the field of (photo-)catalysis, adsorption and gas separation.

Kalliopi Velonia:

She obtained her Ph.D. in 1999, from the Chemistry Department of the University of Crete, Greece. She has worked as post-doctoral researcher in the University of Nijmegen (RUN), The Netherlands and the University of Leuven (KUL), Belgium. In 2004 she joined the Department of Organic Chemistry of the University of Geneva, Switzerland, as an Assistant Professor. In 2007 she was appointed Assistant Professor at the Department of Materials Science, University of Crete. Her research focuses on the synthesis and characterization of multi-functional protein-polymer hybrids, the study of directed self-assembly and biotechnological applications of biomaterials and in cascade and single enzyme (bio)catalysis.

Dimitrios Papazoglou:

He received his PhD in 1998 from the Physics Department of the Aristotle University of Thessaloniki, Greece. He has worked as a postdoc and later as a researcher in the laser applications group in IESL-FORTH. In 2005, he joined the faculty of the Department of Materials Science and Technology of the University of Crete. He is also an affiliated researcher at IESL-FORTH. His research is in the area of optics with emphasis on non-linear optics, ultrafast laser matter interaction phenomena, and wavefront sensing and manipulation.

Ioannis Remediakis:

He obtained his PhD in 2002 from the Physics Department of the University of Crete, Greece. He has worked at Harvard University, Danmarks

Tekniske Universitet (DTU) and the University of Ioannina. His research focuses on atomistic models for nanomaterials and complex processes, with emphasis on superhard materials, low-dimensional nanostructures and catalysis.

Maria Chatzinikolaidou:

She received her PhD from the Dept. of Chemistry of the University of Duisburg-Essen in Germany in 2004. She has worked as post-doctoral fellow at the University Medical School of Essen for MorphoPlant GmbH in Bochum in Germany, and at Institute of Molecular Biology and Biotechnology (IMBB), FORTH. From 2007 to 2010 she was a Visiting Assistant Professor and in 2010 she was appointed as faculty member at the Department of Materials Science and Technology, University of Crete. Her research activities focus on the development of novel biomaterials for tissue engineering applications.

Pending:

Vassilios Koutsos

Professor of English language:

Kalliopi Katsaboxaki-Hodgetts:

Teaching Staff of the Faculty of Sciences and Engineering, University of Crete (UoC).

Laboratory and Teaching Personnel

Emmanouil Spanakis

Technical Support

Stamatis Stamatiadis
Emmanouil Tyllianakis



Participation in Erasmus programme

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Detailed and updated information about the Erasmus program can be found at the web-site http://www.uoc.gr/intrel/cat_1_2_1.htm

Participating Institutions:

The institutions which students have the possibility to visit in the framework of the Erasmus program are listed in the web-site http://www.uoc.gr/intrel/cat_1_1_12.htm. These Institutions for the academic year 2012-2013 are listed in the following Table (Table I).



Table I

COUNTRY	FOUNDATION	WEBSITE
CYPRUS	University Of Cyprus	http://www.ucy.ac.cy/
CYPRUS	Cyprus University Of Technology	http://www.cut.ac.cy/
FRANCE	Universiti Paris-Sud (Paris XI)	http://www.u-psud.fr/
FRANCE	Universiti Montpellier II	http://www.univ-montp2.fr/
UNITED KINGDOM	University of Sheffield	http://www.shef.ac.uk/
UNITED KINGDOM	University of Southampton	http://www.southampton.ac.uk/
UNITED KINGDOM	University of Warwick	http://www2.warwick.ac.uk/
PORTUGAL	Universidade do Minho	http://www.uminho.pt/
TURKEY	Eskisehir Osmangazi Universitesi	http://www.ogu.edu.tr/

Criteria to participate to the Erasmus project

The criteria to be met by the students of the MST for participation in the Erasmus programme are the following

1. Registered in the 3rd or higher year of their studies.
2. Significant progress in their studies, having succeeded in most of the core courses, in order to be able to fulfill the requirements of the host University.
3. Have a Progress index in the top 20% of the students of their year.

