'06-'07

Technical University of Crete

Undergraduate & Postgraduate Studies

GUIDE

Technical University of Crete

Undergraduate & Postgraduate Studies **2006-2007**

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Foreword

"Finding ways to serve the society and offer the best possible quality of engineers is one of our main targets."

Most important than arriving at the target place is what you will acquire, learn, smell, feel and see during your journey to the target place. That is what the Technical University of Crete offers to our students.

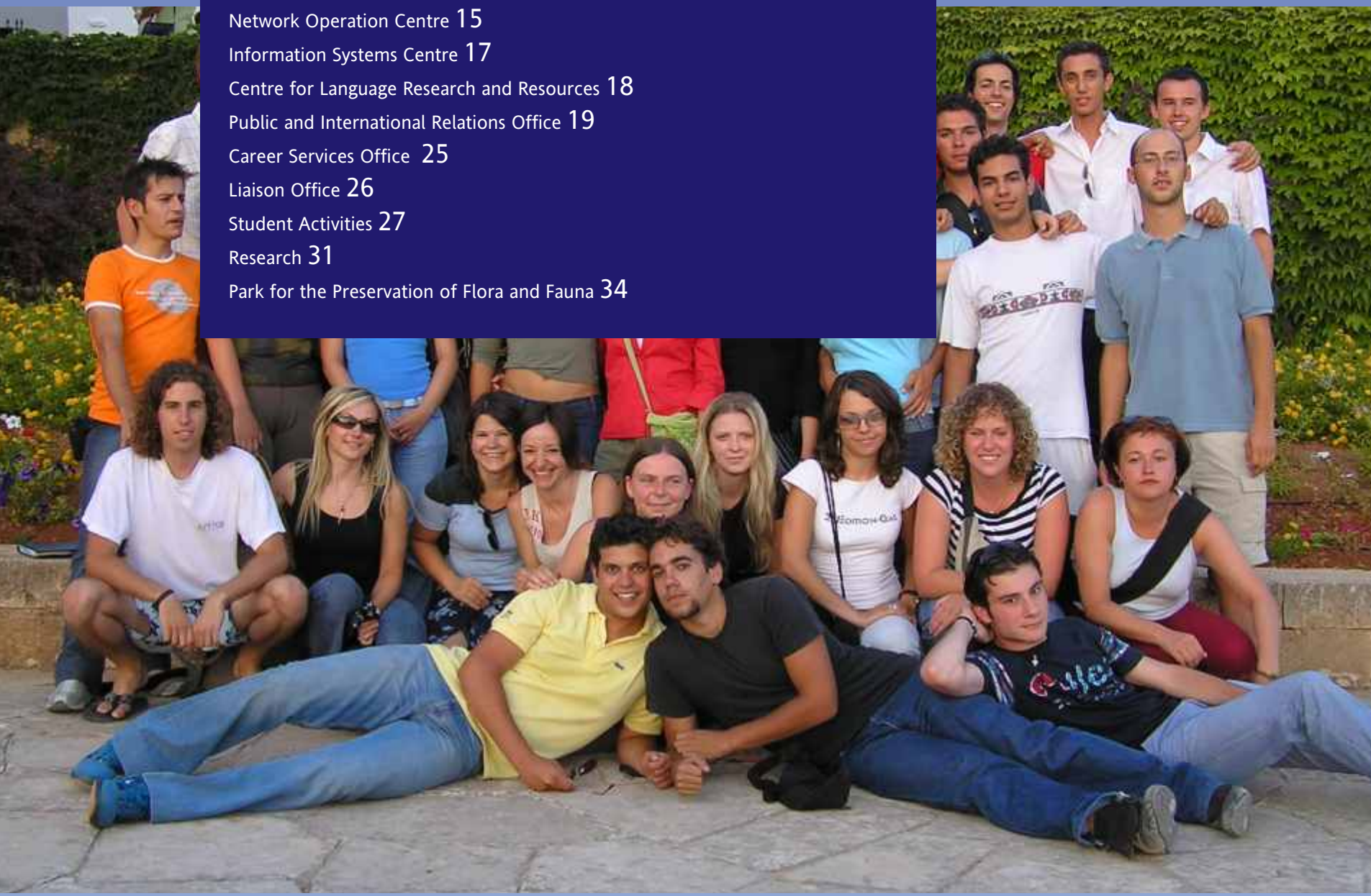
The Technical University of Crete is an Institution of higher education, which gives emphasis on both teaching and research. The six academic departments established after 1984 have set very high scopes. The fifty seven laboratories are very well equipped with high technology infrastructure and well skilled personnel. Concerning the faculty members, most of them had already an international carrier, before coming to Chania. There are five engineering departments, that is the Department of Management & Production Engineering, the Department of Mineral Resources Engineering, the Department of Electronic Engineering & Computer Engineering, the Department of Environmental Engineering and the Department of Architectural Engineering. In addition, we have the Department of Sciences, which offers only postgraduate studies. All of our departments offer post graduate studies, which include course work and examinations, as well as doctoral degrees.

One of the strong points of our Institution is research. With a total of 210 research and development programs and a budget approaching the amount of 19.000.000€, the Technical University of Crete is among the top in Greece in performing research. As a consequence, almost all of our 560 graduate students and candidates for a doctoral degree are employed by their professors who have financial support for a research program. In addition, the Technical University of Crete is among the first Greek Institutions with the highest rate of research publications per faculty member. One of our scopes is to strengthen even more the basic sciences offered in the departments curricula and to attract the best researchers in the fields of our interest.

Finding ways to serve the society and offer the best possible quality of engineers is one of our main targets.

Professor Joachim Gryspolakis
Rector of TUC

A. General Information



Crete & the city of Chania

Crete, the largest island in Greece and the fifth largest island of the Mediterranean, is located in the southernmost extremity of Greece. It is administratively divided into four prefectures (Chania, Rethymnon, Iraklion, Lasithi) and has a total population of 600.000 inhabitants. The island has a diverse landscape with high mountain ranges, the longest gorge (the Samaria Gorge) in Europe, dozens of magnificent beaches as well as one of the most important archaeological sites in Greece, Knosssos.

Crete combines its rich history and archaeological sites with its vibrant present and economic development. On the north side, cities have developed flourishing economies primarily based on agriculture and tourism. On the south side, the rural areas have maintained their traditional features and the population is genuinely warm and hospitable. Crete is also famous for its rare flora (Phoenix theophrastii, Centaurea Raphanina and Ebenus Creticus are some of the endemic and rare trees and plants found on Crete) and its impressive fauna (Gypaetus barbatus, Felis sylvestris and Chalcides ocellatus are a few of the unique species that exist on Crete).

The city of Chania, the second largest city of Crete with a population of approximately 70.000 inhabitants, lies on the northwest coastline of Crete, between the Aegean Sea and the slopes of the White Mountains. It is one of the most picturesque and beautiful cities on Crete. The magnificent site, the lively old Venetian port, the remnants of history, the busy marketplace, the interesting museums and the wonderful beaches make up the city's profile, which manages to maintain its Cretan tradition in harmony with economic growth and progress.

The city (known as Kydonia in ancient times) was inhabited as early as Neolithic times; it flourished during the Age of the Minoan Civilization and was one of the principal cities of Crete. The city suffered Arab, Venetian and Turkish occupation. In 1913, following a revolutionary movement led by Eleftherios Venizelos in Chania, Crete was politically unified with Greece and the Greek flag was raised for the first time at the Firkas Venetian Castle.

Cultural influences and traces of these historic periods remain both in the city and in the surrounding areas boasting a rich architectural heritage (Byzantine, Venetian, Ottoman, and Neo-Classic). The lighthouse and the mosque at the old Venetian port, the traditional houses in the neighbourhoods of the old town and the archaeological museum attract the interest of tourists. The Public Market, the Clock Tower and the House of the Prefecture, which used to be a Turkish hospital, are the most prominent features of the city centre. In the area of Halepa, the building of the former French School, which today houses the University Conference Centre, the house of Eleftherios Venizelos, the old palace of Prince George and the church of Saint Magdalene are worth visiting. The Memorial of Eleftherios and Sophocles Venizelos in the area of Akrotiri offers the best view of Chania and the most idyllic sunset. The heart of the city, however, beats at the Koum-Kapi Quay, where people gather to have coffee and meet their friends at the cafeterias at the sea front.

The Technical University of Crete

Organisation

The Technical University of Crete (TUC) was founded in 1977 in Chania and admitted its first students in 1984. The objective of the institution is to provide undergraduate as well as graduate studies in modern engineering fields, to conduct research in cutting edge technologies as well as to develop links with Greek industry.
The Technical University of Crete is currently comprised of five departments, which grant engineering degrees upon completion of a five-year course, and a Sciences Department, which provides the scientific support of the curricula. All the departments (apart from the new one) run modern postgraduate programmes.

The departments are:

- Department of Sciences (1984).
- Department of Production Engineering and Management (1984).
- Department of Mineral Resources Engineering (1987).
- Department of Electronic & Computer Engineering (1990).
- Department of Environmental Engineering (1997).
- Department of Architectural Engineering (2004).

Approximately 2,300 undergraduate and 563 postgraduate and doctoral students are currently studying at TUC. There are 98 permanent faculty members, 95 adjunct faculty members and 27 laboratory instructors. The university also employs approximately 23 laboratory technicians as well as 126 administrative employees.

The Campus

The campus is located on a panoramic site on the peninsula of Akrotiri and covers an area of 750 acres, 7 km northeast of Chania. It includes the University Hall of Residences, the University Restaurant and Cafeterias, the Departmental Secretariats, the Library, the Information Systems Centre, the Network Operation Centre, the Career Services Office, the Liaison Office, the Technical Services, classrooms, lecture halls and laboratories as well as faculty and graduate students offices.
The institution also owns several historical buildings in the city of Chania, including the former French School, which now houses the Department of Architectural Engineering. The Venetian complex of the Old Prisons and the Barracks, today house the Rectorate and Administration. The former Army Headquarters, also a part of the Venetian complex, is currently under renovation.

The Technical University of Crete is a State University, under article 16 paragraph 5 of the Constitution of the Hellenic Republic: "Higher education is provided exclusively by institutions -legal entities of public law and are self-governed." The main governing bodies are the Senate (21 members) and the Rector's Council. The Rector and the Vice-Rectors have a three-year office.

Degrees Offered

I. Diploma of Engineering

The Greek Ministry of Education determines the number of undergraduate students who can be admitted to the five undergraduate departments of TUC, after having passed national university entrance examinations. Most of the courses offered are compulsory, but there are also a wide variety of elective courses. They include lectures, tutorials, laboratory assignments and practical training, seminars and other activities, including educational visits to industries and field trips.
To become eligible for graduation a student must complete nine semesters of course work and prepare a Diploma Thesis under the supervision of one or more faculty members during the 10th semester.

All undergraduate courses are taught in Greek.

Grading System:

Excellent	**from 8.5 to 10**
Very Good	**from 6.5 to 8.49**
Good	**from 5 to 6.49**
Fail	**from 0 to 4**

II. M.Sc. - Ph.D.

All five departments at the Technical University of Crete offer postgraduate programmes. Courses are usually taught in Greek; subject to the discretion of the professor, they may be taught in English.
The duration of postgraduate studies at the Master's level is two semesters (minimum). Students applying for admission to these programmes should normally have an overall grade point average of 7,5 as well as very good knowledge of English. Students are expected to maintain this average throughout their postgraduate studies. Each Department selects its postgraduate students among applicants from Greece and abroad. Successful postgraduate students or research assistants may receive scholarships.

III. Doctorates

Doctorates are awarded by each Department upon the completion of a Ph.D. dissertation and a successful open defence.

The Technical University of Crete

Admission requirements

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e-mail: **rena@science.tuc.gr**
URL: **tuc.gr/merimna**

Foreign students interested in studying at a Greek university should apply to the Ministry of National Education and Religious Affairs. Inquiries should be addressed to:

Ministry of National Education
Directorate of Organizing and Conducting Examinations
Mitropoleos 15, 10185 Athens, Greece
Tel: +30 210 3247428
Fax: +30 210 3234812
www.ypepth.gr

This department shall provide foreign students with useful information on application requirements, necessary supporting documents and the application form. Students must then submit all supporting documents and applications to the Department of Entrance Examinations of the Greek Ministry of National Education in person (not by post) or by an authorized person.

Applications can be submitted from August 1st - August 10th.

Enrollment Supporting Documents:

1. Greek language certificate
2. Printed application form (supplied by the Secretariats of the Departments)
3. Leaving certificate of High School
4. A statutory declaration mentioning that the intending student does not hold a degree from a school or department of a tertiary level educational institute in Greece or that he/she has not entered a school or department of a tertiary level educational institute in Greece since 1995 or earlier.
5. A photocopy of an identity card or birth certificate
6. 6 passport size photographs

The number of graduate students admitted is determined by the General Assembly of each Department. Foreign students interested in applying for a M.Sc. or a Ph.D. should contact the appropriate Departmental Secretariat.

Students with disabilities

TUC welcomes students with disabilities and makes a continuous effort to improve all its services to better serve the needs of the students. For this purpose, there are two specially arranged rooms in the University Hall of Residences; there are two lifts in the Hall as well as ramps all over the campus to facilitate access. Students who have a specific disability should mention it to the Academic Affairs Office and the Secretariat of their Department so that they may receive help on any matter connected to their studies at the Technical University of Crete.

Academic calendar

The academic year starts on September 1st and ends on August 31st of the following year. The first semester normally starts during the last two weeks of September and the second semester ends during the last two weeks of June (the University Senate determines the exact dates). Each semester includes at least thirteen full weeks of teaching and a two-week examination period. Throughout the year, there are three examination periods. Students who fail to pass a course can be re-examined during the September examination period.

Official Holidays during the academic year:

Winter Semester	Spring Semester
October 28th	Ash Monday (moving holiday)
November 17th	March 25th
November 21st (local holiday)	Easter (2 weeks)
Christmas (2 weeks)	May 1st
January 30th	Whit Monday (moving holiday)
	Student Elections Day

Educational Excursions

Within the framework of compulsory courses in the 3rd, 4th and 5th year of studies, one-week educational excursions are organised for the practical training of students. These excursions include visits to companies and industries and they are held only when student participation is over 70%.

Fees

Greek students do not pay any tuition fees.

ID Card

A student ID card is issued to each student by the Secretariat of each Department upon matriculation. This ID card entitles the student to reduced fare on public transportation, in theatres, cinemas, concerts, museums, etc.

Health Insurance

All students are fully covered for illness or accident. The same applies to foreign students, who automatically benefit from Greek social services.
Students receive a voucher booklet giving them access to free health services: medical or hospital examination, prescriptions, subsidiary examinations, house calls, labour, physiotherapy, dental care, orthopaedic care. Students requiring medical attention can visit a university-designated doctor during regular office hours exhibiting their student voucher booklet issued by the Secretariat of their Department.
The voucher booklet includes the student's name, identification number, identity (or passport) number, the location of health services, and the regulations. The secretariat of every Department renews students' voucher booklets every year.

University books - notes

Undergraduate students are given their university books or notes for free. Other books required for their studies may be borrowed from the University Library thus saving students a lot of money, as they do not have to buy the books themselves.

Scholarships - Awards

The Foundation for State Scholarships (I.K.Y.) offers scholarships and awards to undergraduate and postgraduate students who excel at their studies every academic year.
Also, the Technical Chamber of Greece offers awards to students of Technical Universities in Greece who distinguish themselves in their studies every academic year.
Students of the Technical University of Crete may also receive special awards and scholarships from the institution itself as well as from local authorities or private organizations.

Transportation

The Technical University of Crete has initiated a student support scheme in order to facilitate the transportation of students to and from the University campus: it subsidizes the budget of students by subsidising the student bus fare to and from the University Campus. This was made possible after the conclusion of an agreement between the University and the Local Buses Association. As a result, the student bus fare has been further reduced to

0.40 from 0.80, which was the regular student bus fare. Also, the bus itineraries have become denser thus providing better service to the students commuting to and from the University Campus.

Accommodation - University Halls of Residence

The University Halls of Residence, built on campus, can accommodate up to 78 students in furnished rooms. There are three main buildings with 70 single-bed rooms and 4 double-bed rooms, all of which have private bathrooms. There are 11 spots for all the students staying at the Halls with lounges, TV sets, refrigerators, kitchenettes, a phone and 2 lifts. There are also laundry facilities, a first-aid room, maintenance facilities and a 24hour surveillance security. Two of the rooms have been rearranged to serve the needs of students with disabilities. Students can also connect to the Internet from their rooms at the Halls.
Students may be accommodated for free at the University Halls of Residence provided that they fulfil certain financial and social requirements with regard to their personal or family status and that they apply to the Academic Affairs Office. However, the majority of students rent rooms or small apartments either in the area near the campus or in the city.

Student Rent Subsidy

TUC has initiated a student rent subsidy scheme in an effort to help students who cannot stay in the University Hall of Residence but at the same time cannot afford to pay the high rent of an apartment. Today, the University subsidises 228 students with 180 per month for a 10-month period.

Student Restaurant - Cafeterias

Every day, approximately 590 students have breakfast, lunch and dinner for free at the student restaurant, which is open daily, including weekends and holidays, from 13:00 - 16:00 p.m. for lunch and 19:00 - 21:00 for dinner. Students may have meals for free at the University Restaurant provided that they fulfil certain financial and social requirements with regard to their personal or family status and that they apply to the Academic Affairs Office.A considerable number of undergraduate and postgraduate students as well as Erasmus students have free meals while the rest of the students have meals at extremely low prices. In 2005-2006, students who are not entitled to free meals, pay 2,73 for three meals per day (free breakfast, 1,64 for lunch and 1,09 for dinner or they can choose a monthly meal card for € 2,07 per day). Students may also take their meals in packages if they wish for no extra charge. Apart from students, University personnel (faculty members, administrative employees) and visitors very often choose the University Restaurant for their meals.Two cafeterias are open daily for snacks, coffee and refreshments or/and for relaxation and meetings with friends.

Library

Library opening hours:

During semester:
Monday - Friday | 9.00am - 19.45pm

During University vacations:
Monday - Friday | 9.00am - 14.30pm

Contact: **Maria Ntaountaki**
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The Library of the Techni cal University of Crete provides information services, which primarily support the University's teaching, learning, and research purposes.

The collection of the Library consists of print, non-print and electronic material. The print material is approximately 52.000 book volumes and 389 current journal titles. As for the non-print material, an ever-growing number of scientific and general electronic and multimedia information resources are included, such as electronic journals, electronic books, CD-ROMs, videotapes, audiotapes, microfilms/microfiches, and diskettes. Not only is it a Lending Library for the members of the Campus but also for patrons outside the Technical University of Crete.

The Library uses the GEAC-Advance software system that provides access, and via the Internet, not only to the catalogue of the Library, but also to catalogues of other national and international libraries.

The Library focuses on user education services. A user education application, based on multimedia technology, is available for use. User education seminars are regularly provided mainly to students. Multimedia technology (an audiovisual system consisting of videos, TV sets, satellite receivers and Hi-Fi) is available to patrons for in-library use only for educational and recreational purposes.

The Library's web service gives patrons access to full text electronic journals, electronic books, databases (such as MathSciNet, Web of Science, Compendex, CSA, Dissertation Abstracts International, OCLC's First Search package etc) and Internet resources from their desktop. More information can be found on its web page at http://www.library.tuc.gr

The Library is affiliated with the National Documentation Centre (N.D.C.) and is a member of professional associations such as I.F.L.A. (International Federation of Library Associations and Institutions), ALA (American Library Association) and I.A.T.U.L. (International Association of Technological University Libraries). It is also a member of the Heal-Link Consortium (Hellenic Academic Libraries Link).

Eleven people currently work in the Library.

Network Operation Centre

The mission of the Network Operation Centre (N.O.C.) is the administration, operation and development of the T.U.C. backbone network infrastructure. The N.O.C. manages the daily operations of the T.U.C. network in terms of connectivity, proper distribution of the available bandwidth to final users, and troubleshooting. In addition, N.O.C. designs and implements the future network and telecommunications infrastructure of the University and keeps up with technological advancements. N.O.C. currently consists of six computer network engineers, two technical staff members and an administrative assistant, and operates under the supervision of Associate Professor D. Pnevmatikatos.

The University's core network is based on a Gigabit Ethernet infrastructure. The external connection to the Internet also operates at gigabit switchingspeeds through the GRNET-2 national Research and Technology network, which offers gigabit connectivity within the Cretan metropolitan area network (MAN) as well as to the central network node in Athens. The entire campus is fitted with structured cabling, either fiber, or UTP copper cabling, and has about 1700 active computer connections. N.O.C. provides IEEE 802.11 wireless access to key lecture halls and the library, and is expanding this coverage to the entire campus. Wireless protocols are also used to give Internet access to remote university locations, such as the central administration building.

N.O.C. also provides support and maintenance to the telephone network throughout the University facilities, and is responsible for programming the advanced services the PBXs can offer to final users. These services include voice mail access through the telephone handsets, a unified messaging system (voice, mail and fax through the web), and various features such as private and public libraries, multi- appearance, pickup groups etc.

Furthermore, to keep up with the technological progress in the field of voice communications, N.O.C. is investigating ways to enhance the existing telephone network with advanced features and services. N.O.C. engineers have experimented with VoIP technology in the existing data network infrastructure within the scope of the project "Gunet: Advanced Telematic Services for the members of the Academic Network". Through this project, voice calls to other Greek universities are routed using VoIP technology. Furthermore, N.O.C. plans to use VoIP over wireless connections to replace the dedicated phone lines to remote network locations.

N.O.C. goals in brief:

1. *Providing and ensuring connectivity to all final users.*
2. *Offering general communication services to the T.U.C. community including Dial-up services, Proxy server, Usenet news, Web Mail, Unified Messaging System (Web Messenger), Voice-mail, Help Desk Support, E-mail administration, all-users mailing lists, etc.*
3. *Managing security in the T.U.C. network and precluding and investigating incidents such as viruses, hacker attacks, spamming, etc.*
4. *Designing and managing the expansion of the core network infrastructure.*
5. *Providing new services and expanding already existing ones.*
6. *Managing the top-level domain name servers (DNS)*
7. *Maintaining the central university website (www.tuc.gr).*
8. *Providing helpdesk services to the users during its working hours.*

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Network Operation Centre

N.O.C. members have specified the operational and technical parameters and are proceeding in the operational implementation of a tele-education and tele-conferencing lecture hall that will be the central point for all T.U.C. tele-presence activities.

The history of N.O.C. begins in 1996, when T.U.C. started developing its computer communication network funded by two long-term projects of the 2nd Community Support Framework of the European Union: "The Computer Communication Network of the Technical University of Crete" and the "Greek Universities Network- Gunet". These projects were supervised Professors A. Dollas and M. Paterakis.

During the period of 2000-2003, N.O.C. has managed to offer to all T.U.C. users advanced network services within the scope of two funding initiatives: "Advanced Network Services of the Technical University of Crete" and "Infrastructure upgrade towards Information Society" (both included in the Operational Program for the Information Society of the 3rd Community Support Framework).

Information Systems Centre

The Information Systems Centre (I.S.C.) of the Technical University of Crete is the major information technology service provider in the University. Every member of the academic community may have access to the range of services provided through the centralized local area network that I.S.C. has implemented.
Powerful Pentium IV Windows 2000 workstations supplied mostly with 17" monitors, compact disk readers & writers, optical mice etc are directly connected to the University Gigabit backbone providing local and Internet connectivity. Classrooms are equipped with video projectors and wall-mounted video displays.

Services provided among others are:

- Personal Productivity Programs including Word Processors, Spreadsheets, Database Applications, Presentation Applications, Mathematical Tools and Organizers.
- Course-related applications including every application that is taught in one or more courses offered by the university.
- Task-oriented and specialized software for specific needs (Desktop Publishing, Optical Character Recognition, Audio and Video Net conference, etc).
- Truly Portable and Secure Electronic Mail (e-mail) services. (POP3, Web Access, 48-bit security encrypted).
- World Wide Web Publishing Services with full functionality support (CGI, ASP).
- Print services in a wide range of print platforms including Laser A4 Printers, Laser Colour Printers and InkJet A3 plotters.
- Scanning Service.
- Digital Sound Processing Station equipped with MIDI and Digital Sound Storage systems and Digital Signal Processing (DSP) systems.
- A variety of portable storage media support (zip drives, compact disk record and rewriteable, external hard disks, USB memory sticks, etc).

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All users on the I.S.C. network enjoy a unified environment, regardless of the work- station used. Moreover, extended remote connectivity for personal user resources (home directory, application settings, e-mail box, and personal web pages) is available through a totally secure connection schema. Finally, the strong technical structure of the Information Systems Centre is fortified by extensive user support services provided by a web page helpdesk and highly educated, experienced staff.

Language Research & Resource Centre

The Language Research and Resource Centre, established in 1997, supports students who must satisfy a four-semester foreign language requirement. The Centre provides self-access resources that students may use in addition to or as part of their language courses. Resources also allow the acquisition or development of language skills through autonomous learning, an approach that aims to meet individual student needs and abilities.

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The resources that are available at the Centre are:

- Workstations (PCs) providing access to the Centre's web site www.kegep.tuc.gr, with online exercises and pre-exam testing programs.
- Graded self-study worksheets offering practice in reading, grammar and vocabulary.
- Multimedia materials and web sites for grammar, vocabulary, listening, writing and reading practice.
- Video tapes and DVD's that may be used either individually, on small television sets equipped with headphones, or by a group, on one central television.
- Audio tapes for listening practice through the use of cassette players.
- Classes and tutoring for conversation, Cambridge/Michigan, Proficiency, TOEFL, GMAT, GRE, Zertifikat Deutsch, Zentrale Mittelstufenprufung in addition to the courses designed to complement the department's curricula.
- A small lending library of novels, short stories, grammar reference books, and magazines.
- Availability of the European Language Portfolio designed for students in higher education.
- Languages taught at present: English and German.

Public & International Relations Office

The Public and International Relations Office is actively involved in many activities in order to promote all aspects of the Technical University of Crete in Greece and abroad. It is the University's link to the rest of the world, local, scientific or otherwise.

"TUC NEWS" is a bi-annual magazine published by the Office with all the news, activities and achievements of TUC students, faculty members and laboratories. The Undergraduate and Graduate Studies Prospectus is an annual publication of the University, where students, parents, partners, businesses and all interested parties can find information concerning all academic, research and administrative aspects of the University. The Public and International Relations Office also publishes a significant number of pamphlets and promotional material.

Every year, the University participates in a number of educational fairs and exhibitions both in Greece and abroad such as the International Educational Exhibition in Cyprus and the EDUCATION International Exhibition on Education in Athens.

The Public and International Relations Office also hosts visiting dignitaries, organises lectures, seminars and conferences at the Conference Centre of the University, welcomes and shows schools around the Campus and the University facilities, organises the Welcome Ceremony for first year students, the Degrees Award Ceremony for undergraduate and postgraduate students as well as honorary award ceremonies for distinguished personalities or scientists.

Golden Medals and Honorary Awards

27/2/1995. The Golden Medal of the Technical University of Crete was awarded to Catherine Kelaidi and Maria Papadopetrou, donators of the institution.

25/10/1995. Andreas and Sophia Fytrakis, donators of TUC, were awarded the Golden Medal of the Technical University of Crete.

29/1/1996. His Holiness Irineos, the Archbishop of Kissamos and Selino, was awarded the Golden Medal of the Technical University of Crete in recognition of his outstanding contribution to the Prefecture of Chania and the local society in general.

19/6/1996. The Technical University of Crete together with the Cultural Association the Cretan Muse honoured the veteran soldiers who served from 1918 to 1923 in Minor Asia and came from and/or lived in Chania.

22/7/2000. The Golden Medal of the Technical University of Crete was awarded to George Psyhountakis, hero of the Resistance in Crete during the II World War, famous writer, translator of Homer and awardee of the Academy of Athens.

14/11/2001. Minoas Zombanakis, world famous economist, was awarded the Golden Medal of the Technical University of Crete.

1/3/2002. Antigoni Kefalogiannis was honoured by the Technical University of Crete in recognition of her contribution in the close collaboration of T.U.C. with the Paideia Foundation.

20/4/2004. Konstantinos Stamatakis and Manolis Velivasakis were honoured by the Technical University of Crete in recognition of their contribution in the creation of the Park for the Preservation of Fauna & Flora in Hania Crete.

Public & International Relations Office

Within the framework of forging strong international relations with universities from all over the world, TUC has signed Bilateral Cooperation Agreements with the following institutions:

- University of Strathclyde, Glasgow, U.K
- Georg-Simon-Ohm-Fachhochschule Nurnberg, Germany
- Fachhochschule Aachen, Germany
- Technical University of Ilmenau, Germany
- National Technical University of Athens, Greece
- Technical University Gh. Asachi, Iasi, Romania
- Hame Polytechnic, Finland
- University of Maribor, Slovenia
- University of Zagreb, Croatia
- National University of San Juan, Argentina
- University of South-western Louisiana, USA
- Royal Melbourne Institute of Technology, Australia
- Kunming University of Science and Technology, China
- Priazovskiy State Technical University, Ukraine
- Montana Tech of the University of Montana, Butte, Montana, USA

Memberships

The Technical University of Crete cooperates with universities and other organizations of higher learning and research. Within this framework, it has been a member of the European University Association since 1995 (E.U.A.), a member of the Conference of European Engineering Schools of Advanced Research (CESAER) since 2003, a member of the Réseau Méditerranéen des Ecoles d'Ingénieurs (R.M.E.I.) and a member of the Communauté des Universités Méditerranéennes (C.U.M.). The Public and International Relations Office is responsible for developing and maintaining the University's contacts with these international organizations.

Honorary Doctorate Degree Awards

The Technical University of Crete has conferred the title Doctor honoris causa to the following distinguished scientists:

5/5/1993. Rudolf Kalman, founder of the modern mathematical control theory, Emeritus Professor at the Swiss Federal Institute of Technology.

3/5/1996. Sir David Cox, founder of modern Statistics, Professor at the University of Oxford.

2/12/1996. Michael Athans, founder of the self-adjusting control in the field of automation, Professor at M.I.T.

26/5/2000. Kenneth R. Laker, founder of micro-electronics in the field of active filters of acoustic surface waves, Professor at the University of Pennsylvania.

10/6/2002. Bernard Roy, founder of the European School of Multicriteria Decision Analysis, Emeritus Professor at the Université Paris-Dauphine.

15/12/2004. Mohammad Jamshidi, expert on modeling, control and applications of large-scale complex systems, Regents Professor at the University of New Mexico.

15/12/2004. Athanassios Fokas, expert on nonlinear mathematical science, Professor at the University of Cambridge.

4/3/2005. Laurent Lafforgue, outstanding contribution to Langlands program in the fields of number theory and analysis, Permanent Professor at the Institut des hautes études scientifiques (IHES).

1/2/2006. Eftychios Bitsakis, outstanding contribution to Theoretical Physics, Professor Emeritus at the University of Ioannina.

5/5/2006. Richard Lambert, expert on physical chemistry - surface science, Professor at the University of Cambridge.

5/9/2006. David Ollis, expert on photochemical and biochemical engineering, Distinguished Professor at the North Carolina State University.

Donators

Iosif Papadopetros (1983)
Ioannis Annitsakis (1985)
Aristides Baklatzis 1986)
Eleni Fratzeskaki (1993)
Ekaterini Kelaidi (1994)
Andreas Fytrakis (1995)

Public & International Relations Office

SOCRATES / ERASMUS

Mobility programmes

SOCRATES is a programme funded by the European Union that covers all areas and levels of education. The section involving Higher Education is called Erasmus. Students can participate in this exchange programme by studying at a particular university in another European country for a short period (three months to one academic year). Study placements involve either attending classes at a Host University or undertaking fieldwork abroad in preparation for a dissertation. The Technical University of Crete, has signed many Bilateral Agreements with other Universities. The number of the outgoing and incoming students is increasing, year after year, indicating that the programme is very successful.

Contact: **Elena Papadogeorgaki**
Dimitra Havre (Erasmus Co-ordinator)
Tel: **+30 28210 37047**
+30 28210 37048
Fax: **+30 28210 28418**
e-mail: **intoffice@isc.tuc.gr**
havre@mail.tuc.gr
(for Erasmus & Leonardo)
URL: **tuc.gr/relations**

Public & International Relations Office

ECTS Learning Agreements

Depending on the length of their stay, students will accumulate 30 ECTS credits if they stay for 6 months and 25 ECTS credits if they stay for 4 - 5 months.

Students should visit the web site at www.tuc.gr (English version) and consult the pages of the department in which they are interested, in order to proceed to the selection of their courses. In case they find difficulties, they should contact the International Relations Office, that will provide them with the necessary information and contact details.

Note here that the Electronic and Computer Engineering Department does not accept Erasmus students.

Application procedure

Incoming students should download and complete the online student application form (two originals) and the learning agreement form (two originals) (http://www.tuc.gr/english/erasmus/index.html). Then, they should send these documents together with a transcript of records and two photographs -by registered post- to the Public and International Relations Office (Agiou Markou Street, 73132 Chania, Crete, GREECE) no later than June 15, for the fall semester and October 30, for the spring semester.

University Restaurant

Erasmus exchange students have free meals at the University Restaurant during their ERASMUS study period at the Technical University of Crete.

Accommodation

Exchange students are accommodated at studios or in rooms for rent within the city of Chania. Prices range from 250 to 280 euros per month. The Public and International Relations Office helps students find suitable accommodation at the lowest possible rates.

Student Card

Erasmus students are given a student card upon their arrival. With this card, they get discounts on buses, ferries, etc (but not on airplanes). This Greek student card is only issued once, so it is recommended that students make photocopies of it.

Classes

Classes are held in Greek. Erasmus students attend courses together with the other international students. Most students undertake projects and hand in assignments to their Professors. They have regular meetings with them in order to get new guidelines and discuss the difficulties they might have.
In case a student wants to do part of his dissertation or thesis work, he has to find a Professor at the Receiving University (TUC) who will supervise his work. In this case, the Professors of both Institutions (Sending and Receiving) will need to be in contact during the whole Erasmus period. Prior to starting the course work, the Professors must have agreed on the subject and the credits of the field work to be undertaken.

Greek Language Courses

Twice a year, TUC runs a Greek language and culture course for its ERASMUS students. This course is free of charge. The 1st semester course starts at the beginning of October and finishes in the middle of January and the 2nd semester course starts at the beginning of February and finishes in the middle of June. Foreign students are given the opportunity to learn the Greek language and become acquainted with the country's history and culture. The course does not give any E.C.T.S. credits.

Université des Sciences et Technologies de Lille, France	www.univ-lille1.fr
Université Paul Sabatier Toulouse III, France	www.ups-tlse.fr
Universität Lüneburg, Deutschland	www.uni-lueneburg.de
Technische Universität Bergakademie Freiberg, Deutschland	www.tu-freiberg.de
Technische Fachhochschule Berlin, Deutschland	www.tfh-berlin.de
Georg-Simon-Ohm Fachhochschule Nürnberg, Deutschland	www.fh-nuernberg.de
Freie Universität Berlin, Deutschland	www.fu-berlin.de
Hochschule Zittau Görlitz, Deutschland	www.htw-zittau.de
Fachhochschule fur Technik und Wirtschaft Berlin, Deutschland	www.fhtw-berlin.de
Technische Universität Ilmenau, Deutschland	www.tu-ilmenau.de
Università degli Studi di Trieste, Italia	www.univ.trieste.it
Università degli Studi di Catania, Italia	www.unict.it
Università degli Studi di Torino, Italia	www.unito.it
Università degli Studi di Bologna, Italia	www.unibo.it
Université de Liège, Belgique	www.ulg.ac.be
Universiteit Antwerpen, Belgique	www.ua.ac.be
University of Mining & Technology St Ivan Rilski (Sofia), Bulgaria	www.mgu.bg
Technical University of Sofia, Bulgaria	www.tu-sofia.bg
University of Chemical Technology & Metallurgy (Sofia), Bulgaria	www.uctm.edu
Universidad de Cantabria, Spain	www.unican.es
Universidad de Sevilla, Spain	www.us.es
Universidad Politecnica de Catalunya, Spain	www.etseib.upc.edu
Institute of Chemical Technology (Prague), Czech Republic	www.vscht.cz
Czech University of Agriculture in Prague, Czech Republic	www.tf.czu.cz
BRNO University of Technology, Prague, Czech Republic	www.fme.vutbr.cz
Charles University in Prague, Czech Republic	www.is.cuni.cz
Czech Technical University in Prague, Czech Republic	www.cvut.cz
Transylvania University of Brasov, Romania	www.unitbv.ro
GH-ASACHI Technical University of Iasi, Romania	www.tuiasi.ro
Universidade Nova de Lisboa, Portugal	www.unl.pt
HAME Polytechnic (Hammellina), Finland	www.hamk.fi
LUND Institute of Technology (Lund), Sweden	www.lth.se
University of Cyprus	www.ucy.ac.cy
Tallinn Technical University (Tallinn), Estonia	www.ttu.ee
Süleiman Demirel Üniversitesi (Isparta), Turkey	www.sdu.edu.tr
Ege Üniversitesi (Izmir), Turkey	www.ege.edu.tr
Middle East Technical University (Ankara), Turkey	www.metu.edu.tr

TUC has signed bilateral agreements with the following institutions (Socrates links):

Leonardo Da Vinci

Work placement programme

The Technical University of Crete also participates in the Leonardo da Vinci work placement programme of the European Union. Every year, a number of undergraduate and postgraduate students have the opportunity to work for a specific period in a European company. The Host Organisation {Company receiving the beneficiary (UG - PG student)} undertakes the financing of the mobility expenditure in accordance with the regulation set by the Leonardo da Vinci National Agency (currently, the Technological Educational Institute of Athens).

