ARISTOTLE UNIVERSITY OF THESSALONIKI

(G – THESSAL 01)

FACULTY OF SCIENCES

SCHOOL OF MATHEMATICS

E.C.T.S. GUIDE

EUROPEAN COMMUNITY COURSE CREDIT TRANSFER SYSTEM

ERASMUS/SOCRATES
European Community Action Scheme
For the Mobility of University Students

THESSALONIKI 2012

This information package describes the Aristotle University of Thessaloniki and the courses offered by the School of Mathematics in order to help the prospective ECTS students to prepare their study period in this institution. It also contains information on the city of Thessaloniki and other data useful for the ECTS incoming students.

The editing of the present ECTS guide was made by Professor Theodora Theohari-.Apostolidi , ECTS Coordinator for the School of Mathematics of A.U.TH

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CONTENTS

1. WHAT IS ECTS?

A. GENERAL INTRODUCTION

ECTS, the European Credit Transfer System, was institutionalized by the European Commission in order to develop procedures for organizing and improving academic recognition of studies abroad. Through the use of commonly understood measurements-credits and grades-ECTS provides a means to interpret national systems of credit allocation, comparing students learning achievements and transferring them from one institution to another. The ECTS system includes three core elements: *information* (on study programmes and student achievement), *mutual agreement* (between the partner institutions and the student) and *the use of ECTS credits* (to indicate student workload). Each ECTS department will describe the courses it offers not only in terms of content but also adding credits to each course.

The ECTS system is based on voluntary participation and a climate of mutual trust and confidence in the academic performance of partner institutions. The rules of ECTS are set out to create transparency, to build bridges between institutions, to enable studies abroad and widen the choices available to students.

ECTS provides transparency through the following means:

- The *information package* which supplies written information to students and staff on institution, schools/faculties, the organization and structure of studies and course units.
- *ECTS credits* which are a numerical value allocated to course units to describe the *student* workload required to complete them.
- The *transcript of records* which shows students' learning achievements in a way which is comprehensive, commonly understood and easily transferable from one institution to another.
- The *learning agreement* covering the programme of study to be taken and the ECTS credits to be awarded for their satisfactory completion, committing both home and host institutions, as well as the student.

B. THE ECTS CREDITS

ECTS credits are a numerical value (between 1 and 60) allocated to course units to describe the student workload required to complete them. They reflect the quantity of work each course unit requires in relation to the total quantity of work necessary to complete a full year of academic study at the institution that is, lecture, practical work, seminars, tutorials, fieldwork, private study - in the library or at home - and examinations or other assessment activities. ECTS is thus based on a full student workload and not limited to contact hours only.

From the 60 credits which represent the workload of a year of study, normally 30

credits are given for a semester. It is important to indicate that no special courses are set up for ECTS purposes, but that all ECTS courses are mainstream courses of the participating institution, as followed by home students under normal regulations.

It is up to the participating institutions to subdivide the credits for the different courses. ECTS credits should be allocated to all the course units' available, compulsory or elective courses. Credits can also be allocated to project work, thesis and industrial placements where these "units" are a normal part of the degree programme. Practical placements and optional courses which do not form an integral part of the course of study do not receive academic credit. Non-credit courses may, however, is mentioned in the transcript of records.

Credits are awarded only when the course has been completed and all required examinations have been successfully taken.

C. ECTS STUDENTS

The students participating in ECTS will receive full credit for all an academic work successfully carried out at any of the ECTS partner institution and they will be able to transfer these academic credits from one participating institution to another on the basis of prior learning agreement on the content of study programmes abroad between students and the institutions involved.

All students of the participating schools who are willing to take part in the ECTS Pilot Scheme may do so if their institution agrees and within the limit of available places.

Students selected by each institution to participate in ECTS may only be awarded a student mobility grant if they fulfil the general conditions of eligibility for the ERASMUS grant. These are:

- students must be citizens of one of the EU Member States or citizens of one of the EFTA countries (or recognized by one member State or one EFTA country as having an official status of refugee or stateless person or permanent resident); as to EFTA nationals, students will be eligible provided they are moving within the framework of ERASMUS from the respective EFTA home country to an EU Member State. EFTA nationals registered as students in ECTS participating institutions in other EFTA countries or in Community Member States are only eligible for participation in ECTS if they have established a right of permanent residence;
- students shall not required to pay tuition fees at the host institution; the student may, however, be required to continue to pay his/her normal tuition fees to the home institution during the study period abroad;
- the national grand/loan to which a student may be entitled for study at his/her institution may not be discontinued, interrupted or reduced while the student is studying in another Member State and is received an ERASMUS grant;
- one study period abroad should not last less than three months or more than one year;
- students in the first year of their studies are not eligible for receiving ERASMUS grants.

Most students participating in ECTS will go to one single host institution in one single EU Member State, study there for a limited period and then return to their home institution. Some may decide to stay at the host institution, possible to gain a degree.

Some may also decide to proceed to a third institution to continue their studies. In each of these three cases, students will be required to comply with the legal and institutional requirements of the country and institution where they take their degree.

When the three parties involved – the student, the home institution and the host institution – agree about the study programme abroad, they sign a learning agreement attached to the application form. This agreement, which describes the programme of the study abroad, must be signed before the student leaves for the host institution. Good practice in the use of the agreement is a vitally important aspect of ECTS.

The home institution provides the student with a guarantee that the home institution will give full academic recognition in respect of the course units listed on the agreement.

The host institution confirms that the programme of the study is acceptable and does not conflict with the host institution's rules.

Students may have to modify the agreed programme of study upon arrival at the host institution for a variety of reasons: timetable classes, unsuitability of chosen courses (in level or content), etc. The learning agreement form therefore provides for changes to the original agreed study programme/learning agreement.

It must be stressed that changes to the original agreed programmes of study should be made within a relatively short time after the student's arrival at the host institution. A copy of the new learning agreement should be given to the student and the coordinator of the home and host institutions.

When the student has successfully completed the study programme previously agreed between the home and the host institutions and returns to the home institution, credit transfer will take place, and the student will continue the study course at the home institution without any loss of time or credit. If, on the other hand, the student decides to stay at the host institution and to take a degree there, he or she may have to adapt the study course due to the legal, institutional and school's rules in the host country, institution and school.

USEFUL SERVICES TO STUDENTS

Anyone studying at Aristotle University of Thessaloniki may request the assistance of special university services in order to solve various problems they may face during their studies. They can also become themselves volunteers by offering their services to other colleagues or fellow students in need.

Social Policy and Health Committee

The Social Policy and Health Committee (SPHC) aims to create conditions that will make the University an accessible area to all members of the university community, by giving priority to space (and therefore knowledge) accessibility to disabled persons.
For this reason, qualified members of the teaching staff can train students with visual impairment to use electronic equipment linked with Braille printers installed in some of the University libraries. Also the SPHC, to its best, tries to ensure the granting of books with voice output to these students.

The SPHC also provides a bus for disabled persons, in order to facilitate their movement in campus for classes and exams during the academic year. In this context the University has created a Program for the Promotion of Self-Help, which is basically run by a team of volunteers, the majority of whom are students. Email: selfhelp@auth.gr

Many years ago the Social Policy and Health Committee established the institution of Voluntary Blood Donation, which also led to the creation of a Blood Bank in AHEPA hospital. Since May 2007, a second Blood Bank was founded too, in the Department of Physical Education in Serres with the collaboration of the Social Policy and Health Committee and the General Hospital of Serres. Voluntary blood donation takes place twice a year during the months of November and April, at the Ceremony Hall of Aristotle University. The immediate target is to cover all needs for blood through voluntary blood donation, which currently covers 40% of total needs. Volunteering for blood donation, which is a safe and without complications procedure, is open to every person above 18 years of age, who does not have special health problems.

Email: socialcom@ad.auth.gr
fititikiline@ad.auth.gr
Website: http://spc.web.auth.gr
Tel / Fax: 2310 995386, 2310 995360

Observatory for the Academic Progress of Students belonging to Vulnerable Social Groups

The role of this Observatory is to assist:

- students with disabilities
- foreign students
- minority students, foreign students of Greek descent or repatriate students
- as well as any other category of students who face problems hindering their studies

The above mentioned students can inform directly the Observatory – and also inform the Student Advisors of their Department – of any serious problem that they might face in the course of their studies, which arise either because of their disability or because of cultural or language or health problems.

Email: stud-observ@ad.auth.gr
Website: http://acobservatory.web.auth.gr
Tel./Fax: 2310.995360

Counseling and Psychological Support Committee

The Counseling and Psychological Support Committee (PSC) aims to the better organization and function of the university structures that offer psychological assistance and counseling to AUTh students.

The services provided by the University Center for Counseling and Psychological Support are offered to students and university staff alike.

The Committee works closely with other related Committees and organizes dialogue workshops with students, as well as with the administrative and other staff of the university community.

Among the future aims of the PSC is the operation of a campus hotline, in order to provide immediate assistance to people in crisis and to those facing personal difficulties that could feel safer to talk about their problems in anonymity and in absence of visual contact.

PSC is located on the ground floor of the Lower University Student Club, in the Sanitary Service Section, offices 5 & 8.

Email: vpapadot@ad.auth.gr
Tel.: 2310 992643 & 2310992621
Fax: 2310 992607 & 210992621

Volunteer Committee

The Volunteer Committee has as its main goal to promote to the members of the university community of AUTh the idea of volunteering as a contemporary social demand.

With this aim, the Volunteer Committee having also as its motivation the improvement of the daily life of everyone working in Aristotle University –students and teaching and administrative staff- in areas such as student affairs, environmental issues and social aid, encourages all members of the university community to take initiative by submitting ideas and suggestions.

To this end, some Networks of Volunteers in Departments and Faculties have already been created, consisting of a faculty member and a student, in order to develop a body of volunteers in each Department / Faculty of AUTh.

Email: vrect-ac-secretary@auth.gr
Tel: 2310996713, 996708
Fax: 2310996729

2. GENERAL INFORMATION

A. Brief history of Thessaloniki and its Cultural Life

One of Europe's most ancient cities, and the second largest in Greece, Thessaloniki was founded circa 315 BC by Cassander, King of Macedonia, who named it in honour of his wife, Thessaloniki, sister of Alexander the Great. It rapidly grew into the most important city in the kingdom, and its principal commercial port. The city's intellectual heritage is extraordinarily rich and diverse, for Macedonia had been a centre of intellectual and educational activity since the age of mythology. During the reign of kings Perdikkas II and Archelaos I (438-399 BC), many of the fathers of Hellenic civilisation made their way to Macedonia, among them Hippocrates, the poet Melanippides, the tragic poets Euripides and Agathon, the epic poet Choirilos, the musician Timotheos and the painter Zeuxis.

Next came Aristotle, the greatest of all the Greek philosophers. A native of the town of Stageira, not far from Thessaloniki on the Chalkidiki peninsula, his students included Alexander the Great, who was to carry Hellenic civilisation to most of the known world.

During the Roman age, Thessaloniki was famous for its epigrammatists: Antipatros, Philippos and Epigonos. Saint Paul preached in Thessaloniki; and it was at nearby Philippi that in the year 50 of our era he founded the first Christian Church in Europe. The *Epistoles to the Thessalonikeans*, the two letters he later wrote to the people of Thessaloniki, are among the earliest documents of Christian writing.

With the foundation of the Byzantine Empire, Thessaloniki became its second centre, fostering and developing the intellectual and artistic movements that earned it the appellation of "the Athens of Medieval Hellenism". Unfortunately, there are very few documentary references to the learned institutions that flourished there during this period, and what does exist is tucked away in local monasteries. Those who have studied the history of the city, however, affirm that Thessaloniki never ceased to be a centre of learning. The continuous development of the arts and sciences in the city was further supported by the presence, from the 11th century onwards, of numerous Orthodox monasteries in the surrounding area and on Mount Athos.