Procedures for enrollment in the Department of Materials Science and Technology (MST)

The enrollment in the Department of Materials Science & Technology of the University of Crete follows the rules set by the Ministry of Education and Religious Affairs which determine the enrollment of the students in the higher education institutions in Greece, or by qualifying exams.

Course recognition

Students enrolled in the Department following any of the above procedures who have already attended and succeeded in courses in other Universities in Greece or abroad, can recognize these courses as following:

1) Για For courses of the curriculum of the Department of Materials Science and Technology of the University of Crete:

- A course from other Universities or from other Departments of the University of Crete is recognized only when the syllabus of the course matches that of the corresponding course of the MST Department. The matching is examined by the Undergraduate Studies Committee. The recognized course receives the ECTS credits of the corresponding course of the MST Department. If the student has passed the course in a Greek University with a specific grade, the same grade is assigned in the MST Department. If the student has passed the course in a University abroad, the grade is adapted to the Greek grading scale.

- A course that a student has attended in the framework of a recognized inter-university coop-



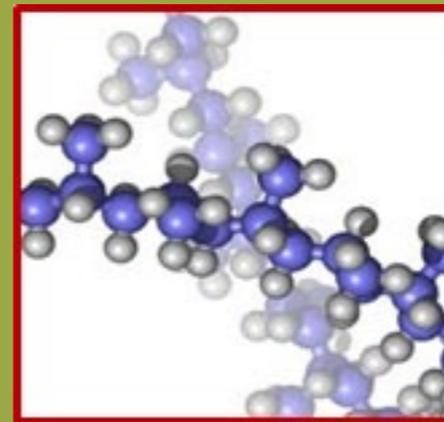
eration program (e.g. ERASMUS) during his/her studies in the University of Crete will be recognized as a regular course and it will get the ECTS credits assigned to it by the MST Department. However, if the Undergraduate Studies Committee finds a significant overlap of the curriculum of the course with another course of the University of Crete which has already been recognized to the student, the ECTS credits for the new course will not be assigned.

- If there is no full match of the syllabus of the course to be recognized with a corresponding MST course, discussion of the student with the course instructor from the MST Department will determine whether the course will be recognized or not, i.e. the instructor will assess if the student has the required knowledge on the course material. This can be done by any method of student assessment. For a course passed during the Erasmus program the grade is decided by the Studies Committee, based on the student's performance.

2) For students enrolled to other Departments of the School of Science and Engineering of the University of Crete prior to their enrollment in the MST Department a certificate from the respective Department of the University certifying the equivalence of the courses to courses of the MST

Department is provided to the Undergraduate Studies Committee which decides the courses to be recognized.. Courses from Departments of the University of Crete in Rethymnon are recognized also requiring the certificate above.

The transactions' minutes of the course recognition are signed by the members of the Undergraduate Studies Committee and by the Head of the Department. In unclear or questionable cases that are not covered by the above general principles, the decision is taken by the Undergraduate Studies Committee after discussion with the Head of the Department.



Objectives of the Department

Teaching and research objectives

The goal of MST Department is to provide education and produce new knowledge in a rapidly grown cutting-edge and highly interdisciplinary research area. The Undergraduate Programme (UGP) is designed so that the students acquire essential theoretical and practical training in this interdisciplinary field and skills required to adapt to a diverse and rapidly changing work environment. The UGP is divided into three phases: introductory, basic and advanced. In the introductory stage the student attends introductory courses in Physics, Chemistry, Mathematics and Computer Science. Besides the basic and general knowledge that these courses provide, they also ensure that the student will have the necessary background knowledge to continue to the next stage. In addition, at this stage the student is introduced to the basic concepts of Materials Science and becomes familiar with the English language terminology used in Materials Science. In the next basic stage of his/her studies, the student becomes aware of the various types of materials, and deepens his/her knowledge in areas of the basic sciences (Physics, Chemistry, Mathematics) which are crucial in the science and technology of materials (courses at this stage range from Solid-State Physics to Differential Equations, Polymer Physics, etc.) and also follows basic courses in Biology. With the completion of this phase the student has gained the skills to understand more advanced topics in all areas of Materials Science and Engineering. In the advanced stage the student has the opportunity to specialize in different sub-fields of the Department and to select courses related to specific types of materials and processes (see