Institutional Coordinator:
Prof. Michael Paterakis
Vice-Rector of Academic Affairs
Socrates Dept. Coordinators:
Environmental Engineering Dept.
Assist. Prof. Michael Lazaridis
lazaridi@enveng.tuc.gr
Mineral Resources Engineering Dept.
Prof. Zacharias Ayioutantis
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Production Engineering andManagement Dept.
Assistant ProfessorPavlos Georgilakis
email: **pgeorg@dpem.tuc.gr**
Dept. of Sciences
Assoc. Prof.Ioannis Yentekakis
email: **yyentek@mred.tuc.gr**

Career Services Office

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(Director)
Thelma Mavridou
(Educational Guidance)
Vassiliki Pagiou
(Occupational Guidance)
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URL: **career.tuc.gr**

The Career Services Office, centrally located on-campus, is a link to the academic institutions and the job market in Greece and abroad, aiming to assist the students and graduates of the Technical University of Crete in successful career planning and placement.

The Career Services Office:

- provides information and guidance for students and graduates on postgraduate studies in Greek and foreign universities, scholarships and seminars provides information on available job positions, companies' profiles and trends of the job market
- provides guidance on related skills such as resume writing, interviewing techniques, job search techniques and career planning
- provides information to firms and organizations regarding the profile of the graduates of the university
- supports collaboration networks with other academic institutions and employment organizations in Greece and abroad
- develops mechanisms in order to inform the University community on current labor market trends and on career prospects for the graduates of T.U.C.

In order to achieve its goals, the Career Services Office:

- publishes and distributes a variety of booklets on career and job placement matters
- develops data bases which include information on company profiles and job positions
- provides information tools and material, using the Career Resources Library and its web page
- facilitates participation in and organization of seminars, conferences and exhibitions
- conducts studies on the employability of the graduates in the labour market
- collaborates with all the Departments of the T.U.C., with other Universities, with the Technical Chamber of Greece, with educational and employment organizations in Greece and abroad.

Liaison Office

The Liaison Office of the Technical University of Crete was established on the initiative of the General Secretariat for Research and Technology of the Ministry of Development and is financed by the National Operational Programme for Research and Technology (EPET II). Its main objective is the promotion of research activities and results that are developed at the Technical University of Crete. The Liaison Office acts as an interface between the university and industry.

The Liaison Office encompasses the following activities:

- Promotion of research activities carried out at TUC and of their results
- Support of the researchers on matters of innovation and technology transfer such as intellectual property rights and financial exploitation of their research results.
- Promotion of co-operation between TUC and regional businesses and organizations of regional development.
- Technology and know-how transfer to enterprises in order to help them increase their competitiveness and expand in the international markets.

More particularly, the Liaison Office:

- Promotes the research activities of TUC and their commercially exploitable results either directly to potential interested parties or indirectly through exhibitions, open days, publications, electronic website etc.
- Identifies the market needs for products and services of intensive know-how and informs the academic community on the financing and exploitation possibilities of their research activities and their results.
- Advises and offers legal support to the researchers on matters of intellectual property rights and the establishment of spin-off companies (market research for a given technology or product, business plans, feasibility studies etc.)
- Supplies information regarding the ways and sources for financing research and investment activities (e.g. forthcoming calls of proposal for European and National programmes, Venture Capital, Business Angels etc.) and partner search.
- Supports the accreditation of research laboratories and the certification of research products and services.
- Supports the submission of proposals to National and European research programmes by assisting the preparation of proposals and partner search in Greece or abroad, by advising the partners during the process of signing contracts and joint agreements.
- Promotes and enhances entrepreneurship in the academic community and private and public benefit companies and encourages technology and innovation transfer to the industry.
- Develops a networking with other Liaison Offices, Technology Transfer Centres, Technology and Science Parks, Research Institutes, Commercial Associations etc.
- Supports the Company for the Management of the University Property in order to be able to take business initiative.

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URL: **liaison.tuc.gr**

Student Unions

An important part of the University experience is participation in an active, democratically governed student union. It is through the unions that student views are represented on all the major university committees, particularly regarding the academic and social life of the students. There are five student unions at T.U.C. as well as an interdepartmental Student Union.

These are:

- The Student Union of the Technical University of Crete.
- The Student Union of the Department of Production Engineering and Management.
- The Student Union of the Department of Mineral Resources Engineering.
- The Student Union of the Department of Electronic and Computer Engineering.
- The Student Union of the Department of Environmental Engineering.
- The Student Union of the Department of Architectural Engineering.

The union council members are elected once a year by all the students who are enrolled in the unions through cross campus elections held at a date set by the Hellenic Association of Student Unions. Graduate students have their own association. Union council members represent their fellow students in the Senate, the Rector's Council and the Departments' General Assembly meetings.

BEST

BEST, the Board of European Students of Technology is a non-profit and non-political organisation for students, managed by students. BEST was founded in March 1989 in Berlin as an answer to the need for an association to promote communication, cooperation and exchange between students of technology throughout Europe. BEST helps make technology students more international minded by encouraging their mobility and intercultural communication.

BEST connects students from 70 technical universities in 29 countries in a network of approximately 1400 active members, which is held together by common projects, common interests and friendship. The activities of BEST include a variety of academic events such as 1-2 weeks courses and international seminars, and other events such as cultural exchanges, ski weeks, sailing meetings internal meetings.

BEST also provides an online database of companies and student CVs called Minerva, which connects European minded students and engineers with companies. It is a unique opportunity for students to discover a new exciting future and start an international career.

BEST is represented in Greece by the Technical University of Crete, the National Technical University of Athens, the University of Patras and the Aristotle University of Thessaloniki. T.U.C. became the local BEST group of Chania in 1995 and ever since, it has run 18 European events with the participation of 450 European engineering students. At the same time, 200

Student Activities

Student Unions & BEST

T.U.C. students took part in events organised by the rest of the local BEST groups. The culminating point of the BEST activities in Chania is its annual seminar, held on campus and combined with cultural events and leisure activities. The experience gained by BEST students is manifold and multidimensional. It involves an opportunity to travel to other European countries, to associate with diverse academic communities in Europe, to learn foreign languages and to get acquainted with the civilization of other European countries.

BEST
Contact: **BEST Chania**
Tel.: **+30 28210 37412**
Fax: **+30 28210 37527**
e-mail: **chania@best.eu.org**
URL: **best.eu.org (BEST International)**
URL: **best.eu.org/chania (LBG Hania)**

Student Clubs

The ***3P Group*** *(Cultural Environmental Action)* is an independent student organisation which exists to support the social life of students, enabling them to make new friends, try out new pastimes and enjoy themselves in a creative way while studying at T.U.C. Students are encouraged to participate in and to promote all artistic and creative initiatives developed within the university. Over the years, 3P has managed to become an integral part of the town's social and cultural life and has forged a dynamic link with the local community.

3P embodies several small creative and artistic groups that are involved in music, cinema, theatre, photography, chess, billiard, table tennis, Internet, hiking, diving, cycling, environment, dancing.

Entassi is the *music club* of T.U.C. It includes the Radio Entassi group, which operates a radio station broadcasting locally, cooperates with local radio stations for the promotion of productions and organises music events and seminars on sound and music technology, and the Entassi live group, which has a studio for rehearsals and recordings and organises music concerts of T.U.C. groups as well as other artists.

Alliassi group is for those students who love *cinema*. The group schedules film projections, helps with the production of videotapes and stages theatrical representations.

Photoskiasi is the *photography group* of T.U.C. It develops photographs in its own dark room, organises seminars on artistic photography for beginners as well as on development and printing techniques and it organises and takes part in many exhibitions.

The ***Table Sports group*** gathers *chess, billiard* and *table-tennis* fans. It offers instructed courses at beginner and advanced level while the chess team in particular regularly takes part in Chess University Championships with a remarkably successful record.
The ***3P INTERNET + ARTISTIC*** team develops

graphics and is involved with *web design* projects together with Photoskiasis and at the same time it operates the 3P network, electronic systems and server.

The ***Touring club*** joins all those interested in *mountaineering, diving* and *cycling* and *organises excursions*.

Geosi is the ***environmental group*** of T.U.C., which informs the University community about *environmental problems*, it operates an *on-campus paper recycling network* and it submits *proposals for improving environmental conditions*.

The ***Dance group*** gathers all students who love *dancing*. Working with an established *dance school* in Chania and following the instructions of their choreographer, the group presents various *choreographies* including all kinds of dance, from *Greek folk dances* to *jazz*, *tango* and *dance drama*.

The ***Theatre group*** consists of *theatre* loving students. It is a very active group which puts up one or two theatrical representations every year with great success.

The ***Sailing group*** is the latest addition to the student activities' groups gathering both students and teaching staff.

3P organises *exhibitions of painting* or *comics* from time to time as well as an annual three-day event of artistic creation with participants from all over the country.

3P / Radio Entassi / Entassi live
Tel.: **+30 28210 37526**
e-mail: **3p@3p.tuc.gr**
entasi_935@3p.tuc.gr
e-mail: **entasi-live@3p.tuc.gr**

Alliassi
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alliasi-mail@3p.tuc.gr

Fotoskiassi
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fotoskiasi-mail@3p.tuc.gr

Geosi
geiosi@3p.tuc.gr

Periigisi
perihgisi@3p.tuc.gr

Internet+Artistic Team
e-mail: **3partisticteam@3p.tuc.gr**
URL: **3p.tuc.gr**

Dance Group
dance.tuc@gmail.com
URL: **dance.tuc.gr**

Student Activities

Sports

Student participation in sports and other recreational activities is optional. However, students at T.U.C. are encouraged to take part in a varied programme of sports and recreational activities not only to keep themselves fit but also in order to represent the University in Pan-Hellenic Student Championships and University Championships, in which T.U.C. has a particularly successful record. The selection of the teams taking part in these events is made based on the performance of the students in each sport. For the time being and until all athletic facilities on campus are concluded, the majority of the athletic activities practised at T.U.C. take place at municipal facilities.

Activities offered at the Technical University of Crete include:

Gymnastics: Instructional classes as well as advanced classes of Swedish / Stretching Gymnastics, Aerobics and cardiovascular exercises catering for different tastes and fitness levels help students keep fit and improve their physical strength and stamina. The classes are offered at the indoor Gym on campus.

Dancing: Instructional classes of Greek traditional and folk dances as well as modern dances are offered on campus for those who wish to combine light exercise and socialising.

Sports: Basketball, volleyball, tennis, ping-pong, taekwondo and soccer teams use the facilities of the National Sports Centre of Chania. Every year T.U.C. takes part in National Championships and has a particularly successful record.

Chess: Games are usually held on campus. Shooting: Those interested in this sport may take instructed courses at the National Shooting Centre of Chania.

Aquatics: These include instructed courses in swimming at both beginner and advanced levels as well as training for the university team, water-polo, aqua aerobics and synchronised swimming. All matriculated students may use the National Aquatic Centre of Chania.

Skiing: The university team consists of skiers already performing at a high level. They may improve their performance further by training at the skiing centres where the games take place. The university sports supervisor is always on hand to give students advice on all aspects of sport, exercise, health and fitness as well as encouragement.

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Katerina Vagioni
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e-mail: **vagioni@mail.tuc.gr**

Research Committee

The Technical University of Crete (T.U.C.), was founded in 1977 in Hania, Greece and admitted its first students in 1984. The purpose of the institution is to provide undergraduate as well as graduate studies in modern engineering fields, to conduct research in cutting edge technologies as well as to develop links with the local and the international industry. The Technical University of Crete places great emphasis on basic and applied research, which is conducted in 57 ultra-modern laboratories with state-of-the-art equipment in all six Departments of the University and at the affiliated Research Institute of Telecommunication Systems of Crete. Approximately, 2300 undergraduate students, 563 postgraduate and doctoral students are currently studying at T.U.C.

T.U.C. is particularly active in conducting basic and applied research. Research and development projects, administrated by the Research Committee, are funded by the European Union, the General Secretariat for Research and Technology, the Ministry of Education, the Ministry of Labour, the Public Electricity Company, the Region of Crete, local administration organisations and by a great number of national and international companies. Research is oriented in areas such as computer science, telecommunications, robotics, laser, electronics, photoelectronics, mechanics, production systems, transport telematics, applied mathematics, management, flexible manufacturing systems, construction of new structural materials, geological-geothermal research, applied hydro-geological studies, environmental engineering subjects, reservoir engineering, drilling engineering, etc. Several undergraduate and postgraduate students are involved in these projects. Their involvement in these projects offers them the opportunity to engage in and become more familiar with research activities and industrial practice. From 1990 until 2002, funds from the Special Research Account amounting to 32,28 million euros have financed 563 research, development and educational projects. At present, 110 programmes are being implemented with a total budget of 14,7 million euros employing approximately 700 research staff members, doctoral students, post graduate as well as undergraduate students.

Research Account

The Research Account of the Technical University of Crete administers all research, educational and development projects assigned to it in accordance with the KA 679/96 joint ministerial decision (by the Ministry of National Education and Religious Affairs and the Ministry of Economics). It is administered and managed by the Research Committee which is headed by the Vice-Rector and includes representatives of all the Departments. In January 2002, taking into consideration amendments that the Departments had proposed, the Research Committee concluded the compilation of the Research Financing Guide and Programme Management Regulation as well as the Product Regulation, which were approved by the Senate and came into force on February 1st, 2002.

Another important development has been the introduction of the Research Account into full V.A.T. status since November 2002. As a result, all fees of employees under work contracts as well as all equipment purchases for the implementation of European Research Programmes have been exempted from V.A.T. (see our web address).

Furthermore, since October 2000, an annual budget is compiled for the allocation of the Research Account surplus for purchasing additional scientific equipment to support the laboratories, to supplement the Network Operation Centre and the Information Systems Centre, for purchasing a new telephone network, for supplementing the students' welfare, for providing scholarships and in general for further supporting the academic functions of the University. The Research Account revenues come from the overhead charged on the projects, from a given percentage, from the revenues of faculty members for conducting extracurricular employment, from subsidies by the Ministry of National Education and the General Secretariat for Research and Technology etc.

Scientific & Technological Park of Chania

The Company for Property Development of the Technical University of Crete and the Management of the Technological Park was approved and started operating in 1993. The Company aims to improve the exploitation of bequests to the University as well as to establish and run a Technological Park in order to assist the academic staff members and graduates of the institution in promoting their research results by channelling them to interested enterprises.
The company is managed by a 7-member Board with a three-year office.
This organisation has succeeded in gathering and coordinating the scientific, social and economic community of Western Crete in the areas of research and new technologies and, at the same time, it has allowed an even greater enhancement and growth of the Technical University of Crete. The Scientific and Technological Park creates a framework within which T.U.C. may further enhance its relations with production, economic and entrepreneurial activities. Furthermore, it creates the appropriate conditions for the productive employment of the scientific staff of the Technical University of Crete.

Research Committee & Research Account

President:
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Director of Secretariat:
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Telecommunication Systems Research Institute (TSI)

The Telecommunication Systems Research Institute (T.S.I.) is a Greek Government-sponsored independent Research Institute established by the Greek Ministry of Education in 1995. T.S.I. operates within the framework of the Technical University of Crete (T.U.C.); however, it is an administratively independent and financially self-sustained entity mainly funded by external research contracts and grants.

Among its main objectives is to promote graduate education, research and development in the broad areas of Telecommunications and Telecommunication Systems. The Institute provides technical support, space, research infrastructure, and access to cooperating faculty members and highly qualified R & D engineers with experience in project planning, execution, and management.

Current research and development interests include the following areas of Telecommunications: Digital Communication Systems, Communication Networks and Computer Networks, Broadband Networks, Wireless Communication Networks, Signal Processing for Physical Layer Communications, Speech and Language Processing and Automated Services over Communication Networks.

Telecommunication Systems Research Institute (TSI)

T.S.I. has participated in various research and development projects. A list of some recent representative major projects is given below:

Telecommunication Systems Research Institute (TSI)

Contact:
Prof. Vassilios Digalakis
(Director)
Prof. Nikolaos Sidiropoulos
(Associate Director)
Tel: **+30 28210 37260**
Fax: **+30 28210 37573**
e-mail: **tsi@tsi.gr**
URL: **tsi.gr**

- "Development and Harmonization of Intelligent Telephone Network (In) Protocols and Creation of the Appropriate Test Bed", funded by the Greek P.T.T. (O.T.E.).
- "Modelling of Terminal Stations for the Provision of Telemedicine Services on Sailing Ferries via the A.T.M. Network of the Greek Telecommunications Organization", funded by the Greek P.T.T. (O.T.E.).
- "Architecture, Design, Support Maintenance and Management of the Data Network for the Athens 2004 Olympic Games", funded by the Organizing Committee of Athens 2004 Olympic Games.
- "Smart Accelerate - Acceleration of Smart Buildings Technologies and Market Penetration", funded by the European Union Save Program.
- "Design and Implementation of a Hyperlan 2 Wireless Lan Modem Components", funded by Intracom S.A.
- "Multi-user Transmit Beam forming for Maximum Sum Capacity in Wireless Multicast Networks", funded by the European Research Office (ERO/ARO, ARL / ERO).
- "Ultra High Bit Rate over Copper Technologies for BROADband Multiservice Access", funded by the European Commission.
- "Multimedia Understanding through Semantics, Computation and Learning", funded by the European Commission.
- "Human Input that Works in Real Environments", funded by the European Commission.
- "Computational Intelligence for Biopattern Analysis in Support of eHealthcare", funded by the European Commission.
- "Improving airport Efficiency, Security and Passenger Flow by Enhanced Passenger Monitoring", funded by the European Commission.
- "Evaluation of EKV for Next Generation Sub-100nm CMOS Technologies for Simulation of Radio-Frequency / Telecommunication Circuits", funded by Infineon Technologies A.G.-Germany.
- "Enabling Technology: EKV 3.0 MOSFET Model for Next Generation CMOS", funded by Toshiba Corporation Japan.
- "Multiuser Downlink Beamforming and Scheduling for Broadband Wireless Access Beyond 3G", funded by the General Secretariat of Research and Technology (GSRT).

The park for the preservation of flora & fauna

The Park for the Preservation of Flora and Fauna at the Technical University of Crete has a fenced area of approximately 30 hectares. With biodiversity rapidly being lost, mainly due to habitat destruction, in the Park the flora and coexisting fauna are left undisturbed.
Crete has a rich flora with 1820 species and subspecies of which 180 are endemic with approximately 200 threatened to varying degrees. Saving and preserving species is but one of the following goals of the Park:

- ✓ Conservation of the native flora of Crete with special attention to threatened and endemic species and plants with economic, aesthetic or cultural value.
- ✓ Research and education on the documentation of biodiversity and the relations among plants, ecosystems and people, with the participation of researchers and students from the Technical University as well as other institutions.
- ✓ Raising public awareness about the importance of conserving biodiversity.
- ✓ Recreation in controlled areas.

Visiting hours:

Monday - Friday
7:30 - 16:30

Saturday
10.00 - 16.00

Free entrance

The Park has a laboratory, a herbarium and facilities for plant reproduction. Sclerophyllous scrub characterizes the natural vegetation in a large area of the Park. Rocky habitats are found in the gorge on the Park's eastern side. An old olive grove and semi-natural grasslands are probably remains of former cultivation. During the migratory season, a number of birds find shelter from hunters here while resident bird species nest in the thickets of the Park every year. Many butterflies and other insects visit the diverse native flowers in the Park year round.
The Park was founded in 1994 by Dr. Yannis A. Phillis, former rector of the University, with financial support from the Pancretan Endowment Fund and other donors. It receives more that 3000 visitors yearly, two thirds of which are schoolchildren as part of their environmental education programme.

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B. Undergraduate Studies

Department of Sciences

The objective of the Department of Sciences of the Technical University of Crete (T.U.C.) is to provide courses in basic disciplines such as Mathematics, Physics, Chemistry, Mechanics and Social Sciences, thus providing curriculum support to all departments. The Department also promotes research in Applied Sciences and Engineering.

Divisions

- Mathematics
- Physics
- Chemistry
- Mechanics
- Social Sciences

Laboratories

- Applied Mathematics and Computers
- Matter Structure and Laser Physics
- Physical Chemistry and Chemical Processes
- Analytical and Environmental Chemistry
- Applied Mechanics
- Applied Socio-Economic Research

Academic and Research Staff

Division of Mathematics

Tryfon Daras, *B.Sc. in Mathematics, University of Patra (1984), M.Sc. (1990), and Ph.D (1995) in Mathematics, Case Western Reserve University, Cleveland, Ohio, USA, Lecturer.*

Anargyros Delis, *B.Sc. in Mathematics, University of Crete (1993), M.Sc. University of Manchester-UMIST (1994), Ph.D University of the West of England, Bristol, UK (1998), Lecturer.*

Demosthenes Ellinas, *B.Sc. in Physics, University of Patra (1979), MSc in Particle Physics, International School for Advanced Studies, Trieste, Italy (1981), Ph.D. in Theoretical Physics, University of Helsinki, Finland (1990). Associate Professor.*

Joachim Gryspolakis, *Diploma in Mathematics, Aristotle University of Thessaloniki (1970), M.Sc. (1974) and Ph.D. (1976) in Mathematics, Wayne State University, USA. Professor.*

Dimitrios Kandilakis, *B.Sc. in Mathematics, University of Crete (1981), Ph.D. University of Illinois Department of Mathematics, USA (1986), Assistant Professor.*

Daphne Manoussaki, *B.A. in Mathematics, University of Oxford (1991), M.Sc. University of Washington, Seattle (1995), Ph.D. Applied Mathematics (1996), University of Washington, Seattle, Assistant Professor.*

Manolis Mathioudakis, *B.Sc. Diploma in Mathematics, University of Crete (1993), M.Sc. (1996) and Ph.D (2001) Technical University of Crete, Lecturer.*

Elena Papadopoulou, *B.Sc. in Mathematics, University of Crete (1981), M.Sc. (1983) and Ph. D. (1987) in Mathematics and Computer Science, Clarkson University, New York, USA, Associate Professor.*

Minos Petrakis, *B.Sc. in Mathematics, University of Athens (1980) M.Sc. in Mathematics, University of Illinois, Urbana- Champain, USA, (1982). Ph.D. in Mathematics, University of Illinois, Urbana-Champain, USA, (1987), Assistant Professor.*

Yiannis Saridakis, *B.Sc. in Mathematics, University of Crete (1981), M.Sc. (1983) and Ph.D. (1986) in Mathematics and Computer Science, Clarkson University, New York, USA, Professor.*

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Associate Prof. Yannis Yentekakis
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Department of Sciences

Division of Physics

Stavros Moustaizis, *B.Sc. University of Athens (1979), Ph. D. Universite de Paris XI (1984), Associate Professor.*

Apostolos Pantinakis, *B.Sc. in Physics University of Athens, M.Sc. and D. Phil. (1981) in Physics, University of Sussex, Assistant Professor.*

Division of Chemistry

Nikolaos Kallithrakas - Kontos. *B.Sc. in Chemistry, Ph. D. University of Athens (1988), Professor.*

Michalis Konsolakis, *Degree in Chemical Engineering University of Patra (1997), Ph.D. University of Patra (2001), Lecturer.*

Ioannis V. Yentekakis, *Degree in Chemical Engineering, University of Patra (1983), Ph. D. University of Patra (1988), Associate Professor.*

Division of Mechanics

Alexandros D. Gotsis, *Diploma in Chemical Engineering, National Technical University of Athens (1981), PhD (1986) Virginia Polytechnic Institute and State University, Assistant Professor.*

Konstantinos P. Providakis, *Degree in Civil Engineering, University of Patra 1985, PhD (1989) University of Patra, Associate Professor.*

Dimitrios Sotiropoulos, *B.Sc. Drew University. M. Sc. and Ph. D. University of California, San Diego, USA, Professor.*

Maria E. Stavroulaki, *Diploma in Civil Engineering, Aristotle University of Thessaloniki (1988), PhD (1996) Department of Sciences, Technical University of Crete, Lecturer.*

Ioannis Tsompanakis, *Diploma in Civil Engineering, National Technical University of Athens (1992), Ph.D. (1997) National Technical University of Athens, Assistant Professor.*

Yannis Zavoleas, *Degree in Architectural Engineering, National Technical University of Athens(1996), M.Sc. U.C.L.A. California (2001), Assistant Professor.*

Division of Social Sciences

Michael Fragomihelakis, *B.Sc. in Economics and B.Sc. in Sociology, University of Neuchatel, Switzerland, Ph.D. in Social Sciences University of Neuchatel, Switzerland (1994), Assistant Professor.*

George Liodakis, *B.A. in Economics University of Athens (1975), Ph.D. in Economics American University, USA, (1980), Professor.*

Efpraxia Maria, *B.Sc. in Law, Faculty of Law, University of Athens (1984), M.Sc. Faculty of Law, Aristotle University of Thessaloniki (1988), Ph.D. Faculty of Law, University of Athens (1998), Assistant Professor.*

Dimitrios Patelis, *B.Sc. State University of Moscow "M. B. Lomonosof" (1988), Ph.D. State University of Moscow "M. Lomonosof" (1991), Assistant Professor.*

Content of Undergraduate Courses

Differential and Integral Calculus I

MATH 101

Functions of one real variable-Limits and continuity of functions-Derivatives-Geometric interpretation of the derivative-Differentials-Applications of the derivative-Indefinite and definite integrals-Basic theorems of integral calculus-Applications of integrals (areas between two curves, volumes by revolution, length of a plane curve, area of a surface of revolution, moments and centre of mass, centroid and centre of mass, the theorems of Pappus, hydrostatic pressure, work)-Exponential and logarithmic functions-Methods of integration-Improper integrals-Diriclet and Fresnel integrals-hyperbolic functions-inverse trigonometric functions-Taylor and Laurent series-Basic differential equations-Fourier series.

Differential and Integral Calculus II

MATH 102

Functions of many variables-plane analytic geometry-Equations of surfaces-Polar and spherical coordinates-Elements of differential geometry and vector calculus-Partial derivatives, div, grad, rot - Lagrange multipliers-Differentials Multiple integrals-Applications in physics and geometry-Surface integrals-Applications in fluid mechanics-Geen's Theorem-Stokes Theorem-Gauss' Theorem-Applications in Mechanics.

Probability Theory

MATH 103

Sample Space, Conditional Probability, Independence, Kolmogorov's Axiomatic theory, Random Variable, Distribution of a random variable, Chebyshevs' Inequality, Law of Large Numbers, Central Limit Theorem.

Introduction to Computer Programming

MATH 105

Introduction to algorithms (design, correctness), structured programming, programming with FORTRAN and C (control structures, I/O, formatting, subroutines-functions, arrays, numerical techniques), programming assignments.

Scientific Programming for Engineers

MATH 106

Use of scientific programming library packages, programming in Unix and Windows environments with Matlab and Maple. Programming assignments.

Probability Theory - Mathematical Statistics

MATH 107

Sample Space, Conditional Probability, Independence, Random Variable, Distribution of a random variable, Chebyshev Inequality, Law of Large Numbers, Central Limit Theorem, Estimation Theory, Hypothesis Testing.

Scientific Programming for Engineering

MATH 108

Use of scientific programming library packages, programming in Unix and Windows environments with Matlab, the IMSL Library, programming assignments.

Numerical Linear Algebra

MATH 201

Introduction to Linear and Matrix Algebra - Direct Methods for Solving Linear Systems - Pivoting Strategies - Error Analysis - Condition Number - Determinants - Eigenvalues and Eigenvectors - Diagonalization - Iterative Methods for Solving Linear Systems.

Numerical Analysis

MATH 202

Solution of Algebraic Equations in one Variable - Interpolation and Polynomial Approximation - Numerical Differentiation - Numerical Integration - Approximation Theory - Initial and Boundary Value Problems for Ordinary Differential Equations.

Ordinary Differential Equations

MATH 203

Introductory concepts, initial value problems. Separable and homogeneous different equations. General linear 1st order different equations Bernoulli, Ricatti and exult different equations. Integrating factors. Equations of 2nd order: linear with constant coefficients, Euler equation, reduction to 1st order. Laplace transformation methods. Systems of differential equations. Methods of serious solvability of two-degree differential equations.

Mathematical Statistics

MATH 204

Estimation Theory - Confidence Intervals - Hypothesis Testing - Regression Analysis.

Stochastic Processes - Queuing Theory

MATH 205

Markov Chains - Queuing System m/M/1 - Queuing system M/G/1.

Discrete Mathematics

MATH 208

This course aims to sharpen the student's reasoning ability through the study of some subjects fundamental to both mathematics and Computer Science.
Topics include: Combinatorics, Logic, Sets, Numbers, and Mathematical Induction, Relations and Functions, Recurrence relations, Languages and Deterministic Automata, Graphs.

Applied Mathematics

MATH 302

Complex functions of one variable-Derivatives-The Cauchy-Riemann Equations-Analytic functions-Harmonic functions-Exponential, trigonometric, hyperbolic functions and transformations-Linear and Moebius transformations-Conferral mappings-Transformations of harmonic functions and boundary conditions-Schwarz-Christoffel transformations-Applications in Potential Theory-Electrostatic Potential-Steady temperatures-Temperatures in a quadrant with one boundary insulated-Potential in a cylindrical space-Two dimensional fluid flow-The stream function-Flow around a corner-Flow around a cylinder-Line integrals-The Cauchy integral formulas- Taylor series-Applications in Fourier and Laplace transformations.

Engineering Mechanics I

MECH 102

General principles. Force vectors. Equilibrium of a particle. Force system resultants. Equilibrium of a rigid body (moments, couples, reduction of a system of forces). Structural analysis. Internal forces. Centre of gravity and centroid. Moments of inertia. Forces in beams and cables.

Strength of Materials

MECH 201

Concept of stress. Internal forces. Stress and strain distribution. Factor of safety. Undetermined problems. Thermal strain problems. Torsion. Pure bending. Asymmetric bending. Transverse loading. Combined loading. Transformation of stress and strain. Morh circles.

Machine Elements Design

MECH 303

Contents: Materials and manufacturing processes and design - Analysis of stresses and displacements - Joints - Rivets - Screws - Welds - Shafts - Belts - Spur gears - Analysis of machine elements by modern computational methods.

Fluid Mechanics

MECH 304

Introduction to the study of fluid motion. Fluid velocity and acceleration, equations of continuity, acceleration in steady and unsteady flow. Pressure variation in accelerated flow. One-Dimensional method of flow analysis. Effects of viscosity on fluid motion, significance of the Reynolds Number, characteristics of fluid

turbulence. Flow in pipes, the Moody diagram. Analysis of branched pipes and systems. Flow in open channels. Pumps and turbines, types of rotodynamic machines, dynamical principles, velocity diagrams. Propellers, fans and wind mills.

Technical Thermodynamics

MECH 306

Principles of classical thermodynamics, first law. Second law analysis of engineering systems, chemical equilibrium. Water air mixtures. Phase diagrams. Thermodynamics of reacting systems. Combustion thermodynamic cycles. Refrigeration. Determination of combustion efficiency. Combustion applications to heating. Internal combustion engines. Power generation systems.

Engineering Seismology and Antiseismic Codes

MP 319

Introduction to Seismic Risk, Elements of Engineering Seismology and Earthquake Soil Dynamics, Seismographs, Accelerometers, Seismo-tectonic of Greece, Seismological data, Anti-seismic measurements and emergency, Greek and International Antiseismic Codes, New Greek Antiseismic Code (EAK2000), GIS and antiseismic protection, Engineering applications.

Structural Analysis & Reinforced Concrete

MP 321

The matrix analysis (direct stiffness) method and its application for the analysis of frame and truss structures. Element stiffness and transformation matrices. Types of loads and supports. Formulation and solution of equilibrium equations. Evaluation and interpretation of member actions. Computer implementation of the direct stiffness method. Introduction to the finite element method for discrete and continuous problems. Introduction to reinforced concrete analysis and design. Theoretical and numerical models for reinforced concrete structural members. Types of limit states. Types of loads and related checks: compression, tension, bending moments, shear forces and moments. Code requirements and detailing provisions.

Physics I

PHYS 101

This course refers to the basic principles of kinematics and dynamics for a particle and for a rigid body. It describes the basic laws of thermodynamics and its mechanical applications and provides the student with the basics of electrostatics analysing Coulomb's and Gauss's laws and the concept of the field. Emphasis is given to the physical meaning of the physical concepts and to the student practising both in solving theoretical problems and in conducting experiments in the laboratory.

Physics I

PHYS 101a

Linear motion, Velocity, Acceleration, Motion on the plane, Vectors - Newton's laws of motion, Gravitational forces, Translational equilibrium, Friction - Momentum, Conservation of momentum, Centre of mass - Kinetic energy, Conservation law of momentum, Work, Power, Potential Energy, Conservative forces, Relation between force and potential energy - Uniform (and not) circular motion of a particle, Rotation of a rigid body. Moment of inertia, Torque, Torque and rotation, General condition of mechanical equilibrium - Angular momentum of a particle and of a rigid body, Torque and angular momentum, Law of conservation of angular momentum - Simple harmonic oscillator (SHO). The simple the compound and the torsional pendulum, SHO and damping - Restriction in the motion of a system, Generalised coordinates, Lagrange's equation of motion, Hamilton's equations of motion - Coulomb's law, Electric field, Motion of charge in an electric field, Gauss's law and applications in electrostatics - Point charges and electric potential difference, Absolute potential, Electric dipole, Electric field from potential , Electric potential energy - Simple electric circuits, Kirchhoff's rules, Charging and discharging effect of a capacitor - Magnetic induction B , Force due to B on electrical currents and moving charges, Motion of charged particles in electric and magnetic fields, Torque on a current loop. The course is completed by (1) solving theoretical problems and (2) participating to laboratory experimental exercises.

Physics II

PHYS 102

This course refers to the basic principles of electromagnetism developing the concepts of magnetic field and analysing Ampere's and Faraday's laws. The course is completed with reference to the principles of geometrical and wave optics as well as to the interaction of electromagnetic waves and light with matter. In the above

topics emphasis is given to practical and technological applications. The course is completed by the students practicing both in solving theoretical problems and in conducting experiments in the laboratory.

Physics II

PHYS 102a

ELECTROMAGNETISM: Ampere's law, Current-carrying conductors, Solenoid, Biot-Savart law - Induction currents, Time varying magnetic flux, Faraday's law, Lenz's law, Self-inductance L, LR circuit - Energy in electric and magnetic field, Electromagnetic oscillations of an LC system, Dumped and forced oscillations, Resonance in an LCR circuit - Wave essentials, Principle of generation of an electro-magnetic wave, Intensity of an e-m wave, Poynting's vector, Magnetic fields from induction, Displacement current, Maxwell's equations. OPTICS: Wave properties, Superposition principle, Huygens's principle, Reflection, Refraction and Snell's law, Total reflection, Fermat's principle - General formula for mirrors, Ray diagrams for mirrors, General equation for refraction, Thin lenses, Ray diagrams for lenses - Wave interference, Young's experiment, Fraunhofer diffraction from a single slit, Limits of resolution, Diffraction from a double slit, Polarization of light, Brewster's law. MODERN PHYSICS: Introduction to modern Physics, Photoelectric effect, properties of the photon, material waves, de Broglie wavelength, Wave mechanics, Wave function - Stationary states, Wave resonances, Eigen frequencies, Standing waves, particle in a box, Energy quantization - Free electrons, Maxwell-Boltzman and Pauli distribution laws. Energy distribution of the electron gas, Electric conductivity, Energy bands, Metals, Insulators, Semiconductors - Pure semiconductors, Energy gap measurement, Doped semiconductors, Type n and type p semiconductors - p-n junction diode, LED diode, p-i-n photodiode. The course is completed by (1) solving theoretical problems and (2) by participating to laboratory experimental exercises.

Inorganic Chemistry

CHEM 101

Atomic Models - Introduction to Quantum Chemistry - Elementary Particles - Orbitals - Atomic Properties and the Periodic Table - Molecular Orbitals and Chemical Bonding - Hybridisation of Atomic Orbitals - Molecular Structure - Bimolecular Forces - Chemical Thermodynamics - Oxidation - Reduction - Acids, Bases and Salts - Complex Ions and Coordination Compounds - Safety Rules in the Laboratory - Chemistry Laboratory Apparatus - Reactions and Identification of Cations and Anions - Types of Chemical Reactions - Chemical Equilibrium - Hydrolysis - Amphoterism - Volumetric Analysis and Titration - Preparation of a Complex Salt.
The above topics are been supplemented by laboratory exercises.

Analytical Chemistry

CHEM 102

Sampling, common apparatus and basic techniques, errors and statistics in analytical chemistry, solvent extraction, principles of chromatography, liquid chromatography, gas chromatography, thin layer chromatography, spectroanalytical methods, mass spectrometry, atomic absorption spectrometry, x-ray fluorescence, nuclear methods. Laboratory activity: working practices, titrimetric analyses, water hardness, pH-meters and ion selective electrodes, spectrophotometric analysis.

General Chemistry

CHEM 103

Structure and Properties of the Elements-Periodic Table - Chemical Bonds and Chemical Reactins - Chemical Thermodynamics - Oxidation Redaction - Acids, Bases and Salts - A short Review of the Main Metals and Non-metals - An Introduction to Organic Chemistry, Hydrocarbons, Esters, Proteins, Synthetic Chemistry - Raw Materials - Petrochemistry - Detergents - Drugs- An Introduction to the Safety Rules of Chemical Laboratories and Industries - Chemistry and the Environment - Laboratory Apparatus - Basic Laboratory Techniques - Qualitative Analysis - A Study of Certain Cupper Reactions - Photometry - Chemical Equilibrium - Atomic Absorption Spectrophotometry - High Performance Liquid Chromatography.
The above topics are supplemented by laboratory exercises.