When Thessaloniki fell to the Turks, most of its leading lights fled to the Christian West. During this period the little progress made in Greek education took place in the nearby Mount Athos, culminating in the foundation in 1749 at Karyes of the Athonite School, where students were taught theology, philosophy, Latin, mathematics and - for the first time - physics (by Evgenios Voulgaris).

It was not until the end of the 19th century, in the last years of the reign of Sultan Hamid II, that the Turks began to take an interest in education. In 1879 they founded a High School in Thessaloniki so that government officials would be trained there. The building that housed it is now the Old Building of the University's School of Philosophy.

Thessaloniki was liberated from the yoke of the Turks on October 26, 1912.

The year 1912 marked the beginning of a new period in Thessaloniki's economic,

social and cultural life, one that turned the city into the economic, political and cultural capital of Macedonia and Thrace and the second largest and most important city in Greece.

When it was founded in 1926, the Aristotle University of Thessaloniki opened its doors to just 65 students: by 1960, the student body had grown to 9000, climbing to 37,000 in 1976, while today it numbers more than 60,000. The city has now two other universities, the "University of Macedonia" and the "International Hellenic University" and one technological institute the "Alexander Technological Educational Institute of Thessaloniki".

In the city there are numerous libraries, a variety of fine cultural and intellectual centres and institutions, museums, sculpture and art galleries, public and private theatres, conservatories and symphony orchestras. It also hosts a wealth of scientific and artistic events, especially during the annual "Dimitria" Festival.

Some of the features of the economic activity of this city, which has developed into one of the most important trade and communications centres in south-eastern Europe, are the Port with its Free Zone, the European Centre for the Development of Vocational Training (CEDEFOP), "Makedonia" International Airport, and the HELEXPO, the International Trade Fair Exhibition Centre. More information is available in http://www.Thessaloniki.gr.

B. The Aristotle University of Thessaloniki

The University of Thessaloniki was founded under the First Hellenic Republic, when a motion introduced by Alexandros Papanastasiou was passed into law by the Fourth National Assembly on June 14, 1925. Law 3341 instituted five Schools Theology, Philosophy, Law and Economics, Physics and Mathematics, and Medicine. To these were soon added Schools of Agronomy and Forestry, Veterinary Science, Engineering, and Dentistry.

The first to open its doors, in 1926, was the School of Philosophy (Faculty of Arts). This was followed a year later by the School of Physical and Mathematical Sciences, initially with a single School of Forestry, and by the 1928-29 academic year with the Schools of Physics, Mathematics and Agronomy. The School of Law and Economics was also established in two stages, with the Faculty of Law in 1928-29 and the Faculty of Political and Economic Sciences a year later. In 1937 the Schools of Forestry and Agronomy were separated from the School of Physics and Mathematics and re-instituted as the School of Forestry and Agronomy. The School of Physics and Mathematics continued to grow, with the successive addition of the Schools of Chemistry, Natural Science (abolished in 1975-76), Pharmacology and in 1973-74, Biology and Geology. The Schools of Medicine and Theology, instituted by the original Law, opened in 1942. A Faculty of Dentistry was established in 1959-60 as part of the School of Medicine, but was hived off from it in 1970 and instituted in the following academic year (1970-71) as a separate School. The School of Veterinary Science - the only one in Greece - was founded in 1950. The School of Engineering, opened in 1955-56 with a single School of Civil Engineering, was successively expanded by the addition of the Schools of Architecture (1957-58), Agronomic and Topographical Engineering (1962-63), Chemical

Engineering (1972-73) and Electrical and Mechanical Engineering (1972-73), this last being divided four years later into a School of Electrical Engineering and a School of Mechanical Engineering.

The years 1951-52 saw the foundation of the Institute of Foreign Languages and Literatures, attached to the School of Philosophy; the School of English Language and Literature, inaugurated that same year, was followed three years later by the School of French Language and Literature and in 1960-61 by the corresponding Schools for Italian and German Language and Literature.

The Aristotle University of Thessaloniki is now the largest university in Greece, with over 60,000 students, a faculty of 2000 persons, 195 special educational staff, and 296 supplementary teaching personnel. The University also has a special technical administrative staff of 748, assisted by 737 administrative employees.

The University campus, where most of the university services are located, occupies an area of 43 hectares in the centre of the city. However, the particular requirements of certain of its schools, in conjunction with the already over-crowded campus, have led to the development of new installations - some still under construction and some already in use - with an eye to the future. Some of these off-campus buildings are located outside the city proper: the School of Fine Arts and the School of Physical Education and Sports, for example, will be located on a 20 hectare site near Thermi; while the School of Forestry and Environmental Science has moved to premises in the Finika's area.

The outline law "on the structure and operation of the Greek Universities", which came into effect in the 1982-83 academic year and has subsequently been supplemented and modified by later legislation, introduced major changes in the structure and administration of the University and in the curriculum. The School of Physics and Mathematics, renamed the School of Sciences, has since the 1992-93 academic year included a School of Informatics. Today, the Aristotle University of Thessaloniki comprises the following Faculties and Schools:

1) **Faculty of Theology**, with:
   * School of Theology
   * School of Ecclesiastical and Social Theology

2**) Faculty of Philosophy**, with:
   * School of Philology
   * School of History and Archaeology
   * School of Philosophy and Pedagogy
   * School of Psychology
   * School of English Language and Literature
   * School of French Language and Literature
   * School of German Language and Literature
   * School of Italian Language and Literature

3) **Faculty of Sciences**, with:
   * School of Mathematics
   * School of Physics
   * School of Chemistry
   * School of Biology
   * School of Geology
   * School of Informatics

4) **Faculty of Law, Economic and Political Sciences**, with:
   * School of Law
   * School of Economics
   * School of Political Sciences
5) **Faculty of Agriculture**
6) **Faculty of Forestry and Natural Environment**
7) **Faculty of Veterinary Medicine**
8) **Faculty of Medicine**
9) **Faculty of Dentistry**
10) **Faculty of Engineering,** with:
   * School of Civil Engineering
   * School of Architecture
   * School of Rural and Surveying Engineering
   * School of Mechanical Engineering
   * School of Electrical and Computer Engineering
   * School of Chemical Engineering
   * School of Mathematics, Physics and Computational Sciences
   * School of Urban-Regional Planning and Development Engineering (Veroia)
11) **Faculty of Fine Arts**, with:
   * School of Visual and Applied Arts
   * School of Music Studies
   * School of Drama
   * School of Film Studies
12) **Faculty of Education**, with:
   * School of Primary Education
   * School of Early Childhood Education
13) **Independent Schools:**
   * School of Pharmacy
   * School of Physical Education and Sports Sciences
   * School of Physical Education and Sports Sciences (Serres)
   * School of Journalism and Mass Media Studies

There are also the following University Units

1) School of Modern Greek Language
2) Institute of Modern Greek Studies
3) Centre for Byzantine Research

Each of these Schools offers a bachelor degree (*ptychio* in Greek).

The School of Modern Greek Language offers both regular semester courses and intensive winter and summer programmes. Its programmes are addressed to the foreign students attending the University.

The “Manolis Triantafillidis” Institute of Modern Greek Studies set up to study and cultivate Demotic Modern Greek and Modern Greek Literature.

The Aristotle University of Thessaloniki is a State University under the responsibility of the Ministry of Education. The decision making bodies are:

1. **The Senate**.
   Consists of the Rector, the three Vice-Rectors, the Deans of all the Schools, the Chairmen of all the Schools, representatives of the faculty, the technical administrative staff and the graduate student body, plus one undergraduate representative from each School.
2. **The Rector's Council**.
   Consists of the Rector, the three Vice-Rectors, one student representative and the University Registrar.
3. **The Rector**.
   For the years 2010-2014 Rector is Professor I. Mylopoulos and Vice-Rectors Professors: D. Laliou, I. Pantis and S. Kouidou-Andreou.

The respective faculty assembly takes decisions on the academic affairs of each School. There is also student participation in issues of their concern. More information is available in http://www.auth.gr

3. STUDENT INFORMATION

A. Freshman Registration

Every year, about 200 students are admitted to the School of Mathematics strictly on the basis of their performance in the National Entrance Examinations administered by the Ministry of Education. There is a limited number of places reserved for transfer students who are admitted after special examinations conducted by the University during the fall semester. Students at the Greek Universities pay no tuition and receive the textbook of their courses free of charge. A limited number of places at state sponsored dormitories are available. Free meals are also offered to all registered students in the student mess hall. Financial aid in the form of honorary scholarships is available. Some of these grants are given to students strictly on the basis of academic performance regardless of financial need, while others are offered only to needy students who have demonstrated a highly satisfactory academic performance.

Successful candidates are invited to register within a period fixed by the Ministry of Education, and are notified to this effect by means of a Presidential Decree issued each year and published in the media.

No student already enrolled in any University School or School in Greece or elsewhere may be registered unless their prior registration is cancelled.

B. The Academic Year

All University of Thessaloniki programmes are structured on a semester system, with two semesters (winter and spring) in each academic year.

The winter semester begins on September 25th and ends on January 11th, while the spring semester begins on February 26th and ends on May 24th.

There are three examination sessions annually, each lasting four weeks: the January session beginning on January 14th, the June session beginning on May 27th, and the September session beginning on September 2nd.

No lectures are given on the following official holidays:
October 26th, October 28th, November 17, January 30th, March 25th, May 1st, and June 24th ,
or during the following holiday periods:
- Christmas New Year's (from December 24th to January 7th).
- Carnival (from 14 to 19 of March).
- Easter (from 29 of April to 12 of May) .

C. Libraries - Reading Rooms

The University Library comprises the Central Library and its Library Annexes, which are the Libraries of the University Laboratories, Reading Rooms and Clinics.

The **Central Library Building** has a Faculty Reading Room, a Central Reading Room on the ground floor and a Student Reading Room on the first floor.

The Central Reading Room is open to students for work relating to assigned projects; students must apply to the Administration for a special pass, presenting the authorization note signed by the professor who assigned the work.

The Student Reading Room is open to all students in the University, and may be used for work on students' own books, textbooks, or the reference material available in the Reading Room itself. Open morning and afternoon at the hours posted.

The integration of the University Library into the Ptolemy II Library Network begun in 1995 is expected to be completed soon; this will provide access to library materials via any computer hooked up to the system.

Anyone with access to the University network can already browse the title files of the libraries of the University of Thessaloniki and the University of Crete. The address is **http:/www.lib.auth.gr**

D. The University Student Union and its Services

Student services are provided by the University Student Union, which is located in its own building in the eastern sector of the University Campus.

The Student Union building houses restaurants, a health service, a reading room, a cafeteria, a barber shop and a hair dresser's with special student rates, etc.

Board is provided on certain conditions; applications must be accompanied by the requisite documentation. Full details may be obtained from the Student Union offices.

Health care (medical, pharmaceutical and hospital) is provided for all under-graduate and post-graduate students. Students not already covered, directly or indirectly, by some other health care plan are issued Health Care Books upon registration. If a Health Book is lost, it may be replaced after an interval of two months. If this replacement book is lost, then a new one will be issued after the beginning of the following academic year.

E. Student Residences

There are three Student Residences on the campus: Residence A, Residence B and Residence C. Admittance to these residences is subject to certain conditions, and applications must be accompanied by the proper documents. Full details are available from the USC Offices.

F. Cultural Activities

On-campus organizations include theatre, film and chess clubs, as well as the traditional Greek dance group and the football, basketball and volleyball teams, all of which organize various events.

In addition, given that the University is located in the heart of Thessaloniki, students have the opportunity to enjoy the wealth and diversity of events that contribute to the artistic and cultural life of this great city.