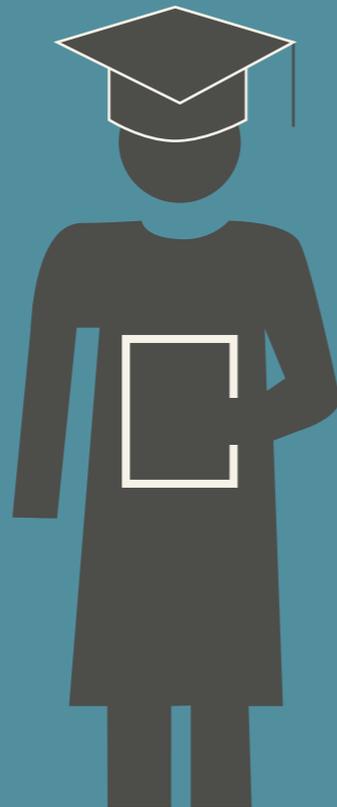
previous sections), depending on his/her interests and professional goals; at this stage the student can also work on a research project during his/her diploma thesis (optional).

Graduates of the MST department are well equipped with the knowledge and expertise they need to successfully meet the demands of the market, which, for Materials Scientists, cover a wide range of possibilities, including various branches of market, research and education. This broad range of possibilities is due to the interdisciplinary nature of their scientific education, the deepening in basic sciences, Physics, Chemistry, Mathematics and Biology, the acquisition of key analytical, mathematical and computational skills and the knowledge on all types of conventional and advanced materials.

A key component of the UGP of the MST Department is the laboratory courses, which have a central role in the department education. The MST Department is a predominately experimental Department, offering many opportunities to its students to become familiar with modern experimental techniques used in the investigation of the composition, the structure and the properties of materials, but also in materials synthesis. The organization and operation of the undergraduate laboratories, as well as their equipment, are of very high standards and in some cases have specifications similar to modern research laboratories. All undergraduate students of the MST Department are obliged to attend a series of laboratory courses: General Chemistry lab course, Physics I: Mechanics-Heat and Physics II: Electricity-Optics lab courses, Chemistry of Materials lab course, and two intensive laboratory courses on Hard and Soft Materials. There are also optional laboratory courses, such as Control and Automation of Systems through the Computer. Moreover, the students attend core courses that include intensive

computer use and training in programming and in solving mathematical and physical problems using a computer. For those who are more interested in modeling and calculation of the structure and properties of materials there are elective laboratory courses on Computational Material Science and Electronic Structure Calculations.

The MST undergraduates are trained mainly in one or more of the material types mentioned earlier (biomaterials, polymers-colloids, optoelectronic-photonic materials, magnetic materials). For each of these types there is a large number of small and large industries or enterprises. In such companies, materials scientists and engineers can be engaged in the production and testing of materials, or in the modification of conventional materials to achieve improved/desired properties and reduced cost.



Professional goals

Materials Science is a field with a very wide range of applications and, therefore, one can mention a series of companies/enterprises that can employ scientists with Bachelor's degree from a Materials Science and Technology Department. Such companies are those specializing, e.g., with metals (steel, aluminum), ceramics (tiles, insulation), glasses (optical fibers), polymers (plastics), electronic and optoelectronic materials (Microelectronics, Optoelectronics, batteries, cables, solar-cells, magnetic materials etc.), colloids (colors, chemicals), as well as with biomaterials and biocompatible materials (materials with applications in tissue engineering, implant, dental, prosthetic orthopedic, etc.).