Physical Chemistry

CHEM 201

The physicochemical properties of matter; Ideal gases: laws, Equation of state of ideal gases, Kinetic theory of ideal gases, Gas diffusion, applications. Real gasses: PVT behaviour of real gases, Equations of state for real Gases. Virial and van der Waals equations of state. Law of corresponding states. The critical region. Mixtures of ideal

or nonideal gases. Chemical Kinetics: Rate equations, Reaction rate constant and Arrhenius theory, order of reaction, experimental methods in reaction kinetics determination in batch, CSTR and PFR reactors, Chemical reaction mechanisms, Heterogeneous catalytic reactions, applications in reactor engineering and design. Thermodynamics: First Law and applications, Chemical thermodynamics. Second Law and applications, Enthalpy, entropy, free energy, chemical potential, Chemical-reaction equilibriums and calculations. Phase equilibrium.
The course is completed by experimental practice in the laboratory which in general includes: Phase equilibriums and distillation, Liquid-gases equilibriums and absorption, gas-solid equilibriums and adsorption, Kinetic studies of homogeneous and heterogeneous reactions. Electrochemistry and fuel cells.

Thermodynamics

CHEM 305 (MPD 224)

General principles of classical thermodynamics, ideal gas behaviour, real gas, equations of state. Energy and the first law of thermodynamics, internal energy, enthalpy, work and heat. Thermochemistry (chemical thermodynamics). Entropy and Free Energy. The second law of thermodynamics. Chemical-reaction equilibria and applications. Conversion of heat into work by power cycles (Carnot, Diesel, Otto cycles).

Sociology

KEP 101

Introductory lectures on Sociology, with particular reference on concepts of the social framework of production, such as: society, socio-economic change and evolution, social classes and social stratification, institutions (political, economic, educational...).

Political Economy

KEP 102

This course includes an analysis of basic concepts and relations of Political Economy, as well as a brief review of recent economic history. It refers more specifically to the theory of value, surplus-value and prices, as well as to the relation between competition and distribution, to fundamental trends and contradictions of growth, and to the phenomena of economic crisis.

Introduction to Philosophy

KEP 104

A brief overview of the history of philosophy. Main categories and laws of dialectic in the areas of knowledge. Theory of ontology and logic (formal and dialectical). Elements of social philosophy. The social structure as an organic whole, social consciousness and its forms.

Micro-Macro-economic Analysis

KEP 201

An analysis of commodity supply and demand is included, as well as the theory of the consumer and of the firm. Macroeconomic topics are also included regarding income and employment determination, the role of investment and the impact of international exchange.

History of Civilization

KEP 202

Review of History of Civilization with particular reference on some periods. Analysis and synthesis of basic concepts and questions on civilization. Critical discussion of theories about recent cultural changes (post-modernism, etc.).

Philosophy and History of Science

KEP 203

Science as a social-cultural phenomenon. The role of science in the social structure. Theoretical issues concerning knowledge, logic and the methodology of scientific research. Sciences in History. Differentiation, integration and inter-disciplinarity of science. Traditions and innovations in the development of science. The subject of scientific activity. Theories, orientations and approaches in the philosophy of science.

Introduction to Legal Systems and Technical Legislation

KEP 204

A. Introduction to the legal system. Basic law classification. Elements of public and European law. Elements of civil law (general principles of civil law, contract law, property law). Elements of labour law (individual contract of employment, collective bargaining, labour accidents) commercial law, industrial property (trade-mark, patent), intellectual property, elements of environmental law.
B. Elements of public works law (undertaking and elaboration of public works projects, undertaking and construction of public works, contractor's counter value, procedures to receive a public work, contractual liability, procedures to resolve conflicts in public works, organization of public works contractors).

Art and Technology

KEP 301

Technology and Art in the social structure. Technology as objectification, as a framework for the human impact on nature and for the relations among people, as a forerunning conception-knowledge and as an instrument implicating upon Nature. The particularity of the aesthetic moment. The aesthetic moment as a specific activity in the division of labor (Art). Art and technology in the history of civilization. Metaphysical discourse on "Appollonean" and "Dionysian" elements.

Industrial Sociology

KEP 302

Lectures on Sociology of Labour and Sociology of Development, with particular reference on historical approach of production systems and on recent changes concerning industry (crisis and restructuring strategies, "flexible" production and labour organization, labour market, inter-firm relations, local productive systems, research and technological development, innovations, know-how, industrial policy...).

Environmental and Technical Legislation

KEP 304

A. Introduction to the legal system. Basic law classification. Elements of public, private and European law. B. Introduction to technical legislation. Procedures for undertaking public works. Adaptation of the Greek technical legislation to the corresponding European legislation. Procedures to resolve conflicts in public works. C. Greek and European environmental legislation. Constitutional protection of the environment (the article 24 of the Greek Constitution). Enlargement of the legal standing in the environmental process. The conflict between the environmental and other constitutional rights. The sustainable development and the Council of State jurisprudence. The Greek Act 1650/1986 for the protection of the environment. The legal framework for the Renewable Energy Sources. The Amsterdam Treaty and the horizontal environmental directives. Greek and European jurisprudence for the protection of the environment. D. The administrative organisation for the protection of the environment. Procedures for environmental authorisation. The European directives for the Environmental Impact Assessment (EIA) and the Strategic Environmental Assessment (SEA). Contents, specifications and evaluation of the environmental studies. The jurisprudence of the Council of State for the environmental studies. The jurisprudence of the European Community Court for the Environmental Impact Assessment.

Department of Production Engineering & Management

Production Engineering and Management is a broad discipline involving the design of effective systems and methods used to develop production resources to their full potential. Production and management engineers draw upon the knowledge of mathematics, physical and engineering sciences, production systems, operations research, computer science, management and behavioral sciences to function as problem solvers, system designers, innovators and managers.

Divisions

- Production Systems
- Decision Science
- Management

Laboratories

- Computer-Aided Manufacturing (CAM)
- Intelligent Technological Systems
- Computer-Aided Design (CAD)
- Robotics
- Environmental Engineering and Management
- Dynamic Systems and Simulation
- Decision Support Systems
- Data Analysis and Forecasting
- Financial Engineering
- Management Systems
- Work Safety and Cognitive Ergonomics

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Interdepartmental Laboratory

Machine Tools Laboratory. The laboratory is involved in educational and research activities in machine tools, manufacturing technology material processing, welding machines, lathes, drilling, milling and planning and shaping machines.

Academic and Research Staff

Production Systems Division

Bilalis Nikolaos, *Dipl. Eng. (1978) National Technical University of Athens - Greece. M.Sc. (1979) Aston University of Birmingham - Great Britain. Ph.D. (1983) Loughborough University of Technology - Great Britain. Associate Professor.*

Georgilakis Pavlos, *Dipl. Elec. Eng. (1990), National Technical University of Athens - Greece. PhD (2000) National Technical University of Athens - Greece. Assistant Professor.*

Kouikoglou Vasilios, *Dipl. Eng. (1985) National Technical University of Athens - Greece. Ph.D. (1989) Technical University of Crete - Greece. Professor.*

Nikolos Ioannis, *Dipl. Mech. Eng. (1990) National Technical University of Athens - Greece. Ph.D. (1996) National Technical University of Athens - Greece. Lecturer.*

Phillis Ioannis, *Dipl. Eng. (1973) National Technical University of Athens - Greece. M.Sc. (1978) University of California, Los Angeles - USA. Ph.D. (1980) University of California, Los Angeles - USA. Professor.*

Pouliezos Anastasios, *B.Sc. (1975) Polytechnic of North London - Great Britain. M.Sc. (1976) Imperial College of London - Great Britain. Ph.D. (1980) Brunel University of London - Great Britain. Professor.*

Tsourveloudis Nikos, *Diploma Eng. (1990), Technical University of Crete. Ph.D. (1995) Technical University of Crete. Assistant Professor.*

Decision Science Division

Doumpos Michael, *B.Sc. (1995) Technical University of Crete - Greece. M.Sc. (1997) Technical University of Crete - Greece. Ph.D (2000) Technical University of Crete - Greece. Lecturer.*

Kosmatopoulos Elias, *Diploma (1990), Technical University of Crete. M.Sc. (1993), Technical University of Crete. Ph.D. (1995), Technical University of Crete. Assistant Professor.*

Mygdalas Athanasios, *B.Sc. (1983) Linkopink University - Sweden. Licentiate of Philosophy (1985) Linkopink University - Sweden. Ph.D. (1985) Linkopink University - Sweden. Professor.*

Papageorgiou Markos, *Dipl.-Ing. (1976) Technical University of Munich - Germany. Dr.-Ing. (1981) Technical University of Munich - Germany. Professor.*

Papamichail Ioannis, *Dipl. Eng. (1998), National Technical University of Athens, M.Sc. (1999) University of London, Great Britain, PhD (2002) University of London, Great Britain. Lecturer.*

Stavroulakis George, *Dipl. Eng. (1985) Aristotle University of Thessaloniki, PhD (1991) Aristotle University of Thessaloniki. Professor.*

Management Division

Doulamis Apostolos, *Dipl. Eng. (1995) National Technical University of Athens, PhD (2001) National Technical University of Athens. Assistant Professor.*

Grigoroudis Evangelos, *Dipl. Eng. (1991) Technical University of Crete, Greece. M.Sc. (1996) Technical University of Crete, Greece. Ph. D. (1999) Technical University of Crete, Greece. Lecturer.*

Kontoyannis Thomas, *Dipl. Eng. (1983) Aristotle University of Thessaloniki - Greece. M.Sc. (1986) University College London - Great Britain. Ph.D. (1988) Loughborough University of Technology - Great Britain. Associate Professor.*

Matsatsinis Nikolaos, *B.Sc. (1980) Aristotle University of Thessaloniki - Greece. Ph.D. (1995) Technical University of Crete - Greece. Associate Professor.*

Moustakis Vasilios, *Dipl. Eng. (1978) University of Patras - Greece. M.Sc. (1980) George Washington University - USA. Ph.D. (1984) George Washington University - USA. Associate Professor.*

Skiadas Christos, *Dipl. Eng. (1967) National Technical University of Athens - Greece. Ph.D. (1985) National Technical University of Athens - Greece. Associate Professor.*

Zopounidis Konstantinos, *B.Sc. (1981) University of Macedonia - Greece. D.E.A. (1982) Univ. Paris Dauphine - France. Doctorat d' Etat (1986) Univ. Paris Dauphine - France. Professor.*

Content of Undergraduate Courses

1st Semester

Differential and Integral Calculus I

MATH 101

Functions of one real variable-Limits and continuity of functions-Derivatives-Geometric interpretation of the derivative-Differentials-Applications of the derivative-Indefinite and definite integrals-Basic theorems of integral calculus-Applications of integrals (areas between two curves, volumes by revolution, length of a plane curve, area of a surface of revolution, moments and centre of mass, centroid and centre of mass, the theorems of Pappus, hydrostatic pressure, work)-Exponential and logarithmic functions-Methods of integration-Improper integrals-Diriclet and Fresnel integrals-hyperbolic functions-inverse trigonometric functions-Taylor and Laurent series-Basic differential equations-Fourier series.

Physics I

PHYS 101

This course refers to the basic principles of kinematics and dynamics for a particle and for a rigid body. It describes the basic laws of thermodynamics and its mechanical applications and provides the student with the basics of electrostatics analysing Coulomb's and Gauss's laws and the concept of the field. Emphasis is given to the physical meaning of the physical concepts and to the student practicing both in solving theoretical problems and in conducting experiments in the laboratory.

Methodology of Computing

MPD 101

Introduction to computer science, evolution of computers (hardware & software), structure and operation of a computer system, architectures, operating systems. Introduction to algorithms and data structures. Development environments, programming languages, program development methodologies (pseudocode, flow charts). Constants & variables, basic data types (integer, real, Boolean). Assignment statements. Input/output statements. Control statements (if ? then ? else, nested ifs, select statement). Operands & precedence. Loops (while, repeat, for structures). Structured data types (tables, strings, records, and sets). User defined data types.Practice: Programming using C language.

Methodology of Operations Research

MPD 102

Methodological framework of operations research, Introduction to graph theory and applications to project management, Inventory control, Wilson's model and extensions, Introduction to linear programming, Multiple criteria decision making, Case studies.

Computer-Aided Mechanical Drawing

MECH 101

Drawing Instruments and Materials, Line Drawing, Dimensions, Scales, Geometric Structures, Mechanical Design, Drawing with the use of Computers.

Sociology

KEP 101

Introductory lectures on Sociology, with particular reference on concepts of the social framework of production, such as: society, socio-economic change and evolution, social classes and social stratification, institutions (political, economic, educational...).

English or German

LANG 101

For the English: students registered in this course are required to cover basic English grammar and vocabulary by utilizing the resources targeted at a lower-intermediate level as they are presented at the Language Research and Resource Center. A minimum of 25 hours per semester is recommended for students to complete the English syllabus of self-access materials. Additional time will be scheduled for grammar and writing tutorials. The mark for the course will be based on the final exam.1

For the German: Basic German with the assumption that students have had previous German instruction. Development of oral skills, grammar, writing skills and progressive enhancement of vocabulary.

Students who hold and show proof of a certificate of Proficiency in English need not participate in English 01 and English 02; upon request, students may ask that the mark received from English 03 be assigned to both English 01 and English 02. Students wishing to exercise this option must inform Mrs. Mandonanaki at the Language Center at the beginning of the semester.

2nd Semester

Differential and Integral Calculus II

MATH 102

Functions of many variables-plane analytic geometry-Equations of surfaces-Polar and spherical coordinates-Elements of differential geometry and vector calculus-Partial derivatives, div, grad, rot - Lagrange multipliers-Differentials Multiple integrals-Applications in physics and geometry-Surface integrals-Applications in fluid mechanics-Geen's Theorem-Stokes Theorem-Gauss Theorem-Applications in Mechanics.

Physics II

PHYS 102

This course refers to the basic principles of electromagnetis m developing the concepts of magnetic field and analysing Ampere's and Faraday's laws. The course is completed with reference to the principles of geometrical and wave optics as well as to the interaction of electromagnetic waves and light with matter. In the above topics emphasis is given to practical and technological applications. The course is completed by the students practicing both in solving theoretical problems and in conducting experiments in the laboratory.

Engineering Mechanics I

MECH 102

General principles. Force vectors. Equilibrium of a particle. Force system resultants. Equilibrium of rigid body(Moments, Couples, reduction of a System of forces). Structural analysis. Internal forces. Centre of gravity and centroid. Moments of inertia. Forces in beams and cables.

General Chemistry

CHEM 103

Structure and Properties of the Elements-Periodic Table - Chemical Bonds and Chemical Reactins - Chemical Thermodynamics - Oxidation Redaction - Acids, Bases and Salts - A short Review of the Main Metals and Nonmetals - An Introduction to Organic Chemistry, Hydrocarbons, Esters, Ptoteins, Synthetic Chemistry - Raw Materials - Petrochemistry - Detergents - Drugs - An Introduction to the Safety Rules of Chemical Laboratories and Industries - Chemistry and the Environment - Laboratory Apparatus - Basic laboratory Techniques - Qualitative Analysis - A Study of Certain Cupper Reactions - Photometry - Chemical Equilibrium - Atomic Absorption Spectrophotometry - High Performance Liquid Chromatography.
The above topics are been supplemented by laboratory exercises.

Electric Circuits

MPD 121

Electric quantities: charge, current, voltage, energy, power. Circuit elements: resistance, capacitor, inductor, independent sources, dependent sources, switches. Electric circuit theorems: Kirchhoff laws, voltage division, current division, series and parallel resistor connections, superposition, series and parallel inductor connections, series and parallel capacitor connections, Kennely theorem, sources transformations, Thévenin and Norton theorems, Millman theorem, symmetric circuits, nodal analysis, loop analysis. Basic first-order and second-order transient circuits. Electric circuits in sinusoidal steady state (SSS): phasors, circuit equations, impedance and admittance, SSS power analysis, electric network theorems in SSS. Three-phase circuits: phase and line quantities, source-load connections, power, load flow, power factor correction. Electric circuit analysis with PSPICE.

Algorithms and Data Structures

MPD 122

Contents: Data types, algorithms, tables, lists, heaps, queues, stacks, search and sorting algorithms, recursive algorithms, trees, balanced trees, optimal search trees, hashing. Introduction to database systems, Files, files structure, organization and processing, sorting-search-merge of files, structure of data base systems, relational model, hierarchical model, network model, database management. Relational database management systems - RDBMS (tables, relationships, queries). Introduction to SQL. Practice: Programming exercises using C language. Database development using Microsoft Access RDBMS.

English or German

LANG 102

For the English: English 02 offers an extension of the grammar and vocabulary skills initiated in English 01 with a further emphasis on academic reading and writing skills. In addition to the minimum 25-hour attendance recommended for the completion of level 02 materials at the Language Center, students may also register in writing skills and conversation tutorials provided at the center. The mark will be based on a final exam. All students must meet the requirements of this course.

For the German: German instruction at the level of Zertifikat Deutsch (first certificate in German from the Goethe Institut).

Content of Undergraduate Courses

3rd Semester

Ordinary Differential Equations
MATH 203
Introductory concepts, initial value problems. Separable and homogeneous different equations. General linear 1st order different equations Bernoulli, Ricatti and exult different equations. Integrating factors. Equations of 2nd order: linear with constant coefficients, Euler equation, reduction to 1st order. Laplace transformation methods. Systems of differential equations. Methods of serious solvability of two-degree differential equations.

Probability & Statistics for Engineers
MPD 201
Events, axioms of probability, conditional probability, independence, random variables and distributions, multidimensional random variables and distributions, moments, moment theorems, functions of random variables, the fundamental theorem of probability, estimation, central limit theorem. Descriptive statistics, sampling distributions, estimations, hypothesis testing, linear regression models, correlation, analysis of variance, factorial experiments, categorical data, nonparametric statistics. Credits: 4.

Numerical Linear Algebra
MATH 201
Introduction to Linear and Matrix Algebra - Direct Methods for Solving Linear Systems - Pivoting Strategies - Error Analysis - Condition Number - Determinants - Eignevalues and Eigenvectors - Diagonalization - Iterative Methods for Solving Linear Systems.

Strength of Materials
MECH 201
Concept of stress. Internal forces. Stress and strain distribution. Factor of safety. Undetermined problems. Thermal strain problems. Torsion. Pure bending. Asymmetric bending. Transverse loading. Combined loading. Transformation of stress and strain. Morh circles.

Materials Science
MPD 202
Introduction to the science of solid materials. Relations between the structure of materials and their mechanical, electrical and thermal properties. Physical, chemical and processing factors affecting the structure of metallic, polymeric, ceramic and semiconducting materials. Introduction to the engineering alloys and composite materials. Optical properties and superconducting materials. Corrosion and corrosion control of materials.

English or German
LANG 201
For the English: English 03 combines a programme of self-access learning at the Language Center with a series of thematic work modules to be covered in class based on a student's field of study. The modules focus on language, texts, and writing skills specifically targeted at what students learn in the context of their departments. Small assignments throughout the course and a final exam will determine the student's mark. All students must meet the requirements of this course.

For the German: Students are introduced to terminology in their field of study. The course aims to develop student abilities in language and communication skills, allowing a competence in a professional work environment.

The students should register in one (1) of the following elective courses:

Electronics
MPD 203
Analog Electronics: semiconductor physics, diodes, special diodes, diode applications, bipolar junction transistors (BJTs), BJT amplifiers, operational amplifiers, junction field-effect transistors (JFETs), metal-oxide semiconductor field-effect transistors (MOSFETs). Digital Electronics: digital analysis and design. Digital systems: digital numbers and codes, digital logic. Boolean algebra. Digital logic gates. Integrated circuits. Simplification of Boolean functions. Combinatorial logic circuits: adders, subtracters, comparators, decoders, encoders, multiplexers. Sequential logic circuits: function and transition tables of flip-flops (FFs), analysis and design of circuits with FFs. Registers, counters, memories. Digital circuit analysis with PSPICE.

Art and Technology
KEP 301
Technology and Art in the social structure. Technology as objectification, as a framework for the human impact on nature and for the relations among people, as a forerunning conception-knowledge and as an instrument implicating upon Nature. The particularity of the aesthetic moment. The aesthetic moment as a specific activity in the division of labor (Art). Art and technology in the history of civilization. Metaphysical discourse on "Appollonean" and "Dionysean" elements.

4th Semester

Numerical Analysis
MATH 202
Solution of Algebraic Equations in one Variable - Interpolation and Polynomial Approximation - Numerical Differentiation - Numerical Integration - Approximation Theory - Initial and Boundary Value Problems for Ordinary Differential Equations.

Linear Programming
MPD 221
Modeling of linear programming (LP) problems, The geometry of LP, The Simplex method: theory and the tableau implementation, Duality theory, The Dual Simplex method, Sensitivity analysis, Parametric programming, Robustness analysis, Integer programming, Special problems of LP (the transportation problem, the assignment problem), Introduction to multi-objective programming, Case studies.

Engineering Management
MPD 222
Management systems. Brief historical overview of the evolution of management thinking: from Xenophon to Business Process Modeling. Process of management: planning, organizing, directing and controlling. Class material includes case presentation and discussion of modern management issues.

Fluid Mechanics
MPD 223
Introduction to the study of fluid motion. Fluid velocity and acceleration, equations of continuity, acceleration in steady and unsteady flow. Pressure variation in accelerated flow. One-Dimensional method of flow analysis. Effects of viscosity on fluid motion, significance of the Reynolds Number, characteristics of fluid turbulence. Flow in pipes, the Moody diagram. Analysis of branched pipes and systems. Flow in open channels. Pumps and turbines, types of rotodynamic machines, dynamical principles, velocity diagrams. propellers, fans and wind mills.

Thermodynamics
MPD 224
General principles of classical thermodynamics, ideal gas behaviour, real gas, equations of state. Energy and the first law of thermodynamics, internal energy, enthalpy, work and heat. Entropy and the second law of thermodynamics. Energy analysis of thermodynamic systems, the Cannot cycle, the Diesel cycle, the Otto cycle. Analysis of process and thermodynamic engines. Vapor power and Refrigeration cycles, the Ranking cycle.

English or German
LANG 202
For the English: Students in English 04 will be required to study texts and language based on materials related to their fields of study. Work assigned in class meetings to be completed with the resources available at the center involve extensive use of the Web in improving English language skills not only with respect to the language itself but regarding such themes as Ethics in Engineering and Academic Report Writing. A project report and the final exam will determine the student's mark. All students must meet the requirements of this course.

For the German: German 04 instruction at the level of Mittelstufe (ZMP), enhancement of specific language tailored to students professional field.

The students should register in two (2) of the following elective courses:

Industrial Processing Systems
MPD 225
Introduction to technical calculations, Material balances, Gases, vapors, liquids and solids, Energy balances, combination of mass and energy balances.

History of Civilization
KEP 202
Review of History of Civilization with particular reference on some periods. Analysis and synthesis of basic concepts and questions on civilization. Critical discussion of theories about recent cultural changes (post-modernism, etc.).

Political Economy
KEP 102
This course includes an analysis of basic concepts and relations of Political Economy, as well as a brief review of recent economic history. It refers more specifically to the theory of value, surplus-value and prices, as well as to the relation between competition and distribution, to fundamental trends and contradictions of growth, and to the phenomena of economic crisis.

Electronic Commerce and Networks
MPD 227
Introduction in Electronic Commerce. Networks VAN, LAN, MAN, WAN. X400 and X435. Bar Coding. Information Technology and Electronic Commerce. Internet. Intranets. Extranets. Electronic Data Interchange. E-Marketing. On-line market research. eServices. E-MarketPlaces. Electronic Commerce & Customer Modelling. Electronic Commerce &

Content of Undergraduate Courses

Positioning. Virtual Enterprises. Workflow Management. Telework. Distance Learning. Electronic Payment Systems. Electronic Documents Management. E-Banking. E-Democracy. E-Government. EDirectories-Libraries-Search Engines. Information Retrieval and Filtering. User Modelling. Security-Authentication. Artificial Intelligence and E-Commerce. Web-based IS. Electronic Commerce Applications. Methodologies and Environments for Electronic Commerce Applications Development. Laboratory: Electronic Commerce Applications - Market Places Development. Programming and eCommerce Applications Development in Java. HTML. Active X.

Game Theory

MPD 407

Introduction, Games with two players, Zero-Sum Games, Pure and Mixed Strategies, Matrix and Bi-matrix Games, Equilibria and Saddle Points, MinMax Theorem, Solution of Matrix Games using Linear Programming, Solution of Bi-matrix Games using Nonlinear and Linear Complementarity Programming, Nash Equilibria and Pareto points, Hierarchical Games, Stackelberg Equilibrtia and Disequilibria, Bi-level Programming, Application to Microeconomy: Cournot Duopoly, Application to Traffic Planning: Traffic Assignment Problem.

5th Semester

Manufacturing Technology I

MPD 301

Introduction, Mechanical Behavior of Materials: tension, compression, torsion, hardness, creep. Structure and Manufacturing Properties of Metals: grains and boundaries, failure and fracture, recovery, recrystallization. Dimensional Tolerances, Metal Casting Processes: solidification of metals, casting alloys, ingot casting and continuous casting, expendable and permanent mold. Cutting Processes: machine tools, chip formation, tool wear, tool materials, tool life, cutting fluids. Introduction to Computer Integrated Manufacturing, Automation, Numerical Control, Material Handling Devices, Robots, Flexibility in Manufacturing.

Human Resource Management

MPD 302

Job and role description models. Performance appraisal. Compensation. Human resource planning. Recruitment. Leadership and human resource development. The role of human resources in innovation. Case studies.

Stochastic Processes

MPD 303

Introduction and definitions, statistics, correlation, moments, mean square calculus, independence, Wiener process, white noise, Poission process, systems with stochastic inputs, ergodicity, Markov chains, introduction to information theory, applications.

Heat Transfer

MPD 304

Basic concepts of heat transfer. Thermophysical properties. Conduction and methods for obtaining approximate solutions. Free convection boundary layer heat transfer. Forced convection, internal flow in ducts. Condensation and boiling. Radiation. Heat exchangers. Credits: 3.

Machine Elements

MPD 305

Contents: Materials and manufacturing processes and design - Analysis of stresses and displacements - Joints - Rivets - Screws - Welds - Shafts - Belts - Spur gears - Analysis of machine elements by modern computanional methods.

The students should register in one (1) of the following elective courses:

Knowlegde and Decision Engineering

MPD 306

Introduction in Artificial Intelligence. Problem Solving. Knowledge Representation and Reasoning. Uncertainty and Fuzzy Knowledge. Planning. Expert Systems. Machine Learning. Rough Sets. Neural Nets. Evolutionary and Genetic Algorithms. Fuzzy Sets. Data Mining. Intelligent Communications Methods (natural language processing. vision. robotics). Agents - Intelligent Agents. Multi-Agent Systems. Intelligent Systems Applications. Laboratory.

Philosophy and History of Science

KEP 203

Science as a social-cultural phenomenon. The role of science in the social structure. Theoretical issues concerning knowledge, logic and the methodology of scientific research. Sciences in History. Differentiation, integration and inter-disciplinarity of science. Traditions and innovations in the development of science. The subject of scientific activity. Theories, orientations and approaches in the philosophy of science.

Micro-Macro Economics
KEP 201
Includes an analysis of commodity supply and demand, of the basic functions and development trends regarding capitalist firms, and of the role of technology in production. The issues analysed on a macroeconomic level include the income and employment determination, inflation, the role of the state, and the problems or development trends within the world economy.

6th Semester

Manufacturing Technology II
MPD 321
Introduction, Deformation Processes: forging, rolling, extrusion. Sheet-Metal Forming Processes: shearing, bending, deep drawing. Powder Metallurgy, Sintering,. Joining Processes: arc-welding with consumable and non-consumable electrode, laser and electron beam welding, friction, resistance, explosion and ultrasonic welding, Properties and processing of Polymers and Plastics.

Production Systems
MPD 322
Introduction, inventory systems with static, dynamic and stochastic demand, discounted orders, production planning, forecasting methods, moving average, minimum square error, ARMA models, scheduling jobs in one and two machines, sequence-dependent set-up times, required precedence among jobs.

Data Analysis
MPD 323
Introduction, basic concepts, time series analysis, regression analysis, principal components analysis, simple correspondence analysis, multiple correspondence analysis, factor analysis, discriminant analysis, cluster analysis, Q-analysis, forecasting techniques, applications and case studies.

Decision Support Systems
MPD 324
Introduction in Information Systems and information technology. Decision Theory. Multicriteria Decision Analysis. Droup Decision Making. Decision Support Systems. DSS's Architectures. Human-Computers Interaction Systems. Data Base Management Systems. Structured Modelling and Model Base Management Systems. DSS's Evaluation. Intelligent Methods for Decision Support. Intelligent DSSs. Multicriteria DSSs. Group and Negotiation DSSs. Executive Information Systems. Executive Support Systems. Data Warehouses & On Line Analytical Processing. Distributed DSSs & Web-based DSSs. Spatial DSSs. DSS Applications in Management. Marketing. Industry. Production. Finance. Health. Environment etc. Practice: Applications using DSS. DSS's Development. Case Studies.

Non-Linear Programming
MPD 325
Mathematical Background. Unconstrained Optimization : Conditions for local minima, ad hoc methods, algorithmic properties, quadratic models, descent methods and stability, algorithms for the line-search subproblem, Newton-like methods, conjugate direction methods. Constrained optimization : Elimination and other transformations, Lagrange multipliers, first order conditions, second order conditions, convex optimization problems, Quadratic Programming, linearly constrained optimization, penalty functions, multiplier penalty functions, Sequential Quadratic Programming, nonlinear elimination and feasible direction methods. Global optimisation.

Hydrodynamic and Combustion Engines
MPD 326
Pumps, centrifugal and axial pumps, compressors, high vacuum pumps and fans. Combustion and fuels. Otto and Diesel cycles. Design and estimation of parameters.

7th Semester

Control Systems I
MPD 401
Mathematical concepts : input signals, complex numbers, Laplace transforms. System description : Transfer functions, block diagrams. Time response, stability, steady-state error, controller design, PID design, MATLAB use.

Financial Management
MPD 402
The Nature of the Enterprise and its Goals, the Evolution of Financial Management, the Credit System, Basic Financial Statements, Balance Sheet, Net Income Statement, Working Capital, Financial Ratios, Financial Analysis Methodology, Profitability, Financial Leverage, Industrial and Financial Risks, Break-even Analysis, Corporate Risk Models, Table of Sources and Uses of Funds, Financial Forecasting Methods, Corporate Financing, Common Stock Financing, Debt and Preferred Stock, Leasing, Case Studies.

Reliability Theory
MPD 403
System's Life Cycle and Reliability. Probability concepts.

Content of Undergraduate Courses

Discrete and Continue Random Variables. Time dependent failure rates. Failure modes. Combinatorial aspects of systems reliability. Series or chain structure. Parallel structure. R out of N structure. Stand-by systems. Reliability evaluation methods. Decomposition method. Minimal cut method. Event trees. Fault trees. Reliability evaluation of repairable systems using Macrov models. Discrete Marcov chains. Continuous Marcov processes. Stochastic transitional matrix. Steady state probabilities. Availability analysis. Reliability centered maintenance.

Project and Production Management & Scheduling

MPD 409

Introduction to Project Management & Scheduling. Mathematical Tools. Optimal Scheduling without or with constraints. CPM, PERT methods. Production Process Selection and Scheduling.

Quality Control

MPD 405

Introduction to quality and quality improvement methods, Concept and techniques of quality control, Basic categories of statistical quality control, Fundamental of statistics, Acceptance sampling, Single, double and multiple sampling plans, Sequential sampling plans, Other acceptance sampling techniques, Introduction to statistical process control and control charts, Control charts for variables and attributes, Other statistical process control techniques.

Marketing

MPD 406

Definition of Marketing, Marketing, Mix, Marketing environment. The market, market research, market segmentation. Consumer, factors affecting consumer behavior. Product, product life cycle. Product promotion. Advertisement. Personal selling. Marketing, Management.

Combinatorial Optimization

MPD 426

Mathematical models and applications of Combinatorial Optimization, Differences in Linear and Combinatorial Optimization, Graphs and Networks, Graph Search, Shortest paths and Discrete Dynamic Programming, Minimal Spanning Trees and Greedy Algorithms, Flow Problems, Algorithm Complexity, Problem Complexity, Linear and Lagrangean Relaxation, The Branch-and-Bound Method, Local Search, Heuristics, Approximation algorithms, Meta-heuristics.

8th Semester

Production Networks (CAM)

MPD 421

Introduction to queuing theory, birth-death models, MM1, non birth-death Markovian models, Erlang distribution, batch arrivals/service, advanced models MG1, MGm, GG1, GGm, efficient models for the analysis of production lines, introduction to flexible manufacturing systems (FMS) - analytical tools and control issues.

Investment Decision Analysis

MPD 422

Financial Mathematics, Investment Decision under Certainty, Net Present Value, the Payback Method, the Accounting Rate of Return, the Index of Profitability, the Internal Rate of Return, Advanced Capital Budgeting Techniques, Investment Decision under Uncertainty, Risk-adjusted Discount-rate Method, Certainty Equivalent Method, the Statistical Decision Method, the Decision Tree Method, the Simulation Analysis, Portfolio Selection and Management, Risk and Return, Market Model, CAPM, APT, Case Studies.

Computer Aided Design (CAD)

MPD 423

Introduction to Computer Aided Design (CAD), CAD and the design process, 3D Geometric modelling systems (Wire frame, Surface, Solid and Parametric Modelling). Representation of Curves and Surfaces (Ferguson, Bezier, B-Splines, NURBS). Solid Modelling Systems (Constructive Solid Geometry CSG, Boundary Representation (B-Rep). Data transfer between CAD systems, IGES, STEP.

Ergonomics

MPD 424

The development of ergonomics. Man-machine systems. Ergonomic work analysis. Noise-vibration. Lighting conditions. Visual perception. Design of displays and controls. Thermal environment. Application of anthropometrics and biomechanics. Workstation design. Circadian rhythms and shift work. Manual skills and mental activities. Human information processing. Fault-diagnosis, decision-making and planning. Workload analysis. Human-computer interaction. Human reliability. Work organisation. Case studies.

Dynamic Programming

MPD 425

Discrete and Continuous Dynamic Systems. The Principle of Optimality. Combinatorial Problems. Optimal Control Problems. Dynamic

Programming Algorithm. Applications to Selected Discrete and Continuous Optimal Control Problems. Discrete and Continuous Linear-Quadratic Control. Stochastic Optimal Control Problems. Stochastic Dynamic Programming Algorithm. Applications to Selected Stochastic Optimal Control Problems. Stochastic Linear-Quadratic Control.

The students should register in two (2) of the following elective courses:

Financial Calculus
MPD 427
Introduction to financial markets, Elementary concepts of portfolio management, Portfolio optimization methods, Bond pricing, Duration and convexity, Bond portfolio optimization, Bond management strategies, Options, Options valuation models (binomial model, the Black & Scholes model), Futures, Value at Risk (VaR): definitions and estimation techniques, VaR optimization.

Control Systems II
MPD 430
Introduction to multivariable control systems. Time response of multi-input, multi-output systems. Controllability, observability, stability, control of multi-input, multi-output systems, Eigenvalue placement, robustness.

Intelligent Industrial Control and Mechanotronics
MPD 431

Total Quality Management
MPD 408
Introduction to quality (definitions, history and importance, dimensions), Principles of Total Quality Management, TQM as a new culture, Quality management philosophies (Deming, Juran, Crosby, Ishikawa, Taguchi, Feigenbaum), Customer satisfaction and customer relationship management, Quality awards (Deming, EFQM, Malcolm Baldridge), Benchmarking, Tools for TQM (quality improvement, SPC, QFD, Taguchi, techniques, etc), Quality standards and quality assurance systems, Cost of quality.

9th Semester

Simulation
MPD 501
Simulation of production and queuing systems, discrete event modelling, random variable generators, statistical techniques for performance estimation and comparison of alternative systems, variance reduction techniques, introduction to perturbation analysis and optimization.

Robotics
MPD 502
Principles of manipulation and sensing. Robot operation. Kinematic and dynamic modelling of mechanical manipulators. Workspace analysis and manipulator synthesis. Robot motion planning, programming and control. Sensor-based strategies and automatic reasoning. Robotic systems and applications. Mechanics, control systems.

The students should register in four (4) of the following elective courses:

Topics in Environmental Protection
MPD 504
Basic principles of ecology, geochemical cycles, air pollution, water pollution, waste management methodologies, statistical analysis of environmental data, wastewater treatment, solid waste management.

Ergonomic Work Analysis
MPD 505
Man-machine systems. The systems design process. Models of human performance. Human information processing. Data recording and analysis methods. Task analysis techniques for manual skills and methal activities. Human reliability approaches. Sociotechnical systems. Case studies.

Technological Forecasting
MPD 507
Definitions. Technique, technology and culture. Polynomial models, binomial models. Coleman, Logistic, Bass and other models. Normal distribution, Lognormal distribution, Weibull and Gompertz. New models, NSRL, GRM I and II. Non-linear regression analysis. Applications to technological and other time-series.

Engineering Economics and Business Plan Analysis
MPD 510
Cost and asset accounting, Cost estimation, Interest and investment costs, Depreciation, Profitability and alternative investments.

Introduction in Legal Systems and Technical Legislation
KEP 204
A. Introduction to the legal system. Basic law classification. Elements of public and European law. Elements of civil law (general principles of civil law, contract law, property law). Elements of labour law (individual contract of employment, collective bargaining, labour accidents) commercial law,

Content of Undergraduate Courses

industrial property (trade-mark, patent), intellectual property, elements of environmental law.
B. Elements of public works law (undertaking and elaboration of public works projects, undertaking and construction of public works, contractor's counter value, procedures to receive a public work, contractual liability, procedures to resolve conflicts in public works, organisation of public works contractors).

Management of Financial Risks
MPD 512
Definition and meaning of the risk in financial management, Types of financial risks, Classical methodologies for the assessment of financial risks : univariate statistical analysis, optimization, new methodologies for the assessment of financial risks : multivariate statistical analysis, multicriteria decision aid, rough sets, intelligent decision support systems, case studies.