G. University Gymnasium

Students may use the facilities of the University Gymnasium, located in the eastern sector of the campus. Information: at the Secretariat of the Gymnasium.

Covering about 9 hectares, the University Gymnasium facilities provide all members of the University - students and faculty alike - with opportunities for physical exercise. Varsity teams in various sports represent the University in competitions both in Greece and abroad. There is also a traditional Greek folk dance group.

H. Public Transport (Student Discount Card)

Under-graduate and graduate students are entitled to a discount on domestic coach, rail and air fares.

The Secretariat of each School will provide, at the time of registration, all students entitled to such discount, with an interim special pass, valid for the holder named only and for one academic year. If this pass is lost, stolen or destroyed (for whatever reason), the student must declare its loss, theft or destruction to the Secretariat and a new card will be issued, after an interval of two months to allow for investigation into the circumstances of the said loss, theft or destruction.

The discount is valid for the duration of the academic year and for as many years as are normally required to complete the course of study, plus half that period again.

The discount granted is fixed by Ministerial decision on the basis of current fares for each form of transportation.

I. Accommodation for ECTS Students

The Aristotle University of Thessaloniki can provide accommodation for ECTS students. Students should see that the Secretariat of EEC European Educational Programmes, AUTH, receives their applications at least three months before the beginning of the semester.

In all schools, registration dates are: September 1-30 for the winter semester and January 1-31 for the spring semester.

The Senate has resolved that ERASMUS students are to be treated as home

students; this means that they have the same rights and obligations as Greek students, including:

1) Free registration, tuition and books,
2) discount card for urban and inter-urban transportation,
3) Health insurance card and free hospitalization and medication,
4) Free meals in the Student Refectory.

In addition, the University has reserved some places in special dormitories which are available to Erasmus students for a small rental fee. The rent is payable by the week so that it is possible for the Erasmus student to stay in the dormitory for as long a period of time as he or she wishes or until he or she finds another arrangement.

For ERASMUS-ECTS students who wish to prepare for their studies in Greece, the University offers intensive and regular Greek Language courses.

The intensive courses are one-month long; these run from mid-September to mid-October and from early February to early March. For ECTS students, payment of the fees is covered by the University.

The regular courses (Beginners, Intermediate, and Advanced level) are year-long and free of charge. These programmes focus on the teaching of the Modern Greek Language, and touch on aspects of Greek civilization and culture. Each of the three levels covers four (teaching) hours a day, five days a week.

A certificate of attendance is delivered at the end of the programme.

ERASMUS students may also, if they wish, follow the regular semester courses offered by the Modern Greek Language School. (For further information: School of Modern Greek Language, AUTH 54124 Thessaloniki, Tel: 0030-2310-997571/ 0030-2310-997572, fax: 0030-2310-997573, http://www.gls.edu.gr).

The Office of European Education Programs is situated on the ground floor of the Administration Building. Opening hours: 08.00 – 14.30. Tel.: 0030-2310-995291, 5293, 5289, 5306. Fax: 0030-2310-995292.

More information is available in http://www.auth.gr

4. THE SCHOOL OF MATHEMATICS

The School of Mathematics has been opened since 1928; together with the Schools of Physics, Chemistry, Biology, Geology and Informatics, it is one of the six divisions of the Faculty of Sciences.

For administrative purposes, the School of Mathematics is sub-divided into the following five departments:

1. Algebra, Number Theory and Mathematical Logic
2. Mathematical Analysis
3. Geometry
4. Numerical Analysis and Computer Sciences
5. Statistics and Operations Research

A. Administrative Structure

1. **The Head of the School**.
2. **The Administrative Board**.
   It consists of the Head, the Deputy Head of the School and the five Department Heads, plus two student representatives.
3. **The School's Council**.
   The School's Council comprises the teaching staff (35 faculty members) plus half their number of student representatives.

Information:

School of Mathematics
Head of the School: Professor George Tsaklidis
Academic Secretary: M. Ekklisiara-Zisi
Aristotle University of the Thessaloniki
Thessaloniki, Greece 54124
Tel.: 0030-2310-997964
0030-2310-997950
Fax: 0030-2310-997952

Erasmus Programme

The ERASMUS Coordinator of the School is:
Professor Theodora Theohari-Apostolidi
theohari@math.auth.gr
Tel: 0030-2310-997907
Fax: 0030-2310-998367

B. The Staff

DEPARTMENT OF ALGEBRA, NUMBER THEORY AND MATHEMATICAL LOGIC

Professors	Charalambous, H. Papistas, A. Theohari-Apostolidi, Th. (Head of Department) Tzouvaras A.
Department's Secretary	Lazaridis, G.

DEPARTMENT OF MATHEMATICAL ANALYSIS

Professors	Mandouvalos, N. Marias, M. (Head of th Department) Siskakis, A
Associate Professors	Betsakos, D. Daskaloyiannis, K. Gasparis, I.
Department's Secretary	Lazaridis, G.

DEPARTMENT OF GEOMETRY

Associate Professor	Stamatakis, S. (Head of Department)
Assistant Professors	Papadopoulou-Florou, D.
Lecturer	Petalidou, F.
Department's Secretary	Lazaridis, G.

DEPARTMENT OF NUMERICAL ANALYSIS AND COMPUTER SCIENCES

Professors	Vardoulakis, A.
	Poulakis, D. (Head of the Department)
Associate Professors	Gousidou-Koutita, M.
	Karabetakis, N.
Assistant Professor	Rachonis, G.
Department's Secretary	Lazaridis, G.
Technical Assistants	Chariopolotis, N.
	Chatziemmanouil, I.

DEPARTMENT OF STATISTICS AND OPERATIONS RESEARCH

Professors	Antoniou, I.
	Kalpazidou, S.
	Moyssiadis, C.
	Tsaklidis, G.
Associate Professors	Farmakis, N. (Head of Department)
	Kolyva-Machera, F.
Assistant Professors	Papadopoulou, A.
Lecturer	Kastanis, N.
Department's Secretary:	Lazaridis, G.

TEACHERS OF FOREIGN LANGUGE

SECRETARIAL STAFF

Secretary
- Ekklisiara-Zisi, M., tel. 0030-2310-997950

Secretarial staff :
- Galitsios, N., tel. 0030-2310-997940
  Mantzouni, G., tel.0030-2310-997920
- Sotiriadou, A. tel. 0030-2310-997842
- Soumelidou-Tyritidou, El., tel.00302310-997910
- Vlachou, Th. , tel.00302310-997930

Mail address: School of Mathematics
Aristotle University of Thessaloniki
Thessaloniki 54124
Greece

C. Library

The Mathematics School Library, located in the western wing of the Sciences Building, has a collection of more than 15,000 titles, and subscribes to 130 periodicals. Open weekdays, from 8:30 - 19:00.

Lending facilities are restricted. Some books (chiefly textbooks used in the School may be taken out, upon presentation of the student's ordinary or student identity card.

Other books and all periodicals must be read in the Library Reading Room.

D. Computer Facilities

Information on the Mathematics School is also available via Internet, at:

http:// www.math.auth.gr

Students may use the computers in the Informatics Laboratory on the first floor of the Biology building.

The School also operates an FTP Server that provides, free of charge, a variety of programmes on different computer systems. The address is:

ftp:// ftp.math.auth.gr

E. Registration for Examinations

Students **must** register for examination in **all** courses (compulsory, compulsory elective, elective and free elective) at the beginning of each semester. This is done electronically in the site of the School, within a period specified by the Secretariat. The number of courses for which students may register is limited.

Students who do not register for their chosen courses in time will not be eligible to sit the examinations. In the January and June examination sessions, students are admitted **only** to examinations in the courses registered for at the beginning of that semester; in the September examination session, students are eligible for examination in courses for which they were registered in either of the two semesters of the academic year just completed.

A student who fails in any course may **re-register** for the same course in any semester when that course is taught (or in the conjugate semester, for students in their 8th or subsequent semester).

Curriculum regulations for students admitted in the 2012-2013 academic year will be announced by the Secretariat of the School.

F. Programme of Undergraduate Studies

The Mathematics undergraduate programme is structured over eight semesters, and leads to the degree of Diploma of Mathematics (Ptychio).

There are four kinds of courses: compulsory, compulsory elective, elective and free elective. In order to complete the programme and be awarded the Diploma, students must successfully pass all the 24 compulsory courses plus 4 compulsory elective courses from four different departments and 12 elective courses. A number of the elective courses not more than 5 can be free elective. The total number of ECTS credits earned from all these courses must be at least 240. Additionally every student must pass the course **Introduction to Computer Programming (Fortran 90/95 or C++).**

Listed below are all the courses offered by the School of Mathematics in the 2010-2011 academic year, with the following information for each: Name of Course, the indication G-LSUD (Greece – Long Study University Diploma), number of semesters taught, the ECTS code and course number, the number of hours per week, the number of weeks per semester, the type of examination (written), whether or not there is a laboratory component, the number of ECTS credits provided, an outline of the course and the name(s) of the instructor(s).

This is followed by the tables setting out a summary of all the above information in compact and easy-to-read form.

FIRST SEMESTER:

Linear Algebra I
G-LSUD1 LALGI - 0101
4h/w, 13 weeks, written exams, credits: 7

Compulsory
Description: Vector spaces - Finite dimensional vector spaces - Matrices - Determinants - Matrices and Linear Transformations.
Instructors: A. Papistas, A. Tzouvaras.

Introduction to Algebra
G-LSUD1 IALG -0102
4h/w, 13 weeks, written exams, credits: 7
Compulsory
Description: Elements of set theory (sets - functions - relations - equivalence relations - partial ordered sets- lattices). Natural numbers and Integers (Mathematical induction- divisibility- prime numbers- Euclidean algorithm- GCD- LCM- Fundamental theorem of arithmetic- modn). Elements of combinatorial theory. Elements of algebraic structures (Groups and subgroups, homomorphism of groups, rings and subrings, fields and subfields).
Instructor: Th. Theohari-Apostolidi.

Calculus I
G-LSUD1 CI - 0201
4h/w, 13 weeks, written exams, credits: 7
Compulsory
Description: Basic notions - Sequences and series of real numbers - Power series - Real functions - Limits - Continuity - The Derivative - Applications of the derivative - Taylor series - Study of functions.
Instructors: C. Daskaloyiannis, A.Siskakis

Introduction to Computer Programming
G-LSUD1 ICPR - 0430
3h/w, 13 weeks, written exams, credits: 4
Compulsory
Description: Introduction to C++ and Fortran 90/95/2003 : Computer hardware - Computer software -Programming languages - An introduction to problem solving with Fortran 90/95 or C++- The structure of a program - Simple input and output - Control structures - Iterations -Array processing (one dimensional and multidimensional matrices) - Functions -Subroutines - Modules - IMSL libraries - File organization (sequential files, direct accessfiles)-Applications to mathematical problems.
Web links: http://users.auth.gr/~grahonis/C++.htm, http://eclass.auth.gr/courses/MATH104
Instructors: N. P. Karampetakis and G. Rachonis.

SECOND SEMESTER:

Linear Algebra II
G-LSUD2 LALGII - 0103

4h/w, 13 weeks, written exams, credits: 7.
Compulsory
Description: Systems of linear equations - Eigenvalues - Eigenvectors - Characteristic polynomial - Euclidean and unitary spaces.
Instructors: H. Charalambous, A. Papistas.

Analytic Geometry I
G-LSUD2 ANGI1 - 0301
4h/w, 13 weeks, written exams, credits: 7.
Compulsory
Description: Vector space: The concept of a vector space - Basis - Dimension - Inner product - Vector product - Orientation. Affine spaces - Affine coordinates - Lines and planes in A^2 and A^3 - Affine transformations - Conics affinity classified - Isometries.
Instructor: D. Papadopoulou-Florou, F. Petalidou.