The professional rights of the graduates of the MST Department, as foreseen by the presidential decree establishing the Department, were consolidated by the Presidential Decree 45/2009. According to that Presidential Decree:

The graduates of the Department of Materials Science and Technology of the Faculty of Sciences and Engineering of the University of Crete can be employed or self-employed to work on (indicatively):

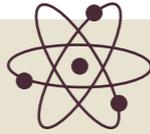
1 research and development, production, standardization, quality control, certification and marketing of materials such as: (a) ceramics, polymers, glasses, metals, liquid-crystal materials, hybrid materials, construction materials, "smart" materials, (b) semiconductor materials, superconducting materials, magnetic materials, nanomaterials and nanostructures, optoelectronic materials, photonic materials, polymeric and more generally molecular materials used in electronics, optoelectronics and telecommunications, (c) biomaterials, biocompatible materials, materials of biological applications and other materials with applications in pharmaceuticals, dentistry and medicine. The above activities are considered both in laboratory and industrial scale and include synthesis, processing, characterization, modeling and simulation of materials,

2 in public and private organizations, energy production and telecommunications, and whenever the research and development of new advanced materials is essential for the progress of any activity of production and distribution of energy and telecommunications,

3 as scientists in organizations and services of the public sector and local government or private laboratories that have responsibility for official control/examination/testing/design and development of materials,



4



as scientists in organizations and services of the public sector and local government or private laboratories that undertake studies for the installation, inspection and certification of quality assurance systems and material accreditation laboratories,

6



as researchers on Materials Science in Universities, Technological Educational Institutes (TEI), research centers, research institutes, and enterprise research establishments and sections

5

as teachers in secondary education in private schools, public and private vocational training institutes (IEK) and vocational training centers (KEK), and other secondary and post-secondary education centers, to teach courses in Materials Science and Technology, but also other courses relevant to Materials Science,



7

as experts drafting technical reports and opinions in materials science.



Access to further studies

Graduates of the Department have access to postgraduate studies for obtaining a Master Degree or a PhD, following the conditions set by the host Department.



Undergraduate studies programme and regulations

Summary and central directions of the curriculum / Courses provided

The basic program of studies of the Department of Materials Science and Technology consists of core courses, which are mandatory (they are marked below with C), of core-elective courses of type 1 and 2 (marked as CE1, CE2, respectively), from which the student is obligated to choose from certain groups of courses, and elective courses (marked as E). The three phases of the UGP are as follows:

• Introductory stage:

In the first three semesters the student attends basic introductory courses in Physics, Chemistry, Mathematics, Materials Science and Computer Science. The understanding of these subjects will provide the student with the basic background knowledge, essential for the continuation his/her studies. At this stage the student becomes

also familiar with the English language, and more specifically with the terminology used in Materials Science.

• Basic stage:

The next three semesters the student attends introductory courses in Biology, acquires laboratory experience, deepens his/her knowledge in subjects of other disciplines that are essential in Materials Science and Technology, such as Thermodynamics (classical and statistical), Solid-State Physics and Electromagnetism, and is also introduced in basic types of materials such as Polymers-Colloids, Electronic and Photonic Materials, Biomaterials, Ceramics and Magnetic Materials, etc.

• Advanced stage:

The third stage enables the student to further specialize in one or more types of materials and to attend a number of elective courses offered by the Department or by other Departments of the University of Crete. The selection of these courses depends on the student's choice:
(a) to specialize in a certain area of Materials Science, with aim to pursue postgraduate studies or an occupation in a specific technological direction of modern engineering,
(b) to achieve a broader education in Natural Sciences and thus expand his/her professional

prospects.

The weight of each course is reflected in credits of the European Credit Transfer System (ECTS). The workload of a student per semester is the sum of ECTS credits of the courses in which he/she has been registered in the semester. The maximum allowed number of courses per semester is 8 (with the exception of the internship (Practice)).

The students of the Department of Materials Science and Technology can focus during their undergraduate studies in one of the following areas:

- Biomaterials
- Polymers-Colloids
- Electronic-Optoelectronic-Photonic Materials
- Magnetic Materials
- Ceramic Materials
- Nano-Structured Materials that can combine the above types
- Theoretical and Computational Materials Science



The following table (Table II) provides a list of the courses of the curriculum and their individual characteristics.

Table II:

Courses offered by the Department, their characteristics and their proposed distribution per semester
 Explanation of symbols: Th: hours of theory, E: hours of exercises, L: laboratory course hours, C: core course, CE1, CE2: core-elective course of type 1 or 2, respectively, E: elective course
 The numbers in parentheses next to the core courses rank them according to a suggested priority that the students should give to them; this ranking can be used in the future for automatic registering in courses. (The odd numbers rank the winter semester courses and the even ones the spring semester courses).