Product Design and Development
MPD 513
The Importance of New Products, Organizational Issues in New Product Development (NPD), Concurrent Engineering, NPD Planning, Customer Needs, Product Specifications, Concept Generation and Testing, Product Architecture, Industrial Design, Prototype Development and Testing, Product Life Cycle Management, Rapid Prototyping & Rapid Tooling, Virtual Prototyping.

Design and Optimization in Supply Chain Management
MPD 514
Role of Supply Chain Management. Planning demand and supply in a supply chain. Applications and Mathematical modeling. Algorithmic Complexity. Traveling Salesman Problem, Bin Packing Problem. Transportation and Distribution of products in Supply Chain. Network Design Problem. Distribution Channels. Route Design. Fleet size problems. Vehicle Routing Problem. Variants of vehicle routing problem (time windows, multicommodity, dial - a - ride, pickup and delivery problems). Vehicle Scheduling Problem. Ship Routing Problem. Inventory Routing Problem. (Single Period Inventory Routing Problem, MultiPeriod Inventory Routing Problem, Infinite horizon Inventory Routing Problem). Location Problems. Covering Problems. P-center and P-median Problems. Capacitated and Uncapacitated Facility Problems. Location Routing Problem. Integrated Logistics. E-Supply Chain Management. Case Studies (Modeling, Development and solution methods).

Seminar: Geographic Information Systems
Seminar: Modelling of Corporate Processes
Seminar: Data storage - Olap systems - Data mining & Decision making

10th Semester

DIPLOMA THESIS
Minimum number of credits for awarding of the diploma: 212.

Department of Mineral Resources Engineering

The purpose of the Department of Mineral Resources Engineering is to educate engineers through a broad range of scientific and technical activities related to mineral extraction and processing. Special emphasis is given to those mineral resources, which are important in the development of the national economy, plus covering the present and future needs of the country.

Divisions

- Exploration and Positioning
- Mineral Exploitation
- Mining Technology

Laboratories

- Applied Geology
- Applied Geophysics
- Applied Mineralogy
- Ceramics and Glass Technology
- Coal Beneficiation and Solid Fuels Technology
- Geodesy and Geomatics
- Inorganic and Organic Geochemistry and Organic Petrography
- Mine Design
- Ore Processing and Beneficiation
- Petrology and Economic Geology
- Reservoir Engineering
- Rock Mechanics

Undergraduate Studies

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Department of Mineral Resources Engineering

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Emmanuel Manoutsoglou, *B.Sc. (1982) University of Patras - Greece, Dr. rer. nat. (1990) F.U. Berlin - Germany, Assistant Professor.*

Nikolaos Pasadakis, *B.Sc. (1985) University of LVOV - Russia, Ph.D. (1991) University of LVOV - Russia, Lecturer.*

Nikolaos Varotsis, *Dipl. Eng. (1976) National Technical University of Athens -Greece, M.Sc. (1977) Herriot Watt University - UK, Ph.D. (1984) Herriot Watt University - UK, Professor.*

Mineral Exploitation Division

Georgios Alevizos, *B.Sc. (1986) Technischen Universitat Berlin - Germany, Ph.D. (1997) Technical University of Crete - Greece, Lecturer.*

Georgios Kostakis, *B.Sc. (1970) University of Munich - Germany, Dr. rer. nat. (1973) University of Munich - Germany, Professor.*

Elias Stamboliadis, *B.Sc. (1971) National Technical University of Athens - Greece, M.Sc. (1973) University of London - UK, Ph.D. (1977) University of McGill - Canada, Associate Professor.*

Despina Vamvuka, *B.Sc. (1982) University of Traian Vuia of Timisoara - Romania, M.Sc. (1983) University of Manchester - UK, Ph.D. (1988) University of Manchester - UK, Associate Professor.*

1st Semester

Differential and Integral Calculus I
MATH 101
Functions of one real variable, Limits and continuity of functions, Derivatives, Geometric interpretation of the derivative, Differentials, Applications of the derivative, Indefinite and definite integrals, Basic theorems of integral calculus, Applications of integrals (areas between two curves, volumes by revolution, length of a plane curve, area of a surface of revolution, moments and center of mass, centroid and center of mass, the theorems of Pappus, hydrostatic pressure, work), Exponential and logarithmic functions, Methods of integration, Improper integrals, Diriclet and Fresnel integrals, hyperbolic functions, inverse trigonometric functions, Taylor and Laurent series, basic differential equations, Fourier series.

Introduction to Computer Programming
MATH 105
Introduction to Algorithms, (design, correctness), Structured Programming, Programming with FORTRAN and C (control structures, I/O, formatting, subroutines-functions, arrays, numerical techniques), Programming assignments

Geology
MRED 101
Introduction to geology, composition/formation of the Earth's crust, introduction to elements of geomorphology, stratigraphy and structural geology, geological maps and geological sections (drawing and interpretation)

Physics I
PHYS 101
This course refers to the basic principles of kinematics and dynamics for a particle and for a rigid body. It describes the basic laws of thermodynamics and its mechanical applications and provides the student with the basics of electrostatics analysing Coulomb's and Gauss's laws and the concept of the field. Emphasis is given to the physical meaning of the physical concepts and to the student practicing both in solving theoretical problems and in conducting experiments in the laboratory.

Inorganic Chemistry
CHEM 101
Atomic Models, Introduction to Quantum Chemistry, Elementary Particles, Orbitals, Atomic Properties and the Periodic Table, Molecular Orbitals and Chemical Bonding, Hybridization of Atomic Orbitals, Molecular Structure, Bimolecular Forces, Chemical Thermodynamics, Oxidation, Reduction, Acids, Bases and Salts, Complex Ions and Coordination Compounds, Safety Rules in the Laboratory, Chemistry laboratory Apparatus, Reactions and Identification of Cations and Anions, Types of Chemical Reactions, Chemical Equilibrium, Hydrolysis, Amphoterism, Volumetric Analysis and Titration, Preparation of a Complex Salt, Laboratory exercises.

Introduction to Mineral Resources Engineering
MRED 103
Introduction to Mineral Resources Engineering.

Drawing
MRED 105
Elements of engineering and topographical drawing.

English I
LANG 101
Basic English grammar and vocabulary targeted at a lower and intermediate level as they are presented at the Language Research and Resource Centre, use of self-access materials, grammar and writing tutorials.

German I
LANG 103
Introductory instruction of the German language with emphasis on oral skills, vocabulary expansion, grammar and written skills (basic knowledge of the German language required)

2nd Semester

Differential and Integral Calculus II
MATH 102
Functions of many variable plane analytic geometry, equations of surfaces, polar and spherical coordinates, elements of differential geometry and vector calculus, partial derivatives, div, grad, rho-Lagrange multipliers, differentials, multiple integrals, applications in physics and geometry, surface integrals, applications in fluid mechanics, Green's theorem, Stokes theorem, Gauss theorem, applications in mechanics.

Physics II
PHYS 102
This course refers to the basic principles of electromagnetism developing the concepts of magnetic field and analysing Ampere's and Faraday's laws. The course is completed with reference to the principles of geometrical and wave optics as well as to the interaction of electromagnetic waves and light with matter. In the above

topics emphasis is given to practical and technological applications. The course is completed by the students practicing both in solving theoretical problems and in conducting experiments in the laboratory.

Analytical Chemistry
CHEM 102
Sampling, common apparatus and basic techniques, errors and statistics in analytical chemistry, solvent extraction, principles of chromatography, liquid chromatography, gas chromatography, thin layer chromatography, spectro-analytical methods, mass spectrometry, atomic absorption spectrometry, x-ray fluorescence, nuclear methods. Laboratory activity: working practices, titrimetric analyses, water hardness, pH-meters and ion selective electrodes, spectrophotometric analysis.

Mechanics I (Statics)
MECH 102
General principles. Force vectors. Equilibrium of a particle. Force system resultants. Equilibrium of rigid body(Moments, Couples, reduction of a System of forces). Structural analysis. Internal forces. Centre of gravity and centroid. Moments of inertia. Forces in beams and cables.

General Mineralogy (Principles and Methods)
MRED 102
Crystal morphology, crystal structure, elements of crystal chemistry and physical chemical mineralogy, elements of x-ray crystallography, laboratory exercises.

Field Trip I
MRED 702
Participation in five local one- or two-day trips for identifying and mapping geological structures, developing geological sections, etc.

English II
LANG 102
Grammar and vocabulary skills, academic reading and writing skills, conversation tutorials.

German II
LANG 104
Advanced instruction of the German language equivalent to the level of Zertifikat

3rd Semester

Numerical Linear Algebra
MATH 201
Introduction to linear and matrix algebra, direct methods for solving linear systems, pivoting strategies, error analysis, condition number, determinants, eigenvalues and eigenvectors, diagonalization, iterative methods for solving linear systems.

Ordinary Differential Equations
MATH 203
Introductory concepts initial value problems. Seperable and homogeneous different eequations. General linear 1st order different equations Bernoulli, Ricatti and exult different equations. Integrating factors. Equations of 2nd order: linear with constant cofficients, Euler equation, reduction to 1st order. Laplace transformation methods. Systems of differential equations. Methods of serious, solvability of two-degree differential equations.

Mechanics II (Strength of Materials)
MECH 201
Concept of stress. Internal forces. Stress and Strain distribution. Factor of safety. Indeterminated problems. Thermal strain problems. Torsion. Pure bending. Assymetric bending. Transverse loading. Combine loading. Transformation of stress and strain. Morh circles.

Physical Chemistry
CHEM 201
The physicochemical properties of mater. Ideal gases: laws, Equation of state of ideal gases, Kinetic theory of ideal gases, Gas diffusion, applications. Real gasses: PVT behaviour of real gases, Equations of state for real Gases. Virial and van der Waals equations of state. Law of corresponding states. The critical region. Mixtures of ideal or nonideal gases. Chemical Kinetics: Rate equations, Reaction rate constant and Arrhenius theory, order of reaction, experimental methods in reaction kinetics determination in batch, CSTR and PFR reactors, Chemical reaction mechanisms, Heterogeneous catalytic reactions, applications in reactor engineering and design. Thermodynamics: First Law and applications, Chemical thermodynamics. Second Law and applications, Enthalpy, entropy, free energy, chemical potential, Chemical-reaction equilibria and calculations. Phase equilybria.
The course is completed by experimental practice in the laboratory which in general includes: Phase equilybria and distillation, Liquid-gases equilibria and absorption, gas-solid equilibria and adsorption, Kinetic studies of homogeneous and heterogeneous reactions. Electrochemistry and fuel cells.

Systematic Mineralogy
MRED 201
Physical characteristics of minerals, origin, mode of occurrence and association of minerals, native elements, sulfides and sulfosalts, halides, oxides and hydroxides, carbonates, nitrates, borates, sulfates, chromates, molybdates, tungstates, phosphates, arsenates, vanadates, silicates.

Applied Geophysics I (Seismics)
MRED 205
Seismic wave propagation, body and surface waves, instruments for seismic data acquisition, seismic reflection and refraction methods, seismic velocity, corrections to seismic data, synthetic seismograms, introduction to seismic imaging and interpretation, use of seismic methods for petroleum exploration, mineral exploration and geotechnical engineering, laboratory exercises.

English III
LANG 201
Self-access learning at the Language Center, thematic work modules on a student's field of study, focus on language, texts, and writing skills.

German III
LANG 203
Introduction to German terminology for technical subjects.

4th Semester

Numerical Analysis
MATH 202
Solution of algebraic equations with one variable, interpolation and polynomial approximation, numerical differentiation, numerical integration, approximation theory, initial and boundary value problems for ordinary differential equations

Technical Thermodynamics
MECH 306
Principles of classical thermodynamics, first law, second law analysis of engineering systems, chemical equilibrium, water air mixtures, phase diagrams, thermodynamics of reacting systems, combustion thermodynamic cycles, refrigeration, determination of combustion efficiency, combustion applications to heating, internal combustion engines, power generation systems.

Petrology
MRED 202
Composition of the earth's crust, rock forming minerals, igneous, sedimentary and metamorphic rocks, optical petrography, and laboratory exercises.

Electric Circuits
MRED 210
Networks laws, ideal circuit elements, inductors, transformers, power supplies, electric power transfer, electric motors, high-voltage electric circuits, high-voltage equipment, safety procedures, fire-protection circuits, automatic control circuits.

Applied Geophysics II
MRED 204
Elementary potential theory as required for gravity, magnetic, electrical and electromagnetic studies of shallow and deep geological structures, instrumentation, data collection, data analysis, applications in mineral exploration, groundwater exploration, environmental monitoring, geotechnical engineering and archaeology, laboratory exercises.

Field Trip II
MRED 704
One-day field trip to Western Crete for observation of representative rock types and geological formations, five-day field trip to Santorini and/or Milos Island for observation of different volcanic and metamorphic rocks, visits to manifestations of present hydrothermal activity, geological mapping.

English IV
LANG 202
Study of texts and language for specific disciplinary fields, extensive use of the Web, ethics in engineering and academic report writing.

German IV
LANG 204
Advanced instruction of the German language equivalent to the level of Mittelstufe.

Design of Physical Processes
MRED 206
Basic physical processes in the production and exploitation of mineral resources, Balance of mass and energy, Design of installations, Equipment, Diffusion, Heat transfer, Distillation, Absorption, Balance of fluid and solid and gas and fluid, Exercises.

Political Economy
KEP 102
This course includes an analysis of basic concepts and relations of Political Economy, as well as a brief review of recent economic history. It refers more specifically to the theory of value, surplus-value and prices, as well as to the relation between competition and distribution, to fundamental trends and contradictions of growth, and to the phenomena of economic crisis.

Industrial Sociology
KEP 302
Lectures on Sociology of Labour and Sociology of Development, with particular reference on historical approach of production systems and on recent changes concerning industry (crisis and restructuring strategies, "flexible" production and labour organization, labour market, inter-firm relations, local productive systems,

research and technological development, innovations, know-how, industrial policy...).

Geology of Greece
MRED 208
Structure and geodynamic Evolution of the Aegean Region. Classical and new structural models for the Evolution of the Hellenides. Autochthonous and Paraautochthonous. West-, Central- and Inner Hellenic Nappes. Vardar Zone and Zircum-Rhodope Belt. Post-alpine Formations. Present Geodynamic Situation.

5th Semester

Elements of Equipment Design
MECH 110
Fundamentals of machines, maintenance, strength, fatigue, materials, connecting components: rivets, screws, bolts, welding, rotating components: axles, shafts, mounting parts, rolling bearing elements, power, transmission components: belts, pulleys, chains, gears, engineering drawings and graphics.

Surface Mining I
MRED 303
Introduction and definitions, mine planning methods, principles of equipment selection and operation, analysis of the main equipment (bucket wheel excavators, belt conveyors etc.) used in continuous mining methods, detailed mine planning of lignite and coal deposits, actual problems during development and operation of lignite mines.

Engineering Geology-Soil Mechanics
MRED 307
Introduction to engineering geology and Soil Mechanics (geotechnical classification, mechanical properties of rocks and soils), geological conditions in construction works (foundations, roads, water management projects, dams, tunneling, mining, etc.), hazardous geologic phenomena, treatment, supporting measures and works, laboratory and field tests, exercises.

Mineral Processing I
MRED 309
Mass balance, degree of separation, particle size, crushing, grinding, screening, classification, comminution circuits, agglomeration, solid-liquid and solid-air separation, waste disposal.

Philosophy and History of Sciences
KEP 203
Science as a social-cultural phenomenon. The role of science in the social structure. Theoretical issues concerning knowledge, logic and the methodology of scientific research. Sciences in History. Differentiation, integration and inter-disciplinarity of science. Traditions and innovations in the development of science. The subject of scientific activity. Theories, orientations and approaches in the philosophy of science.

Art and Technology
KEP 301
Technology and Art in the social structure. Technology as objectification, as a framework for the human impact on nature and for the relations among people, as a forerunning conception-knowledge and as an instrument implicating upon Nature. The particularity of the aesthetic moment. The aesthetic moment as a specific activity in the division of labor (Art). Art and technology in the history of civilization. Metaphysical discourse on "Apollonean" and "Dionysian" elements.

Sociology
KEP 101
Introductory lectures on Sociology, with particular reference on concepts of the social framework of production, such as: society, socio-economic change and evolution, social classes and social stratification, institutions (political, economic, educational...).

Micro-Macroeconomic Analysis
KEP 201
Analysis of commodity supply and demand, the theory of the consumer and of the firm, macroeconomic topics regarding income and employment determination, the role of investment and the impact of international exchange.

Introduction to the Legal Systems and to the Technical Legislation
KEP 204
A. Introduction to the legal system. Basic law classification. Elements of public and European law. Elements of civil law (general principles of civil law, contract law, property law). Elements of labour law (individual contract of employment, collective bargaining, labour accidents) commercial law, industrial property (trade-mark, patent), intellectual property, elements of environmental law.
B. Elements of public works law (undertaking and elaboration of public works projects, undertaking and construction of public works, contractor's counter value, procedures to receive a public work, contractual liability, procedures to resolve conflicts in public works, organisation of public works contractors).

Methodology of Operations Research
MPD 102
Historical perspective, operations research and decision support systems, methodological framework, models for decision making under certainty and uncertainty, case studies.

6th Semester

Mineral Deposits I
MRED 306
Magma and magmatic deposits, hydrothermal fluids, deposition of the ores, depositional textures, deposits related to plutonism and volcanism, deposits related to sedimentation, deposits related to metamorphism, ore microscopy, field trip exercises, emphasis to metallic ores.

Geochemistry
MRED 304
Introduction to geochemistry of igneous, metamorphic rocks with special emphasis to the geochemistry of sedimentary rocks, introduction to geothermodynamics, diagenesis, environmental geochemistry (case studies), tutorials, laboratory exercises and analytical techniques.

Mineral Processing II
MRED 302
Liberation, sampling, separation test evaluation, optical sorting, heavy media, washability curve, gravity concentration, magnetic separation, electrostatic separation, froth flotation, elements of surface chemistry, leaching and bioleaching, gold metallurgy, feasibility of mineral processing operations.

Applied Fluid Mechanics
MRED 308
Principles of fluid mechanics, fluid statics, fluid dynamics, mass balance, momentum and energy balance equations, rheological equations (Navier-Stokes, Euler, Bernoulli), applications (pipes, channels, submerged bodies, nozzles, fluid engines), similitude, laminar flow of real fluids (Couette, Hagen-Poiseuille, Stokes), turbulent flow or real fluids (mathematical description, flow near walls, flow in circular pipes), flow through porous media (one-phase flow, two-phase flow), motion of particles through fluids (mechanics, one-dimensional flow).

Geostatistics
MRED 310
Probability, random variables, probability distributions, mean, standard deviation, least squares method, regression, correlation, semi-variograms, spectral analysis, filters distributions in the 3-D space, directional data analysis, moving average, kriging, trend surfaces, multivariable analysis, classification, grouping, main variables analysis, exercises.

Hydrogeology and Water Management Projects
MRED 312
Sources and origin of ground water-hydrologic cycle, relationship between underground water and sea water, flow and reserves of ground water, karst hydrology and hydrogeology, measurement of hydraulic parameters-characteristics of the aquifers, mining projects in surface and groundwater environment, laboratory and field tests and exercises.

Field Trip IV
MRED 708
Seven-day field trip to Eastern Crete for geophysical measurements.

Management Systems for Engineers
MPD 222
Introduction to the principles of management, theory and methodology of systems, communication, management techniques, examples and case studies.

Investment Decision Analysis
MPD 422
Financial mathematics, investment decision under certainty, net present value, the payback method, the accounting rate of return, the index of profitability, the internal rate of return, advanced capital budgeting techniques, investment decision under uncertainty, the risk-adjusted discount rate method, the certainty equivalent method, the statistical decision method, the decision tree method, the simulation analysis, portfolio, selection and management, risk and return, market model, CAPM, ART, case studies.

Introduction to Philosophy
KEP 104
A brief overview of the history of philosophy. Main categories and laws of dialectic in the areas of knowledge. Theory of ontology and logic (formal and dialectical). Elements of social philosophy. The social structure as an organic whole, social consciousness and its forms.

History of Civilization
KEP 202
Review of History of Civilization with particular reference on some periods. Analysis and synthesis of basic concepts and questions on civilization. Critical discussion of theories about recent cultural changes (post-modernism, etc.).

Content of Undergraduate Courses

7th Semester

Applied Geostatics

MRED 401

Geostatistics and energy raw materials (fuels), statistical description of data in the 3-D space, sampling, quality control, variograms and other functions, estimation with normal kriging, universal kriging, Markov-Bayes kriging, tonnage estimation by conventional and geostatistical methods, conditional simulations and multivariable simulations, risk estimation, applications on boreholes, geophysical and energy, interpretation of the results.

Drilling, Blasting and Introduction to Underground Development

MRED 403

Properties of industrial explosives, drilling and blasting techniques for surface and underground mines, design of surface and underground blasting, introduction to underground mining, computational exercises.

Geodesy Engineering

MRED 405

Definition and classification of geodesy, historic development, earth and its motions, precession, nutation and polar motion, gravity field of the earth, gravity potential, spherical harmonics, actual shape of the earth, geoid, biaxial ellipsoid, time, methods for determining and disseminating time, applications to geophysics, maps, mercator, Lambert, Greek Geodetic reference systems, instruments, methods of positioning, applications to geophysics, mining, environmental monitoring, geodynamics etc.

Reservoir Engineering

MRED 407

Introduction to petroleum engineering, elements of petroleum chemistry, properties of hydrocarbon gases and liquids, properties of two phase systems, hydrocarbon phase behavior, reservoir fluid sampling, PVT and physical property analysis of reservoir fluids, interpretation of PVT reports, properties of the porous media, porosity, permeability, Darcy's law.

Topics in Environmental Protection and Reclamation

MRED 409

Basic principles of ecology, geochemical cycles, air pollution, water pollution, waste management methodologies, statistical analysis of environmental data, wastewater treatment, solid-waste management.

Quality Control in Mineral Resources

MRED 411

Introduction to quality control, definitions and terms about quality assurance, ISO series, TQC, sampling theory and statistical quality, control, laboratory accreditation, case studies from the mineral industry, metallurgy, cement, ceramic and construction material industry.

Evaluation of Industrial Minerals

MRED 413

Description of industrial minerals and rocks, properties, physical, chemical and technological characteristics, evaluation criteria for diverse applications.

Physico-Chemical Characterization of Fossil Fuels

MRED 415

Origin, occurrence and properties of the organic matter in the geosphere, natural gas, hydrates, petroleum, tar sand, oil shale and coal, basics of petroleum chemistry and refining, analytical methods for the characterization of fossil fuels, gas chromatography, liquid chromatography, mass spectroscopy, UV and IR spectroscopy, environmental impact from fossil fuels exploitation, analytical determination of the organic pollutants in environmental samples.

Material Science

MRED 417

Crystalline and non-crystalline materials, phase distribution in solids, grain surface properties, surface tension, surface energy, atom mobility, Fick's law, molecular diffusion, generation of crystals, mechanical properties of crystals, transformation.

8th Semester

Design of Quarries and Geotechnical Excavations

MRED 406

Theories of mechanical cutting of rocks, control blasting, design principles of open pit quarries, selection of equipment, marble open pit exploitation, physicomechanical properties of marble, mechanical excavation of tunnels.

Rock Mechanics

MRED 408

Application of continuum mechanics theory to rocks, stress and strain in two and three dimensions, equations of state, failure criteria, creep, support of underground openings, rock classification systems, laboratory and computational exercises.

Remote Sensing

MRED 412

Definition and historic outline, remote sensor platforms, remote sensing applications, fundamental considerations of energy distribution, interaction mechanisms, atmospheric effects, aerial photography, photographic LANDSAT imagery, thermal infrared imagery, microwave imagery, ground truth data collection, rectification of digital LANDSAT imagery, future extraction from digital imagery, spatial and spectral analysis of digital image, applications to geosciences.

Coal Geology (Geology of Energy Resources)

MRED 402

Introduction to energy resources of Greece (hydrocarbons, uranium, solid fuels) Reserves and evaluation of resources, exploration and exploitation of coal deposits, environment of peat, lignite and coal deposit formation, logging of coal drill holes, exploration techniques, geological problems relevant to exploration, coal petrology, assessment of coal basins for various uses, tutorials and laboratory exercises.

Coal Beneficiation

MRED 410

Formation and classification (petrographic classification, rank classification), physical and chemical properties (chemical analysis, chemical structure, mineral matter, porosity), preparation/cleaning (crushing and particle size distribution, physical and chemical cleaning, drying), briquetting (briquetting o bituminous coal and anthracites with binding materials, briquetting of subbituminous coals and lignite, properties of briquetting, carbonization of briquettes, thermal briquetting), carbonization (behavior during heating, carbonization at low temperatures, carbonization at high temperatures, formed coke processes, byproducts of carbonization), liquefaction (principles of coal liquefaction processes), gasification (principles of coal gasification, gasification processes, underground gasification), laboratory exercises.

Ceramics

MRED 414

Characteristics of ceramic materials, ceramic phases, sintering, glazing, structure of ceramics, ceramic raw materials, properties, structural ceramic products, pottery and white ware, refractory.

Reservoir Engineering

MRED 416

Flow in porous media, linear and radial flow, diffusivity Equation for radial flow in the porous media, steady state, and unsteady state flow, displacement of oil by water, fluid-rock interactions, wettability, relative permeability, phase distribution in the porous media, capillary pressure, drainage and inhibition displacement mechanisms, material balance equation, applications of the MBM for the estimation of the reserves and the prediction of future production.

Mining Technology

MRED 418

System's analysis of continuous and non-continuous surface mining methods, operational analysis of the conventional mining equipment and of complex mining systems, reliability and availability of equipment, operational design of loading-transportation systems, operations programming and equipment maintenance, special topics: handling and transportation of materials, dewatering and pumping of surface mines.

Health and Safety in Mining and Underground Works

MRED 420

Design of equipment for injury prevention, emissions and toxic substances, dust control and monitoring, hazard detection, principles of ventilation and lighting, surveillance and statistical activities, human factors, training and education.

Stability of Underground and Surface Excavations

MRED 422

Rock elasticity, rock plasticity, plastic limit analysis of excavations and applications, poroelasticity, rock discontinuities, analytical methods for slope stability problems (elasticity - plasticity - poroelasticity), numerical analysis of slopes, analytical methods for underground stope stability analysis, numerical analysis of stability of underground systems of openings.

Chemical Kinetics and Catalysis

MRED 424

Definitions, thermodynamics of chemical reactions, energy balance, chemical equilibrium, kinetic equations, effect of temperature, catalysis and adsorption, heterogeneous catalysts, solid catalysts, reactions between solids, reactions between liquids and solids, oxidation, corrosion, dehydration.

Geomechanics - Geothechnical Construction

MRED 426

Introduction to geomechanics, Stress and strain, Elastic foundation, analysis of construction geomaterials, Bearing capacity, Slope stability, Use of piles in foundations.

Content of Undergraduate Courses

Microscopy of Minerals and Artificial Materials
MRED 428
Advanced microscopy with polarized microscopes of transmitted and reflective light (indices of reflection, chemical reactions on mineral surfaces). Quantitative determination of minerals with point counting, Procedures for making thin and reflective sections of microphotography.

Introduction to Metallurgy
MRED 404
Mass and energy balance, Metallurgical processes, Reactor design, Best metallurgical techniques in pyrometallurgy, hydrometallurgy and biohydrometallurgy, Waste minimization, Legislation, Issues regarding production of steel, nickel (ferronickel), alumina and aluminium, gold, copper and lead will be covered.

Field Trip III
MRED 708
Seven-day field trip to Western and Central Greece, visits to mineral deposits, open cast and underground mining operations, beneficiation plants.

9th Semester

Drilling Engineering
MRED 509
Description of drilling operations for oil and gas well drilling, equipment description, cements and cementing operations, casing design and placement, properties of drilling fluids, drilling hydraulics and optimization, drill bits, directional and horizontal drilling equipment and operations and equipment, completion procedures, open hole logging.

Environmental Remote Sensing
MRED 501
Image Analysis, geometric corrections of a digital image, contrast enhancement, Supervised and unsupervised classification, theory of evidence, neural networks, in image classification, applications of remote sensing to the environment.

Geothermics
MRED 503
Exploration, exploitation of geothermal fields, geotectonic evolution of the earth's crust, description of geothermal areas in Greece, geochemistry and mineralogy of deep geothermal drillings, geothermometry, laboratory exercises.

Underground Mining Methods & Tunnel Construction
MRED 505
Terminology of mining methods, description of types of exploitation faces, mining methods classification, underground methods of marble quarrying, open stopping, cut-fill stopping, caving stopping, CAD of mining methods, ventilation principles, hoisting systems, history of tunneling, tunnel design, tunnel construction (NATM, TBM etc.), tunnel support, soft ground engineering, numerical analysis of tunnel and underground excavations stability, laboratory exercises on CAD, numerical modeling, analogue modeling.

Formation Evaluation with Geophysical Methods
MRED 507
Principles of well logging techniques, gamma ray, self potential, density, neutron, sonic and electrical logs, instrumentation, data collection, interpretation of petroleum well logs.

Materials Technology
MRED 511
Mechanical properties of metals, alloys and thermal processes, structure, properties and applications of ceramics and polymers, composite materials, semi-conductors. corrosion and degradation of materials, material selection.

New Technologies of Coals Evaluation for Power Production
MRED 517
Coal characteristics affecting combustion, emerging clean combustion technologies (fluidized-bed, sulfur oxide and nitrogen oxide control technologies, demonstration projects), coal characteristics affecting gasification, classification of gasification processes, gasification processes (fixed-bed, fluidized-bed, entrained-bed, molten-bath), underground gasification, purification of combustion and gasification flue gases (particulate matter, SO_2 , NO_x and other pollutant compounds' cleaning technologies, hot gas cleaning technologies), environmental impacts of air pollutants, water pollutants and solid wastes, air pollution, water pollution and solid waste control technologies.

Organic Geochemistry
MRED 515
Introduction to organic chemistry relevant to hydrocarbons, saturated and unsaturated hydrocarbons (cyclic and noncyclic), polynuclear aromatic compounds, environments of deposition, oil generation and oil migration from source rocks, biomarkers, diagenesis, rock-eval pyrolysis, organic petrology, tutorials and laboratory exercises.

Applications of Numerical Methods in Geomechanics
MRED 519
Problem formulation, governing differential equations, the finite element method, the boundary element method, applications in simulation of mining, rock mechanics and soil mechanics problems.

Summer Practical Exercise
MRED 709
Each student should complete at least on month of practical training in a company or institution related to mineral resources engineering.

Fracture Mechanics
MRED 521
Fundamentals of Fracture Mechanics, Historical Notes, Stresses and Strains in Continua, Crack Modes, Mathematical Analysis of Cracks, Experimental Fracture Mechanics, Applications in Rock Engineering, Applications in Seismology.

Petrology of Aggregates and Construction Materials
MRED 513
Characterization and type of aggregate and construction materials, specification and selection of construction materials, properties and uses of natural stones, types and properties of mortars, quality control of mortars, types and properties of concretes.

Computer Aided Mine Planning and Design
MRED 523
Introduction to the computer applications in the mineral industry (historical background), data storage and manipulation, modeling of deposits, 2D and 3D visualization techniques, GIS, open pit and underground design, feasibility and environmental impact studies.

Mineral Processing Plant Design
MRED 525
Mineral processing plant design by the use of MODSIM simulator. What is MODSIM and how to use it. The graphics editor. Data entry. Specifying the data in the plant feed streams. Specifying parameters for the unit models. Examples of unit models. Running the simulator and getting results. Coal washing plants. Writing subroutines for unit models. Troubleshooting.

Analytical Environmental Geochemistry
MRED 527
Field sampling (grid and other sampling), homogenization and specimen preparation. Statistical evaluation of samples, Grain size Separation methods, classification and sorting. Analysis of geochemical samples, precision and accuracy of analysis, error and error propagation, sensitivity and detection limit. Treatment and Solubilization of geochemical samples. Analytical methods: (Flame emission spectrophotometry, A.A. (Atomic Absorption spectrophotometry). ICP--ES and ICP-MS (Inductively Coupled Plasma Emission and Mass Spectrometry), colorimetric methods, XRF (X-Ray fluorescence Spectrometry), XRD (Powder X-Ray-Diffraction), SEM (Scanning Electron Microscopy) Electron Microprobe Analysis. Examples of analytical environmental Geochemistry.

Mineral Deposits II
MRED 529
Geological occurrence, origin, properties and uses of industrial mineral deposits, exercises, field trips.

10th Semester

DIPLOMA THESIS
A minimum of 209 credits are required for the award of the diploma.

Department of Electronic & Computer Engineering

The purpose of the Department of Electronic & Computer Engineering is to educate engineers by providing in depth background in the fields of electronics, control systems, computer software, information systems and telecommunication networks and systems. The course of studies in this department places special emphasis on the use of computers, on the design of electronic circuits (CAD, CAM), engineering systems, robotics, automation, communication systems and networks, distributed computing and information systems as well as computer applications.

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Divisions

- Electronics and Computer Architecture
- Computer Science
- Systems
- Telecommunications

Laboratories

- Automation
- Digital Image and Signal Processing
- Distributed Multimedia Information Systems
- Electronics
- Electric Circuits & Renewable Sources of Energy
- Information and Computer Networks
- Microprocessors and Hardware
- Programming and Intelligent Systems Engineering
- Software Systems and Network Applications Engineering
- Telecommunications

Research Institutes

The department is strongly affiliated with the Telecommunication Systems Institute, which has been approved by the Greek Ministry of Education. The approval of the Institute of Electronic Publishing & Distributed Multimedia Systems (MUSIC) and the Institute of Intelligent Automation are pending.

Academic and Research Staff

Electronics and Computer Architecture Division

Konstantinos Balas, *B.Sc. (1988) University of Patra, Ph.D. (1992) University of Patra, Associate Professor.*

Matthias Bucher, Dipl. Eng. (1993) & *Ph.D. (1999) Swiss Federal Institute of Technology, Lausanne (EPFL), Assistant Professor.*

Apostolos Dollas, *B.Sc. (1982) University of Illinois at Urbana-Champaign - USA, M.Sc. (1984) University of Illinois at Urbana-Champaign - USA, Ph.D. (1987) University of Illinois at Urbana-Champaign - USA, Professor.*

Kostas Kalaitzakis, *Dipl. Eng. (1977) National Technical University of Athens - Greece, Ph.D. (1983) Democritus University of Thrace - Greece, Professor.*

Dionysios Pnevmatikatos, *B.Sc. (1989) University of Crete - Greece, M.Sc. (1991) University of Wisconsin Madison - USA, Ph.D. (1995) University of Wisconsin Madison - USA, Associate Professor.*

Apostolos Samelis, *Diploma EE (1990) University of Patras - Greece, M.Sc. (1991) University of Michigan, Ann Arbor - USA, Ph.D. (1996) Michigan, Ann Arbor - USA, Assistant Professor.*

George Stavrakakis, *Dipl. Eng. (1980) National Technical University of Athens - Greece. M.Sc. (1981) Diplome "D.E.A. (Diplome d' Etudes Approfondies) en Automatique, INSA, Toulouse - France, Ph.D. (1984) Universite Paul Sabatier (Toulouse III) - France, Professor.*

Computer Science Division

Stavros Christodoulakis, *B.Sc. (1971) National & Kapodistrian University of Athens - Greece, M.Sc. (1977) University of Toronto - Canada, Ph.D. (1981) University of Toronto - Canada, Professor.*

Michael Lagoudakis, *Dipl. Eng. (1995) University of Patra, M.Sc. (1998) University of Louisiana Laffayette, USA, Ph.D. (2003) Duke University, USA, Assistant Professor.*

Aikaterini Mania, *B.Sc. (1994) University of Crete, M.Sc. (1996) & Ph.D. (2001) University of Bristol, UK, Assistant Professor.*

Evripidis Petrakis, *B.Sc. (1985) National and Kapodistrian University of Athens - Greece. Ph.D. (1993) University of Crete - Greece, Assistant Professor.*

Vasilios Samoladas, *Dipl. Eng. (1992) Aristotle University of Thessaloniki- Greece, M.Sc. (1995) University of Texas at Austin - USA, Ph.D. (2001) University of Texas at Austin - USA, Associate Professor.*

Systems Division

Emmanuel Christodoulou, *Dipl. Eng. (1978) National Technical University of Athens - Greece, M.Sc. (1979) University of Maryland - USA, Dipl. Eng. (1980) University of Southern California - USA, Ph.D. (1982) Democritus University of Thrace - Greece, Professor.*

Peter Stavroulakis, *B.Sc. (1969) New York University - USA, M.Sc.(1970) Caltech - USA, Ph.D.(1973) New York University - USA, Professor.*

Telecommunications Division

Michael Zervakis, *Dipl. Eng. (1983) Aristotle University of Thessaloniki - Greece, M.Sc. (1986) University of Toronto - Canada, Ph.D. (1990) University of Toronto - Canada, Professor.*

Vassilis Digalakis, *Dipl. Eng. (1986) National Technical University of Athens - Greece. M.Sc.(1988) Northeastern University - USA, Ph.D. (1992) Boston University - USA, Professor.*

Athanassios Liavas, *Dipl.Eng. (1989) University of Patra, Ph.D. (1993) University of Patra, Associate Professor.*

Michael Paterakis, *Dipl. Eng. (1984) National Technical University of Athens - Greece. M.Sc. (1986) University of Connecticut - USA, Ph.D. (1988) University of Virginia - USA, Professor.*

Alexandros Potamianos, *Dipl. Eng. (1990) National Technical University of Athens - Greece, M.Sc. (1991) Harvard University - USA, Ph.D. (1995) Harvard University - USA, Associate Professor.*

Nikolaos Sidiropoulos, *Dipl. Eng. (1988) Aristotle University of Thessaloniki - Greece. M.Sc. (1990) University of Maryland U.S.A., Ph.D. (1992) University of Maryland U.S.A., Professor.*

1st Semester

Differential and Integral Calculus I

MATH 101

Functions of one real variable-Limits and continuity of functions-Derivatives-Geometric interpretation of the derivative-Differentials-Applications of the derivative-Indefinite and definite integrals-Basic theorems of integral calculus-Applications of integrals (areas between two curves, volumes by revolution, length of a plane curve, area of a surface of revolution, moments and center of mass, centroid and center of mass, the theorems of Pappus, hydrostatic pressure, work)-Exponential and logarithmic functions-Methods of integration-Improper integrals-Diriclet and Fresnel integrals-hyperbolic functions-inverse trigonometric functions-Taylor and Laurent series-Basic differential equations-Fourier series.