Calculus II
G-LSUD2 CII -0202
4h/w, 13 weeks, written exams, credits: 7
Compulsory
Description: The definite Riemann integral - Fundamental theorems of integral calculus - The indefinite integral modes of integration - Application of the definite integral (area, length of curves, area and volumes of revolution) - Improper integrals - Differentiation and integration of power series.
Instructor: C. Daskaloyiannis,

Theoretical Informatics
G-LSUD2 ITI - 0401
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory
Description: Sets, relations, algorithms. Analysis of algorithms. Alphabets, languages and regular languages. Finite automata: deterministic, non-deterministic and equivalence. Finite automata and regular expressions. Decidability results.
Instructor: G. Rahonis.

Mathematical Programming
G-LSUD2 MAPR - 0501
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory
Description: Mathematical models- Linear programming - Graphical solution and graphical analysis of the sensitivity of the linear model - Simplex method - Sensitivity analysis - Introduction to Integer Programming - Transportation problem - Principles of dynamical programming - Non-linear methods of optimization - Applications.
Instructor: A. Papadopoulou.

Symbolic Programming Languages
G- LSUD2 ISYMA- 0461

3h/w, 13 weeks, written exams, credits: 4
Elective
Description: Introduction to computer algebra systems - Introduction to Mathematica - Building expressions Numerical calculations - Symbolic calculations - Symbolic manipulation of mathematical representations - Basic functions - List manipulation - Functions and programs - Mathematica packages - Special topics in Algebra (expansion - factorization - simplification - sets and matrices) - Analysis (equation solving - system equation solving - differentiation - integration - sums and products - limits - Taylor series) and Geometry (second order curves - second order surfaces - two and three dimensional plotting) - Introduction to other computer algebra systems such as Maple, Matlab, Reduce, Macsyma etc.
Instructor: N. Karampetakis

Mathematical Software and Knowledge Representation
G-LSUD2 MSOKR - 0966
3h/w, 13 weeks, written exams, credits: 4
Free Elective
Description: Introduction to software for simulation and exploration of Mathematical Problems suitable for presentations in the secondary education, like Skechpad, Cabri Geometry II for Plane Geometry Cabri Geometry 3D for Solid Geometry, Geogebra for Geometry and Analytic Geometry, Functionprobe for the study of functions. Introduction to the software packages Mathematica and Maple suitable for a wide range of Mathematical Applications.
Languages for structureing Mathematical Texts (XML-MathML), Mathematical software for the Web (Ontology Web Language-OWL) and applications to the Semantic Web, Reasioning in Description Logics and Rules for the Semantic Web using Ontology Languages OWL-DL (Ontology Web Language Description Logic), Semantic Representation of Mathematical Knowledge (Open Math Document Ontology). Methods of Knowledge Discovery in the Semantic Web.
Instructors: I. Antoniou, C. Bratsas, C. Moyssiadis.

THIRD SEMESTER:

Algebraic Structures I
G-LSUD3 ALG I - 0106
4h/w, 13 weeks, written exams, credits: 7
Compulsory
Description: Groups, subgroups, group generated by set- Homeomorphisms of groups- Lagrange's theorem- Order of a group element- Euler's theorem, Fermat's theorem- Normal subgroups- Isomorphism theorems- Cyclic groups and their classification – Action of a group on a set- Permutation groups- Dihedral groups- Direct sums of groups.
Instructor: A. Papistas.

Analytic Geometry II
G-LSUD3 INGII - 0302
4h/w, 13 weeks, written exams, credits: 7
Compulsory
Description: Applications in Euclidean spaces E^2, E, Ellipse - hyperbola and parabola - Tangents - Poles and polars - Conjugate diameters - Metric classification of figures of second degree in E^2- Hyperboloids, paraboloids, ellipsoids, cylinders and cones of second degree - Tangent planes - Metric classification of figures of second degree in E^3.
Instructor: D. Papadopoulou-Florou.

Calculus III
G-LSUD3 CALIII - 0203
4h/w, 13 weeks, written exams, credits: 7
Compulsory
Description: Functions of several variables - Limits and continuity - Partial derivatives - Differentiation of scalar and vector functions - The chain rule - Higher order partial derivatives - Directional derivatives - Taylor's formula - Extremes of real valued functions - Lagrange multipliers - The implicit function theorem and the inverse function theorem.
Instructors: I. Gasparis, M. Marias.

Introduction to Meteorology and Climatology
G-LSUD3 METCLI – 1061
3h/w, 13 weeks, written exams, credits: 5
Free elective
Description: Climatic elements: solar and terrestrial radiation - Energy balance - air-temperature - atmospheric pressure - local winds - hydrologic cycle – evapotranspiration - water vapours - precipitation - Distribution of the climatic elements - Climates' classifications - The climatic classification of Koppen, and Thornthwaite - Climatic change's theories.
Instructors: C. Fidas, P. Zanis.

Probability Theory I
G-LSUD3 PROB - 0502
4h/w, 13 weeks, written exams, credits: 7
Compulsory
Description: The sample distribution space - events - classical definition of mathematical probability - statistical regularity - axiomatic foundation of probability - Finite sample distribution spaces - combinatorics - geometric probabilities - Conditional probability - independence - Univariate random variables - distribution functions - function of a random variable - moments, moment-generating function - probability generating function - Useful univariate distributions: Discrete (Bernoulli, Binomial, Hypergeometric, Geometric, Negative Binomial, Poisson), Continuous (Uniform, Normal, Exponential, Gamma) - Applications.
Instructor: N. Farmakis**,** F. Kolyva-Machera, C. Moyssiadis, G.Tsaklidis.

Topology of Metric Spaces
G-LSUD3 ELTOP - 0204
4h/w, 13 weeks, written exams, credits: 7
Compulsory
Description: Basic notions of the Set Theory - Metric spaces - Topology of metric spaces - Convergence of sequences - Continuous functions - Compactness and Connectedness of metric spaces.
Instructors: C. Daskaloyiannis, I. Gasparis.

FOURTH SEMESTER:

Algebraic Structures II
G-LSUD4 ALG II - 0107
4h/w, 13 weeks, written exams, credits: 7
Compulsory
Description: Rings, subrings and ring homeomorphisms - Ideals and sum and product of ideals- Isomorphism theorems of rings- Integral domains - Quotient field- The ring of integers, the field of rational numbers- Prime fields- Prime and maximal ideals- Principal ideal domains - Unique factorization domains- Euclidean domains - Polynomial rings - Irreducible polynomials in Q[x], R[x], C[x]- Field extensions - Algebraic and transcendental elements - Algebraic extensions and the minimal polynomial - Field constructions.
Instructor: Th.Theohari-Apostolidi.

Calculus IV
G-LSUD4 CIV – 0205
4h/w, 13 weeks, written exams, credits: 7
Compulsory
Description: Multiple integrals - Line integrals - Surface integrals - The integral theorems of Vector Analysis.
Instructors: I. Gasparis, N. Mandouvalos.

Differential Equations
G-LSUD4 DE - 0206
4h/w, 13 weeks, written exams, credits: 7
Compulsory
Description: Differential equations of first order - The method of Pickard - Linear differential equations of order n□2 - Reduction of the order of a differential equation - Euler's equations systems of differential equations.
Instructors: N. Mandouvalos, M. Marias.

History of Mathematics Culture/Education
G-LSUD4 HMCE - 0961
3h/w, 13 weeks, written exams, credits: 5

Free elective
Description: The lectures treat the Mathematics Culture/Education during the following historical periods: Early Civilizations: Mesopotamia - Ancient Egypt - Ancient Greek Civilization - Western Medieval World - Arabic Civilization - Renaissance and Age of Scientific Revolution - Neohellenic Reality - From the French Revolution to the End of 19th Century - The First Decades of the Modern Greek State up to 1900 - Early of the 20th Century - The Time of the Moderns Mathematics Reformation 1950-1980.
Instructor: N. Kastanis

Mathematical Methods in Operational Research
G-LSUD4 MMOR - 0504
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory
Description: What is a stochastic process - Queuing Theory: birth-death processes - some well-known queuing systems - Markov Chains: n-step transition probabilities - classification of states - steady-state probabilities and mean first passage times - absorbing chains.
Instructor: A. Papadopoulou.

Statistics
G-LSUD4 ST - 0503
4h/w, 13 weeks, written exams, credits: 7
Compulsory
Description: Elements of probability theory - Distributions of some useful statistics - Descriptive statistics - Methods of point estimation - Confidence intervals and tests of hypotheses for the mean, the variance and the proportion for one and two samples - Test of Goodness-of-Fit - Contingency tables - Tests of homogeneity - The method of least squares-Regression - Tests of hypotheses and Confidence intervals in simple linear Regression - Simple, multiple and partial correlation coefficient - Analysis of variance - The one-way layout - The two-way layout with and without interaction - Non-parametric methods - Kolmogorov-Smirnov tests, runs tests, rank tests and sign tests for one and two samples - Tests concerning k>2 independent and dependent samples - The Spearman correlation coefficient - Applications using statistical packages.
Instructor: F. Kolyva-Machera.

General and Dynamic Meteorology
G-LSUD4 GDM - 1062
3h/w, 13 weeks, written exams, credits: 5
Free elective
Description: Chemical composition of air - Change of meteorological parameters of height – Barometric systems - General Circulation of the atmosphere - Introduction to dynamic meteorology - Meteorological coordinate systems - The fundamental equations of motion. Scale analysis - The geotropic wind. The gradient wind - The cyclostrophic wind - Thermal wind. Continuity equation - Pressure tendency equation - The concepts of circulation and vorticity - Absolute, relative and potential vorticity - The vorticity equation - Principles of weather modification - Conceptual and theoretical models -

Operational and experimental weather modification projects.
Instructors: T.S. Karakostas.

FIFTH SEMESTER:

Advanced Analysis of Mathematical Texts in German/English/French
G-LSUD5 LANGII –701
3h/w, 13 weeks, written exams, credits: 2
Optional
Description: Texts of Algebra, Analysis, Geometry, Set Theory and Computer Science.
Instructors: To be announced

Classical Differential Geometry I
G-LSUD5 CDG - 0303
5h/w, 13 weeks, written exams, credits: 7
Compulsory
Description: Definition of a curve - The method of moving frame - Fundamental Theorem of Curves Theory- Definition of a surface - Curves on surfaces - Fundamental forms - Asymptotic lines - Christoffel symbols - Theorema egregium - The Gauss mapping - Fundamental Theorem of Surface Theory.
Instructor: F.Petalidou, S. Stamatakis.

Numerical Analysis
G-LSUD5 NA - 04023h/w, 13 weeks, written exams, credits: 5.5
Compulsory
Description: Structure of Computational systems and algorithms, number systems and errors - Interpolation and approximation (interpolation by Lagrange and Newton polynomials) - Numerical integration (midpoint, trapezoid and Simpson's rules, Romberg integration) - Numerical solution of non-linear equations (bisection method, secant, regula-falsi and modified regula-falsi, Newton's method) - Introduction to iterative methods for linear systems and ODE.
Instructor: M. Gousidou-Koutita.

Introduction to Real Analysis
G-LSUD5 REAN - 0207
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory
Description: Real numbers - Countable and uncountable sets - Sequences and series - permutations of series - representations of real numbers - The Cantor set and Cantor's function - Special classes of functions (monotone, bounded variation, absolutely continuous, convex) - Sequences and series of functions - uniform convergence and applications - nowhere differentiable continuous functions - space filling curves - equicartinuity - Azzela's-Ascoli's theorem - Weierstrass approximation theorem - Lebesque's measure.
Instructor: D. Betsakos.