Course Code	1st Semester	Hours			ECTS	Prerequisites
		(Th)	(E)	(L)		
101	General Physics I	4	2	0	C 6	-
121	General Chemistry	4	2	0	C 6	-
141	Materials I: Introduction to Materials Science	3	1	0	C 6	-
111	General Mathematics I	4	2	0	C 6	-
114	Computers I: Introduction to programming	3	0	3	C 6	-
011	English I	3	0	0	C 4	-
Course Code	2st Semester	Hours			ECTS	Prerequisites
		(Th)	(E)	(L)		
102	General Physics II	4	2	0	C 6	-
122	Organic Chemistry	4	2	0	C 6	-
124	Chemistry labor. course (6)	2	0	4	C 8	121
112	General Mathematics II	4	2	0	C 6	-
116	Applied Mathematics	3	2	0	C 6	-
012	English II	3	0	0	C 4	011
Course Code	3st Semester	Hours			ECTS	Prerequisites
		(Th)	(E)	(L)		
203	Physics Laboratory I: Mechanics-Heat	0	0	3	C 8	101
225	Laboratory course: Materials Chemistry	2	0	4	C 8	124
223	Inorganic Chemistry	4	1	0	C 6	121
201	Modern Physics I – Introduction to Quantum Mechanics	3	2	0	C 6	-
211	Differential Equations I	3	2	0	C 6	112, 111
260	Thermodynamics	3	1	0	C 6	112

Course Code	4st Semester	Hours			ECTS	Prerequisites
		(Th)	(E)	(L)		
204	Physics Laboratory II: Electricity-Optics	0	0	3	C 8	102
243	Materials II: Polymers-Colloids	4	0	0	C 6	-
242	Materials III: Microelectronic and optoelectronic materials	4	0	0	C 6	-
232	Biochemistry & Molecular Biology	3	0	0	C 6	122
212	Differential Equations II	3	1	0	CE1 6	211
213	Computers II: Introduction to Numerical Analysis	2	0	3	CE1 6	114, 116
215	Advanced Programming I C++	0	0	3	E 5	114
PAE-016	Didactics of Materials Science I	-	-	-	E 3	-

Course Code	5st Semester	Hours			ECTS	Prerequisites
		(Th)	(E)	(L)		
343	Laboratory Course: Soft Materials	1	0	5	C 8	243
305	Solid-State Physics: An Introduction	3	2	0	C 6	201
301	Electromagnetism	3	2	0	C 6	102, 112
335	Molecular Cell Biology	3	0	0	C 6	122
391	Materials IV: Science of Natural Biomaterials	3	0	0	C 6	122
202	Modern Physics II: Matter and Light	3	1	0	CE1 6	201, 116
PAE-017	Didactics of Materials Science II	-	-	-	E 3	-
PAE-001	Practice I	-	-	-	E 5	-

Course Code	6st Semester	Hours			ECTS	Prerequisites
		(Th)	(E)	(L)		
344	Laboratory course: Solid Materials	1	0	5	C 8	204
362	Materials V: Ceramic and Magnetic materials	3	0	0	C 6	201
302	Optics & Waves	3	0	0	E 5	102, 112
306	Solid State Physics II:					

	Electronic and magnetic properties of materials	3	0	0	E 5	201
340	Transport phenomena in Materials Science	3	0	0	E 5	211
346	Nanomaterials Surface Science	3	0	0	E 5	141
PAE-018	Didactics of Materials Science III	-	-	-	E 3	-
PRAC-002	Practice II	-	-	-	E 5	-