Numerical Linear Algebra

MATH 201

Introduction to Linear and Matrix Algebra - Direct Methods for Solving Linear Systems - Pivoting Strategies - Error Analysis - Condition Number - Determinants - Eigenvalues and Eigenvectors - Diagonalization - Iterative Methods for Solving Linear Systems.

Probability Theory - Mathematical Statistics

MATH 107

Sample Space - Conditional Probability, Independence, Random Variable - Chebyshev Inequality, Large Number Law - Hypothesis Testing - Distribution of a random variable - Central Limit Theorem - Estimation Theory.

Physics I

PHYS 101

Linear motion, Velocity, Acceleration, Motion on the plane, Vectors - Newton's laws of motion, Gravitational forces, Translational equilibrium, Friction - Momentum, Conservation of momentum, Centre of mass - Kinetic energy, Conservation Law of momentum, Work, Power, Potential Energy, Conservative forces, Relation between force and potential energy - Uniform (and not) circular motion of a particle, Rotation of a rigid body, Moment of inertia, Torque, Torque and rotation, General condition of mechanical equilibrium - Angular momentum of a particle and of a rigid body, Torque and angular momentum, Law of conservation of angular momentum - Simple harmonic oscillator (SHO). The simple the compound and the torsional pendulum, SHO and damping - Restriction in the motion of a system, Generalised coordinates, Lagrange's equation of motion, Hamilton's equations of motion - Coulomb's law, Electric field, Motion of charge in an electric field, Gauss's law and applications

Content of Undergraduate Courses

in electrostatics - Point charges and electric potential difference, Absolute potential, Electric dipole, Electric field from potential , Electric potential energy - Simple electric circuits, Kirchhoff's rules, Charging and discharging effect of a capacitor - Magnetic induction B , Force due to B on electrical currents and moving charges, Motion of charged particles in electric and magnetic fields, Torque on a current loop. The course is completed by (1) solving theoretical problems and (2) participating to laboratory experimental exercises.

Introduction to Computing

PLH 101

Introduction to algorithms and programming, structured programming, development of fast algorithms, characteristics of high-level languages, programming in FORTRAN, functions, parameters, local and non-local variables, laboratory exercise.

English I

LANG 101

Students registered in this course are required to cover basic English grammar and vocabulary by utilizing the resources targeted at a lower-intermediate level as they are presented at the Language Research and Resource Centre. A minimum of 25 hours per semester is recommended for students to complete the English syllabus of self-access materials. Additional time will be scheduled for grammar and writing tutorials. The mark for the course will be based on the final exam. Students who hold and show proof of a certificate of Proficiency in English need not participate in English I and English II; upon request, students may ask that the mark received from English III be assigned to both English I and English II.

Sociology

KEP 101

Introductory lectures on Sociology, with particular reference on concepts of the social framework of production, such as: society, socio-economic change and evolution, social classes and social stratification, institutions (political, economic, educational...).

Art and Technology

KEP 301

Technology and Art in the social structure. Technology as objectification, as a framework for the human impact on nature and for the relations among people, as a forerunning conception-knowledge and as an instrument implicating upon Nature. The particularity of the aesthetic moment. The aesthetic moment as a specific activity in the division of labor (Art). Art and technology in the history of civilization. Metaphysical discourse on "Appollonean" and "Dionysean" elements.

Philosophy and History of Science

KEP 203

Science as a social-cultural phenomenon. The role of science in the social structure. Theoretical issues concerning knowledge, logic and the methodology of scientific research. Sciences in History. Differentiation, integration and inter-disciplinarity of science. Traditions and innovations in the development of science. The subject of scientific activity. Theories, orientations and approaches in the philosophy of science.

2nd Semester

Differential and Integral Calculus II

MATH 102

Functions of many variables-plane analytic geometry-Equations of surfaces-Polar and spherical coordinates-Elements of differential geometry and vector calculus-Partial derivatives, div, grad, rot - Lagrange multipliers-Differentials. Multiple integrals-Applications in physics and geometry-Surface integrals-Applications in fluid mechanics-Green's Theorem-Stokes Theorem-Gauss' Theorem-Applications in Mechanics.

Ordinary Differential & Difference Equations

MATH 203

Introductory concepts initial value problems. Seperable and homogeneous different eequations. General linear 1st order different equations Bernoulli, Ricatti and exult different equations. Integrating factors. Equations of 2nd order: linear with constant cofficients, Euler equation, reduction to 1st order. Laplace transformation methods. Systems of differential equations. Methods of serious, solvability of two-degree differential equations.

Physics II

PHYS 102

Electromagnetism: Ampere's law, Currenr-carrying conductors, Solenoid, Biot-Savart law - Induction currents, Time varying magnetic flux, Faraday's law, Lenz's law, Self-inductance L, LR circuit - Energy in electric and magnetic field, Electromagnetic oscillations of an LC system, Dumped and forced oscillations, Resonance in an LCR circuit - Wave essentials, Principle of generation of an electro-magnetic wave, Intensity of an e-m wave, Poynting's vector, Magnetic fields from induction, Displacement current, Maxwell's equations. OPTICS: Wave properties, Superposition principle, Huygens's principle, Reflection, Refraction and Snell's law, Total reflection, Fermat's principle - General formula for mirrors, Ray diagrams for mirrors, General equation for refraction, Thin lenses, Ray diagrams for lenses - Wave interference, Young's experiment, Fraunhofer diffraction from a single slit, Limits of resolution, Diffraction from a double slit, Polarization of light, Brewster's law.

Modern Physics: Introduction to modern Physics, Photoelectric effect, properties of the photon, material waves, de Broglie wavelength, Wave mechanics, Wavefunction - Stationary states, Wave resonances, Eigenfrequencies, Standing waves, particle in a box, Energy quantization - Free electrons, Maxwell-Boltzman and Pauli distribution laws. Energy distribution of the electron gas, Electric conductivity, Energy bands, Metals, Insulators, Semiconductors - Pure semiconductors, Energy gap measurement, Doped semiconductors, Type n and type p semiconductors - p-n junction diode, LED diode, p-i-n photodiode. The course is completed by (1) solving theoretical problems and (2) by participating to laboratory experimental excercises.

Software Engineering I

PLH 111

Introduction to abstract data structures. Stacks, queues, lists, trees, graphs, their implementation and their applications. Program construction and correctness, simulation. Searching in main memory (binary search, hashing, etc.). Introduction to object oriented programming. Use of classes to represent abstract data types.

Logic Design of Digital Systems

ELE 111

Review of Boolean Algebra and Logic Gates. Digital Integrated Circuits. Simplification of Boolean Functions. Combinational Logic. Combinational Logic with MSI and LSI. Synchronous Sequential Logic. Registers, Counters, and the Memory Unit. Algorithmic State Machines. Asynchronous Sequential Logic.

English II

LANG 102

English II offers an extension of the grammar and vocabulary skills initiated in English 01 with a further emphasis on academic reading and writing skills. In addition to the minimum 25-hour attendance recommended for the completion of level 02 materials at the Language Center, students may also register in writing skills and conversation tutorials provided at the center. The mark will be based on a final exam. Students who hold and show proof of a certificate of Proficiency in English need not participate in English I and English II; upon request, students may ask that the mark received from English II be assigned to both English I and English II.

Political Economy

KEP 102

This course includes an analysis of basic concepts and relations of Political Economy, as well as a brief review of recent economic history. It refers more specifically to the theory of value, surplus-value and prices, as well as to the relation between competition and distribution, to fundamental trends and contradictions of growth, and to the phenomena of economic crisis.

Introduction to Philosophy

KEP 104

A brief overview of the history of philosophy. Main categories and laws of dialectic in the areas of knowledge. Theory of ontology and logic (formal and dialectical). Elements of social philosophy. The social structure as an organic whole, social consciousness and its forms.

History of Civilization

KEP 202

Review of History of Civilization with particular reference on some periods. Analysis and synthesis of basic concepts and questions on civilization. Critical discussion of theories about recent cultural changes (post-modernism, etc.).

Numerical Analysis

MATH 202

Solution of Algebraic Equations in one Variable - Interpolation and Polynomial Approximation - Numerical Differentiation - Numerical Integration - Approximation Theory - Initial and Boundary Value Problems for Ordinary Differential Equations.

3rd Semester

Signals and Systems

TEL 201

Basic principles of signal representation, signal characterization and processing, methods for signal description (Laplace, Fourier transforms, differential equations), the Discrete Fourier Transform, Fast Fourier transform, applications in control systems, communication systems, etc.

Digital Computers

HRY 201

Introduction to Boolean algebra, information computer organization, assembly language to microprocessors and microcontrollers (registers, and addressing models, ALU, I/O unit).representation, basic programming, introduction memory organization

Basic Circuit Theory HPY 202

English III

LANG 201

English III combines a program of self-access learning at the Language Center with a series of thematic work modules to be covered in class based on a student's field of study. The modules focus on language, texts and writing skills specifically targeted at what students learn in the context of their departments. Small assignments throughout the course and a final exam will determine the student's mark. All students must meet the requirements of this course.

Introduction to Legal Systems and to the Technical Legislation

KEP 204

A. Introduction to the legal system. Basic law classification. Elements of public and European law. Elements of civil law (general principles of civil law, contract law, property law). Elements of labour law (individual contract of employment, collective bargaining, labour accidents) commercial law, industrial property (trade-mark, patent), intellectual property, elements of environmental law.
B. Elements of public works law (undertaking and elaboration of public works projects, undertaking and construction of public works, contractor's counter value, procedures to receive a public work, contractual liability, procedures to resolve conflicts in public works, organization of public works contractors).

Micro- & Macro- Economic Analysis

KEP 201

An analysis of commodity supply and demand is included, as well as the theory of the consumer and of the firm. Macroeconomic topics are also included regarding income and employment determination, the role of investment and the impact of international exchange.

4th Semester

Data Structures and File Structures

PLH 211

Algorithms and complexity. Optimal and heuristic algorithms (exhaustive search, divide and conquer, branch and bound, dynamic programming etc.). Data structures in the main and in the secondary memory. Search in the main and in the secondary memory; performance. Binary search trees, balanced trees, optimal trees, direct addressing, hashing, file structures, ISAM, B-trees, tries).

Probabilities and Random Signals TEL 211

Electric Circuits

ELE 212

Network graphs (Tellegen's theorem, energy and complex power conservation), mesh analysis and node analysis method (integral-differential equations, sinusoidal steady-state, dual networks),

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state equations (transfer function, poles-zeros, linear non-linear circuits), the Laplace transform (direct and inverse, properties, complete response), natural frequencies, network functions, network theorems (substitution, superposition, Thevenin-Norton, reciprocity), two-port networks, power and energy, stability, equivalent circuits, Fourier series and integral (non-sinusoidal periodic signals, the Fourier transform and applications). Circuit analysis using SPICE.

Advanced Logic Design HPY 211

English IV

LANG 202

Students in English IV will be required to study texts and language based on materials related to their fields of study. Work assigned in class meeting to be completed with the resources available at the centre involve extensive use of the Web in improving English language skills not only with respect to the language itself but regarding such themes as Ethics in Engineering and Academic Report Writing. A project report and the final exam will determine the student's mark. All students must meet the requirements of this course.

Discrete Mathematics

MATH 208

This course aims to sharpen the student's reasoning ability through the study of some subjects fundamental to both mathematics and Computer Science. Combinatorics, Logic, Sets, Numbers, and Mathematical Induction, Relations and Functions, Recurrence relations, Languages and Deterministic Automata, Graphs.

Applied Mathematics

MATH 302

Complex functions of one variable-Derivatives-The Cauchy-Riemann Equations-Analytic functions-Harmonic functions-Exponential, trigonometric, hyperbolic functions and transformations-Linear and Moebius transformations-Conferral mappings-Transformations of harmonic functions and boundary conditions-Schwarz-Christoffel transformations-Applications in Potential Theory-Electrostatic Potential-Steady temperatures-Temperatures in a quadrant with one boundary insulated- Potential in a cylindrical space-Two dimensional fluid flow-The stream function-Flow around a corner-Flow around a cylinder-Line integrals-The Cauchy integral formulas- Taylor series-Applications in Fourier and Laplace transforms.

Industrial Sociology

SOC 302

Lectures on Sociology of Labour and Sociology of Development, with particular reference on historical approach of production systems and on recent changes concerning industry (crisis and restructuring strategies, "flexible" production and labour organization, labour market, inter-firm relations, local productive systems, research and technological development, innovations, know-how, industrial policy...).

5th Semester

Algorithms and Complexity PLH 302
Software Development Tools and System Programming PLH 303
Statistical Modelization and Model Recognition TEL 303

Operating Systems

PLH 301

Operating Systems introduction. The concept of process and process management: Race conditions, mutual exclusion, starvation, deadblock, multiprogramming and CPU scheduling. Memory management: virtual memory, memory maps and Page Tables, paging, pre-paging and demand paging, segmentation. File systems: The concept of files, organization of file data on disk, files indexing, directories, naming buffer caching, I/O Systems: Disks, terminals, clocks. Disk scheduling algorithms, device drivers, caching Deadlocks: prevention, avoidance.

Analog Telecommunication Systems I

TEL 301

Analog and digital signals; mathematical representation of Signals (Fourier transform); linear, non linear, analog and digital modulation; noise theory in telecommunications; spectral theory, power spectrum; filtering theory and autocorrelation. Analog telecommunication systems laboratory.

Electronics I

HRY 301

Multiple transistor circuits. The operational amplifier and its applications. Frequency and speed limitation of bipolar transistor and FET amplifiers. Analysis and design of feedback amplifiers. Frequency compensation of operational amplifiers. The Nyquist stability criterion. Bode plots. Audio power amplifiers. Oscillators. Sample & Hold circuits. Converters D/A and A/D. Timing circuits. Laboratory exercises covering the above topics.

Electromagnetic Wave Propagation, Antenna Theory and Radio Wave Propagation

TEL302

Time-Varying E/M fields - Maxwell's equations, Wave-equation through non-conducting media, Helmholtz's equation. Plane E/M waves - Propagation, Polarization. Reflection and refraction of plane waves - Snell's law, equations of Fresnel, Brewster's angle, scattering of electromagnetic waves. Waveguides - TE, TM and TEM modes, geometrical optics approximation of speed of propagation, cylindrical waveguides.
Fundamentals of Electromagnetic radiation, antennas and antenna impedance: Basic antenna parameters, radiation from a small current loop, half-wave dipole antennas. Introduction to antenna arrays: Broadside arrays and end-fire arrays, uniform two-dimensional arrays, parasitic arrays. Aperture-type antennas: Radiation from a rectangular and a circular aperture. Horn antennas, Microwave lens, paraboloidal reflector antennas. Receiving antennas: reciprocity theorem, Friis transmission formula, noise in communication systems. Antenna noise temperature. Antennas located over a flat earth and antennas located over a spherical earth. Surface-wave propagation. Ionospheric propagation: effect of the earth's magnetic field and Faraday rotation.

Digital Signal Processing

TEL 304

Complex variables and applications in discrete signals and systems, FFT algorithms, filters, sampling and quantization errors, design and implementation of non-recursive and recursive filters, structures for digital signal processing, spectral estimation.

Inorganic Chemistry

CHEM 101

Atomic Models - Introduction to Quantum Chemistry - Elementary Particles - Orbitals - Atomic

Properties and the Periodic Table - Molecular Orbitals and Chemical Bonding - Hybridization of Atomic Orbitals - Molecular Structure - Bimolecular Forces - Chemical Thermodynamics - Oxidation - Reduction - Acids, Bases and Salts - Complex Ions and Coordination Compounds - Safety Rules in the Laboratory - Chemistry Laboratory Apparatus - Reactions and Identification of Cations and Anions - Types of Chemical Reactions - Chemical Equilibrium - Hydrolysis - Amphoterism - Volumetric Analysis and Titration - Preparation of a Complex Salt. The above topics are supplemented by laboratory exercises.

Simulation

MPD 301

Simulation of production and queuing systems, discrete event modeling, random variable generators, statistical techniques for performance estimation and comparison of alternative systems, variance reduction techniques, introduction to perturbation analysis and optimization.

6th Semester

Linear Systems

SYS 211

Introduction to the theory of linear systems, state space modeling and representation, examples from signal and image processing etc. Applications in systems of continuous and discrete time, analysis methods, minimal realizations, elements of linear system design methods.

Databases

PLH 311

Knowledge bases, object-oriented database management systems, logic and databases, recursive query processing, active databases, databases for CAD/CAM applications. Design and management of databases, physical design, logical design, performance analysis, scheduling.

Telecommunication Systems II

TEL 311

Signal space and Grahm, Schmidt orthogonalization procedure. M-ary basebard systems: signal representation, optimal decoding in noise, and probability of symbol error. M-ary telecommunication systems in a band-limited channel: intersymbol interference, Nyguist criterion, partial response signalling, channel equalization. M-ary bandpass telecommunication systems. Viterbi decoding: optimal decoding of partial-response signals; convolutional codes; soft and hard decision decoding.

Electronics II

HRY 311

Review of semiconductor physics. P-n junction diodes. Diode circuits. Operation and characteristics of bipolar transistors and FETs. Biasing and thermal stability of bipolar transistors and FETs. Analysis and design of small-signal, low-frequency amplifiers which use bipolar transistors and FETs. Laboratory exercises covering the above topic.

Digital Image Processing

TEL 313

Digital Image Representation, Image Perception and color representation, digital image fundamentals, sampling and quantization, Fourier and other image transforms image enhancement, image restoration, optimal filters, principles of image compression and encoding.

Computer Organization

HRY 312

Computer organization, the microprocessor from the programmer's view, internal organization, pins, interfacing, DRAM-SRAM memory systems, common integrated peripheral circuits, serial and parallel interfaces, DMA, Interrupt control. System integration, peripherals (printers, monitors), interfacing techniques, development and simulation systems, scaled development, simulation in the circuit, logical analyzers. Hardware interface for PC bus, applications such as temperature measurement.

Computer Aided Design (CAD)

MPD 302

Introduction to Computer Aided Design (CAD), CAD and the design process, 3D Geometric modelling systems, Wire frame modelling, Surface Modelling, Solid and Parametric Modelling.

7th Semester

Theory and Applications of Control Systems

SYS 403

Introduction to the classical control systems, system modeling based on the transfer function, analysis and synthesis of systems via classical methods, application of the Bode, Nyquist and Nichols diagrams in compensator design, applications in the control of ships, aircraft etc. Use of software tools for the design of control systems.

Theory of Computation and Algorithms

PLH 401

Alphabets and languages. Finite Automata. Properties of finite automata and the languages they accept. Regular expressions and regular languages. Equivalence of finite automata and regular expressions. Applications of finite automata and regular expressions. Context-free languages and context-free grammars. Pushdown automata. Equivalence of context-free grammars and pushdown automata. Applications of context-free grammars. Turing machines. The Church-Turing thesis. Undecidability. Computational Complexity. The classes P and NP. NP-complete problems. Interesting problems from the class P (mainly from graph-theory).

Principles of Programming Languages

PLH 402

Purpose of programming languages, getting from the problem to the solution, correctness, reusability, language mechanisms. Object-oriented programming, data types and abstraction mechanisms, data hiding, assertions, polymorphism, inheritance (using Smalltalk, C++ etc.). Functional programming, functions as parameters, higher order functions, naming and binding issues (using Lisp). Logic programming, problem solving, reasoning about logic programs, contrasting, functional and logic programming (using Prolog). Applications of logic in problem solving (systems configuration etc.). Concurrent programming. Concurrent programming languages.

Principles of Interactive and Web Application Development

EKP 403

Human - Computer interaction models, interactive systems design and usability testing, advanced interactive devices (touch screens, FAX, flat screens, pointing devices), natural language

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processing and translation, speech recognition and smart interfaces, handwriting recognition. Windowing systems (X Windows, MS Windows), hypermedia models and systems, hypermedia authoring systems, storyboarding, distributed hypermedia documents - HTML, advanced user interface management systems, cross media translation, help systems and history tracking, user adaptation, computer-supported cooperative work. Virtual reality systems, interaction in 3D spaces, 3D objects representation, 3D object reconstruction and handling with interactive video.

Multimedia Information Systems

EKP 404

Technology of multimedia information systems: usefulness, and applications. Storage technology: Optical disks and comparison with their magnetic counterparts; CD-ROMs, WORM, CD-I, Rewritable. Digital images and video. Standards: MPEG, JPEG, MHEG, HTML. Multimedia software. Multimedia file retrieval and index structures. Content-based access and addressibility. Similarity queries. Information retrieval principles. Real time and distributed multimedia systems. Modeling of multimedia information. Design and development of large multimedia applications.

Computer Vision and Pattern Recognition

EKP 406

Survey of image processing techniques (fourier transform, filtering, edge detection, enhancement). Image formation, reflectance, color, texture. Segmentation, edge segmentation, region segmentation. Stereo vision, motion understanding. Image content representation, two-dimensional and three-dimensional structures. Applications of computer vision and pattern recognition (robotics, medicine, image information systems etc.).

Computer Networks I

TEL 401

Design Principles for Communication Networks, Switching and Multiplexing, Review of the OSI Layered Architectural Model, The Physical Layer (Error Control and Digitizing Information), The Data Link Layer (data link protocols: alternating bit, go back N and selective repeat protocols, and their performance evaluation), The Media Access Layer (ALOHA, tree based and stack based collision resolution protocols), Local and Metropolitan Area Networks (Ethernet, Token Ring and FDDI), Third Generation Wireless Digital Cellular

Neuronic Networks and Applications SYS 401

Microprocessor Systems HPY 401

Biomedical Electronics HRY 403

Sensors and Computer Interfacing

HRY 402

Analog signal preprocessing (amplification, noise reduction, filtering, linearization, correlation, etc), analog-to-digital conversion, digital-to-analog conversion. Introduction to transducers, sensors and detectors, types of sensors (temperature, humidity, proximity, displacement, force, velocity, acceleration, power, magnetic strength, frequency, liquid level, flow, pressure, light intensity, radiation, smoke, fire, sound, etc). Transducers for biomedical applications. Interfacing sensors to the PC, parallel and serial interfacing, DMA, interrupts, the IEEE488 (GPIB) protocol, modem interconnections, automated measurements, and data acquisition. Actuators.

8th Semester

Artificial Intelligence and Expert Systems

PLH 405

Knowledge representation, reasoning with knowledge, advanced searching techniques, backtracking, organizational techniques for representing knowledge, reasoning for a non-static world, other artificial intelligence issues (natural language recognition, common sense knowledge, learning, planning).

Optimal Control

SYS 402

Introduction to the calculus of variations, Pontryagin's maximum principle, Application of the method for finding a solution in the problem of optimal control for a deterministic dynamical system and determinations of the boundary conditions for the boundary value problem, application in practical problems, such as a minimum fuel consumption, application in biological problems, application in economic models.

Compilers

PLH 411

Introduction to compiling. Implementing a simple one-pass compiler in C. Lexical analysis, regular expressions, regular languages, implementation of lexical analyzers using lex. Parsing, top-down and bottom-up methods, implementation of parsers using yacc. Syntax-directed translation, type-checking, semantic analysis. Intermediate code-generation. Run-time environments. Code generation and optimization. Modern topics in compiling.

Integration of Information and Services on the Internet ΕΚΠ 412

Information and Code Theory TEL 412

Agent Computing on the Internet ΕΚΠ 413

Distributed Systems

PLH 414

Introduction to Distributed Systems: What, Why, How, Obstacles and Models for processes. Threads. Communication Subsystems: Overview of OSI Protocol Stack, IPC, Reliability, Buffering, Blocking, RPC Mechanisms. Threads and IPC in Mach OS and DCE/OSF. Group Communication and the ISIS system. Distributed File Systems: Stateful/less File Servers, Naming, Semantics in the Presence of Failures, Cache Consistency and Replication. The Andrew and Coda File Systems. Synchronization and Consistency in Distributed Systems: Transactions, Atomic Commitment, Mutual Exclusion, Deadlocks, Clocks and Ordering of Events. Modern I/O Servers: Disk Arrays, RAID, Striping and Declustering, Robotic Tertiary Storage Libraries.

Education and Information Technology PLH 415

Computer Networks II

TEL 411

Computer Network Interconnection (repeaters, bridges, routers, the Internet Protocol (IP)), Transport Layer Protocols (transport layer, TCP, UDP), Broadband Integrated Services Networks (B-ISDN networks), the Asynchronous Transfer Mode for packet switching (ATM, source characterization and quality of service metrics in ATM networks, traffic management and switching in ATM networks), Introduction to modeling and evaluation of packet delays in

computer networks (basic principles from queuing theory, priority queuing and networks of queues).

Speech synthesis
TEL 413
Introduction to speech recognition and hidden Markov models (HMMs). Applications of speech recognition: remote database access, telephony applications, voice dialing and speech-enabled information systems. Speaker identification and verification.

Theory and Applications of Fuzzy logic
SYS 411
Introduction to fuzzy sets and logic, fuzzy correlation, approximate reasoning, fuzzy rules, Decision-making under uncertainty, Applications of fuzzy logic to control and pattern recognition.

Automatic Control
SYS 412
Introduction to Neural Networks, linear separability, learning and training, back propagation, Hopfield network, supervised and non supervised algorithms, simulated annealing, applications in pattern recognition, dynamic neural networks, applications in control of industrial environments.

Automation and Technology in Industrial Systems
SYS 413
Introduction to automatic production systems. Scheduling and control. Cost reduction and optimization with simultaneous quality improvement. Real time quality control. Continuous quality improvement methods. Introduction to simulation software packages, used for optimization. The SIMPLE++ system. Heuristic and non-heuristic optimization methods. Adaptive optimization methods. Student participation in industrial applications. Visits in local industry.

Signal Statistical Processing TEL 502

Computer Architecture
HRY 411
Computer organization review. Amdahl's law, quantitative methods of computer efficiency and cost analysis. Instruction set, RISC and CISC computers. Computer design and functions. Control logic, microprogramming, hardwired control, nanoprogramming. Advanced design methods, pipelines, out of order execution and Tomasulo's algorithm, Superscalar, VLIW, vector processors. Memory systems, virtual memory, cache memory, I/O systems. Introduction to parallel architectures, SIMD, MIMD (shared memory and message passing).

Microprocessor-based Real-Time System Implementation
HRY 412
Definition and principles of Real Time systems. Specifications, simulation, implementation, confirmation of system operation. Advanced logical design methods and use of microcontrollers with interrupts for Real Time system implementation. Graph methods for worst system operation and PERT charts. Rapid system development with PAL/GAL/FPGA. Design with limited pins and space. Use of CAD for design. Reliability design. Debugging and counting techniques. Implementation of a system during the semester, such as anemometer, micromouse, JTAG port for digital system testing, etc.

Optoelectronics HRY 414

Parallel and Distributed Computer Architecture
HRY 413
Parallel architecture models (and Flynn's taxonomy), historical evolution (SOLOMON, ILLIAC IV, STARAN, MPP, BBN Butterfly, Connection Machines). Technology effects on maximum parallelism. Parallel computer performance evaluation and benchmarking. Recent developments (ALEWIFE, SHRIMP, NOW), networked multiprocessors. Graph theory applications on load balancing, examples of program parallelization.

Power Systems and Power Electronics
HRY 415
Three-phase circuits. Electric machinery fundamentals. AC (synchronous and inductive) and DC generators and motors. Electric power systems (power stations, transmission lines, buses, substations, protection devices, load-flow analysis, voltage and frequency control, transient behavior, fault analysis, dispatch). Thyristors, triacs, non-controlled and controlled rectifiers, inverters, DC converters, choppers, switching mode power supplies, uninterruptible power supplies (UPS), and AC controllers.

Renewable Energy Sources
HRY 416
Introduction, solar radiation, wind power, photovoltaic arrays, wind-generators, interconnection to the power grid.

Production Networks - CAM
MPD 401
Introduction to queuing theory, birth-death models, MM1, non birth-death Markovian models, Erlang distribution, batch arrivals/service, advanced models MG1, MGm, GG1, GGm, efficient models for the analysis of production lines, introduction to flexible manufacturing systems (FMS) - analytical tools and control issues.

9th Semester

Software Engineering PLH 501

Computer Graphics
PLH 503
Mathematical background, transformations (translation, rotation, scaling), data structures, input-output devices, picking, interrupting, polling, hidden surfaces and shading, curves and higher order surfaces, other subjects (ray tracing, color theory, antialiasing, animation, visualization).

Man-Computer Communication EKP 502
Information Society Economy EKP 504
Information Society and Technologies EKP 505

Content of Undergraduate Courses

Mobile Telephony
TEL 501
Mobile Telephony Systems as voice services and digital data transmission providers. Design, analysis and applications.

Modern Topics on Telecommunications TEL 52x

Optical Communications
TEL 521
Fiber Optics and Electrooptical Devices Technology, Lasers as a source of optical communication signals, transmission and detection of optical signals. Applications of Optical Signals in Modern Communication Systems.

Theory and Design of Satellite Communication Systems
TEL 522
Design and Analysis of Satellite Links. Applications of Digital Communication Systems in Satellite Links. Satellite Communications and their application in Wide Area Communication Networks. Analysis of Interference in Satellite Communication Links.

Advanced Topics on Digital Telecommunications TEL 523
Modern Code Theory TEL 524

Introduction to Asynchronous Transfer Mode Networks
TEL 525
Broadband Integrated Services Digital Networks (Circuit, Message and Packet Switching B-ISDN), Asynchronous Transfer Mode (ATM), Source Characterization in ATM Networks, Quality of Service Metrics in ATM Networks, (Call Admission Control, Traffic Policing, the Leaky Bucket Algorithm, Reactive Congestion Control Mechanisms), Routing in ATM Networks, ATM Switching (shared-medium, shared-memory and space division architectures, Banyan Networks, Performance Analysis of ATM Switch Architectures), Introduction to Modeling Data Networks using results from Queuing theory (Little's Theorem, Markovian Queues: M/M/1, M/M/m, M/M/m/m, the M/G/1 and M/G/1 with vacations guenes, Priority Queuing), Media Access Protocols for Third Generation Wireless Integrated Services Systems, Scheduling for Data Broadcasting over Wireless Links.

Principles of Biomedical Systems SYS 501
Automatic Control Systems Design SYS 503

Robotics
SYS 502
Introduction, Historical Development, Robot Sensing, The Direct Kinematics Problem, The Inverse Kinematics Solution, Manipulator Jacobian, Lagrange-Euler Formulation, Newton-Euler Formulation, General Considerations on Trajectory Planning, Planning of Manipulator Cartesian Path Trajectories, Control of the Puma Robot Arm, Computed Torque Technique, Adaptive Control, Robot Programming Languages, Case Studies and Examples from the Industry.

Neural Network & Fuzzy Logic Applications in Automation Systems
SYS 504
Scheduling and routing problems. Industrial optimization. QoS control for multimedia applications. ATM traffic control. Channel equalization and channel assignment. Neural network applications in character recognition and document analysis.

VLSI Design
HRY 501
Introduction to VLSI design. Fabrication steps and methods. The CMOS inverter. Full custom design methodologies. Stick diagrams. Design rules. Full custom CMOS design. Power and clock distribution, pads, frames, I/O buffers. Simulation methods. Advanced clocking schemes (multi-phase) and design methodologies (DCVS, domino). Synthesis of circuits and semi-custom methodologies. Laboratory exercises and project.

Electronic Systems Testing HRY 502
Modern Topics on Electronics HRY 52x
FPGA Digital Systems HRY 521

Introduction to fault-resistant systems
HRY 522
Resistance to hardware faults. Active, passive and hybrid redundancy. Cold-warm-hot standby's. Types of faults, errors and failure. Identification/detection of faults. Coding for fault detection, TMR, estimation of system reliability.

Real Time Systems HRY 523
Low Power Consumption Systems HRY 524
High Performance Architecture HRY 525
Computational Methods for the Solution of Circuits HRY 526
Energy Electric Systems HRY 527
Electronic Systems in Energy Management HRY 528
RF Telecommunication Circuit Design HRY 529
MOSFET Physics and analogue CMOS circuit design HRY 50X

10nd Semester

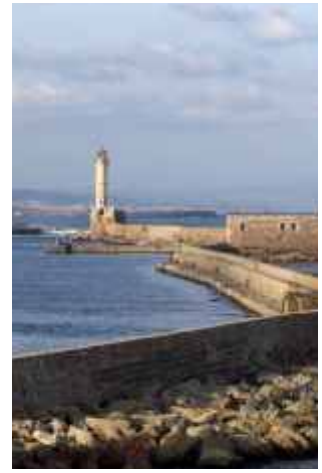
DIPLOMA THESIS
Total no of credits required for diploma award 176 (minimum).

Department of Environmental Engineering

The Environmental Engineering Department admitted its first 30 students in the autumn of 1997. Five years later, the department awarded degrees to graduating students for the first time. In 2003, the department transfered its offices to new buildings on campus equipped with the utmost in modern laboratory facilities.

The academic staff of this department is of a high international reputation. Many of the faculty members have come from abroad having had careers at outstanding universities or technical universities in Europe and North America. Since its initiation, the department has expanded dynamically and many of its first graduates have succeeded in following advanced graduate studies in Greece and abroad. Furthermore, several of its students who have completed practical summer internships in Greek companies have successfully contributed high caliber solutions to company problems. Still other students have participated in international conferences and have helped their professors in the preparation of teaching material including books.

Our vision is for our students to rectify the negative environmental impacts of any detrimental implementations of technology from the past, and to protect and restore the environment making it a suitable and pleasant place in which to live. Modern technologies such as New Membrane Technology, Bioremediation, Small Decentralized Units, New Analytical Tools, Methods of Recovery, Environmentally Friendly Thermodynamic Cycles, all within the philosophical framework of Human Science, the forgotten "Fronesis" of Aristotle, characterize our efforts. We are confident that the fruits of these efforts will not be long awaited!



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Mission of the Department

The Mission of the Department of Environmental Engineering is to educate engineers in the field of environmental management and protection. Graduate engineers are able to develop, design and implement technologies in order to prevent and treat pollution and to minimise the impact of human activity on the environment. In order to be able to solve major environmental problems, our students have a sound knowledge of the underlying physical, chemical and biological processes that govern interactions in environmental systems.

Environmental Engineering

Professional employment opportunities can be found in industry, municipalities, engineering consulting firms, governmental regulatory bodies and various research establishments. The discipline of Environmental Engineering has seen significant growth worldwide over the last decades and encompasses many areas of specialization such as water and wastewater treatment, air pollution control, groundwater and contaminant transport solid waste and hazardous waste management, environmental impact assessment, sustainable development, noise control, radiation protection and control and radioactive waste management.

In our technological world characterized by an ever-lasting desire for progress, the expertise of environmental engineers will always be high in demand in Greece and worldwide.

Divisions

Environmental Management.

The focus of Division I is on the following subjects: Collection, treatment, transfer and disposal technologies for gaseous, aqueous, solid, toxic and hazardous wastes and sludges; treatment technologies for potable water; Source inventory models; Monitoring of waste sources and ambient quality; Environmental meteorology; Air and water quality, hydraulic and hydrological models; Pollution risk assessment, ambient quality and emission standards; Energy conservation and alternative sources, transportation modelling and landplaning; Ecology; Development of optimal management plans; Environmental impact assessment; Application of Geographic Information Systems; Compilation of environmental data and interlinking with relevant international databases; Production of multimedia presentations for educational and research purposes.

Environmental Process Design and Analysis.

Division II covers the following scientific areas: Biochemical processes, biological treatment of solid, liquid and gas wastes, application of cell cultures to environmental

protection. Environmental microbiology, environmental toxicology, environmental biotechnology, design of subsurface biological barriers. Phytoremediation and wetlands. Biogeochemical cycles and energy flow in ecosystems. Fluid dynamics, heat & mass transfer, unit operations, physico-chemical processes, chemical reaction engineering, environmental thermodynamics, thermo-physical properties, chemical equilibrium, partition of pollutants in the environmental phases.

Environmental Hydraulics and Geoenvironmental Engineering.

The objectives of the Division III include environmental hydraulics, hydrology, geology and hydrogeology, as well as the environmental applications of the above subjects (wastewater pipe nets, irrigation, runoffs, water resources, flow in porous media, contamination of soils and ground waters, drinking water pip systems). In addition some other interests of the Division II include remediation techniques for contaminated soils and ground waters, soil mechanics, foundations, design of environmental structures, and applications of GIS (Geographical Information Systems) to environmental data.

Laboratories

Ecology and Biodiversity

Impacts of anthropogenic and natural sources of disturbance on communities and ecosystems. Development of univariate and multivariate techniques for analysis of ecological data. Development of biodiversity indicators. Study of factors affecting biodiversity. Optimization of environmental monitoring. Indicators of health/disturbance of ecosystems. Integrated coastal zone management. Environmental impacts of aquaculture. Environmental training.