Special Didactics of Mathematical Analysis
G-LSUD5 SPEDIMA-0523
3h/w, 13 weeks, written exam., credits: 5
Free elective.
Description: The ways to approach mathematical thinking, and the respective schools - Mathematical categories and cognitive operation - Problems in understanding mathematical concepts - Construction of the line of the real numbers – The concepts: limit, differential, integral.
Instructor: M. Marias.

Probability Theory II
G-LSUD5 PROBII - 0505
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory
Description: The algebra of events - Probability Space - The axioms of Probability - Random variables - The notion of stochastic distribution - Multidimensional random variables - Multidimensional distribution functions - Marginal distributions - Denumerable multidimensional random variables - Continuous multidimensional distributions - Multidimensional normal distribution - Stochastic independence - Conditional Probability - Conditional density - Conditional distributions - Mean values for multidimensional random variables - Conditional mean values - Regression line - Mean square error - Random variable transforms - Compound distributions - Inequalities - Multiple Correlation coefficient - Ordered random variables - Characteristic functions - The sum of independent random variables - Characteristic functions of multidimensional random variables - Moment generating functions - Probability generating functions - Limit theory of random variables - Convergences - Relations between convergences - Central Limit Theorem - Laws of large numbers - The log log law.
Instructors: S. Kalpazidou, F.Kolyva-Machera, G. Tsaklidis.

Stochastic Processes with Complete Connections and Learning Theory
G-LSUD5 SPCCLT - 0507
3h/w, 13weeks, written exams, credits: 5
Elective
Description: Stochastic processes with complete connections - Definition - Basic notions - The homogeneous case - Stochastic properties - Application of stochastic processes with complete connections to Learning Theory - Introduction to Learning theory - some notions of learning theory - The modelling of the learning phenomenon, -The model of the stimulus choice.
Instructor: S. Kalpazidou.

Seismology
G-LSUD5 SEIS - 1063
3h/w, 13 weeks, written exams - lab., credits: 5
Elective

Description: Theory of elastic waves - Quantification of earthquakes - Plate tectonics theory - Seismotectonics of the Aegean area - Macroseismic effects of earthquakes.
Instructor: T. Tsapanos.

Stochastic Strategies
G-LSUD5 STOSTRA - 0506
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory
Description: Stochastic problems - Stochastic networks - Stochastic problems of tools replacement and repairing - Renewal theory - Inventory.
Instructor: G. Tsaklidis.

Theoretical Mechanics
G-LSUD5 THMI -1064
3h/w, 13 weeks, written exams, credits: 5
Free Elective
Description: Kinematics of a mass particle - Forces and laws of motion - Conservation theorems - Systems with one degree of freedom - Oscillations - Stability of equilibrium points - Phase diagrammes - Central forces - Kepler's problem - Systems of mass particles - Noninertial frames of reference.
Instructor: C. Varvoglis.

SIXTH SEMESTER:

Applied Analysis of Regression and Variance
G-LSUD6 ANVARE - 0531
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory elective (for the Department of Statistics and Operational Research)
Description: Multiple linear regression: parameter estimation - confidence intervals of the estimators - tests of hypotheses - orthogonal polynomials - best model selection criteria - stepwise regression - Analysis of variance: one factor parametric models - two or more factors - block randomized experimental designs.
Instructor: C. Moyssiadis.

Classical Differential Geometry II
G-LSUD6 CDGII -0332
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory elective (for the Department of Geometry)
Description: The Darboux frame - Normal curvature, geodesic curvature, geodesic torsion - Principal curvatures, Gauss curvature and mean curvature - Lines of curvature - Dupin indicatrix and conjugate directions - Geodesics - Levi-Civita parallelism - The Gauss-Bonnet formula.

Instructor: S. Stamatakis.

Complex Analysis
G-LSUD6 COMAN- 0208
4h/w, 13 weeks, written exams, credits: 7
Compulsory
Description: Complex numbers, the complex plane, topology of the plane, elementary complex functions - Holomorphic functions, Cauchy-Riemann equations - The complex integral, Cauchy's theorem and integral formula - The maximum principle, theorems of Morera and Liouville, the Schwarz lemma - Power series, the identity theorem. - Laurent series, singularities, residues.
Instructor: A. Siskakis.

Computational Mathematics
G-LSUD6 COMMA- 0431
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory elective (for the department of Numerical Analysis and Computer Science)
Description: Interpolation and approximation with piecewise polynomials and splines , Numerical linear algebra: Gauss elimination for linear systems pivoting, LU-factorization and an introduction to the stability of systems and algorithms, norms of vectors and matrices, condition number, Iterative methods, Introduction to the numerical solution of eigenvalue-eigenvector problem, Numerical solution of ODEs (existence and uniqueness of initial value problem). Euler method, Taylor method, Runge-Kutta methods and multistep methods.
Instructor: M. Gousidou-Koutita.

Continuum Mechanics
G-LSUD6 CM - 1066
3h/w, 13 weeks, written exams, credits: 5
Free elective
Description: Introduction to Tensor Analysis - Lagrangian and Eulerian description of the motion - Local and total derivatives - Streamlines and pathlines of particles - Potential flow - Strain tensor - Displacement vector - Rate of deformation tensor - Velocity distribution in infinitesimal regions - Circulation and turbulent flow - The equation of continuity - Mass forces, stress vector and stress tensor - Equations of motion of a continuum - Ideal and Newtonian fluids - Euler and Navier-Stokes equations - Applications - examples.
Instructor: N. Stergioulas, C. Stokos.

Deterministic Methods of Optimization
G-LSUD6 DEMEOP - 0533
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory elective (for the Department of Statistics and Operational Research)

Description: Introductory concepts: Convex and Concave functions. Solving NLPs with one variable. Iterative methods of finding extrema of functions in R^n, n>1.
Instructor: G. Tsaklidis.

Didactics of Mathematics
G-LSUD46 DIMA - 0963
3h/w, 13 weeks, written exams, credits: 5
Free elective
Description: This course is an introduction to the general didactics of mathematics and concentrates on the following: Mathematics as a scientific discipline and as a school subject, emphasising on the epistemological aspects - Cognitive approach of the learning of Mathematics - Ethomathematics aspects of mathematics education - Elementarization of Mathematics - Methods of teaching mathematics.
Instructor: S. Kalpazidou.

Group Theory
G-LSUD6 GTH - 0131
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory Elective (for the Department of Alegbra, Num. Theory and Math. Logic)
Description: The groups Dn,Sn,GL(n,K) - Action of a group on a set. Countatif formulas - Applications: orbits and decoration problems, symmetric groups, crystallographic and wallpaper groups - Sylow theorems - Applications: groups of small order - Simple groups - Normal and solvable series - Solvable groups - Exact sequences - Finitely generated abelian groups.
Instructor: A. Papistas.

Language, Automata, Grammars
G-LSUD6 LAG - 0432
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory elective (for the Department of Numerical Analysis and Computer Sciences).
Description: Context-free grammars, syntactic trees, pushdown automata. The equivalence of pushdown automata and context-free grammars. Closure properties of the class of context-free languages. Application of context free languages: the syntactic analysis.
Instructor: G. Rachonis.

Linear Geometry
G-LSUD6 LINGEO - 0331
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory Elective (for the Department of Geometry)
Description: Multidimensional affine spaces – Affine subspaces – Affine mappings.
Instructor: S. Stamatakis.

Matrix Theory

G-LSUD6 MATRIX - 0532
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory elective (for the Department of Statistics and Operational Research)
Description: Prerequisite matrix theory - Matrix polynomials and normal forms - Functions of matrices - Inner products and matrix norms - Normal matrices - polar decomposition - singular value decomposition - Kronecker and Hadamard products - Nonnegative matrices - Generalized inverses.
Instructor: G. Tsaklidis.

Measure Theory
G-LSUD6 METHE - 0231
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory Elective (for the Department of Mathematical Analysis)
Description: Lebesgue measure on the real line - Measurable functions - Lebesgue integral - Monotone and dominated convergence theorems - Comparison of integrals of Riemann and Lebesgue - The fundamental theorem of Calculus for Lebesgue integral - Abstract measure theory - Signed and complex measures - Product measures - Fubini's theorem.
Instructor: D. Betsakos.

Special Topics A
G-LSUD6 ST-1161
3h/w, 13 weeks, written exams, credits: 5
Elective
Description: The subject can be specified by the instructor in collaboration with the student.
Instructor: Any one of the teaching staff upon decision to teach the course.

Stochastic Processes
G-LSUD6 STPR - 0563
3h/w, 13weeks, written exams, credits: 5
Elective
Description: Definition of a stochastic process - Classification of the stochastic processes - Stochastic dependence - Martingales - The Markov property - The strong Markov property - Classification of the states - Classifications of the Markov chains - The matrix method - Regular chains - Cyclic chains - Inverse Markov chains - General properties of Markov chains - Extension of the Markov property - The ergodic behaviour - Random walks - Galton-Watson Processes (or Branching Processes), Processes with independent increments - The Poisson process - The Wiener process - The Brownian motion - Continuous parameter Markov processes - The transition probability function - Kolmogorov's equations - Feller's algorithm - Noteworthy classes of Markov processes - Renewal Processes - Diffusion processes - Applications.
Instructor: S. Kalpazidou.

SEVENTH SEMESTER:

Classical Control Theory
G-LSUD7 CLCOTH - 0433
3h/w, 13 weeks, written exam., credits: 5.5
Compulsory Elective ((for the Department of Arithmetical Analysis and Computer Sience).
Description: Introduction to the concepts of systems signals and Automatic Control, (brief historical review, basic structure of feedback control, examples) - Mathematical concepts and tools for the study of continuous and discrete time signals and systems. (Laplace transform, z-transform, applications, block diagrams and signal flow graphs) - Classification of signals and systems. Continuous and discrete time signals and systems - Time invariance, linearity - Classical analysis of systems and control in the time and frequency domains - Linear time invariant single-input, single-output systems described by ordinary, linear diferential equations - Input output relation and the transfer function description of a linear time invariant system - Free forced and total response of systems in the time domain - Stability of linear time invariant systems and algebraic stability criteria - Routh test for stability - Frequency response of linear time invariant systems - Closed loop systems - Root locus - Nyquist stability Criterion - Stabilizability and Stabilization of systems via precompensation and output feedback - Synthesis of controlers and paraperisation of stabilising controlers.
Instructor: N. Karampetakis

Data Structure
G-LSUD7 DB – 0461
3h/w, 13weeks, written exams, credits: 5
Elective
Description: Definitions of Data Structures, Algorithms and Complexity, Revision of C++ programming language and the use of Pointers, Arrays, Singly and doubly linked lists, Insertion and Deletion, Stacks and their Applications, Queues, Trees (Binary Search Trees, AVL, B-Trees), Heaps, Leftish Trees, Red-Black Trees, Huffman Encoding, Graphs and their Applications (Graph Coloring), Sorting algorithms, Search algorithms and Applications (Pattern matching), Hashing, The course contains a theoretical part and a lab that focuses in implementing Data Structures and Algorithms in C++ programming language.
Instructor: To be announced.

Differential Manifolds I
G-LSUD7 DMI – 0304
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory Elective

Description: Topological spaces - Differentiation in Euclidean spaces - Differentiable Manifolds - Differential of functions and mapping - Tangent space - Tensor Algebra - Tensor fields - Lie brackets - Covariant derivative of vector and tensor fields - Connections - Parallele displacement - Geodesics - The curvature tensor.
Instructor: S.Stamatakis

Error Correcting Codes
G-LSUD7 ECC- 0465
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory Elective (for the Department of Computer Sciences and Arith. Analysis)
Description: Hamming Distance - Perfect Codes - Equivalent Codes - Linear Codes - Generator Matrices - Encoding - Parity Check Matrices - Decoding a Linear Code - Majority Logic Decoding - MDS Codes - Hamming Codes - Golay Codes - Reed-Muller Codes
Instructor: D. Poulakis.