Course Code	7st Semester	Hours			ECTS	Prerequisites
		(Th)	(E)	(L)		
447	Computational Materials Science	2	0	3	CE2 6	114
461	Elements of Ceramics Science	3	0	0	CE2 6	-
481	Elements of Semiconductor Physics	3	0	0	CE2 6	242
483	Elements of Magnetic Materials	3	0	0	CE2 6	362
491	Biological Materials and Synthetic Biomaterials	3	0	0	CE2 6	232
443	Laboratory course: Nanomaterials & Biomaterials	0	0	5	E 6	343
500	Symmetry in Materials Science	3	0	0	E 5	116, 305
401	Diploma Thesis I	-	-	-	E 6	-

Course Code	8st Semester	Hours			ECTS	Prerequisites
		(Th)	(E)	(L)		
410	Laboratory Course: Control and Automation of Systems Through the Computer	2	0	2	E 5	114
440	Laboratory Course: Mechanical Drawing	2	0	2	E 5	-
442	Diploma Thesis II	-	-	-	E 6	401
445	Fluid Dynamics	3	0	0	E 5	211
446	Electron Microscopy	3	0	0	E 5	-
448	Special topics in Computational Materials Science	2	0	3	E 5	-
450	Polymer Physics	3	0	0	CE2 6	243
452	Polymer Synthesis	3	0	0	E 5	243

Course Code	8st Semester	Hours			ECTS		Prerequisites
454	Rheology and Polymer Processing Methods	3	0	0	E	5	211
462	Ceramic Materials and Propert.	3	0	0	E	5	362
464	Special Topics in Ceramic Materials	3	0	0	E	5	362
470	Synthesis & Characterization of Colloidal Dispersions	3	0	0	E	5	243
471	Elements of Colloidal Dispersions	3	0	0	CE2	6	243
472	Physical Chemistry of Colloidal Systems	3	0	0	E	5	
480	Heterostructures, Nanostructures & Nanotechnology of Semiconductors	3	0	0	E	5	242
482	Introduction to Microelectronics	3	0	0	E	5	242
484	Optoelectronic and Photonic Materials	3	0	0	E	5	242
486	Semiconductor Processing Technology	3	0	0	E	5	242
488	Special Topics in Magnetic Materials	3	0	0	E	5	362
490	Photonic Materials	3	0	0	E	5	-
492	Cell Biology	3	0	0	E	5	232, 335
494	Introduction to Biomedical Engineering	3	0	0	E	5	232 ή 335 (ένα από τα δύο)
512	Computational Materials Science II: Electronic Structure Laboratory	2	0	3	E	5	305, και ένα από τα EY1
570	Special Topics in Soft Materials	3	0	0	E	5	243
580	Optoelectronics & Lasers	3	0	0	E	5	242
582	Special Topics in Optoelectronic Materials	3	0	0	E	5	242
584	Spintronics	3	0	0	E	5	362
590	Special Topics in Bio-Engineering	3	0	0	E	5	-

594	Protein Motion and Molecular Machines	3	1	0	E	5	335
596	Molecular Imaging	3	0	0	E	5	-
598	Bio-Organic Nanostructures	3	0	0	E	5	121, 122, 012
911	Publication I	-	-	-	E	5	-
912	Publication II	-	-	-	E	5	-

The Core-Elective courses of the Department are divided into two groups: Core-Elective courses 1 and 2 (CE1 and CE2) from which the student is obliged to get at least 6 and 18 ECTS credits, respectively, in order to receive his/her degree. Moreover, up to 10 ECTS credits are given for student internships (Practice I and II of Table II), as described in detail below.

The total weight of core-elective and elective courses is 58 ECTS credits, which can be obtained by either courses of the MST Department (at least 44 ECTS credits), or from courses of other Departments (up to 20 ECTS credits – with up to 12 ECTS credits being from courses from the Departments of Philosophy and Education).



Courses from other departments of the University of Crete

MST students can attend courses of other Departments of the University of Crete, as mentioned above. These courses are decided each year by the Undergraduate Studies Committee, based on the courses offered by the other Departments

Examination periods and exams

There are three examination periods: for the winter semester it is usually in January), for the spring semester it is usually in June) and the September examination period. In January and in June the students can be examined only in the courses in which they were registered in the corresponding semester. In September (the so-called second exam period) they can be examined in all courses in which they were registered both previous semesters. Besides, the students have also the possibility to be examined in courses of previous years in which they had failed and have not registered in the current academic year if they submit to the Secretariat of the Department a "Request for course addition", not later than July 20 of each year.