Toxic and Hazardous Waste Management

The main goal of the laboratory of Toxic and Hazardous Waste Management is the development of advanced scientific technologies, the promotion of scientific research on the area of hazardous waste management, as well as technology transfer. Thermal and physicochemical treatment of hazardous waste, safe disposal at special landfills, waste recycling and hazardous waste management, as well as soil and groundwater remediation are some of the basic fields on which the laboratory focuses. The scientific fields of the laboratory also include hazardous waste treatment with feasible and economical (for Greek standards) technologies and the promotion of innovative technologies on the following sections: thermal processes, physicochemical processes and safe disposal on special landfills. In the framework of an integrated hazardous waste management the laboratory aims at the development and the design of administrative programs. The main goal is to achieve the minimization of the produced wastes by source and waste volume reduction or recycling. As far as soil and groundwater remediation from inorganic (e.g. heavy metals) and organic pollutants (e.g. petroleum products) is concerned the laboratory focuses on electrokinetic treatment processes and new innovative restoration technologies.

Atmospheric Aerosols

Study of the dynamics of atmospheric aerosols, heterogeneous reactions in the atmosphere, development and application of air quality models, nucleation processes, measurements of air pollutants and meteorological parameters, modeling and measurements of indoor air quality, dosimetry modeling and transport of pollutants inside the human body.

Environmental Engineering and Management

The Laboratory of Environmental Engineering and Management of the Technical University of Crete is involved (in terms of teaching and research activities) with the development and application of technologies for the appropriate management and treatment of water, wastewater and solid wastes. The Laboratory has several advanced analytical systems for the determination of organic pollutants and heavy metals in water and wastewater, as well as several lab-scale and pilot scale treatment units

Hydrogeochemical Engineering and Soil Remediation

Water quality management at the watershed scale, development of hydrogeochemical models, pollution prevention and sustainable development. Assessment and remediation of soils polluted by heavy metals as well as the impact of organic pollutants on the fate and transport of heavy metals in the environment. Development of new technologies and use of existing ones for the remediation of soils and aquatic ecosystems from inorganic pollutants.

Biochemical Engineering & Environmental Biotechnology

Development, analysis, design, process control and optimization of biochemical processes. Biological treatment of solid, gas and liquid wastes. Application of mammalian and insect cultures to environmental protection. Design of Phytoremediation systems and wetlands for the remediation of contaminated water and/or soil. Design of subsurface biological barriers. Environmental microbiology, development of enzymatic processes for toxicological assessment, environmental biotechnology, Application of process design software to environmental processes.

Geoenvironmental Engineering.

Environmental geology and hydrogeology, flow in porous media, contamination of soils and ground waters, remediation techniques for contaminated soils and ground waters, Department of Environmental Engineering treatment of solid wastes, landfills, soil mechanics, foundations, design of concrete environmental structures, design of metal environmental structures, and development and

applications of geo-environmental software packages.

- **Air, Water and Solid Wastes Management.**
  Source inventory methods; Collection, treatment, transfer and disposal technologies for gaseous, aqueous, solid and toxic wastes; Air and water quality models; Pollution risk assessment, ambient quality and emission standards; Energy conservation and alternative sources, transportation modelling and landplaning; Ecology; Development of optimal management plans; Environmental impact assessment studies; Monitoring of waste sources and ambient quality; Development of software packages; Application of Geographic Information Systems; Collection, processing and compilation of environmental data and interlinking with relevant international databases; Production of multimedia presentations for educational and research purposes.

- **Chemical Processes and Wastewater Treatment Laboratory.**
  Design, analysis and optimization of water and wastewater treatment processes. Advanced oxidation and thermal treatment technologies of industrial effluents. Integrated physicochemical and biological processes. Clean technologies and waste minimization. Environmental catalysis.

- **Transport Phenomena & Unit Operation.**
  Fluid dynamics, Heat & Mass Transfer, Environmental Thermodynamics and environmental friendly thermodynamic cycles. Development, analysis and design of unit operations. Thermophysical properties, physical and chemical equilibrium, biogeochemical cycles, and energy flow in ecosystems. Specific software for the design of environmental processes. Unit operations for the treatment of agrofood wastes. Dispersion of air pollutants. Meteorology and climatology, physics of the atmosphere.

- **Treatment Technology of Gas Waste.**
  Analysis, development and design of air-waste- and odour-control treatment systems. Emission monitoring systems. Applications of specific software.

- **Water Resources Management and Coastal Mechanics Laboratory.**
  Water resources management, water resources modeling & GIS databases, Environmental hydraulics & hydrology, urban and irrigation networks. Coastal modeling, pollutant dispersion in coastal areas, diffusion and dispersion, wave mechanics, environmental impact of pollutant discharges in surface and coastal waters. Multimedia educational productions.

Academic and Research Staff

Environmental Management Division

Alexadros Economopoulos, *Dipl.Ch.Eng. (1967) National Technical University of Athens, Ph.D., (1973) University of Calgary, Canada, Professor.*

Vassilios Gekas, *Dipl. Ch. Eng. (1971) National Technical University of Athens, M.Sc.(1986) Lund Institute of Technology, Sweden, Ph.D.(1987) Lund Institute of Technology, Sweden, Professor.*

Evangelos Gidarakos, *B.Sc. in Physics (1977) University of Hamburg, Germany, Ph.D. (1980) University of Hamburg, Germany, Associate Professor.*

Michael Lazaridis, *B.Sc. in Physics (1988) Aristotle University of Thessaloniki, M.Sc. (1991) University of Helsinki, Finland Ph.D. (1993) University of Helsinki, Finland, Assistant Professor.*

Dionyssios Mantzavinos, *Dipl. Ch. Eng. (1991) Aristotle University of Thessaloniki, M.Sc. (1993) London University, Imperial College, England, Ph.D. (1996) London University, Imperial College, England, Associate Professor.*

Eleftheria Psyllaki, *B.Sc. (1994) University of Montpellier II, France, Ph.D. (1997) University of Bristol, United Kingdom, Assistant Professor.*

Kostas Synolakis, *B.Sc. in Civil Engineering (1978) Technological Institute of California, USA, M.Sc. (1979) Technological Institute of California, USA, Ph.D. (1985) Technological Institute of California, USA. Professor.*

Theocharis Tsoutsos, *B.Sc. (1984) National Technical University of Athens and (1990) National University of Athens, Ph.D. (1990) National Technical University of Athens, Assistant Professor.*

Environmental Processes Design and Development Division

Evangelos Diamandopoulos, *Dipl. Ch. Eng. (1978) Aristotle University of Thessaloniki, M. Eng. (1982) McMaster University Canada, Ph.D. (1985) McMaster University Canada. Professor.*

George Karatzas, *B.Sc. in Forestry (1982) Aristotle University of Thessaloniki, Greece, M.Sc.(1987) Rutgers University, USA, Ph.D. (1992) Rutgers University, USA, Professor.*

Nikolaos Nikolaidis, *B.Sc. in Civil Engineering and Environmental Engineering (1982) University of Iowa, USA, M.Sc. (1984) University of Iowa, USA, Ph.D. (1987)University of Iowa, USA, Associate Professor.*

Environmental Hydraulics and GeoEnvironmental Engineering Division

Nikolas Kalogerakis, *Dipl.Ch.Eng. (1977) National Technical University of Athens, M.Eng. (1979) McGill University, Montreal, Canada, Ph.D. (1983) University of Toronto, Canada, Professor.*

Ioannis Tsanis, *B.Sc. in Civil Engineering (1976) Aristotle University of Thessaloniki, M.Sc. (1979) University of Toronto, Canada, Ph.D. (1986) University of Toronto, Canada, Professor.*

1st Semester

Differential and Integral Calculus I

MATH 101

Functions of one real variable-Limits and continuity of functions-Derivatives-Geometric interpretation of the derivative-Differentials-Applications of the derivative-Indefinite and definite integrals-Basic theorems of integral calculus-Applications of integrals (areas between two curves, volumes by revolution, length of a plane curve, area of a surface of revolution, moments and centre of mass, centroid and centre of mass, the theorems of Pappus, hydrostatic pressure, work)-Exponential and logarithmic functions-Methods of integration-Improper integrals-Diriclet and Fresnel integrals-hyperbolic functions-inverse trigonometric functions-Taylor and Laurent series-Basic differential equations-Fourier series.

Physics I

PHYS 101

This course refers to the basic principles of kinematics and dynamics for a particle and for a rigid body. It describes the basic laws of thermodynamics and its mechanical applications and provides the student with the basics of electrostatics analysing Coulomb's and Gauss's laws and the concept of the field. Emphasis is given to the physical meaning of the physical concepts and to the student practising both in solving theoretical problems and in conducting experiments in the laboratory.

Environmental Geology

MRED 121

Introduction to geology, composition/formation of the earth's crust, introduction to elements of geomorphology, stratigraphy and structural geology, geological maps and geological sections (drawing and interpretation).

Computer-aided Design of Environmental System

MP133

Introduction to the techniques of designing in PC with use of CAD. Configuration of drawing environment (objects, scales, printers). Basic concepts of CAD system, structure and drawing processing. Properties of objects and blocks. Dimensions, text introduction and processing. Three-dimensional design methodology. Surface and solid elements in design space. Axonometric and perspective projections of objects. Photorealistic processing and representation of objects.

Introduction to Computer Programming

MATH 105

Introduction to Algorithms, (design, correctness) Structured Programming, Programming with FORTRAN and C (control structures, I/O, formatting, subroutines-functions, arrays, numerical techniques). Programming assignments.

English I

LANG 101

Students registered in this course are required to cover basic English grammar and vocabulary by utilizing the resources targeted at a lower-intermediate level as they are presented at the Language Research and Resource Centre. A minimum of 25 hours per semester is recommended for students to complete the English syllabus of self-access materials. Additional time will be scheduled for grammar and writing tutorials. The mark for the course will be based on the final exam.

German I

LANG 103

Basic German with the assumption that students have had previous German instruction. Development of oral skills, grammar, writing skills and progressive enhancement of vocabulary.

Sociology

KEP 101

Introductory lectures on Sociology with particular reference on concepts of the social framework of production, such as: society, socio-economic change and evolution, social classes and social stratification, institutions (political, economic, educational...).

Philosophy and History of Science

KEP 203

Science as a social-cultural phenomenon. The role of science in the social structure. Theoretical issues concerning knowledge, logic and the methodology of scientific research. Sciences in History. Differentiation, integration and inter-disciplinarity of science. Traditions and innovations in the development of science. The subject of scientific activity. Theories, orientations and approaches in the philosophy of science.

Art and Technology

KEP 301

Technology and Art in the social structure. Technology as objectification, as a framework for the human impact on nature and for the relations among people, as a forerunning conception-knowledge and as an instrument implicating upon Nature. The particularity of the aesthetic moment. The aesthetic moment as a specific activity in the division of labor (Art). Art and technology in the history of civilization. Metaphysical discourse on "Appollonean" and "Dionysean" elements.

2nd Semester

Differential and Integral Calculus II

MATH 102

Functions of many variables-plane analytic geometry-Equations of surfaces-Polar and spherical coordinates-Elements of differential geometry and vector calculus-Partial derivatives, div, grad, rot - Lagrange multipliers-Differentials Multiple integrals-Applications in physics and geometry-Surface integrals-Applications in fluid mechanics- Geen's Theorem-Stokes Theorem- Gauss' Theorem-Applications in Mechanics.

Environmental Chemistry

MP132

Atom, Quantum numbers, Periodic Table and its properties, Chemical bonds, Valency and Oxidation number, Weak bonds, Molecular geometry and hybridism, Crystal Field Theory, Inductive effects, Resonance effect, Fate of pollutants in the environment, Physicochemical properties of pollutants determining their distribution, solubility, Adsorption, Exchange with

the atmosphere, Reactions of Hydrolysis, Reactions of Photolysis, Oxidation and reduction reactions, Instrumental methods of analysis, statistical treatment of Data, Calibration, Volumetric measurements, Optical methods, Electrical methods, Chromatographic Methods.

Mechanics I

MECH 102

General principles. Force vectors. Equilibrium of a particle. Force system resultants. Equilibrium of rigid body (Moments, Couples, reduction of a System of forces). Structural analysis. Internal forces. Centre of gravity and centroid. Moments of inertia. Forces in beams and cables.

Ecology

MP 112

Ecosystems, background laws of energy flow, food pyramids, recycling. Biogeochemical cycles: water, carbon, nitrogen, phosphorus, sulphur. Productivity: primary productivity photosynthesis factors controlling photosynthesis rate Community structure / synthesis and primary productivity, Secondary productivity ecological gain. Primary productivity calculation methods. Ecological evolution, climax. Environmental abiotic factors: Light, temperature, water, wind, topography, soil. Population ecology: competition predation- succession natural evolution. Mediterranean ecosystems, Anthropogenic impacts on ecosystems: desertification, erosion, eutrophication, toxic wastes, greenhouse effect, and climate changes.

Scientific Programming for Engineering

MATH 106

Use of scientific programming library packages, programming in Unix and Windows environments with Matlab and Maple. Programming assignments.

English II

LANG102

English II offers an extension of the grammar and vocabulary skills initiated in English 01 with a further emphasis on academic reading and writing skills. In addition to the minimum 25-hour attendance recommended for the completion of level 02 materials at the Language Center, students may also register in writing skills and conversation tutorials provided at the center. The mark will be based on a final exam.

German II

LANG 104

German instruction at the level of Zertifikat Deutsch (first certificate in German from the Goethe Institut).

Introduction to Philosophy

KEP 104

A brief overview of the history of philosophy. Main categories and laws of dialectic in the areas of knowledge. Theory of ontology and logic (formal and dialectical). Elements of social philosophy. The social structure as an organic whole, social consciousness and its forms.

Political Economy

KEP 102

This course includes an analysis of basic concepts and relations of Political Economy, as well as a brief review of recent economic history. It refers more specifically to the theory of value, surplus-value and prices, as well as to the relation between competition and distribution, to fundamental trends and contradictions of growth, and to the phenomena of economic crisis.

History of Civilization

KEP 202

Review of History of Civilization with particular reference on some periods. Analysis and synthesis of basic concepts and questions on civilization. Critical discussion of theories about recent cultural changes (post-modernism, etc.).

Industrial Sociology

KEP 302

Lectures on Sociology of Labour and Sociology of Development, with particular reference on historical approach of production systems and on recent changes concerning industry (crisis and restructuring strategies, "flexible" production and labour organization, labour market, inter-firm relations, local productive systems, research and technological development, innovations, know-how, industrial policy...).

3rd Semester

Numerical Linear Algebra

MATH 201

Introduction to Linear and Matrix Algebra - Direct Methods for Solving Linear Systems - Pivoting Strategies - Error Analysis - Condition Number - Determinants - Eigenvalues and Eigenvectors - Diagonalization - Iterative Methods for Solving Linear Systems.

Ordinary Differential Equations

MATH 203

Introductory concepts initial value problems. Seperable and homogeneous different eequations. General linear 1st order different equations Bernoulli, Ricatti and exult different equations. Integrating factors. Equations of 2nd order: linear with constant cofficients, Euler equation, reduction to 1st order. Laplace transformation methods. Systems of differential equations. Methods of serious, solvability of two-degree differential equations.

Mathematical Statistics

MATH 204

Estimation Theory - Confidence Intervals - Hypothesis Testing - Regression Analysis.

Strength of Materials

MECH 201

Concept of stress. Internal forces. Stress and Strain distribution. Factor of safety. Indeterminated problems. Thermal strain problems. Torsion. Pure bending. Assymetric bending. Transverse loading. Combine loading. Transformation of stress and strain. Morh circles.

Fluid Mechanics

MP 221

Fluid Properties (definition of a fluid, dimensions and units, viscosity, mass and weight variables, pressure and a perfect gas, bulk modulus of elasticity, vapor pressure and surface tension), Fluid statics (Force, stress and pressure at a point, basic equations of fluid statics, units and scale of pressure, manometers, forces on planes, forces on curved surfaces, buoyant force, relative equilibrium), Fluid flow Concepts and basic governing equations (flow concepts and kinematics, control volume, the continuity equation, the momentum equation, conservation of mechanical energy and Bernoulli equation, environmental applications) dimensional analysis and Dynamic Similitude (dimensional homogeneity and dimensional ratios, dimensions and units, the Π-theorem, Reynolds number, Froude number, environmental studies and similitude), Viscous flow in pipes and channels (laminar and turbulent flow, turbulent flow losses in open and closed conduits, Moody diagram, minor losses).

English III

LANG 201

English III combines a program of self-access learning at the Language Center with a series of thematic work modules to be covered in class based on student's field of study. The modules focus on language, texts and writing skills specifically targeted at what students learn in the context of their departments. Small assignments throughout the course and a final exam will determine the student's mark.

German III

LANG 203

Students are introduced to terminology in their field of study. The course aims to develop student abilities in language and communication skills, allowing a competence in a professional work environment.

4th Semester

Environmental Microbiology

MP 226

Introduction to microbiology. Chemicals of the cell, macromolecules. Biodiversity and the origin of microorganisms. C and N cycles. Taxonomy. Prokaryotic and eukaryotic cells. Metabolism, enzymes, metabolic pathways. Krebs cycle. Physiology and cell growth. Growth in batch and continuous systems. Measurement techniques of cell growth. Applications of environmental microbiology. Microbial communities in biological wastewater treatment systems. Biodegradation of xenobiotics (chlorinated hydrocarbons, pesticides etc).

Physical Chemistry

CHEM 201

The physicochemical properties of mater. Ideal gases: laws, Equation of state of ideal gases, Kinetic theory of ideal gases, Gas diffusion, applications. Real gasses: PVT behaviour of real gases, Equations of state for real Gases. Virial and van der Waals equations of state. Law of corresponding states. The critical region. Mixtures of ideal or non-ideal gases. Chemical Kinetics: Rate equations, Reaction rate constant and Arrhenius theory, order of reaction, experimental methods in reaction kinetics determination in batch, CSTR and PFR reactors, Chemical reaction mechanisms, Heterogeneous catalytic reactions, applications in reactor engineering and design. Thermodynamics: First Law and applications, Chemical thermodynamics. Second Law and applications, Enthalpy, entropy, free energy, chemical potential, Chemical-reaction equilibria and calculations. Phase equilibria. The course is completed by experimental practice in the laboratory which in general includes: Phase equilibria and distillation, Liquid-gases equilibria and absorption, gas-solid equilibria and adsorption, Kinetic studies of homogeneous and heterogeneous reactions. Electrochemistry and fuel cells.

Geographical Information Systems

MP 224

GIS systemic parts. Geographical data. Hardware and software of GIS. Collection of geographical data. Organization and storage of geographical data, data models, introduction to data bases, GIS architectonics, treatment and analysis of geographical databases, elements of GIS databases and analysis of results, GIS applications.

Soil Mechanics And Foundations

MP 264

Soil mechanics: nature and properties of soils, Granulometric classification. Atterberg limits. Classification of soils. Soil permeability - the role of water in the mechanical behavior of the soils, Coefficient of hydraulic permeability. Filtration forces. Filters. Soil mechanical behavior. Fracture criteria. Mohr - Coulomb. Laboratory and in - situ test. Tensions in soils. Deformations. Consolidation. Lateral forces. Methods of analysis and redemption. Foundation: surface foundation Morphology, Soil Strength.

Heat & Mass Transfer

MP 222

Basic concepts: Driving Force & Flux. Unified approach & analogies. The Laws of Fourier & Fick. The Transport Equation and its solution. Source term. Environmental applications of heat & mass transfer, case studies in thermodynamic cycles and in the transport of pollutants. Streeter-Phelps equations, mixing and plug-flow models for rivers & lakes.

Water Pollution And Monitoring

MP 212

Physical, inorganic, organic and biological characteristics of waters and wastewaters; Methods of analysis and laboratory instruments; Pollution sources, removal mechanisms, health and environmental effects; Water quality limits and wastewater treatment requirement according to WHO guidelines, E.U. directives, and national regulations; Models for computing the assimilative capacity of lakes and rivers and the total wastewater dilution from submarine outfalls; Field measurement of hydrological and physical characteristics waters and wastewaters; Sample collection, preservation and transportation; Planning of water quality monitoring programs for rivers, lakes and coastal waters. Planning of wastewater monitoring programs; Exercises with field measurements, collection of samples from natural waters (river, lake, sea) and wastewaters (various stages of a municipal wastewater treatment plant) and laboratory analysis.

English IV

LANG 202

Students in English IV will be required to study texts and language based on materials related to

their fields of study. Work assigned in class meetings to be completed with the resources available at the center involve extensive use of the Web in improving English language skills not only with respect to the language itself but regarding such themes as Ethics in Engineering and Academic Report Writing. A project report and a final exam will determine the student's mark. All students must meet the requirements of this course.

German IV

LANG 204

German instruction at the level of Mittelstufe (ZMP), enhancement of specific language tailored to students professional field.

5th Semester

Environmental Thermodynamics

MP 329

Axiomatic approach (Caratheodory approach) and the approach of ensembles. Work & heat. 1st & 2nd Laws. Internal energy, enthalpy, entropy, free enthalpy (Gibbs) and free energy (Helmholz). Chemical thermodynamics, fugacity, chemical potential, activity, models of activity. Thermodynamic cycles with emphasis in environmental friendly cycles with energy production in heliothermal systems. Ensembeles of Gibbs and Callen, Irreversible thermodynamics.

Structural Analysis & Reinforced Concrete

MP 321

The matrix analysis (direct stiffness) method and its application for the analysis of frame and truss structures. Element stiffness and transformation matrices. Types of loads and supports. Formulation and solution of equilibrium equations. Evaluation and interpretation of member actions. Computer implementation of the direct stiffness method. Introduction to the finite element method for discrete and continuous problems. Introduction to reinforced concrete analysis and design. Theoretical and numerical models for reinforced concrete structural members. Types of limit states. Types of loads and related checks: compression, tension, bending moments, shear forces and moments. Code requirements and detailing provisions.

Air Pollution and Monitoring

MP 311

Sources and nature of primary air pollutants; Formation of secondary air pollutants; Air pollutant removal mechanisms; Global effects of air pollution (Ozone depletion and greenhouse effect). Local effects of air pollution on health and vegetation; Air quality standards and indicators; Emission standards; Methods for measuring gas flows in ducts and stacks and monitoring pollutant concentrations in ambient air and in stacks; Ambient air quality monitoring with stationary and mobile station networks; Laboratory training with monitoring of ambient TSP, PM10 and PM2.5 concentrations, and measurement of gas flow and pollutant concentrations (SO2, NO, NO2, CO, CO2 and TSP with isokinetic sampling) in stacks; Calculation of emission factors from the measurement results.

Reaction Engineering

MP 317

Introduction to reaction kinetics (stoichiometry and extent of reaction, activation energy, the Arrhenius law); Design of ideal homogeneous reactors (batch, CSTR, PFR); Multiple reactors (CSTR in series and in parallel, PFR in series and in parallel, combination of CSTRs and PFRs); Reactors with recycle; Isothermal and non-isothermal operation; Models of non-ideal reactors (axial dispersion, residence time distribution, CSTR in series); Heterogeneous catalysts (catalyst preparation and characterization); Mass transfer and reaction rate (the effectiveness factor and the Thiele modulus); Fixed bed, fluidized bed and slurry reactors.

Optimization Methods of Environmental Systems

MP 335

Introduction, Classification of the optimization models, Convex and Concave sets, Theorems of Mathematical Optimization, The Geometry of the Optimization Problem, Unconstrained Optimization Problems, Lagrange Multipliers, Linear Programming Problems, Simplex method, Nonlinear Programming Problems, Constrained Optimization, Dynamic Programming, applications of optimization methods to Water Resources Management, Design of Groundwater Systems, Optimal Groundwater remediation design, Optimal Saltwater Systems, and Optimal waste-water management systems.

Engineering Seismology And Antiseismic Codes

MP319

Introduction to Seismic Risk, Elements of Engineering Seismology and Earthquake Soil Dynamics, Seismographs, Accelerometers, Seismo-tectonic of Greece, Seismological data, Anti-seismic measurements and emergency, Greek and International Antiseismic Codes, New Greek Antiseismic Code (EAK2000), GIS and antiseismic protection, Engineering applications.

Aquatic Chemistry

MP 445

Universal Biogeochemical Cycles, Determination of pH in natural waters, Carbonate equilibria, Chemical speciation in solution, Buffer intensity and Neutralizing capacity, Composition of natural waters, Kinetic considerations, Determination of equilibrium constants, Chemical activity and ionic strength, Fate of metals in the environment, Metal Hydrolysis and Complexation, Inorganic ligands, Ligands' competition, Interaction of water solutions with sediments and soils, Solubility and sorption, Influence of chemical species in solubilisation, Complex formation, Redox aquatic chemistry, Heterogenic reactions and cycles, Redox equilibria and volumetric methods for redox reactions (pE scale), Application of aquatic chemistry.

6th Semester

Environmental Meteorology - Climatology

MP 332

General aspects of the atmosphere of the earth. Energy balance and green house effect. Thermodynamics of atmospheric air - vertical stability. Equations which control the movement of air masses inside the boundary layer. Statistical methods for description of atmospheric turbulence. Atmospheric stability and dispersion of air pollutants. Stratospheric ozone and climatic effects. Temporal and spatial distribution of particulate matter and gaseous air pollutants in the atmosphere.

Cloud formation, dry and wet deposition. Prognostic equations for turbulent flow. General circulation in the earth atmosphere.

Unit Operations for Water and Wastewater Treatment

MP 324

Sedimentation, Flotation, Deep bed filtration, Surface filtration (Screening flow equalization, Vacuum filter, filterpress) Membrane separation processes (Reverse osmosis, nanofiltration, sand bed dewatering).

Numerical Methods in Environmental Hydraulics

MP 336

Numerical simulation of environmental systems, error analysis, error propagation, solution of non-linear hydraulic equations (graphical, Newton-Raphson and bisection methods), solution of a system of linear equations (Gauss elimination, Gauss-Siedel, Thomas algorithm), linear, polynomial and multiple linear regression, Newton's and Lagrange interpolating polynomials, numerical integration (trapezoidal and Simpson's rule), solution of ordinary differential equations (Euler, Runge-Kutta). Applications in environmental engineering, heat transfer, environmental hydraulics and water resources. Introduction to partial differential equations. Engineering applications.

Municipal Solid Waste Treatment and Management

MP 338

Waste categories and approaches for separation at the source. Temporary storage systems; Design of waste collection systems; Road, rail and sea transport; Design of central and local transfer stations. Mechanical separation, composting and incineration of wastes; Quality and use of compost; Design and operation of sanitary landfills; Leachate collection and treatment methods and quantity prediction models; Collection and use of biogas; Landfill restoration; Equipment for transport, spreading and compression; Development of optimal regional management plans.

Environmental Hydraulics

MP 342

Closed conduit flow. Pipes in series, pipes in parallel, pipe junctions, pipes with pumps. Open channel hydraulics, specific energy, critical depth, subcritical and supercritical flows, discharge measurements (Venturi), uniform depth, nonuniform flows, slowly varied flows (surface profiles), hydraulic jump, weirs, Introduction to mixing in rivers, lakes and impoundments. Multiport diffusers, Design of submerged sewage outfalls.

Field Studies I

MP 340

The Field Exercises imply the practical acquaintance of students of topics taught during the courses of the 2nd and 3d year of the Curricula. They include environmental applications of Thermodynamics, i.e. Stirling cycles, heliothermic systems and systems of wind energy. Also desertification phenomena, visiting places on Crete where this phenomenon is manifested and studying methods to avoid the problem.

Renewable Sources of Energy

MP 440

Introduction, terms. Energy and environment. Main aspects of the Renewable Energy Sources. Biomass-biofuels. Solar energy exploitation systems. Active-passive systems, Photovoltaics, Bioclimatic. Wind energy. Small hydro systems. Geothermal energy. Main aspects of energy saving. Prototype energy applications (desalination, autonomous energy systems, solar cooling). Dimensioning of RES systems. Environmental impacts from the renewable and conventional energy sources.

7th Semester

Introduction To Environmental Modeling

MP 421

Introduction to Environmental Systems Modeling, Transport Phenomena, Dispersive Systems, Advective Systems, Advective/Dispersive Systems, Compartmentalization, Sediment Transport, Simple Transport Models, Parameter Estimation, Chemical Reaction Kinetics, Eutrophication, Ecosystem Models, Conventional Pollutants in Rivers and Estuaries, Toxic Organic Chemicals in Lakes, Rivers and Estuaries.

Biochemical Engineering

MP 423

Reactions with free enzymes. Michaelis-Menten kinetics. Determination of kinetic parameters. Enzymatic reactions with multiple intermediates, co-enzymes, substrate inhibition. Effect of inhibitors, temperature and pH. Immobilized enzymes. Inter and intra particle mass transfer. Mass transfer through cellular membranes. Mathematical models of microbial growth. Non-segregated models. Effect of toxic compounds. Sterilization. Bioreactor design (batch, continuous, fed-batch). CSTR systems with recycle. Agitation and aeration of bioreactors. Determination of best operating conditions.

Hydrology

MP 431

Hydrologic cycle, Hydrometeorology, Precipitation, Evapotranspiration, Interception, Snow hydrology, Infiltration, Overland flow, Hydrologic measurements, Stream flow and hydrographs, Stream flow routing, Watershed hydrology and models, Computer applications.

Chemical Processes in Water and Wastewater Treatment

MP 437

Principles of water equilibrium chemistry, Solubility of salts, Chemical precipitation, Coagulation-Flocculation, Adsorption, Ion exchange, Disinfection processes (chlorine, ozone, UV)

Design of Transfer Stations and Sanitary Landfills for Municipal Solid Wastes

MP439

Waste collection system analysis: temporary storage system; design parameters (bins, selection of capacity, etc); collection and transfer system (collection routes design, evaluation and selection of appropriate vehicles, capacity, design parameters, annual cost for waste collection and transfer, design paradigms); Waste Transfer Stations (WTS) (structure and operation, design, selection criteria and technologies compatibility, annual cost, financial evaluation).

Procedure for assessing the number of landfills or integrated solid wastes management sites in a study region; Sanitary landfill sitting criteria; Selection of the most appropriate site among alternative ones; Biological and chemical degradation of wastes; Biogas formation; Leachate production rates and characteristics; Landfill design: Development phases, capacity, earthworks, liner insulation, leachate and biogas collection and management systems, technical infrastructure (fences, gates, scales, access roads etc.); Mechanical equipment; Operation, environmental monitoring, landfill closure and postclosure care.

Financial Management

MPD 402

The nature of the enterprise and its goals, the evolution of financial management, the credit system, basic financial statements, balance sheet, net income statement, working capital, financial ratios, financial analysis methodology, profitability, financial leverage, industrial and financial risks, break-even analysis, corporate risk models, table of sources and uses of funds, financial forecasting methods, corporate financing, common stock financing, debt and preferred stock, leasing, case studies.

Sustainable Development (ISO14000 & LCA)

MP 443

Introduction. Terms. Monetary system and the environment. Sustainability. Examples. The meaning of development. Income. Impact of the development rate. Development level and categorization of countries. Determinants of the development. Development with and without technology progress. Productivity. Natural sources. Relation monetary sphere/biosphere. Examples in energy and recycling. Sustainable management. Monetary development models. Non balanced development. Agricultural, industrial, postindustrial development. International financial dealings and technology transfer. Desirable development rate. Relation between economical development and environmental protection. Re-estimation of the national income and welfare. National capital depreciation. Examples form the World Bank. Sustainable economical Welfare indicators. Long-term development and sustainability. Economics of ecology. IPAT equation. Economics of the Climate Change. Cost-benefit analysis. EMAS Environmental Management Systems. Life Cycle Analysis. European policies on sustainability. The Framework Programmes on sustainable development. Environmental taxes. Transition in sustainable production systems. The example of energy.

Agricultural Engineering Systems

MP 451

Agricultural systems and environmental pollution. Sustainability. Irrigation systems and methods (surface, dripping, subsurface). Irrigation networks (closed and open conduits, network equipment, pumps and pumping stations). Drainage works. Soils management (flattening, drainage, and desalination). Water abstraction technical works (rain water collection reservoirs, floating reservoirs and spring water collection systems).

Project Management MP 453

8th Semester

Field Studies II

MP 430

The Field Exercises II have the objective of providing practical acquaintance of students with basic topics taught in the 3rd and 4th year of their curriculum. More specifically, they include exercises related to: The management of air, water and solid wastes and with the operation of relevant collection, recycling, transport, treatment and final disposal installation; Environmental applications of Fluid Dynamics, i.e. Hydraulics, surface and subsurface waters, hydrology, fate of pollutants in surface and subsurface waters, and; The operation of wind energy systems.

Groundwater Flow & Contaminant Transport

MP 432

Introduction to porous media, Distribution of Groundwater, Porosity, Hydrogeological formations, Hydraulic head and Hydraulic Gradient Hydraulic conductivity, Darcy's Law, Homogeneity and Anisotropy, Unconfined aquifers, Confined aquifers, Continuity Equation, Mathematical Groundwater Models, Wells, Steady flow towards a well (confined, unconfined and leaking aquifers), Unsteady groundwater flow, Pumping test, Unsaturated zone, Soil properties, Water Budget, Contaminant sources, mass transport processes, Advection and groundwater contamination, Flick's Law, Molecular diffusion, Diffusion in porous media, Dispersion, applications of 1-D and 2-D flow and mass transport to groundwater contamination problems, Numerical Models of groundwater contamination.

Toxic & Hazardous Waste Treatment and Management

MP 438

Properties and classification of hazardous wastes based on their physical and chemical properties. Pollutant distribution and effect on the environment and particularly on the biosphere and human health. Carcinogenetic mechanisms. Transport mechanisms of toxic pollutants. Review and choice of treatment methods for toxic and hazardous wastes. Production, management and storage of hazardous wastes. Hazardous substances marking. Thermal conversion, landfilling and stabilization/solidification of toxic wastes. Biodegradation of toxic pollutants and bioremediation (physically and mechanically assisted). Case studies and management of toxic and hazardous wastes. Legal framework. Present situation in Greece.

Biological Processes in Wastewater Treatment

MP 442

Activated sludge treatment; Aeration and secondary settling tanks; Trickling filters; Aerated lagoons; Stabilization ponds; Sludge treatment (aerobic/anaerobic digestion); Anaerobic processes; Thermochemical and advanced oxidation processes for industrial effluents treatment; Integrated physicochemcal and biological treatments.

Management of Air Emissions

MP 444

Sources and abatement options in industrial sectors with significant emissions in Greece; Design and operation principles for major emission-control systems; Computational source inventory methods with emphasis on the "Rapid Assessment" method and the use of source and control system simulation models (models for estimating emissions and fuel consumption from traffic, gas volume from combustion sources, temperature drop in stacks and efficiency of selected control systems); Combined use of the computational and direct monitoring

methods; Meteorology and pollutant dispersion models. Presentation of models allowing calculation of the maximum hourly pollution levels from point sources and the mean seasonal or annual concentrations from point and area sources; Systemic approach for the analysis of air pollution problems and the synthesis of effective air pollution abatement strategies.

Environmental & Technical Legislation
KEP 3O4
A. Introduction to the legal system. Basic law classification. Elements of public, private and European law.
B. Introduction to the technical legislation. Procedures for undertaking public works. Adaptation of the Greek technical legislation to the corresponding European legislation. Procedures to resolve conflicts in public works.
C. Greek and European environmental legislation. Constitutional protection of the environment (the article 24 of the Greek Constitution). Enlargement of the legal standing in the environmental process. The conflict between the environmental and other constitutional rights. The sustainable development and the Council of State jurisprudence. The Greek Acte 1650/1986 for the protection of the environment. The legal framework for the Renewable Energy Sources. The Amsterdam Treaty and the horizontal environmental directives. Greek and European jurisprudence for the protection of the environment.
D The administrative organisation for the protection of the environment. Procedures for environmental authorisation. The European directives for the Environmental Impact Assessment (EIA) and the Strategic Environmental Assessment (SEA). Contents, specifications and evaluation of the environmental studies. The jurisprudence of the Council of State for the environmental studies. The jurisprudence of the European Community Court for the environmental impact assessment.

Bioremediation
MP 446
Design of in situ and ex situ remediation systems for contaminated soil and groundwater with organic compounds (chlorinated and non-chlorinated). Design of subsurface barriers (in situ reactive walls). SBR operation of bioreactors for ex situ bioremediation. Natural attenuation. Phytoremediation technologies for decontamination of soils and groundwater from heavy metals and organics. Air biofilter technology. Predicting the byproducts from bioremediation of organic compounds. Field applications.

Thermal Unit Operations MP 448

Analysis of Urban Transportation Systems
MP 450
Analysis of traffic conditions within urban transportation systems in order to identify and reduce potential negative environmental impacts. Analysis of urban transportation system: data collection, trip generation, trip distribution, modal split, and traffic assignment. Prediction of future transportation needs. Software tools for the analysis and the investigation of alternative strategies aiming to the reduction of any potentially negative consequences, and the continuous improvement of the environmental conditions within the considered systems.

Decentralized Wastewater Treatment Systems
MP 434
Wastewater treatment requirements and receiver water quality limits based on the WHO guidelines and the E.U. directives; Analysis of alternative wastewater reuse and disposal options through the use of models for assessing the irrigation water requirements, the assimilative capacities of rivers and lakes and the size or performance of submarine outfalls. Optimal design and performance simulation of selected treatment systems, with emphasis on waste stabilization ponds, constructed wetlands with surface and subsurface flows, slow rate land treatment and onsite treatment. Use of an expert system for the analysis of water pollution problems and the synthesis of an optimal dynamic (season-dependent) management schemes through simultaneous consideration of the alternative treatment, reuse for irrigation, and disposal options. Cost estimation of wastewater management projects.

Surface Water Quality Models
MP 436
Introduction to Environmental Systems Management (Types of pollution, Criteria for management), Systems Theory (Mass balances and transport phenomena, Model development), Models for Management of Lakes and Coastal Areas Ecosystems (Eutrophication theory, methodology for management and restoration, WASP model), Waste Load Allocation in River Basins (Waste load allocation methodology, Uncertainty analysis, AQUATOX model), Geochemical Watershed Models (Acid Rain, Geochemical Models, Ecological Effects, ETD Model).