Functional Analysis
G-LSUD7 FA – 0232
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory elective (for the Department of Mathematical Analysis)
Description: Basic notions - Metric spaces - Normed spaces - Inner product spaces - Linear operators and functionals - Norms in B(X,Y), Hahn-Banach, Banach-Steinhaus, open mapping and closed graph Theorems.
Instructor: A. Siskakis

Galois Theory
G-LSUD7 GALTHE-0134
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory Elective (for the Department of Algebra, Number Theory and Math. Logic)
Description: Construction of fields. Algebraic extensions - Classical Greek problems: constructions with ruler and compass. Galois extensions - Applications: solvability of algebraic equations - The fundamental theorem of Algebra - Roots of unity - Finite fields.
Instructor: Th.Theohari-Apostolidi.

Harmonic Analysis
G-LSUD7 HARAN - 0266
3h/w, 13 weeks, written exams, credits: 5
Elective
Description: Harmonic functions on R^n - Poisson kernels - Harmonic extensions of the upper half-space - Singular integral operators and the Calderon - Zygmund theory.
Instructor: M. Marias.

Mathematical Logic I
G-LSUD7 MLI-0133

3h/w, 13 weeks, written exams, credits: 5.5
Compulsory elective (for the Department of Algebra, Number Theory and Math. Logic)
Description: Propositional and predicate calculus - Soundness and Completeness theorems.
Instructor: A. Tzouvaras.

Mathematical Statistics
G-LSUD7 MASTI - 0534
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory elective (for the Department of Statistics and Operation Research)
Description: Distributions of functions of random variables - Normal distribution and the derived distributions from the normal - The exponential family - Sufficiency of a statistic for a parameter or for functions of parameters. The Rao-Blackwel theorem - Completeness and uniqueness - Unbiased estimators with minimum variance - The Cramer-Rao inequality - Efficient statistics - Consistent statistics - Maximum likelihood and moment estimators and their properties - Prior and posterior distributions and Bayes estimators - The minimax principle - Interval estimation. General methods for construction of confidence intervals - Approximate confidence intervals - Confidence regions.
Instructor: N. Farmakis.

Observatory Astronomy and Astrophysics
G-LSUD7 QBASTR - 1067
3h/w, 13 weeks, written exams, credits: 5
Free elective
Description: Sun as a typical star. Stars: Characteristics, classification, distances, photometry, H-R diagram - Stellar evolution: Equations of state, gravitational collapse, nucleosynthesis, neutron stars, black holes - Interstellar medium: Transfer equation, dispersion phenomena - Galaxies. Experimental astronomy: The celestial sphere. Telescopes - Classification of galaxies using the Palomar Sky Survey plates.
Instructors: J. Seiradakis.

Partial Differential Equations
G-LSUD7 PDF - 0235
3h/w, 13weeks, written exams, credits: 5.5
Compulsory elective (for the Department of Mathematical Analysis
Description: First order Partial Differential Equations - Classification of Equations and Characteristic - Initial Value problems - Systems of PDEs - Classification and Initial Value Problems.
Instructor: N. Mandouvalos.

Special Topics A and B
G-LSUD7 SPETO-1161
3h/w, 13 weeks, written exams, credits: 5
Elective

Description: The subject can be specified by the instructor in collaboration with the student.
Instructor: Any one of the teaching staff upon decision to teach the course.

Stochastic Operational Research
G-LSUD7 STOPER - 0535
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory Elective (for the Department of Statistics and Operational Research)
Description: Renewal theory - Semi-Markov processes
Instructor: To be announced

EIGHTH SEMESTER:

Combinatorics
G-LSUD8 COMB - 0561
3h/w, 13 weeks, written exams, credits: 5
Elective
Description: Enumeration techniques: basic counting rules, permutations, combinations, binomial coefficients - Designs: balanced incomplete block designs (BIBD), incidence matrices, existence theorems, combinatorial structures (Hadamard matrices, difference sets, finite geometries, Latin squares, magic squares, (0,1)-matrices) - Graph theory: fundamental concepts, connectedness, special graphs (eulerian paths, hamiltonian cycles, Ramsey numbers, planar graphs).
Instructor: To be announced.

Cryptography
G-LSUD8 CRYPT- 0434
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory elective
Description: Basic concepts-Historical examples of cryptosystems - The RC4 and DES cryptosystems - Basic computational number theory - The RSA and Rabin cryptosystems - The Diffie-Hellman Key Exchange Protocol - The ElGamal and Massey-Omura cryptosystems - Hash functions - The RSA, ElGamal and DSA Digital Signatures.
Instructor: D. Poulakis.

Differential Manifolds II
G-LSUD8 DIFMAII - 0333
3h/w, 13weeks, written exam., credits: 5.5
Compulsory elective.
Description: Riemannian metrics-Affine connections-Parallel transport-Curvature tensor-Hopf-Rinow theorem-Geodesics and Jacobi fields.
Instructor: F. Petalidou.

Fourier Analysis

G-LSUD8 FOURAN-0234
3h/w, 13 weeks, written exams, credits: 5
Compulsory Elective
Description: Trigonometric series - Fourier coefficients - Fourier series - Convergence of Fourier series - Theorems of Dini and Dirichlet - Summability of Fourier Series - The space of square integrable functions and Fourier series- Parseval identity - Applications.
Instructor: D. Betsakos.

Sampling
G-SLUD8 SAM - 0566
3h/w, 13 weeks, written exams, credits: 5
Elective
Description: What's Sampling? Estimation and Estimators - Simple Random Sampling in order to estimate Population (and Subpopulations) Mean - Percentages and Variance - Ratio Estimators and Regression with socioeconomic applications - Coefficient of Variation - Stratified Sampling with proportional and optimal drawing of sample - Systematic Sampling with administrative applications and applications in populations where the studied random variables have some trend - Cluster Sampling, introduction and study of the cases with 1 and 2 level sampling techniques - Comparison of the studied sampling methods. Indices and their screening, general introduction to indices and a specialized study on price indices - The currency unit ECU as a weighted index.
Instructor: N. Farmakis.

Set Theory I
G-LSUD8 STHI -0132
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory elective (for the Department of Alebra, Num. Theory and Math. Logic)
Description: Axiomatic set theory ZF - Natural numbers and transitive sets - Binary relations - Functions - Equipollent sets - Finite sets - Ordering relations - Well ordered sets - Operations and ordering of natural numbers - Integers - rationales - reals.
Instructor: A. Tzouvaras.

Modern Control Theory
G-LSUD8 MOCQNTR - 0462
3h/w, 13weeks, written exam., credits: 5
Elective.
Description: State space models of LTI continuous time systems. Single input – single output systems. Multivariable systems. Block diagrams and realizations of state space models. Examples. System equivalence and state space coordinate transformations. Examples. Eigenvalues and eigenvectors. Diagolalization of matrices and diagonalization of state space models by coordinate transformations. State space realizations of transfer functions. State space system responses. Unit impulse and unit step response of state space models. LTI systems. Free and forced response of state space models. Canonical forms of state space models. Controllability. Observaability. Controllability and Obserability criteria. Stabilization of state space models and

decoupling zeros. Stability of state space models. Eigenvalue criteria for stability. Asymptotic and BIO stability. State feedback. Eigenvalue assignment by state feedback. Constant output feedback. State Observers and state reconstruction. Stabilization by state observers and state feedback. The separation principle.
Instructor: N. Karampetakis.

Number Theory
G-LSUD8 NTH -0136
3h/w, 13 weeks, written exams, credits: 5.5
Compulsory Elective (for the Department of Algebra, Number Theory and Math. Logic)
Description: Linear congruents modulo n. Systems of linear congruents . Euler function. Arithmetic multiplicative functions. Polynomial congruents, Diophantic equations. Pythagorean Triples. Fermat's Theorem for n=4. Quadratic reciprocity low. Quadratic number fields. Unsolved problems.
Instructor: Th.Theohari-Apostolidi.

Operators Theory
G-LSUD8 OP – 0267
3h/w, 13 weeks, written exams, credits: 5
Elective
Description: Inner product spaces, Hilbert spaces, Orthogonal projections, orthonormal bases. Bounded linear operators in Hilbert space. The adjoint of an operator, selfadjoint operators, normal operators. Positive operators and the square root of a positive operator. The spectrum of an operator, spectral radius, the resolvent of an operator. The spectral theorem for a compact, selfadjoint operator.
Instructor: I. Gasparis.

Special Topics B
G-LSUD8 SPETOPB – 1162
3h/w, 13 weeks, written exams, credits: 5
Elective
Description: The subject is specified by the instructor in collaboration with the student.
Instructor: Can be any one of the teaching staff if he/she accepts to teach the course.

Statistical Inference
G-LSUD8 STIF – 0569
3h/w, 13 weeks, written exams, credits: 5
Elective
Description: Introduction to testing hypothesis - Selecting the test procedure - Testing simple hypothesis - Neyman-Pearson's fundamental lemma - Uniformly most powerful tests - Tests for the parameters of one or two normal populations - Likelihood ratio tests.
Instructor: To be announced

Stochastic Methods in Finance
G-LSUD8 STMFIN-0562

3h/w, 13 weeks, written exams, credits: 5
Elective
Description: Introduction to probability theory - rates, time value of money - Options and derivatives - Options evaluation - Conditional mean value - Martingales - Self-financed processes - Brownian motion - The Black-School model - Stochastic differential equations - Stochastic integration - Evaluation of the European option.
Instructor: A. Papadopoulou.

Theoretical Astrophysics and Cosmology
G-LSUD8 THASTRCO - 1068
3h/w, 13 weeks, written exams, credits: 5
Free elective
Description: Principles of Cosmology - Gravitation as a geometric and physical phenomenon - Observations of cosmological importance - Cosmology and Gravitation - Newkoman cosmology - Relativistic cosmology- Cosmic kinematics - Cosmic dynamics- Microcosmology and astronomy.
Instructor: D. Papadopoulos, C. Tsagas.