For laboratory courses, whether and under what conditions there will be a final exam is decided by the instructor and is announced to the students at the beginning of the course.

The specific examination procedures (e.g., final exam, mid-term exams, etc.) must be announced by the instructor at the beginning of each semester and within two weeks after the first lecture.

Re-examinations

Students who succeeded in a course in the first examination periods (January or June) and want to increase their grade in a particular course can participate in the second examination period (September) of the same academic year if they declare this intention to the secretariat by July 20 of each year. In this case the grade assigned is the highest among the two.

In case the student re-registers for the same course in another academic semester, then his/her first grade is deleted and the grade assigned is the last one.

Rating and conditions for graduation

The requirements to be fulfilled for receiving the MST Department degree are as follows:

1. Register in the Department and coursework for at least eight (8) semesters.
2. Acquire at least 240 ECTS credits in total, of which at least 226 from courses of the MST Department. The ECTS credits received from courses of other Departments are subject to the restrictions of the next table, Table III.
3. Successful completion of all core courses of the Department (listed in Table I) corresponding to 180 ECTS credits (8 ECTS credits from the English language courses and 174 from other courses).

The requirements for each student to receive his/her degree are those described in the Studies Guide that was in force during the year of first registration of the student in the MST Department. The requirements of the current Studies Guide are described in the following table.

Table III:
Requirements to receive the MST Department degree

Courses	ECTS	Details
Total	≥240	
Total from the MST Department	≥226	Πίνακας II
Core courses:		
From MST Department (other than English)	174	Table II
English	8	
Core-Elective 1	≥6	Table II
Core-Elective 2	≥18	Table II
Elective		
From MST Department	≥20	Table II
Philosophical/Pedagogical ¹	≤12	Given by other Schools of the University

From other Departments of School of Sciences & Engineering and School of Medicine 1	≤20
Practice1	≤10

¹ the sum of ECTS credits from internship, philosophical-educational cycle courses, and courses from other departments must be less than or equal to 30.

Detailing:

There are two groups of Core-Elective courses (CE1 and CE2) from which the student is obliged to take at least 6 and 18 ECTS credits, respectively. Elective courses can include courses from other Departments of the University. The maximum number of ECTS credits allowed from courses of the Departments of Philosophy, Social Sciences or Education is 12. From courses from the other departments of the School of Sciences and School of Medicine the maximum number of ECTS credits allowed is 20.

The Undergraduate Studies Committee can decide the replacement of a specific elective course of the MST Department by a course of another Department of the University.

It is also possible for an undergraduate student to register in a postgraduate course of the Department but only after permission from the postgraduate course instructor. The ECTS credits of the graduate courses are added to the credits of the undergraduate courses.

Distribution of courses/ Curriculum Example

In the next few tables an example of a curriculum is given:

1st Semester			ECTS	2nd Semester			ECTS
101	General Physics I	6		102	General Physics II	6	
111	General Mathematics I	6		112	General Physics II	6	
121	General Chemistry	6					
141	Materials I: Introduction to Materials Science	6		116	Applied Mathematics	6	
011	English I	4		122	Organic Chemistry	6	
114	Computers I: Introduction to programming	6					
				124	Chemistry Laboratory Course	8	
				012	English II	4	
			Total ECTS				36
			34				
3rd Semester			ECTS	4th Semester			ECTS
201	Modern Physics I: Introduction to Quantum Mechanics	6		204	Physics Laboratory II: Electricity-Optics	8	
223	Inorganic Chemistry	6		232	Biochemistry and Molecular Biology	6	

3rd Semester ECTS

225	Laboratory Course: Materials Chemistry	8
203	Physics Laboratory I: Mechanics-Heat	8
211	Differential. Equations I	6
260	Thermodynamics	6
Total ECTS		40

5th Semester ECTS

301	6th Semester	6
305	Solid State Physics: An Introduction	6
335	Molecular Cell Biochemistry	6
343	Laboratory Course: Soft Materials	8
391	Materials IV: Science of Natural Biomaterials	6
Total ECTS		32