Electric Circuits
ECE 121
Basic electric quantities, elements of electric networks, surveying instruments of electric quantities, errors. Thevenin theorem, Norton theorem, first and second order electric circuits, Methods of Analysis of Electric Circuits (Mesh Analysis, Nodal Analysis), electric circuits in sinusoidal steady state.

Analytical Chemistry
CHEM 102
Sampling, common apparatus and basic techniques, errors and statistics in analytical chemistry, solvent extraction, principles of chromatography, liquid chromatography, gas chromatography, thin layer chromatography, spectroanalytical methods, mass spectrometry, atomic absorption spectrometry, x-ray fluorescence, nuclear methods. Laboratory activity: working practices, titrimetric analyses, water hardness, pH-meters and ion selective electrodes, spectrophotometric analysis.

9th Semester

Sewer and Water Networks
MP 531
Water Supply: water uses and quantities, design period, demand variations, pipework design, pipe materials and appurtenances, break pressure tanks, pumping mains, service reservoirs, network analysis, linear method, Newton's rule, Hardy Cross method. Urban Drainage: combined and separate systems, storm and waste-water flow rates, return period, I-D-F relationships, velocities and slopes, network design and analysis, pipe materials. Treatment Plant Hydraulics: d.w.f. and peak flows, flumes, weirs and distribution chambers, treatment units

hydraulic analysis and operation, PF and CS bioreactor flow regimes and RTDs, plant layout and hydraulic profile, sludge pumping, air-supply system calculations. Pumps: centrifugal, positive displacement, screw and air-lift type of pumps, manometric head, characteristic curves, multiple pump systems, affinity laws, pump selection, P.S. design.

Design of Environmental Systems and Environmental Impact Assessments
MP 555
Theory and methodology of environmental systems design. Methodology of conducting Environmental Impacts Assessments (EIA). Categories of environmental systems and environmental impacts. International and Hellenic legal framework. Group project designing and assessing the impacts of an environmental problem.

Air Quality Modelling
MP 533
Vertical structure of the atmosphere, atmospheric boundary layer, chemical composition of the atmosphere. Basic principles of meteorology and atmospheric pollution, atmospheric stability. Atmospheric theories for pollutant dispersion, methods of Euler and Lagrange. Analytical solutions of the atmospheric diffusion equation - Gaussian solutions. New particle formation in the atmosphere. Atmospheric models for chemistry and dispersion. Numerical solutions with finite differences and finite volumes. Applications of atmospheric models. Statistical models of air pollution.

Indoor Air Quality
MP 537
Introduction to indoor air quality. Gaseous and aerosol air pollutants in indoor air. Radon, cigarette smoke, carbon dioxide, PAHs, bioaerosols, heavy metals, formaldehyde. Human exposure, climatic parameters, infiltration. Microenvironmental models, measurements of indoor air pollutants. Indoor air quality in residential houses, in industry and museums. Protection of human health from indoor air pollutants.

Coastal Hydraulics
MP 535
Introduction to coastal hydraulics, Seawater (Ingredients of water, Density of Seawater) Coastal water oscillations (genesis of waves, measurements in nature, mathematical and real waves, Short and Long surface waves theories), Influence of seabed (wave breaking, diffraction), Currents, Definitions, Wave-induced Currents, Wind-induced Currents, Measurements of Currents, Coastal Sediments, Sediment Motion, Sediment transport in the coastal zone, Quality of Seawater, Sources of pollution, Sea' s ability of self-purification - Pollution Control, Environmental Control of coastal works, Examples - Coastal management.

Risk Analysis
MP 541
Introduction. Uncertainty and Risk Analysis, Risk for the human health. Examples from the natural systems. Risk assessment methodology. Risk factors. Methods to estimate the parameters. Sensitivity analysis. Correlation between risk and cost/benefit. Statistical value of life. Years of life loss. Expose/response functions of populations in pollution. Risk management Safety. Occupational Safety. Quality management and risk. Risk depiction in local/regional level. Decision making under uncertainty. Decision trees. Simulation. Environmental safety. Information on Risk and public perception. Environmental Impact Assessment. Methods. Examples

Control Systems I
MPD 401
Mathematical concepts : input signals, complex numbers, Laplace transforms. System description : Transfer functions, block diagrams. Time response, stability, steady-state error, controller design, PID design, MATLAB use.

Noise Control MP 549

Airwaste Treatment Technology
MP 551
Brief introduction to air pollution, description of most common air pollutants, air pollutant emissions in Greece. Description of different approaches to air pollution control: dilution, clean production technologies, control of air pollution at the source. Control technologies for air pollutants: absorption, adsorption, condensation, combustion-thermal oxidation, control of air pollutants by chemical processes (sulfur dioxide, nitrogen oxides). Control technologies for particulate matter: gravitational settling chambers, cyclones, fabric filters-baghouse filters, ceramic filters, wet scrubbers-collectors, electrostatic precipitators. Criteria for the selection of appropriate control technologies, for different pollutants and processes. Control technologies for air pollutant emissions from mobile sources: catalytic converters, metal and ceramic filters for the control of particulate matter from diesel engines.

Soil & Groundwater Remediation Technologies
MP 539
Contaminant Transport and Behavior in the Subsurface: Advection, Dispersion, Retardation, Adsorption Isotherms. In-Situ Bioremediation of Soils and Ground Water Contaminated with Petroleum Hydrocarbons: Bioventing, Bioslurping, Air Sparging, Chlorinated Solvents Using Alternate Electron Acceptors. Physical and Chemical Treatment: Washing Processes, Clean-up and Assessment of Heavy Metals Contaminated Soils, Supercritical Water and Supercritical Carbon Dioxide for Cleaning of Soil Material, Desorption Technologies for Soil Decontamination. Electrokinetic Processes: Thermal Desorption and Thermally Enhanced Vapor Stripping: Rotary Kilns, Fluidized-Bed Incineration, Pyrolysis, In-Situ Vitrification. Chemical Stabilization of Contaminated Soils.

Agro-Industrial Waste Process Technologies
MP 553
Definition, Properties, and Pollutant load from agro-chemical activities and from the food industry. Strategies in the agro-industrial wastewater treatment. Processes in the gaseous, liquid, and solid wastes treatment. The particularity of the anaerobic treatment. Recovery of valuable substances from the agro-industrial wastes. Modern methods: solar detoxification, membrane bioreactors.

10th Semester

DIPLOMA THESIS
Minimum number of credits for awarding of the diploma: 200.

Department of Architectural Engineering

The new Department of Architectural Engineering admitted its first students in September 2004. It aims to promote, through teaching and research, the scientific areas of architecture, urban and land use planning, architectural technology, the protection and rehabilitation of monuments and the environmental dimension of architectural design.

Divisions

- History and Theory of Architecture and Visual Arts
- Architectural Design, Rehabilitation and Reuse of Monuments and Architectural Landscaping
- Urban and Land Use Planning
- Architectural Technology

Laboratories

- Computers
- Library - Study Area
- Studios
- Audiovisual Means and Visual Arts
- Rehabilitation of Monuments and Environmental Protection
- Construction Technology
- Documentation on Architecture and the City

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Karydis Dimitris, *Professor (National Technical University of Athens)*
Providakis Konstantinos, *Associate Professor (Sciences Department)*
Zavoleas Ioannis, *Assistant Professor (Sciences Department)*

Adjunct Faculty Members

Andreadakis Dimitris
Deligiannis Christos
Giannoudis Socrates
Laskaris Nikolaos
Mavrakakis Konstantinos
Patsavos Nikolaos
Proimos Konstantinos
Rigos Iakovos
Skoutelis Nikos
Stavroulaki Maria
Tripodakis Alexandros
Tsakalakis Dimitrios
Varoudakis Aristomenis

Content of Undergraduate Courses

1st Semester

- Architectural Design I *(Lectures, seminar, studio: 12 hours)*
- Visual Arts and Representation Means I *(Lectures, seminar, studio: 8 hours)*
- History Theory I *(Lectures: 4 hours)*
- Architectural Technology I *(Lectures, seminar, studio: 4 hours)*
- Mathematics I *(Lectures and exercises: 2 hours)*

2nd Semester

- Architectural Design II *(Lectures, seminar, studio: 12 hours)*
- Mathematics II *(Lectures, exercises: 2 hours)*
- History Theory II *(Lectures: 4 hours)*
- Architectural Technology II *(Lectures, seminar, studio: 4 hours)*
- Visual Arts and Representation Means II *(Lectures, seminar, studio: 8 hours)*

3rd Semester

- Architectural Design III *(Lectures, seminar, studio: 12 hours)*
- History Theory III *(Lectures: 4 hours)*
- Representation Means I *(Lectures, studio: 6 hours)*
- Architectural Landscape *(Lectures, studio: 4 hours)*
- Structural Engineering I *(Lectures and studio: 4 hours)*

4th Semester

- Architectural Design IV *(Lectures, seminar, studio: 12 hours)*
- History Theory IV *(Lectures: 4 hours)*
- Urban planning Analysis *(Lectures, studio: 4 hours)*
- Structural Engineering II *(Lectures, studio: 4 hours)*
- Representation Means II *(Lectures, studio: 6 hours)*

5th Semester

- Architectural Design V *(Lectures, seminar, studio: 12 hours)*
- History Theory V *(Lectures: 4 hours)*
- Urban planning I *(Lectures, seminar, studio: 8 hours)*
- Architectural Technology III *(Lectures, seminar, studio: 4 hours)*
- Electromechanical Installations (Lectures: 2 hours)

6th Semester

- Architectural Design VI *(Lectures, seminar, studio: 12 hours)*
- Residential Units *(Lectures, seminar, studio: 4 hours)*
- Urban planning II *(Lectures, seminar, studio: 8 hours)*
- Architectural Technology IV *(Lectures, studio: 4 hours)*
- Bioclimatic Architecture *(Lectures: 2 hours)*

7th Semester

A. Mandatory classes

- Architectural Design VII *(Lectures, seminar, studio: 12 hours)*
- Interior Architecture I *(Lectures, seminar, studio: 12 hours)*

B. Elective classes

- History Theory VII *(Lectures: 4 hours)*
- Building and unit Restoration I *(Lectures, seminar, studio: 12 hours)*
- Urban planning I *(Lectures, seminar, studio: 12 hours)*
- Architectural Technology III *(Lectures, seminar, studio: 12 hours)*
- Representation Means II *(Lectures, studio: 6 hours)*
- Optional class *(Lectures, seminar, studio: 12 hours)*

8th Semester

A. Mandatory classes

- Architectural Design VII *(Lectures, seminar, studio: 12 hours)*
- Interior Architecture I *(Lectures, seminar, studio: 12 hours)*

B. Elective classes

- History Theory VII *(Lectures: 4 hours)*
- *Building and unit Restoration I* (Lectures, seminar, studio: 12 hours)
- Urban planning I *(Lectures, seminar, studio: 12 hours)*
- Architectural Technology III *(Lectures, seminar, studio: 12 hours)*
- Representation Means II *(Lectures, studio: 6 hours)*
- Optional class *(Lectures, seminar, studio: 12 hours)*

9th Semester

A. Mandatory classes

- Lecture
- Literature research: 16 hours
- Professional Practice *(Lectures: 2 hours)*

B. Elective classes

- History Theory VII *(Lectures: 4 hours)*
- Building and unit Restoration I *(Lectures, seminar, studio: 12 hours)*
- Urban planning I *(Lectures, seminar, studio: 12 hours)*
- Architectural Technology III *(Lectures, seminar, studio: 12 hours)*
- Representation Means II *(Lectures, studio: 6 hours)*

10th Semester

- Thesis *(30 hours)*

C. Postgraduate Studies

Graduate Programmes

The Technical University of Crete is committed to staying at the forefront of educational and intellectual development in the areas of research and teaching both in Greece and internationally. This commitment is reflected in the wide range of M.Sc. & Ph.D. programmes run by the five Departments of the Institution and the growing number of graduate student population. TUC offers opportunities for graduate students to pursue the following programmes of study:

Department of Sciences

MSc and PhD programmes in Applied Sciences and Technology:

- Applied and Computational Mathematics.
- Mechanics and Materials and Structure Technology.
- Applied and Technological Physics and Laser Technology.
- Analytical and Environmental Chemistry.
- Social and Technological Development.

Department of Production Engineering and Management

MSc and PhD programmes in:

- Engineering Management.
- Operations Research.
- Production Engineering.

Department of Mineral Resources

MSc and PhD programmes in Geotechnology and the Environment:

- Exploration and Positioning in the Management of the Geo environment.
- Exploitation of Mineral Resources and Geotechnical Construction.
- Exploitation of Industrial Minerals, Materials, and Energy Resources.

Department of Electronic and Computer Engineering

MSc and PhD programmes in Electronic and Computer Engineering

Department of Environmental Engineering

MSc and PhD programmes in Environmental and Sanitary Engineering:

- Environment and Health.
- Integrated Water Resources and Coastal Management

Interdepartmental Graduate Programme

MSc and PhD programmes in Environmental Management and Quality Control.

Applied Sciences & Technology

General Information

Duration 1 year (M.Sc.), 3 years (Ph.D.)

Entry requirements: Candidates must be graduates of a Technical University or Technical University Schools or University Departments of Sciences and Social Studies (Mathematics, Physics, Chemistry, Economics, Social Sciences, Chemical Engineering, Production Engineering and Management, Mechanical Engineering, Electronics, Computer Engineering, Mineral Resources Engineering, Electrical Engineering, Biochemistry, Biophysics, Civil Engineering etc) in order to be eligible for studies leading to M.Sc.

Holders of a Master's degree are eligible for studies leading to a Ph.D. degree.

Applications: Applications must be made on the standard form, which is available from the secretariat of the Department or can be downloaded online **(www.science.tuc.gr/postg_all.html)**. Documentary evidence of qualifications should be submitted with the application; it includes: (a) detailed record of grades, (b) recent curriculum vitae, (c) certified copy of degree/s, (d) certified copy of certificates of foreign language competency, (e) two (2) reference letters. The applications of all the candidates are reviewed by the Postgraduate Studies Committee of the Department, which approves the application after consideration.

Fees: None

Assessment: Taught courses (lectures, seminars or laboratory exercices) and dissertation.

Object and Aim of the Programme

The postgraduate programme of the Department focuses on the creation of a quality centre in applied sciences and encompasses innovation and new technologies in Greece; it supports economic growth and the country's potential to be competitive, particularly as a member of the European Union. Postgraduate studies in the Sciences Department educate and train students through research for the development of technology and the promotion of science in the scientific fields catered to in the Department, so that students may be able to participate actively in every research and technological field connected with their specialties.

The Department of Sciences offers M.S. and Ph.D. Programs in Applied Sciences and Technology with specialisation in Applied and Computational Mathematics, Mechanics and Materials and Structure Technology, Applied and Technological Physics and Laser Technology, Analytical and Environmental Chemistry, Social and Technological Development.

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Structure and Courses

The courses below must be selected towards an M.S. degree in Applied Sciences and Technology:

Mathematics Division

Compulsory Courses:

- 1. Applied Mathematics for Applied Sciences
- 2. Matrix Computation and Iterative Methods
- 3. Finite Elements and Finite Differences Methods for the Solution of Boundary Value Problems
- 4. Applied Sciences & Technology

A Selection of three courses from:

- 1. Complex Analysis and Dynamic Systems
- 2. Computer Algorithms
- 3. Parallel Processing
- 4. Computational Mechanics
- 5. Partial Differential Equations
- 6. Numerical Methods for the solution of Boundary Value Problems and Integral Equations

Mechanics Division

Compulsory Courses:

- 1. Quality control and testing of materials and structures
- 2. Mechanics of Materials
- 3. Computational Mechanics

A Selection of three courses from:

- 1. Applied Mathematics for Applied Sciences
- 2. Finite Elements and Finite Differences Methods for the Solution of Boundary Value Problems
- 3. Structural Dynamics
- 4. Mechanical waves
- 5. Instruments and Measurements
- 6. Advanced courses in mechanics of materials
- 7. Advanced Composites
- 8. Advanced Topics in structural design
- 9. A course from the Mathematics, Physics or Chemistry division

Physics Division

Compulsory Courses:

- 1. Instruments and Measurements
- 2. Quantum Mechanics in Physics and Chemistry
- 3. Introduction to Optoelectronics, Laser Technology and applications

A Selection of three courses from:

- 1. Special topics in Quantum Mechanics
- 2. Special topics in Physics
- 3. A course from the Mathematics division
- 4. Environmental Chemistry
- 5. Physical Chemistry
- 6. A course from the Mechanics division

Chemistry Division

Compulsory Courses

- 1. Advanced topics of chemical instrumentation
- 2. Environmental chemistry
- 3. Special topics of chemistry

A selection of three courses from:

- 1. Physical chemistry
- 2. Instrumental analytical chemistry
- 3. Applied Mathematics for Applied Sciences
- 4. Quantum Mechanics in Physics and Chemistry
- 5. Regional Development and Transfer of Technology

Social Sciences Division

Compulsory Courses

- 1. Regional Development and Transfer of Technology
- 2. Economic Development and Technology
- 3. Environmental and Resource Economics

A Selection of three courses from:

- 1. Comparative Industrial Development
- 2. Dynamic Methods for the Solution of Business Research Problems
- 3. Prediction Models
- 4. Multi-criteria Analysis
- 5. Matrix Computation and Iterative Methods

Department of Production Engineering & Management

Engineering Management, Operations Research & Production Engineering

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General Information

Duration of M.S. DEGREE

The minimum duration of the M.S. program is one (1) academic year and the maximum is three (3) academic years. Each course is assigned 3 credits. To fulfill the requirements for an M.S. degree, a student must earn a minimum of 30 credit hours. This may be accomplished following one out of two alternative tracks:

- *Track 1:* 7 courses (21 credit hours) and a research oriented M.S. thesis (9 credit hours)
- *Track 2:* 9 courses (27 credit hours) and a compositional M.S. thesis (3 credit hours).

Duration of Ph.D. DEGREE

The minimum duration of the Ph.D. program is 6 semesters and the maximum is 12 semesters.

Fees: None

Applications: Applicants seeking admission to an M.S. program should have a bachelor's or diploma degree in engineering or science. Applicants seeking admission to a Ph.D. program should have a bachelor's or diploma degree and an M.S. degree. All degrees must be approved by DOATAP - the Hellenic NARIC - the academic standards committee of the Greek Ministry of Education and Religion.

Admission is based upon evaluation by the Graduate Affairs Committee (GAC) of previous academic achievements as measured by grades on all courses attended, area of interest special courses, research work, publications, diploma projects, thesis and letters of recommendation.

To be eligible for admission to a Ph.D. program, applicants must have a minimum grade point average of 8.0 in an M.S. program. Applications may be submitted at any time throughout the academic year.

The application consists of: (1) application for Ph.D. program admission specifying the faculty advisor and the subject to the project, (2) degree certifications and grades on all courses attended, (3) at least two letters of recommendation, and (4) overview of the Ph.D. project approved by a faculty advisor. Overseas applicants can submit item (4) within six months after their admission.

Applications for admission to an M.S. program are received once a year. The application package includes:

- Application for M.S. program admission
- Degree certifications and grades on all courses attended, and
- At least two letters of recommendation.

Applicants are also encouraged to submit reprints of published papers, if any, a statement of research interests and

a detailed resume.

Assessment: Students are expected to attend classes regularly. Lecturers base the final evaluation upon class participation, homework, projects, mid-term and final examinations. Course work evaluation is in terms of numerical value numbers ranging from 0 to 10 (outstanding performance). The grade 6 is the minimum passing grade.

A minimum grade point average of 7.5 is required toward an M.S. degree. A student, who concludes with a grade point average of less than 7.5 or has failed in a total of three attempts to pass one or more courses, will be dismissed.

In addition to attending graduate courses, overseas students must also take a course in Modern Engineering Management, Operations Research & Production Engineering Greek Language, which is offered by the University of Crete at Rethymnon, Crete.

Courses are classified in mandatory core courses, subject program area elective courses and general elective courses.

Students should enroll in at least four (4) courses per academic year. Requests for enrollment in a course offered by another department or another university, as well as requests for part-time or exception of attendance should be submitted for consideration by the GAC not later than two (2) weeks after the beginning of the corresponding semester.

The overall program of studies is decided between the graduate student and the assigned academic advisor. Graduate students following Track 1 must register in courses offered by 6 different instructors. Graduate students following Track 2 must register in courses offered by 7 different instructors. Exceptions to the rule may be granted by the GAC on a request basis with proper justifications.

Students with undergraduate degrees in fields other than management, operations research and production engineering may be required to register in undergraduate courses to acquire the necessary background.

The M.S. thesis project is elaborated under the supervision of a faculty advisor, the research advisor. M.S. theses are classified as research-oriented or compositional (surveys, etc). Research-oriented projects are elaborated for a minimum of six (6) months and should constitute original contributions to science or engineering. Compositional theses are elaborated for a minimum of three (3) months and should demonstrate the candidate's ability to carry out a survey, comparison or application of existing methods to a problem.

The thesis advisor suggests a three-member examining committee, the title of the thesis and its classification, to be approved by the General Assembly of the Department at least six or three months before the scheduled thesis examination (depending on the type of thesis). The M.S. examining committee will consist of a minimum of 2 regular faculty members of the Department and at most 1 regular faculty member of another department or university.

The candidate must submit three copies of his/her thesis to the Secretary of the department not later than 20 days (for research-oriented theses) or 10 days (for compositional theses) prior to the scheduled examination date.

The oral M.S. thesis examination must be passed in a maximum of two attempts. The thesis evaluation is based upon the quality of research orientation, literature review and methodology, the usefulness of results, and the overall written and oral presentation.

Ph.D. DEGREE

The minimum duration of the Ph.D. program is 6 semesters and the maximum is 12 semesters. The Ph.D. degree requirements are as follows:

- Successful completion of a number of courses, specified by the General Assembly of the Department.

- The courses be taken depend on the candidate's background on the specific Ph.D. program he or she has enrolled.

- Elaboration of a Ph.D. research project, supervised by a faculty advisor.

- Oral Ph.D. dissertation defense.

Within the first three semesters, the candidate presents to the advisory committee the objectives, literature review, methodology, and expected benefits of the research undertaken.

The members of the advisory committee evaluate the progress of the candidate's research work and, when it concludes, they give him/her permission to write the dissertation. Upon submission of the dissertation to the advisory committee the candidate may request in writing to the General Assembly of the Department to set up the examining committee and the examination date.

The examining committee consists of seven (7) regular faculty members whose areas of research are relative to the subject of the thesis. Three (3) the members of the committee are the 90 Postgraduate Studies members of the candidate's advisory committee and at least three (3) should be full professors.

The oral Ph.D. dissertation defense must be passed in a maximum of two attempts. The thesis evaluation is based upon the originality of the subject, the contribution to the advancement of science, and the oral presentation. The candidate is qualified for nomination if at least five (5) members of the committee approve the dissertation.

Object and Aim of the Programme

The Department of Production Engineering and Management at the Technical University of Crete conducts research and offers graduate-level programs leading to M.S. and Ph.D. degrees. Depending on personal goals, students can select one of the following programs:

- Engineering Management
- Operations Research
- Production Engineering

The Department of Production Engineering and Management offers M.S. and Ph.D. Programs in Engineering Management, Operations Research and Production Engineering.

Structure and Courses

The courses below must be selected towards an M.S. degree in Engineering Management, Operations Research, Production Engineering.Course InformationCore courses are identified separately in each graduate program.

Students must earn credits on core courses, subject area elective courses and general elective courses as indicated below.

Operations Research (OR)

OR Core Courses

Students must select at least four courses (12 credits) taught by at least three different instructors.

Natural and Artificial Intelligence (Markos Papageorgiou)
Philosophical background, Evolution theory, biological neural networks, biological control systems, artificial knowledge representation, artificial learning, expert systems, artificial life.

Advanced Telematics in Road Transportation (Markos Papageorgiou)
Intelligent transportation systems. Microscopic transportation models and simulation tools. Macroscopic transportation models. Macroscopic model validation. Modeling of urban road networks. Traffic assignment. Modeling of traffic networks. Macroscopic modeling of corridor traffic. Macroscopic simulation tools. Fuel consumption models. Measurement devices for traffic flow variables. Real-time

estimation of traffic variables. Kalman filters. State estimation. Automatic incident detection. Origin-destination matrix estimation. Freeway traffic control. Ramp metering. Freeway network control. Route guidance. Road traffic control. Research projects overview. Automated highway systems.

Multicriteria Decision Systems (Michael Doumpos)

Preference modeling. Cosistent family of criteria. ELECTRE methods. Multiattribute utility theory under certainty and uncertainty. Multiobjective programming. Preference disaggregation approach. UTA method and relevant approaches. Software tools and applications. (Prerequisites: an introductory course in operations research and a course in linear programming)

Large Scale Systems Optimization (Athanasios Mygdalas)

Real-world applications often result in complex, large-scale optimization problems, which, however, possess special structures that can be exploited in the development of efficient solution algorithms. The notions of problem decomposition, Lagrangean duality and relaxation, convexification, and subdifferentials are crucial in this respect. The course introduces the theory and the algorithmic development through a diverse set of applications.

Evolutionary and Metaheuristic algorithms (Athanasios Mygdalas)

Differences between heuristic and exact algorithms, Simple Heuristic Algorithms, Local Search Algorithms, Metaheuristics, Tabu Search Algorithms, Simulated Annealing Algorithms, Genetic Algorithms, Evolutionary Algorithms, Application of Neural Networks in Optimization, Randomized Search Algorithms, Scatter Search, Applications of Parallel Algorithms, Case Studies.

Adaptive and Learning Methods (Elias Kosmatopoulos)

Introduction to the theory of convergence for Adaptive and Learning Algorithms (ALA). Introduction to the theory of approximation and identification of systems. ALA for static and dynamic systems. ALA for continuous-time and discrete-time systems. ALA for linear-in-the-parameters and non-linear-in-the-parameters systems. Robust ALA. Convergence of ALA. ALA for neural networks, fuzzy systems, and nonlinear approximators. Applications.OR Elective Courses IStudents must select at least two courses (6 credits).

Information Systems and Decision Systems (Nikos Matsatsinis)

The evolution of computer based information technology and decision making, decision making, decision support systems, introduction and scientific background of information and decision systems, human computer interaction, visual interactive modeling, data base management systems (distributed data bases, client/server), modeling, model base management systems, artificial intelligence and knowledge based systems, intelligent decision support methods, intelligent dss, data warehousing, distributed dss, web-based dss, group dss, executive information systems, executive support systems, multicriteria dss, spatial dss, IS and DSS applications in business, finance, manufacturing, marketing, management.

Advanced Queueing Systems (Yannis Phillis)

G/G/1 queueing systems, Lindley's integral equations, spectral solutions, perturbation analysis, stochastic approximation, Robbins-Monro theorem, analysis of complex production networks.

Fuzzy Sets and Systems (Nikos Tsourveloudis)

The goal of this course is to provide an introduction to fuzzy sets theory and logic. The following topics will be addressed: Definitions and Basic Operations with Fuzzy Sets, Fuzzy Relations and the Extension Principle, Linguistic Variables, Operations and Fuzzy IF-THEN Rules, Approximate Reasoning, Fuzzy Knowledge-based Systems, Fuzzy-Neurofuzzy Control, Decision Making, MATLAB's Fuzzy Logic ToolboxTM.

Multicriteria Analysis and Financial Decisions (C. Zopounidis)

Basic concepts and characteristics of multicriteria analysis, Aletrnatives, procedures for multicriteria aggregation, multicriteria character of financial problems, applications of the multicriteria analysis in financial management, venture capital investment, financial analysis of firms, bankruptcy risk, credit granting, country risk, financial planning, mergers and acquisitions,

portfolio management, multicriteria decision support systems, case studies.

Computational Mechanics - Finite Elements (G. Stavroulakis)
Non-even engineering and Optimization (G. Stavroulakis)
Optimal Structural Design of Materials and Constructions (G. Stavroulakis)
Advanced Topics of Non-Linear Programming (I. Papamichail)

Optimal Control (supervisor Anastasios Pouliezos)
Basic concepts, introduction to calculus of variations, optimal control, Pontryagin's maximum principle, minimum time/fuel/energy problems, case studies, numerical methods. (Prerequisite: a course in control systems).

Production Scheduling (Vassilis Kouikoglou)
Single-machine, parallel-machines, flow-shop, and job-shop scheduling. Overview of dynamic programming and branch-and-bound methods; Kuhn-Tucker conditions. Flow and routing control of complex production systems. Stability.

Distributed Artificial Intelligence and Multi-Agents Systems (Nikos Matsatsinis)
Architectures, Technical life, cooperation, Distributed Artificial Intelligence Historical Background, Blackboard Systems, Intelligent Agents, Software Agents, Multiagent interaction, User interfaces, Multiagent Systems and Societies of Agents, Distributed Problem Solving and Planning, Negotiation, Distributed Rational Decision Making, Formal Methods in DAI: Logic-Based Representation and Reasoning, Industrial and Practical Applications of DAI.

Service quality and customer satisfaction (Vangelis Grigoroudis)
Introduction to service quality (principles and definitions), Methodology for applied Total Quality Management practices in services, Alternative methodological approaches (Servqual, Servperf, Oliver, Fornell and Kano models Structural equation models MUSA method), Customer value management, Quality awards and satisfaction barometers, Customer satisfaction surveys, Employee satisfaction, Customer loyalty, Advanced topics on service quality, Applications and studies. Research Methodology.

OR Elective Courses II
Students may select courses from all programs (OR, EM, PE).

Engineering Management (EM)

EM Core Courses

The courses below must be selected towards an M.S. degree in Engineering Management (9 credits).

Multicriteria Analysis and Financial Decisions (C. Zopounidis)
Basic concepts and characteristics of multicriteria analysis, Aletrnatives, procedures for multicriteria aggregation, multicriteria character of financial problems, applications of the multicriteria analysis in financial management, venture capital investment, financial analysis of firms, bankruptcy risk, credit granting, country risk, financial planning, mergers and acquisitions, portfolio management, multicriteria decision support systems, case studies.

Information Systems and Decision Systems (Nikos Matsatsinis)
The evolution of computer based information technology and decision making, decision making, decision support systems, introduction and scientific background of information and decision systems, human computer interaction, visual interactive modeling, data base management systems (distributed data bases, client/server), modeling, model base management systems, artificial intelligence and knowledge based systems, intelligent decision support methods, intelligent dss, data warehousing, distributed dss, web-based dss, group dss, executive information systems, executive support systems, multicriteria dss, spatial dss, IS and DSS applications in business, finance, manufacturing, marketing, management.

Management Problem Solving (Vassilis Moustakis)
Methodology and decision making and problem solving framework. Fundamental concepts and models: symptom, cause, problem, model, and planning and control of solutions.

Knowledge management and the learning organization. Prototypical problem representations: functional, supply-chain, introduction of new technology and management of innovation in the workplace. Quantitative analysis support methods: Statistics, factor analysis, machine learning, and decision making under uncertainty. Projects and analysis of prototype case studies. (Prerequisite: a course in management and statistics).

EM Elective Courses I

Students following Track 1 must select at least two courses (6 credits);

students following Track 2 must select at least three courses (9 credits).

Man-Machine Systems Modelling and Analysis (Tom Kontogiannis)

Industrial Safety and Work Organisation (Tom Kontogiannis)
Human performance models: Fault-diagnosis, decision-making, task planning. Ergonomic design of process information systems. Accident recording and analysis methods. Risk analysis. Techniques for reducing and managing human error. New technology and work organisation. Participatory ergonomics. Application of ergonomics to automated production systems. Case studies.

Multicriteria Decision Systems (Michael Doumpos)
Preference modeling. Cosistent family of criteria. ELECTRE methods. Multiattribute utility theory under certainty and uncertainty. Multiobjective programming. Preference disaggregation approach. UTA method and relevant approaches. Software tools and applications. (Prerequisites: an introductory course in operations research and a course in linear programming).

Service quality and customer satisfaction (Vangelis Grigoroudis)
Introduction to service quality (principles and definitions), Methodology for applied Total Quality Management practices in services, Alternative methodological approaches (Servqual, Servperf, Oliver, Fornell and Kano models Structural equation models MUSA method), Customer value management, Quality awards and satisfaction barometers, Customer satisfaction surveys, Employee satisfaction, Customer loyalty, Advanced topics on service quality, Applications and studies.

Forecasting Models (Christos Skiadas)
Introduction to systems theory. Deterministic systems, basic modeling methodology, model development using Taylor expansions, autonomous systems and time series applications using nonlinear techniques Stochastic models, Ito's theory, Fokker-Planck equation, stochastic simulation, applications to electric energy consumption. Chaotic models (logistic function, Hennon model, Lorenz model, Rossler model), concepts of dynamic systems, Poincare maps, bifurcation, strange attractors, simulation of chaotic systems, the role of hysteresis in chaotic models. Application of chaotic models to forecasting.

Quantitative methods of banking risks (C. Zopounidis)
Risk management: basic concepts, quantitative methods of analysis: statistics, econometrics, neural networks, multicriteria analysis, rough sets, fuzzy logic, banking risks: operating risk, credit risk, market risk, venture capital, evaluation of bank branches, presentation of a goal programming software for the banking management.

Industrial Risk Management (supervisor Tom Kontogiannis)
Companies handling dangerous substances are required to develop Safety Reports and to implement Safety Management Systems (SMS) which include hazard analysis, consequence assessment and the major-accident prevention measures. The lessons include: Risk management approaches (deterministic & probabilistic methodologies and standards) for the control of technological hazards (EU Seveso Directive, Safety Reporting). Hazard Analysis (Dow Index, What If analysis, HAZOP, FTA). Reliability & QRA principles. Consequence/Risk Assessment models (BLEVE, UVCE, Fires, Gas Dispersion, Vulnerability). Safety Management Systems (small enterprises), Audit and Inspection models. Field application (Safety Report) in a hazardous industrial site.

EM Elective Courses II

Students may select courses from those listed under EM Core Courses, EM Elective Courses I, or below:

Special Topics on Computer Aided Design (Nicolaos Bilalis)

Life cycle management, Review of CAD systems, Concurrent engineering, Quality Function Deployment, Product data management, Rapid prototyping and rapid tooling systems, Virtual prototype and manufacture, Work teams organisation for new product development, Design for manufacture, Design for Assembly, Data exchange between CAD systems, IGES and STEP.

Distributed Artificial Intelligence and Multi-Agents Systems (Nikos Matsatsinis)

Architectures, technical life, cooperation, distributed artificial intelligence (DAI) historical background, blackboard systems, intelligent agents, software agents, multiagent interaction, user interfaces, multiagent systems and societies of agents, distributed problem solving and planning, negotiation, distributed rational decision making, formal methods in DAI: logic-based representation and reasoning, industrial and practical applications of DAI.

Project Management (supervisor: Vassilis Moustakis)

Research Methodology.

Production Engineering (PE)

PE Core Courses

The courses below must be selected towards an M.S. degree in Production Engineering (9 credits).

Special Topics on Computer Aided Design (Nikolaos Bilalis)

Life cycle management, Review of CAD systems, Concurrent engineering, Quality Function Deployment, Product data management, Rapid prototyping and rapid tooling systems, Virtual prototype and manufacture, Work teams organisation for new product development, Design for manufacture, Design for Assembly, Data exchange between CAD systems, IGES and STEP.

Production Scheduling (Vassilis Kouikoglou)

Single-machine, parallel-machines, flow-shop, and job-shop scheduling. Overview of dynamic programming and branch-and-bound methods; Kuhn-Tucker conditions. Flow and routing control of complex production systems. Stability.

PE Elective Courses I

Students following Track 1 must select at least two courses (6 credits); students following Track 2 must select at least three courses (9 credits).

Optimum Operation and Planning of Electric Power Systems (Pavlos Georgilakis)

Conventional and renewable energy sources. Load forecasting. Economic optimisation of electric energy system, economic analysis and costing of investments in new technologies for energy production, economic analysis of renewable energy sources and energy saving. Introduction to the analysis of electric power systems: equivalent circuits of generators, transformers and lines. Digital methods for the solution of the load flow problem. Operations of electric energy control centers. Applications of artificial intelligence techniques to the analysis and control of electric power systems. Operation and planning of electric power systems in the context of the deregulated energy market environment.

Advanced Queueing Systems (Yannis Phillis)

G/G/1 queueing systems, Lindley's integral equations, spectral solutions, perturbation analysis, stochastic approximation, Robbins-Monro theorem, analysis of complex production networks.

Fuzzy Sets and Systems (Nikos Tsourveloudis)

The goal of this course is to provide an introduction to fuzzy sets theory and logic. The following topics will be addressed: Definitions and Basic Operations with Fuzzy Sets, Fuzzy Relations and the Extension Principle, Linguistic Variables, Operations and Fuzzy IF-THEN Rules, Approximate Reasoning, Fuzzy Knowledge-based Systems, Fuzzy-Neurofuzzy Control, Decision Making, MATLAB's Fuzzy Logic ToolboxTM.

Systems Development and Product Design with the use of Intelligent Optimization Methods (Ioannis Nikolos)

Modelization and Man-Machine Systems Analysis (Tom Kontoyannis)

Optimal Function and Development of Electric Power Systems (P. Georgilakis)

Algoriths for robotics problems (N. Vlassis)

Advanced Topics of Computative Engineering (G. Stavroulakis)

Computational Mechanics - Finite Elements (George Stavroulakis)

Optimal Control (supervisor Anastasios Pouliezos)
Basic concepts, introduction to calculus of variations, optimal control, Pontryagin's maximum principle, minimum time/fuel/energy problems, case studies, numerical methods. (Prerequisite: a course in control systems).

Industrial Risk Management (supervisor Tom Kontogiannis)
Companies handling dangerous substances are required to develop Safety Reports and to implement Safety Management Systems (SMS) which include hazard analysis, consequence assessment and the major-accident prevention measures. The lessons include: Risk management approaches (deterministic & probabilistic methodologies and standards) for the control of technological hazards (EU Seveso Directive, Safety Reporting). Hazard Analysis (Dow Index, What If analysis, HAZOP, FTA). Reliability & QRA principles. Consequence/Risk Assessment models (BLEVE, UVCE, Fires, Gas Dispersion, Vulnerability). Safety Management Systems (small enterprises), Audit and Inspection models. Field application (Safety Report) in a hazardous industrial site.