Time Series
G-LSUD8 TIMSER - 0564
3h/w, 13 weeks, written exams, credits: 5
Elective
Description: Introduction - Autocorrelation and Autocovariance Function - Linear Stationary Models - Linear non Stationary Models - Forecasting.
Instructor: To be announced

Information Theory and Chaos
G-LSUD8 INFCH - 0570
3h/w, 13 weeks, written exams, credits: 5
Elective
Description: Information and Observations. Probability and Uncertainty. Messages as Events represented as Time Series. Digital and Analog Messages, Harmonic Analysis, Wavelets, Sampling. Entropy, Conditional Entropy, Mutual Entropy and Interdependence. Uncertainty, Predictability, Complexity, Innovation. Stochastic Processes and Dynamical Systems as Information Sources. Ergodicity, Mixing, Chaos, Noise, Bernoulli Processes, Kolmogorov Processes, Markov Processes. Communication Channels as Transformations of Stochastic Processes, Markov Channels. Coding, Design Principles. Selective Applications on Statistical Physics, Biology, Inference, Learning, Decisions and Games, Graphs and Communication Networks.
Instructor: I. Antoniou

Special Functions

G-LSUD8 SPFUN- 0264

3h/w, 13 weeks, written exams, credits: 5
Elective

Description: Gamma and Beta Fuctions: Infinite Products, Wierstrass theorems. Analytic continuation of analytic functions. Euler, Gauss and Weierstrass definitions and Properties of Gamma and Beta functions on the complex plane. Stirling asymptotic formulas. Pochhammer symbols. Applications of Gamma and Beta functions.
Hypergeometric functions:Frobenius series solution of second order differential equations. hypergeometric equations, representations of ordinary functions using hypergeometric functions. Integral representations of hypergeometric functions.
Orthogonal Polynomials: Hermite, Lagueree and Legendre polynomials Definitions, generrating functions, Differential equations related to the orthogonal polynomials, Sturm-Liouville problems. Rodrigues formulae, integral representations. Orthocanonical relations and summation formulae. Series expansion of functions using bases of orthogonal polynomials.
Cylindrical Functions:Bessel differential equation, power series solution. Bessel, Hermite and Neumann functions. Wronskians of cylindrical functions, recurrence relations. Bessel functions with integral index. Integral representation of Bessel functions.
Laplace and Poisson differential eqution in three dimensions. :Solution of Dirichlet problems of Laplace equations. Separation of variables in spherical and cylidrical coordinates. Applications in Electrostatics and Quantum Mechanics.
Instructor: C. Daskaloyoannis

FIRST SEMESTER

Code	Courses	Hrs/Credits	
	Compulsory		
0101	Linear Algebra I	4	**7**
0102	Introduction to Algebra	4	**7**
0201	Calculus I	5	**7**
0430	Introduction to Computer Programming	3	**4**

Code	Courses	Hrs/Credits
	Elective	

SECOND SEMESTER

Code	Courses	Hrs/Credits	
	Compulsory		
0103	Linear Algebra II	4	**7**
0202	Calculus II	5	**7**
0301	Analytical Geometry I	4	**7**
0401	Theoretical Informatics	3	**5.5**
0501	Mathematical Programming	3	**5.5**

Code	Courses	Hrs/Credits	
	Free Elective		
0966	Mathematical Software and Knowledge Representation	3	**4**

THIRD SEMESTER

Code	Courses	Hrs/Credits	
	Compulsory		
0106	Algebraic Structures I	4	**7**
0203	Calculus III	4	**7**
0204	Topology of Metric Spaces	4	**7**
0302	Analytical Geometry II	4	**7**
0502	Probability Theory I	4	**7**

Code	Courses	Hrs/Credits	
	Elective		
1061	Introduction to Meteorology and Climatology	3	**5**

FOURTH SEMESTER

Code	Courses	Hrs/Credits	
	Compulsory		
0107	Algebraic Structures II	4	**7**
0205	Calculus IV	4	**7**
0206	Differential Equations	4	**7**
0503	Statistics	5	**7**
0504	Mathematical methods in Operational Research	3	**5.5**

Code	Courses	Hrs/Credits	
	Free Elective		
0961	History of Mathematics Culture/Education	3	**5**
1062	General and Dynamic Meteorology	3	**5**
	Optional		
701	Analysis of Mathematical Texts in English/ French/ German	3	**2**

FIFTH SEMESTER

Code	Courses	Hrs/Credits	
	Compulsory		
0207	Introduction to Real Analysis	3	**5.5**
0303	Classical Differential Geometry I	5	**7**
0402	Numerical Analysis	3	**5.5**
0505	Probability Theory II	3	**5.5**
0506	Stochastic Strategies	3	**5.5**

Code	Courses	Hrs/Credits	
	Free Elective		
1063	Seismology	3	**5**
1064	Theoretical Mechanics	3	**5**
	Elective		
0507	Stochastic Processes with Complete Connections and Learning Theory	3	**5**
0523	Special Didactics of Mathematical Analysis	3	**2**
	Optional		
	Analysis of Mathematical Texts in English/ French/ German		

SIXTH SEMESTER

Code	Courses	Hrs/Credits	
	Compulsory		
0208	Complex Analysis	4	**7**
	Elective		
1161	Special Topics A	3	**5**
0563	Stochastic Processes	3	**5**
	Free Elective		
0963	Didactics of Mathematics	3	**5**
1066	Continuum Mechanics	3	**5**

Code	Courses	Hrs/credits	
	Compulsory Elective		
0131	Group Theory	3	**5.5**
0231	Measure Theory	3	**5.5**
0331	Linear Geometry	3	**5.5**
0332	Classical Differential Geometry II	3	**5.5**
0431	Computational Mathematics	3	**5.5**
0432	Language, Automata, Grammars	3	**5.5**
0531	Applied Analysis of Regression & Variance	3	**5.5**
0532	Matrix Theory	3	**5.5**
0533	Deterministic Methods of Optimization	3	**5.5**

SEVENTH SEMESTER

Code	Courses	Hrs/Credits	
	Elective		
1161	Special Topics A	3	**5**
1162	Special Topics B	3	**5**
0266	Harmonic Analysis	3	**5**
0461	Data Structure	3	**5**

Code	Courses	Hrs/Credits	
	Compulsory Elective		
0134	Galois Theory	3	**5.5**
0133	Mathematical Logic I	3	**5.5**
0235	Partial Differential Equations	3	**5.5**
0433	Classical Control Theory	3	**5.5**
0534	Mathematical Statistics	3	**5.5**
0535	Stochastic Operations Research	3	**5.5**
0304	Differential Manifolds I	3	**5.5**
0465	Error Correcting Codes	3	**5.5**
0232	Functional Analysis	3	**5.5**
	Free Elective		
1067	Observatory Astronomy and Astrophysics	3	**5**

EIGHTH SEMESTER

Code	Courses	Hrs/Credits	
	Elective		
1162	Special Topics B	3	**5**
0163	Mathematical Logic II	3	**5**
0267	Operation Theory	3	**5**
0564	Time Series	3	**5**
0566	Introduction to Sampling	3	**5**
0569	Statistical Inference	3	**5**
0462	Modern Control Theory	3	**5**
0562	Stochastic Methods in Finance	3	**5**
0570	Information Theory and Chaos	3	**5**
0264	Special Functions	3	**5**
0561	Combinatorics		

Code	Courses	Hrs/Credits	
	Compulsory Elective		
0132	Set Theory I	3	**5.5**
0136	Number Theory	3	**5.5**
0234	Fourier Analysis	3	**5.5**
0333	Differential Manifolds II	3	**5.5**
0434	Cryptography	3	**5.5**
	Free Elective		
1068	Theoretical Astrophysics and Cosmology	3	**5**

G. Postgraduate Programmes

There are two postgraduate programmes in the School of Mathematics of the Aristotle University of Thessaloniki:

- The postgraduate programme in «**Mathematics»** with three specializations and it is in place since the fall of 2002.
- The postgraduate programme on «**Web Science»** and it is in place since the fall of 2009.

The postgraduate programme in **«Mathematics»** leads to a Master's Degree and to a Doctorate's Degree in Mathematics. The objective of the programme is the promotion of knowledge and the development of mathematical research and applications.

Master's Degree of this programme has three specializations:

1. **Pure Mathematics.**
2. **Statistics and Mathematical modeling.**
3. **Theoretical Information and Theory of Control and Systems**.

The duration of the Master's Degree on Mathematics is typically three semesters. Students are expected to complete the coursework during the first two semesters and write a Master's Degree dissertation during the third semester.

The requirements for the Masters Degree are:

1. In the specialization in «Pure Mathematics»: satisfactory completion of at least 6 courses from categories A, B, C and at least one each from A, B, C of this specialization.
2. In the specialization in «Statistics and Mathematical Modeling»: satisfactory completion of at least 6 courses from the category SM.
3. In the specialization in «Theoretical Computer Science and Control Theory»: satisfactory completion of at least 6 courses from categories A and B, and at least 1 from the categories A and B of this specialization.

The postgraduate programme on **«Web Science»** leads to a Master's Degree and to a Doctorate's Degree on Web Science. The objective of the programme is to promote the research and knowledge in Mathematics and all the other disciplines involved in the WEB in order to contribute in the development of Greece and the whole world and to contribute in the organization, classification and development of the Web Science.

The duration of the Master's Degree on «**Web Science** » is typically three semesters.

Students are expected to complete the coursework during the first two semesters and write a Master's Degree dissertation during the third semester.

For each of the three semesters of both programmes the number of ECTS credits earned must be at least 30.

Listed below are all the courses offered by the Department of Mathematics in the 2012-2013 academic year, with the following information G-MDUD (Greece-

Master's Degree University Diploma), number of semester taught, the ECTS code and course number, the number of hours per week, the number of weeks per semester, the type of examination (written), whether or not there is a laboratory component, the number of ECTS credits provided, and an outline of the course.

Information on the Postgraduate Programmes may be obtained by the Head of the Consulting Committee Associate Prof. G. Tsakidis;

e-mail tsaklidi@math.auth.gr
Tel. 0030-2310-997964,
Fax 0030-2310-997903.

Information is also available via internet at:

http://www.math.auth.gr/gr/gr/studies.grad.

To inquire information about the programme, please communicate with the ERASMUS coordinator of the School..

M.Sc. Course on
«Pure Mathematics»

Semester: A

A.1. Basic Algebra
A.7. Representation Theory of Lie Algebras
B.1. Complex Analysis
B.7. Hyperbolic Analysis and Geometry
C.1. Global Differential Geometry

Semester: B

A.2. Commutative Algebra
A.6. Algebraic Geometry
B.5. Analysis on Manifolds
B.2. Banach Spaces of Analytic Functions
B.12. Special Topic I (Partial Differential Equations)
C.4. Differential manifolds

Semester: C

Master's Degree Dissertation.

Semester: A

A.1. Basic Algebra
G-MScUD1 BALG- 0664
3h/w, 13 weeks, written exams, credits 10
Elective
Description: Elements of group and ring theory - Finitely generated abelian groups. Algebraic extensions of fields - Galois extensions - Group algebra - Modules and rings of Artin and Noether - Semisimple Rings and Algebras- Simple

Rings and Algebras- Elements of Representations of finite groups - Category theory - Tensor products and Hom – Exact sequences of modules.

References

1. D.S. Dummit, R.M. Foote, Abstract Algebra, Wiley, (2004).
2. S. Lang, Algebra, Springer, (2002).
3. S. MacLane, Homology, Springer, (1995).
4. M. Hazewinkel, N. Gubareni, V.V.Kirichenko, Algebras, Rings and Modules, 2004, Kluwer Academic Publishers, New York.
5. R.S. Pierce, Associative Algebras, Springer, (1982).

Instructor: Th. Theohari-Apostolidi

A. 7. Representation Theory of Lie Algebras
G-MScUD2 RETHEAL - 0634
3h/w, 13 weeks, written exams, credits 10
Elective

Description: 1.Introduction - Introduction to Lie groups - construction of Lie algebras from Lie groups - Basic definitions - derivations - ideals solvable and nilpotent Lie algebras - example of Lie algebra $sl_n(C)$ 2. Simple and semisimple Lie Algebras - Cartan subalgebras - Killing forms - Weyl group - Dynkin diagrams - classification of semisimple Lie algebras 3. Enveloping Algebras - Definition of enveloping algebras - Poincaré-Birkhoff-Witt theorem - Exponential embeding of Lie algebras to Lie groups - Casimirs - Hopf structure of enveloping algebra 4. Representations and modules - Theorem Ado-Isawa - finite dimensional irreducible representations - adjoint representation - tensor representations - Inducible representations - Representations of solvable - nipotent and semisimple algebras - Verma modules 5. Applications - Symmetries of integrable systems - Backlund-Lie symmetries -Lax operators in Hamiltonian systems - Lie-Poisson algebras - Symmetries of quantum systems and Lie agebras su(2), su(3).