7th Semester ECTS

401	Diploma Thesis I	6
	Core-Elective course or Elective Course	10
Total ECTS		16

4th Semester ECTS

242	Materials III : Microelectronic and Optoelectronic Materials	6
243	Materials II: Polymers-Colloids	6
	Επιλογής Υποχρεωτικό	16
Total ECTS		32

6th Semester ECTS

362	Materials V: Ceramic and Magnetic Materials	6
344	Laboratory Course: Solid Materials	8
PRA0-001	Practice I	5
	Elective Courses	15
Total ECTS		34

8th Semester ECTS

442	Diploma Thesis II	6
	Elective Courses	10
Total ECTS		16

Diploma thesis

A student can carry out a small research project under the guidance of a Professor/ Adviser, which he/she will have to present as a Diploma thesis and receive up to 12 ECTS credits (sum of credits of Diploma thesis I and II in Table II). The Diploma thesis work should be presented in a public presentation, followed by an oral examination by a two-member Committee, one has to be a faculty member of the Department whereas the other can be a Researcher of a recognized research center or a member of the Department holding a PhD or a member of another Department of the UoC also holding a PhD. In any case, the members of the Committee are appointed by the Undergraduate Studies Committee.

The grade of the Diploma thesis is assigned by the Professor/Adviser. The ECTS credits of the thesis are credited as ECTS of an elective course of the MST Department.

Internship (Practice)

After the end of the fourth semester, preferably during the summer vacation period, students can perform an internship in Greek, and international organizations and companies, of the public or the private sector with the aim of getting working or research expertise in materials science and related technological applications. The duration of the internship is typically 2 months with the possibility of extension in cases where the internship is performed outside Greece. The Internship Committee of the department is responsible for approving proposed internships and corresponding the interested parties (student and company/organization). After the end of the internship the student should submit an "activity report", which will be assessed by the Internship Committee, which will then decide on the final grade and ECTS credits (up to 5 ECTS credits per internship, with a maximum of 2 internships in total). In this way students can get up to 10 ECTS credits. The ECTS credits achieved from the Internship belong to the category of ECTS credits from other Departments of the Universities, which can be up to 30.

Any further obligations of the participating parties (student, company/organization and the Department) that may arise due to the financing scheme on the Internship Program will be regulated by the Internship committee.

Foreign language

Nowdays, more than ever, within the framework of a United Europe with all the emerging work and education possibilities (e.g. international student exchange programmes such as ERASMUS, etc.), foreign language skills, and especially English, are essential. The students of the MST Department are required to successfully complete two courses of English, which will give a total of 8 ECTS in order to receive their degree. The main aim of these two courses is to teach the students the basic scientific terminology used in Materials Science, as well as to prepare them for the study of scientific textbooks and publications.

Certificate of proficiency in computer

The certificate of proficiency in computer can be given by the department to the students if they succeed in the course ETY – 114 Computers I: Introduction to programming and in at least three of the following courses:

ETY – 113 Computers 0

ETY – 215 Advanced Programming I C++

ETY – 213 Computers II: Introduction to Numerical Analysis

ETY – 343 Laboratory Course: Soft Materials

ETY – 344 Laboratory course: Solid Materials

ETY – 410 Laboratory Course: Control and Automation of Systems Through the Computer

ETY – 440 Laboratory Course: Mechanical Drawing

ETY – 447 Computational Materials Science

ETY – 512 Computational Materials Science II: Electronic Structure Laboratory

Teaching competence certificate:

The students of MST Department can obtain the teaching certificate of competence, which will allow them to teach in public schools, following at the third and fourth year of their study the Interdepartmental Teaching Certification Program (PTCP). The program consists of three groups of courses: a) Training and Education, b) Teaching and Learning, c) Special Teaching - Internship. To obtain the certificate of teaching competence the students should attend one course from each of the above groups plus the internship. The courses which will be available each semester in the framework of the PTCP and their ECTS credits for MST Department students will be announced on the website <http://www.materials.uoc.gr/el/undergrad/syllabus/ppde.pdf>.

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