PE Elective Courses II
Students may select courses from all programs (OR, EM, PE).

Department of Mineral Resources Engineering
Geotechnology & the Environment

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General Information

The Department of Mineral Resources Engineering offers M.Sc. and Ph.D. Programs in Geotechnology and the Environment.

Duration: 2 years (M.Sc.), 3 years (Ph.D.)

Admission requirements: Candidates for the M.Sc. Program must have a first degree in a scientific or engineering discipline related to Geotechnology and the Environment in order to be eligible for admission to the Graduate Program. If the degree was obtained from a foreign University, it must be recognised by DOATAP - the Hellenic NARIC - the academic standards committee of the Greek Ministry of Education and Religion. Holders of a Master's degree (recognised by DOATAP) are eligible to register directly in the Ph.D. program. Applications: Applicants must submit an application for admission to the Department. Application forms are available from the secretariat of the Department and online at the address **http://www.mred.tuc.gr/publications/aitisi_2003.pdf**.

Supporting documents that must be submitted with the application include (1) detailed University transcripts (2) a certified copy of each degree earned (3) a recent curriculum vitae (4) certified copies of foreign language certificates (5) two reference letters. All the applications are reviewed by the Departmental Graduate Studies Committee, which makes recommendations to the Faculty of the Department regarding the admission of candidates.

Fees: None

Progress Evaluation:
The progress of the M.Sc. and Ph.D. degree candidates is evaluated based on their performance in graduate courses and their research for the M.Sc. thesis or Ph.D. dissertation.

Scope and Objectives

The Graduate Program in Geotechnology and the Environment focuses on the study of issues related to mineral resources exploration and exploitation and their impact on the environment.

The objective of the program is to provide future engineers and researchers with the knowledge and technical skills required to contribute to the development of novel, environmentally friendly methods for the exploitation of mineral resources (including solid and liquid fuel and various industrial materials). The Program aims to educate graduates in modern skills that will allow them to develop successful careers in academic or applied research or to pursue professional careers in the mineral resources industry as engineers and entrepreneurs.

Structure and Courses

Each graduate student must select one of the three fields of study that are offered in the Geotechnology and the Environment program. These fields are:

- Exploration and Positioning in the Management of the Geo-environment.
- Exploitation of Mineral Resources and Geotechnical Construction.
- Exploitation of Industrial Minerals, Materials, and Energy Resources.

Department of Mineral Resources Engineering

Geotechnology & the Environment

Each field involves a number of compulsory, elective and integration courses. Students can select a limited number of courses from a different field.
The courses below must be selected towards a M.S. and Ph.D. degree in Geotechnology and the Environment:

Exploration and Positioning in the Management of the Geo-environment Cycle

Compulsory Courses (At least 1):
G&P101 Data Analysis.
G&P102 Mineral Resources Exploration and Positioning.

Elective Courses (At least 3):
G&P103 Applied Geochemistry.
G&P104 Environmental Remote Sensing.
G&P105 Geo-technologies and Geographical Information Systems.
G&P106 Satellite Positioning Systems.
G&P107 Environmental Geophysics.
G&P108 High-Resolution Geophysical Data Processing.
G&P109 Geostatistics and Environmental Pollution.
G&P211 Geothermics and the Environment.
G&P310 Geo-materials and the Environment.
EM102 Satellite Positioning in Geotechnology (summer intensive course).
EM103 Gravity in Geotechnology (summer intensive course).

Integration Courses (At least 1):
OA101 Introduction to Geosciences.
OA102 Introduction to Geo-informatics.

Exploitation of Mineral Resources and Geotechnical Construction Cycle

Compulsory Courses (At least 1):
G&P201 Fluid Systems Behaviour in Energy Resources Exploitation.
G&P202 Advanced Topics in Geo-mechanics.

Elective Courses (At least 3):
G&P203 Primary and Secondary Production of Hydrocarbon Reservoirs.
G&P204 Environment-Friendly Drilling.
G&P205 Environmental Management of Hydrocarbon Exploitation.
G&P206 Advanced Geomechanical Engineering.
G&P207 Numerical Simulation Methods in Geo-mechanics.
G&P208 Petroleum Geology.
G&P209 Special Topics in Applied Geology.
G&P210 Design Principles of Safe Industrial Systems and Equipment.
G&P211 Geothermics and the Environment.
G&P308 Biomass, Bio-energy and Environment.
G&P310 Geo-materials and the Environment.

Integration Courses (At least 1):
OB201 General and Applied Geology.
OB202 Technologies of Mineral Extraction and Geo-mechanics.

Exploitation of Industrial Minerals, Materials, and Energy Resources Cycle

Compulsory Courses (At least 1):
G&P301 Laboratory Methods of Mineral and Chemical Analysis.
G&P302 Physical and Chemical Operations Design.

Elective Courses (At least 3):
G&P303 Physical and Engineering Properties of Minerals and Rocks.
G&P304 Ceramics and Coatings Technology.
G&P305 Materials for Monument Construction and Maintenance.
G&P306 Environmental Management in Mining Industry and Energy Production
G&P307 Processing Plant Design & Environment-Friendly Metallurgical Processes.
G&P308 Biomass, Bio-energy and the Environment.
G&P309 Economic Geology of Minerals and Rocks.
G&P310 Geo-materials and the Environment.
G&P311 Analysis and Characterization of Petroleum Products.

Integration Courses (At least 1):
OA101 Introduction to Geosciences.

OC302 Physical & Chemical Processes.
Compulsory Courses (All directions)
G&P401 Research Methodology.
G&P402 Special Topics in Geotechnology and the Environment I.
G&P403 Special Topics in Geotechnology and the Environment II.

The Special Topics Courses may include subjects such as:

Decontamination technologies for soils, solid wastes and effluents, air emission control (EG402).
Sustainable development in the mining and metallurgical industry (EG403).

Summer Intensive Courses

EM101 **Synthetic Aperture Radar in Remote Sensing**
Overview of radar remote sensing, review of electromagnetic theory, fundamental concepts, resolution, radar equation, SAR, surface and volume scattering concepts, principles of radar image interpretation, image interpretation exercise, radar image distortion and correction, radar applications, radar polarisation and polarisation signatures, use of DTMs and other methods for geometric correction, introduction to radar interferometry, calculation of height from stereo radar images, detailed consideration of surface, volume and hard target scattering, advanced radar interferometry and DEM generation, calculation and estimation of typical backscatter, passive microwave imaging systems, Doppler beam sharpening and SAR image formation methods, Radar Image processing, Future developments.

EM102 **Satellite Positioning in Geotechnology**
Introduction to time and coordinate reference systems, overview of satellite positioning technology, principles of range-based positioning systems, the Global Positioning System (GPS), background and positioning principles, point positioning and differential positioning techniques, GPS receiver hardware, high precision carrier phase-based techniques, applications in geotechnology, planning and executing GPS surveys for mapping and control applications, GPS data processing, GPS heighting, standards and specifications, future developments.

EM103 **Gravity in Geotechnology**
Fundamentals of potential theory, the Earths gravity field, global gravitational models, satellite tracking, surface and airborne gravity, satellite altimetry, new satellite missions (CHAMP, GRACE, GOCE), computations of field functionals, land applications, ocean applications, dynamic ocean topography, local and regional gravity determination, Stokes and Hotine formulas, data interpolation and combination by collocation, geophysical and other applications of the gravity field, exploration applications, geodynamic applications, oceanographic applications, navigation and positioning applications, establishment of vertical datum.

Electronic & Computer Engineering

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General Information

Duration: 2 years (M.Sc.), 3 years (Ph.D.)

Entry requirements: Candidates should have a first degree in an appropriate subject of Technical University Schools or Departments of Economics and Social Sciences) in order to be eligible for studies leading to M.Sc.

Holders of a Master's degree are eligible for studies leading to a Ph.D. degree.

Applications: Applications must be made on the standard form, which is available from the secretariat of the Department or can be downloaded online **(http://www.ece.tuc.gr/)**. Documentary evidence of qualifications should be submitted with the application; it includes: (a) detailed record of grades, (b) recent curriculum vitae, (c) certified copy of degree/s, (d) certified copy of certificates of foreign language competency, (e) two (2) reference letters. The applications of all the candidates are reviewed by the Postgraduate Studies Committee of the Department, which approves the application after consideration.

Fees: None

Assessment: Taught courses (lectures, seminars or laboratory exercises) and dissertation.

Object and Aim of the Program

The postgraduate program aims to tailor the specialization of engineers to the demands of the new labor market and the needs of the country. The main fields of the program extend to computer engineering (both hardware and software), telecommunications, control systems and electronics, which are currently crucial sectors of new technology. The education of engineers in these areas enables high technology companies to create groups of expert technical and managerial staff.

The Department of Electronic and Computer Engineering offers M.S. and Ph.D. Programs in Electronic and Computer Engineering.

Structure and Courses

The courses below must be selected towards an M.S. degree in Electronic and Computer Engineering:

Electronics & Computer Architecture

HRY601 VLSI Systems Design
HRY602 Electric Measurements and Sensors
HRY603 Biomedical Electronics
HRY612 Microelectronics Systems
HRY613 Parallel and Distributed Computer Architecture
HRY614 Optoelectronics
HRY616 Renewable Energy Sources
HRY620 CAD Tools for Integrated Circuit Design
HRY621 Advanced Computer Architecture
HRY622 VLSI Systems Design
HRY623 Design of Specialised Architectural Computers
HRY624 Microelectronic Systems
HRY625 Architecture for Communication and Network Processors
HRY630 Special Topics in Circuit and System Design
HRY631 Special Topics in Reconfigurable Logic

HRY632 Special Topics in Computing Systems
HRY633 Special Topics in Energy Power Systems
HRY634 Special Topics in Optoelectronics & Biomedical Technology
HRY635 Special Topics in Electronic Power Management Systems

Computer Science

EKP601 Information Systems Applications on the Internet
PLH602 Distributed Computing Systems Principles
EKP603 Multimedia Management Methods
EKP604 Integration of Information and Services on the Internet
PLH605 Artificial Intelligence
EKP606 Agent Computing on the Internet
PLH607 Mechanical Vision
PLH608 Software Systems Development Engineering
EKP609 Human Computer Interaction
PLH610 Graphics
PLH611 Theory on Databases
PLH612 Virtual Representation and Virtual Reality
PLH613 Artificial Learning and Data Acquisition
PLH614 Language Processing
PLH615 Mobile Computing
PLH616 Special Topics in Algorithms and Complexity
PLH617 Special Topics in Systems Software
EKP618 Special Topics in Information Systems
PLH619 Special Topics in Artificial Intelligence
PLH620 Special Topics in Software Engineering
EKP621 Special Topics in Multimedia Data Bases
PLH622 Special Topics in Data Bases
EKP623 Information Society Economy
EKP624 Society and Information Technologies

Systems

SYS601 Automatic Control of Industrial Production Systems
SYS602 Digital Image Processing
SYS603 Advanced Topics in Optimal Control
SYS604 Neural Networks
SYS605 Non-linear Systems
SYS606 Stochastic Control
SYS607 Systems Reliability and Applications
SYS608 Adaptive Control
SYS609 Optimization Techniques
SYS610 Advanced Topics in Pattern Recognition
SYS611 Standards & Video Applications
SYS612 Real-Time Quality Control in Production Systems
SYS613 Scheduling and Automatic Control of Production Systems
SYS614 Biomedical Apparatus' Operating Principles
SYS616 Special Topics in Biomedical Systems
SYS617 Special Topics in Linear Systems
SYS618 Special Topics in DSP based Digital Control
SYS619 Special Topics in Image Processing
SYS620 Special Topics in Robotics
SYS621 Special Topics in Adaptive Filters and their Applications
SYS622 Special Topics in Automation
SYS623 Special Topics in Fuzzy Logic

Telecommunications

TEL601 Probability & Random Processes Theory
TEL602 Telecommunication Systems II
TEL603 Assessment & Detection Theory
TEL604 Statistical Signal Processing for Telecommunications
TEL605 Communication Networks Protocols
TEL606 Introduction to Asynchronous Digital Transmission Networks
TEL607 Advanced Topics on Speech Processing
TEL608 Codification Theory
TEL609 Special Topics in Telecommunication Systems
TEL610 Special Topics in Communication Networks
TEL611 Special Topics in Signal and Speech Processing

Department of Environmental Engineering

Environmental & Sanitary Engineering

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General Information

Duration: 1 year (M.Sc.), 3 years (Ph.D.)

Entry requirements: Candidates must be graduates of a Technical University or Technical University Schools or graduates of University Departments of Physics, Chemistry, Agriculture, Mathematics, Environmental Sciences, Computer Science, Medicine and Biology in order to be eligible for studies leading to M.Sc. Holders of a Master's degree are eligible for studies leading to a Ph.D. degree.

Applications: All applications are reviewed by the Postgraduate Studies Committee of the Department, which approves the application after consideration of the candidate's overall grades as well as his/her grades in specific courses that are related to the object of the programme, the candidate's diploma thesis, knowledge of foreign languages (English in particular) and any research - professional activities.

Applications must be made on the standard form, which is available from the secretariat of the Department or can be downloaded online **(http://www.enveng.tuc.gr/Education/graduate/grad_6.htm#dwnlds)**. Documentary evidence of qualifications should be submitted with the application; it includes: (a) detailed transcript of grades, (b) recent curriculum vitae, (c) certified copy of degree/s, (d) certified copy of certificates of foreign language competency, (e) two (2) reference letters at least. The applications of all the candidates are reviewed by the Postgraduate Studies Committee of the Department, which approves the application after consideration. Holders of a Master's degree are eligible for studies leading to a Ph.D. degree. The Postgraduate Studies Committee may hold an interview with the candidate.

Fees: None

Assessment: Taught courses (lectures, seminars or laboratory exercises) and dissertation.

Object and Aim of the Programme

The Department of Environmental Engineering runs a postgraduate studies programme on Environmental and Sanitary Engineering with two cycles (a) Environment and Health and (b) Integrated Water Resources and Coastal Management. The programme is concerned with the development of cutting edge technology and know-how in the field of environmental and health engineering. Emphasis is placed on the enhancement of interdisciplinary knowledge and scientific practices developed in the field as well as the further specialization of graduate students in specific areas of environmental and health engineering. The programme aims to promote research conducted in the fields of Environment and Sanitary Engineering and to provide students with specialized training. Upon the completion of the programme, students shall be able to conduct original scientific research and to contribute significantly to the solution of major environmental problems, encountered in Greece and globally, as well as the protection of public health.

Structure and Courses

The courses below must be selected towards an M.Sc. and Ph.D. degree in Environmental and Sanitary Engineering.

Environmental and Sanitary Engineering Cycle Courses

Compulsory course

Research Seminar	PMP601

Integration courses

Introduction to Solid Waste Management and Treatment	PMP605
Introduction to Atmospheric Pollution	PMP606
Introduction to Environmental Models	PMP607
Introduction to Liquid Waste Treatment Processes	PMP608

Soil Rehabilitation Technologies

PMP830

Contamination source control; soil and ground water rehabilitation using in situ methods; biorehabilitation methods (bioventing, bioslurping, air-sparging); soil rehabilitation from special heavy metal contaminants; thermal processes; solidification/stabilization processes; chemical rehabilitation (oxidation, reduction, neutralization).

Advanced Oxidation Processes

PMP810

Advanced oxidation processes (ozonation, photocatalysis, Fenton reactors and photo-Fenton); new technologies (electrochemical oxidosis, splitting with the use of ultrasounds); thermal processes (hydrated oxidosis, oxidosis at hypercritical conditions, catalytic oxidosis, plasma techniques); design of treatment systems, performance estimates, size escalation and treatment cost; advantages and disadvantages of catalyst use; treatment examples (waste from oil press mills and polymer production processes).

Atmospheric pollution and health impact

PMP820

Criteria for the enforcement of containment measures for chemical elements in the atmosphere; calculation of the effect of chemical elements in the atmosphere on public health; organic pollutants; inorganic pollutants; typical pollutants; interior space pollutants; the respiratory system; toxicity; mathematical models of depositing and removal of particles from the respiratory system; dosage determination models.

Soil rehabilitation technologies

PMP830

Introduction to remediation of polluted soil, approval of technologies; pollution source control; soil and underground water rehabilitation by in situ methods: active walls, biorehabilitation (bioventing, bioslurping, air-sparging); pumping of volatiles under subpressure; rehabilitation from special pollutants of heavy metals: washing processes, electrokinetic processes: solidification / stabilization, chemical extraction; dangerous pollutants' analysis; determination of possible exposure paths, toxicity estimation; collection of quantitative and qualitative information on toxicity, risk characterization and estimation; selection of soil rehabilitation technologies.

Urban and toxic waste management

PMP840

Classification and management of solid waste (recycling, incineration, composting, biostabilization, burial; urban waste management (definitions, warehousing, collection, transfer, disposal in landfills); dangerous and toxic waste (definitions, qualities and classification), toxicity and risk analysis); toxic waste treatment technologies; management and disposal.

Sanitation and food technology

PMP750

Food quality parameters: sensorial, nutritional, microbiological and environmental quality; conservation processes (traditional, innovative with the use of pressure, electrical fields, osmosis means); organization and environment (ISO 14001 & HACCP); strategies (end of pipe, prevention at the source, zero rejection); food waste treatment; biological membrane reactors; case studies.
Exploitation design of land and marine biological resources

Solid Waste Management and Treatment	PMP705
Liquid Waste Treatment Processes	PMP708
Liquid Waste Management	PMP716
Environmental Systems Simulation	PMP726
Toxic Waste Management & Health Impact	PMP730
Special Topics on Environmental Chemistry	PMP746
Environmental Geochemistry	PMP751
Risk Analysis	PMP755
Sustainable Energy Systems	PMP756
Environment & Public Health	PMP766
Biological Soil Remediation	PMP846
Sustainable Energy Systems	PMP856
Advanced Waste and Residuals Processing	PMP860.7
Biochemical Engineering - Biofilm	PMP866
Regression Analysis and Experimental Design	PMP870
Agro-industrial Waste Treatment	PMP876
Membrane Separation Techniques	PMP886

Special environmental and health topics

PMP860

Introduction in environmental rehabilitation technologies; in-situ and ex-situ technologies for soil bio-rehabilitation from carbohydrates (soil and underground waters); technologies for soil bio-rehabilitation from chlorinated organic compounds; rehabilitation particularities of marine ecosystems from oil spills; natural environmental attenuation forms; ex-situ technologies for environmental bio-rehabilitation: design of three-phase bio-reactors (slurry bioreactors); design of composting systems of toxic and hazardous substances; landfarming and biopiles system design; biocell system function; function of SBR bioreactors; soil plant-rehabilitation from organic compounds; soil plant-rehabilitation from metals (soil and underground water); design of air bio-filters; field applications and project presentation.

Integrated Water Resources and Coastal Zone Management Cycle Courses

Meteorology and climatic changes
PMP805
Atmospheric dynamic and composition; radiation laws; atmospheric stability and circulation; basic concepts of atmospheric pressure, humidity and temperature; ozone in the stratosphere; local dispersion of pollutants from point and surface sources; cell models, Hadley's cell, clouds; atmospheric models of general circulation; suspending particles; radiation balance and climatic changes.

Computational hydraulics
PMP815
Numerical approach and interference; numerical integration; numerical solution of algebraic systems; numerical analysis in finite Fourrier series; finite differences method in differential equations; numerical solutions of the parabolic, hyperbolic and elliptic equation; applications in applied hydraulics; permanent flow in closed-open mains; mathematical simulation of non permanent flow in open pipes; numerical solution of long wave propagation; permanent variable flow; super-elevation curves; filtration under dams and flow in underground water beds; applications of mathematical simulation flow in porous means.

Regression analysis and experimental design
PMP870
Introduction in statistics: definition of the terms population and statistic specimen regular distribution and distribution t, statistical dependence; functions of possibility density with more than one variables; trust intervals, case control; dispersion analysis (ANOVA); retrogression analysis (linear retrogression, generalised least squares, non-linear retrogression, problems in the use of least squares. Parameter assessment from multiple responses; experimental design (2k factorial design, 2k-1 fractional factorial design, 2k-p fractional factorial design, factorial design for non-linear models.

Environmental hydraulics
PMP825
Mathematical models in Environmental Hydraulics (design of algorithms, mistake control and finding, support and maintenance); mass, momentum and energy conservation laws; Navier Stokes equations and introduction in turbulent theory; Environmental hydraulics applications; contaminant transfer phenomena; design of sub-soil sewage pipes.

Underground water pollution and rehabilitation
PMP835
Review of underground hydrology; underground flow equations; well mechanics; pollution sources of underground waters; data collection methods; transfer methods of contaminants in underground waters; transfer equations; flow and contaminant transfer in unsaturated zone, contaminant transfer models in underground waters, design and rehabilitation of underground waters.

Simulation of coastal biogeochemical processesand sediment dynamics
PMP875
Physical chemistry of sea water, biogeochemistry of coastal zone, salinity as tracer, water circulation, simulation of biogeochemical cycles of carbon, nitrogen and phosphorus, geochemistry of sediments, pollution of coastal zone sediments, mass balance, eutrofication of coastal systems, application of eutrofication model.

Water resources management
PMP845

Applications of G.I.S.
PMP765

Risk analysis
PMP755

Coastal zone management
PMP725

Special topics in water resources management
PMP885

Elective

Atmospheric Pollution	PMP706
Environmental Models	PMP707
Environmental Systems Simulation	PMP726
Special Topics on Environmental Chemistry	PMP746
Environmental Geochemistry	PMP751
Sustainable Energy Systems	PMP756
Applied Hydrology	PMP855

Department of Environmental Engineering

Interdepartmental Graduate Programme: Quality Control & Environmental Management

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General Information

Duration: 1 year (M.Sc.), 3 years (Ph.D.)

Entry requirements: Candidates must be graduates of a Technical University or Technical University Schools or graduates of University Departments of Physics, Chemistry, Agriculture, Mathematics, Environmental Sciences, Computer Science, Medicine and Biology in order to be eligible for studies leading to M.Sc.

Holders of a Master's degree are eligible for studies leading to a Ph.D. degree.

Applications: Applications must be made on the standard form, which is available from the secretariat of the Department or can be downloaded online **(http://www.enveng.tuc.gr/Education/graduate/diatmhm_grad.htm)**.

Documentary evidence of qualifications should be submitted with the application; it includes: (a) detailed transcript of grades, (b) recent curriculum vitae, (c) certified copy of degree/s, (d) certified copy of certificates of foreign language competency, (e) two (2) reference letters. The applications of all the candidates are reviewed by the Postgraduate Studies Committee of the Department, which approves the application after consideration.

Fees: None

Assessment: Taught courses (lectures, seminars or laboratory exercises) and dissertation.

Object and Aim of the Programme

The interdepartmental graduate studies programme on Environmental Management and Quality Control is realized with the collaboration of the Department of Environmental Engineering, the Department of Mineral Resources Engineering and the Department of Production Engineering and Management. The programme is concerned with the development of cutting edge technology and know-how on matters concerning quality control and environmental management. Emphasis is placed on the enhancement of interdisciplinary knowledge and practices in environmental engineering and on further specialization in specific areas of environmental engineering. The programme aims to promote research conducted in this field and to provide students with training so that they may be able to conduct original scientific research and to contribute significantly to the solution of major environmental problems encountered in Greece as well as globally.

The Department of Environmental Engineering offers M.Sc. and Ph.D. Programs in Environmental Management and Quality Control.

Structure and Courses

The courses below must be selected towards an M.Sc. degree in Environmental Management and Quality Control.

Integration Courses

PDP601 Research Seminar
PDP602 Research Methodology
PDP603 Environmental Microbiology
PDP604 Introduction to Biochemical Engineering

PDP605 Introduction to Hydrology
PDP606 Fluid Mechanics
PDP607 Introduction to Environmental Models
PDP608 Statistical Data Analysis

Specialisation Courses

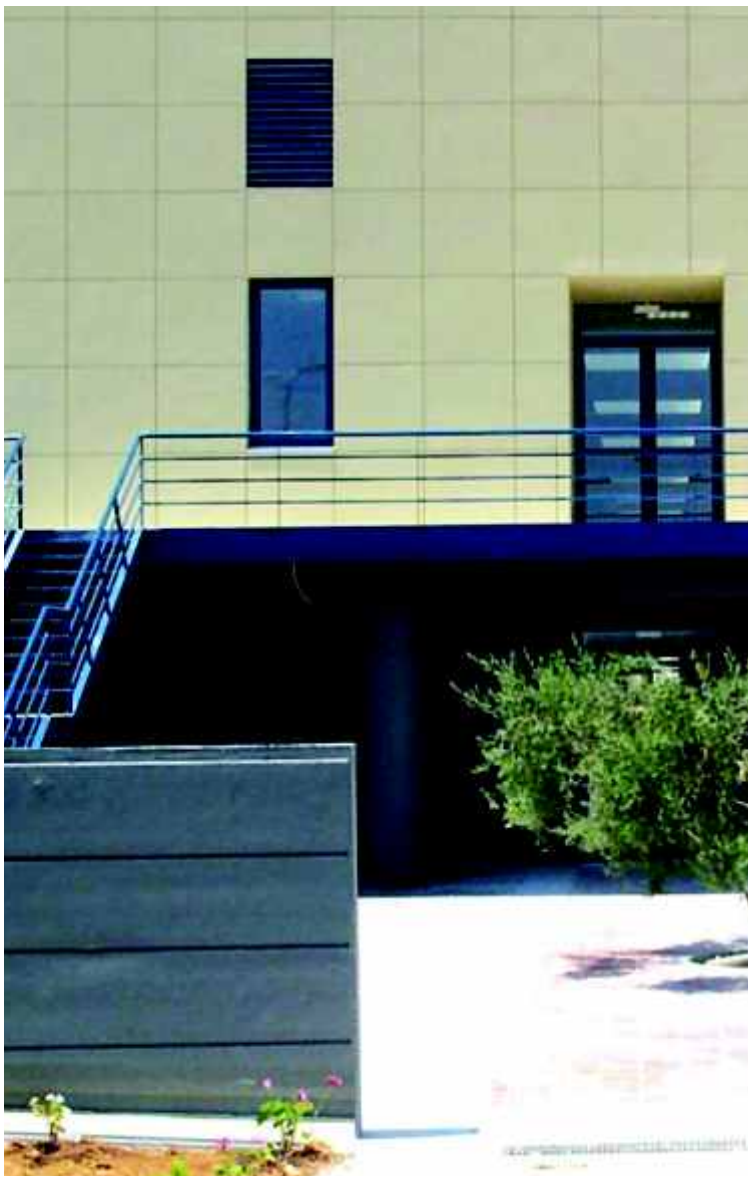
PDP723 Dynamic Environmental Systems
PDP771 Mathematical Methods for Environmental Data Analysis
PDP798 Research Project
PDP801 Environmental Impact
PDP803 Risk Assessment
PDP867 Optimization of Environmental Systems
PDP869 Numerical Methods for Environmental Engineers
PDP899 Special Topics on Environmental Engineering

Environmental Quality Control Cycle Courses

PDP711 Environmental Chemistry
PDP713 Analysis of Trace Elements
PDP715 Environmental Specimen Analysis
PDP717 Soil Remediation
PDP719 Aquatic Ecosystems and Biodiversity
PDP721 Air Pollution Control
PDP735 Biological Methods for Wastewater Treatment
PDP737 Physicochemical methods for Wastewater Treatment
PDP739 Drinking Water Quality Analysis
PDP751 Environmental Geochemistry
PDP775 Geomaterials and the environment
PDP777 Biomass, Bioenergy and the environment
PDP779 Occupational Safety & Analysis of Accidents
PDP821 Treatment of Agro-industrial waste
PDP829 Air Quality Models

Environmental Systems Management Cycle Courses

PDP731 Environmental Hydraulics
PDP732 Municipal Hydraulics
PDP733 Coastal Engineering
PDP734 Applied Hydrology
PDP753 Flow in Porous Media
PDP755 Management of soil quality and underground water
PDP759 Management of Water Resources
PDP761 Management of Municipal Waste
PDP807 Toxic and Hazardous Wastes
PDP841 Numerical Methods for Hydraulic Systems
PDP843 Modeling of Contaminant Transport in the Subsoil
PDP845 Quality Models for Surface Waters
PDP849 Environmental Remote Sensing
PDP863 Environmental Information Systems (EIS)



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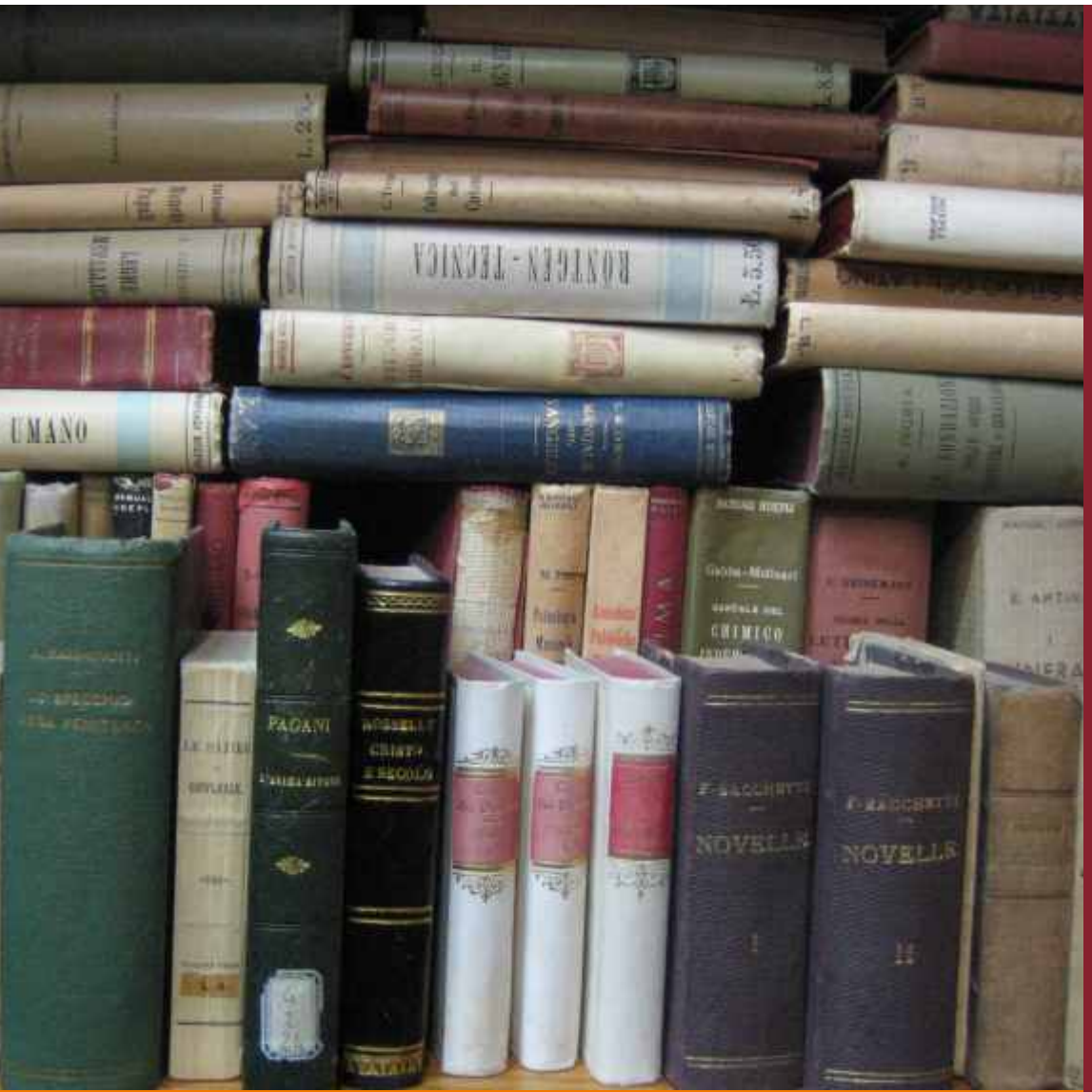

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Matter Structure and Laser Physics	+30 28210 28450
Physical Chemistry and Chemical Processes	+30 28210 37661-37694
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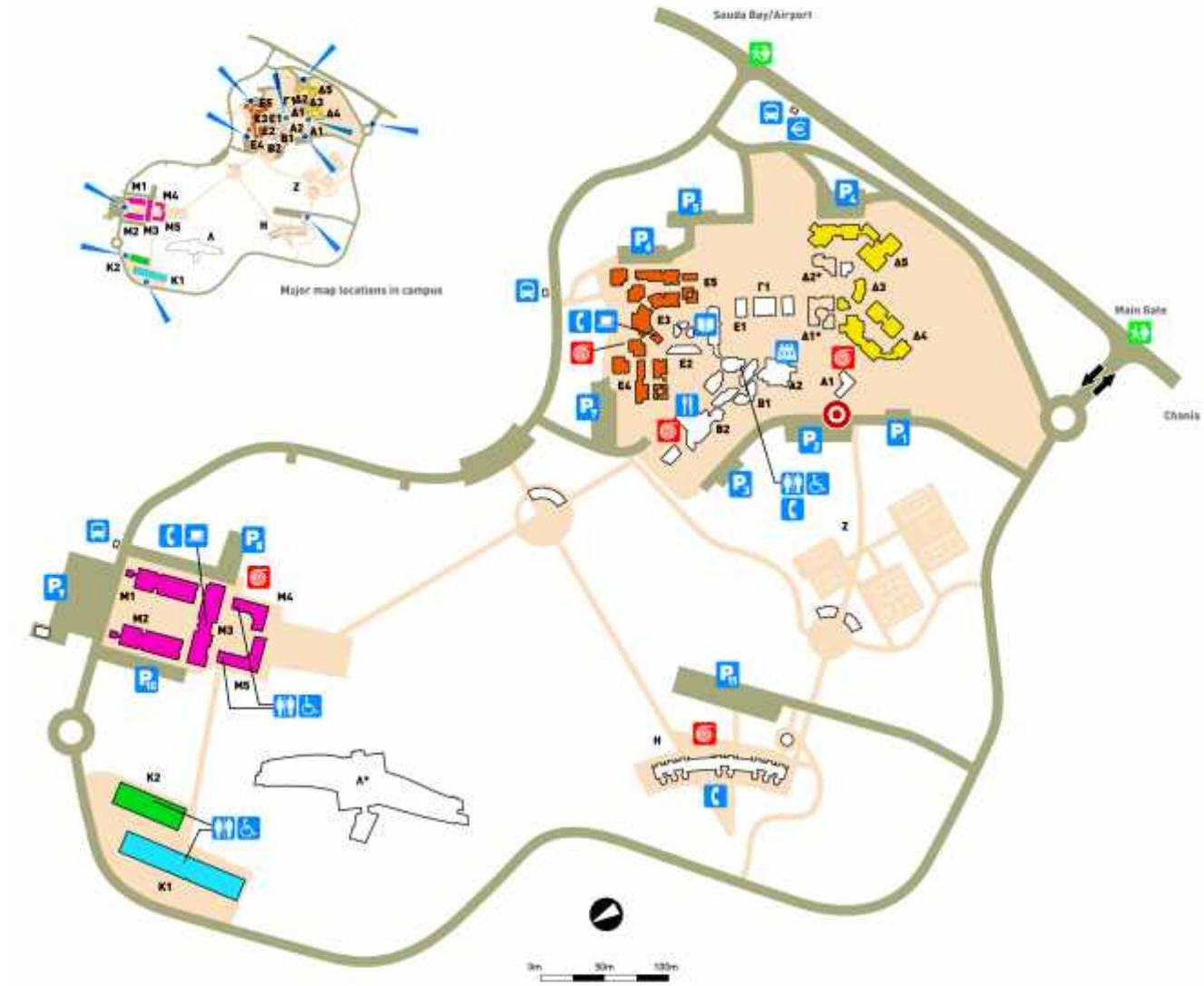
Air, Water and Solid Waste Management	+30 28210 37778
Chemical Processes & Wastewater Treatment	+30 28210 37797
Environmental Engineering and Management	+30 28210 37380
Treatment Technology of Air Waste	
Biochemical Engineering &Environmental Biotechnology	+30 28210 37804
Atmospheric Aerosols	+30 28210 37815
Toxic and Hazardous Waste Management	+30 28210 37821
Transport Phenomena & Applied Thermodynamics	+30 28210 37783
Water Resources Management and Coastal Engineering	+30 28210 37764
Geoenvironmental Engineering	+30 28210 37802
Ecology and Biodiversity	+30 28210 37809
Hydrogeochemical Engineering and Soil Remediation	+30 28210 37784

University Campus



- A2 Amphitheatre A2
- A1 A2 E1 Library
- B2 Restaurant
- M3 E3 Cafeteria
- Elevator
- WC
- Under Construction
- Public Phone
- Bank (ATM)
- Bus Stop
- Parking
- Stairs
- Exit
- Fire Hose
- A K2 Dept of Sciences
- Δ3 - Δ5 Dept of Production Engineering & Management
- M1 - M5 Dept of Mineral Resources Engineering
- K1 K2 Dept of Environmental Engineering
- E3 - E5 Dept of Electronic & Computer Engineering
- E3 Classrooms E
- B1 Classrooms B
- Γ1 Information Systems Centre
- E3 Language Research & Resource Centre
- A1 Network Operation Centre
- Δ3 Career Services
- Z Sports Facilities
- A1 Technical Services
- H Halls of Residence

Indicates your present position

Technical University of Crete

Public and International Relations Office

Contact Information

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If you have any questions or wish to learn more about the Technical University of Crete, please feel free to contact the Public and International Relations Office at the address above.

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