References

1. J. E. Humphreys, Introduction to Lie Algebras and Representation theory, Springer Graduate Texts in Mathematics, (1972).
2. W Fulton & J Harris, Representation Theory, Grad. Texts in Maths, Springer (1991).
3. B C Hall Lie Groups, Lie Algebras and Representations, Grad. Texts in Maths. Springer (2003).
4. R. W. Carter et al,Lecture Notes on Lie Groups and Lie Algebras, London Math. Soc. Student texts 32 (1995).
5. N. Jacobson , LIE ALGEBRAS, Dover (1962).
6. A. Roy Chowdhury, Lie algebraic methods in integrable systems, ed. Chapman & Hall (2000).
7. A. O. Barut and Ra czka, Theory of Group Representations and Applications, ed. Ars Polona (1977).

Instructor: C. Daskaloyiannis.

B.1. Complex Analysis
G-MScUD1 COAN-0641
3h/w, 13 weeks, written exams, credits 10
Elective
Description: Local uniform convergence of analytic functions - Infinite products - Canonical decomposition - the theorem of Weierstrass - Blaschke products - Normal families of analytic functions - Conformal mapping - the Riemann mapping theorem - Mittag-Lettler theorem - Runge's theorem - Harmonic functions - maximum principle - Dirichlet problem - Subharmonic functions - Harnack's principle - Harmonic measure - Green's function.
References

1. T. H. Gamelin (2001). Complex Analysis. Springer Verlag.
2. Fisher S. (1999). Complex Variables. 2nd Ed. Dover Publications.
3. Saks S. and A. Sygmund (1971). Analytic Functions. Elsevier Sience Ltd.

Instructor : D. Betsakos.

B.7. Hyperbolic Analysis and Geometry
G-MscUD1 HANGE-0648
3h/w, 13 weeks, written exams, credits 10
Elective
Description: Study of the Laplace Operator - of the resolvent kernel and estimates of the heat kernel on hyperbolic space and Kleinian groups - Rudiments of the theory of Einstein series for Kleinian groups.
References

1. Davies E.B. and N. Mandouvalos (1988). Heat kernels bounds on Hyperbolic Space and Kleinian groups. Proc. London Math. Soc. **57** (No 3): 182-208.
2. Davies E.B. and N. Mandouvalos (1987). Heat kernel bounds on Manifolds with Cusps. J Funct. Anal. **75** (No2): 311-322
3. Mandouvalos N. (1988). Spectral Theory and Eisenstein Series for Kleinian Groups. Proc. London Math. Soc. **57** (No 3): 209-238.
4. Mandouvalos N. (1989). Scattering Operator, Eisenstein Series, Inner Products Formula and "Maass-Selberg" relations for Kleinian Groups. Memoirs Amer. Math. Soc. 400

Instructor: N. Mandouvalos.

B.12. Special Topics I (Partial Differential Equations)
G-MscUD1 PDIFEQ- 0670
3h/w, 13 weeks, written exams, credits 10
Elective
Description
Instructor: M. Marias

C.1. Global Differential Geometry
G-MscUD1 GLDIGE-0655

3h/w, 13 weeks, written exams, credits 10
Elective
Description: Closed surfaces – Triangulation - Surfaces of constant Gaussian and constant mean curvature - The Gauß-Bonnet formula - Ovaloids - Characterizations of the sphere - Minkowski´s formulas - Rigity of ovaloids - Uniqueness Theorems for Minkowski´s and Christoffel´s problems - Complete surfaces - Proof methods in the global Differential Geometry.
References

1. Blaschke W. und Leichtweiß K. (1973). Elementare Differentialgeometrie Springer.
2. Hopf H. (1983). Differential Geometry in the large. Lecture Notes N^{o} 1000. Springer.
3. Hsiung C.C. (1981). A first Course in Differential Geometry. Wiley.
4. Huckusw (1973). Beweismethoden der Differential geometrie im Großen. Lecture Notes N^{o} 335 Springer.
5. Klingenberg W. (1978). A Course in Differential Geometry. Springer.
6. Stephanidis N. (1987): Differential Geometry, Vol. II, Thessaloniki. (in Greek).

Instructor: G. Stamou.

Semester: B

A.1. Commutative Algebra
G-MScUD1 COAL-0631
3h/w, 13 weeks, written exam., credits 10
Elective
Description: Historical aspect: connections with algebraic number theory, algebraic geometry, invariant theory. Introductory material to the theory of commutative rings and modules, homomorphism, exact sequences, tensor products, flat modules. Localization. Noetherian and Artinian rings and modules, Hilbert's Basis Theorem . Associated primes, primary decomposition. Integral dependence and the Nullstellensatz. Filtrations and Artin-Rees' Lemma. Completion, Hensel's lemma and Cohen structure theory. Dimension Theory and Hilbert-Samuel polynomials. Noether Normalization. Discrete valuation rings and Dedekind domains. **Requirements:** General Knowledge of Algebraic Structures such as groups and of Galois theory
References:

1. M. F. Atiyah and I. G. MacDonald (1994) Introduction to Commutative Algebra, Addison-Wesley.
2. H. Matsumura, (1989) Commutative Ring Theory, Cambridge University Press.
3. D. Eisenbud, (1997) Commutative Algebra with a View Toward Algebraic Geometry, Springer-Verlag.

Instructor: H. Charalambous

A.6. Algebraic Geometry
G-MScUD1 ALGEOM-0671
3h/w, 13 weeks, written exams, credits 10
Elective

Description: Polynomial rings with many variables – Plane curves – Projective curves – Intersection of curves – Bezout's theorem – Algebraic sets – Fundamental varieties – Hilbert's Nullstellensatz.

Instructor: D. Poulakis

B. 6. Analysis on Manifolds

G-MScUD2 ANMAN-0646

3h/w, 13 weeks, written exams, credits 10

Elective

Description: Introduction to analysis on Euclidean spaces - Convolution operators - Calderon-Zygmund theory - The Laplacian on Riemann manifolds - Eigenvalues of the Laplacian and their estimates - Multipliers on positive curvature manifolds - The heat kernels on the hyperbolic space**.**

References

1. R. Schoen and S.T.Yau. Lectures on Differential Geometry, Intern. Press, 1995.
2. P. Li and S. T. Yau. On the parabolic kernel of the Schroediger equation, Acta Mathematica, (1986).
3. N. Varopoulos, L. Saloff-Coste, Th Coulhon. Analysis and Geometry on Groups, Cambridge University Press, (1992).
4. E.B. Davies, Heat Kernels and Spectral Theory, Cambridge University Press, (1989).
5. E. Davies, N. Mandouvalos. Heat kernel bounds on Hyperbolic space and Kleinian groups, Proc. London Mathematical Society, (1988).

Instructor: M. Marias.

B.12. Special Topics I (Partial Differential Equations)

G-MscUD1 PDIFEQ- 0670

3h/w, 13 weeks, written exams, credits 10

Elective

Description: The basic partial differential equations in R^n: Laplace, heat and wave equations. – Theory of 2e order linear partial differential equations on $R^{n.}$: a) Sobolev spaces, second order elliptic partial differential equations, second order parabolic partial differential equations, second order hyperbolic partial differential equations.

References:

1. Evans, Lawrence C. Partial differential equations. Second edition. Graduate Studies in Mathematics, 19. American Mathematical Society, Providence, RI, 2010. xxii+749 pp.
2. Folland, Gerald B. Introduction to partial differential equations. Second edition. Princeton University Press, Princeton, NJ, 1995. xii+324 pp.
3. Gilbarg, David; Trudinger, Neil S. Elliptic partial differential equations of second order. Reprint of the 1998 edition.

Instructor: M. Marias

C.4. Differenrial Manifolds
G-MScUD2 DM an -0658
3h/w, 13 weeks, written exams, credits 10
Elective
Description: Differentiable Manifolds, tangent space - Immersions and embeddings - Vector fields – brackets - Riemannian metrics - Affine connections - Riemannian connections - The geodesic flow - Minimizing properties of geodesics - Curvature, sectional curvature - Ricci curvature and scalar curvature - Tensors on Riemannian manifolds.
References

1. Boothby W.M. (2002).An introduction to Differentiable Manifolds and Riemannian Geometry.Academic Press;N.Y.
2. Carmo M.P.(1992).Riemannian Geometry.Birkhauser Verlag AG;Boston.
3. K.Yano, M Kon.Structurs on Manifolds.Pure Mathimatics-Vol.3.

Instructor: F. Petalidou

Semester : C

- **Master's Degree Dissertation**

13 weeks, credits 30.

M. Sc. Course on «Statistics and Mathematical Modeling»

Semester: A

SM.05. Statistics and Decision Making
SM.06. Time Series Analysis
SM.09. Dynamic Modeling
SM.19 Quantum Information and Computations

Semester: B

SM.01. Probabilistic Simulation and Graphs
SM.02. Stochastic Methods
SM.07. Sampling and Statistical Processing

Semester: C

Master's Degree Dissertation

Semester: A

SM.05. Statistics and Decision Making
G-MScUD1 STDM - 0749
3h/w, 13 weeks, written exams, credits: 10
Elective
Description: The characteristic functions for the multivariate random variables - The multivariate normal distribution and related topics - Application in statistical analysis (Cochran's theorem, ANOVA, regression, X^2) - Statistical inference: The Neyman-Pearson lemma - Likelihood ratio test and related procedures - decision theory.
References

1. Lehman E.L. (1986), Testing Statistical hypotheses. John Wiley & Sons.
2. Patrick Billingsley (1995), Probability and Measure. John Wiley & Sons.
3. Feller W. (1971), An Introduction to probability theory and its Applications.
   John Wiley & Sons.
4. Dacunha Castelle P. and Duflo M. (1986), Probability and Statistics. Volume I
   and II. Springer-Verlag.
5. F. Kolyva-Machera (1998), Mathematical Statistics. Ziti,Thessaloniki.(in Greek).

Instructor: D. Ioannidis, F. Kolyva-Machera.

SM.06. Time Series
G-MScUD1 TSER- 0747
3h/w, 13 weeks, written exams, credits 10
Elective
Description: Introduction- Basic characteristics of T-S - Linear stochastic processes - Stationary linear models - Non-stationary linear models – Forecasting - Spectral analysis - Non-linear analysis of T-S.
References

6. Brockwell P.J. and R.A. Davis (2002). Introduction to Time Series and Forecasting. 2nd edition. Springer Verlag, New York.
7. Cryer J. (1986). Time Series Analysis. Wadsworth Pub Co.
8. Kantz H. and T. Schreiber (1999). Nonlinear Time Series Analysis. Cambridge University Press.
9. Tong H. (1997). Non-Linear Time Series: A Dynamical System Approach (Oxford Statistical Science Series, 6). Oxford University Press.
10. Vandaele W. (1997). Applied Time Series and Box-Jenkins Models. Academic Press, New York.

Instructors: D. Kugiumtzis

SM.09. Dynamic Modeling
G-MScUD1 SDM – 0750
3h/w, 13 weeks, written exams, credits: 10
Elective
Description: Phenomenological Laws, Scientific Method, Mathematical Modeling, The Prediction Problem. Differential Equations, Difference Equations and Dynamical Systems.Classification, Stability, Solutions (Analytic, Approximate, Numerical), Simulations.Selective Applications.Chaos, Random Number Generators, Population Dynamics and ChemicalReactions, Economics, Biology, Signals and Filters, Cellular Automata, Dynamics of Communication Networks.
The Objectives of the course are:
1) The understanding of Mathematical modeling in terms of Dynamical Systems in discrete time (Difference Equations) and in continuous time (Differential Equations).
2) The exploration of the possibilities and the identification of the difficulties to find solutions of dynamical models
3) the relevance of approximations and errors in applications.
References:

1. Arnold V.I. 1978, Ordinary Differential Equations, MIT Press, Cambridge, MA.
1. Blum L., Cucker F., Shub M., Smale S. (1988), Complexity and Real Computation. Springer, New York.
2. Gustafson K. (1999), Introduction to Partial Differential Equations and Hilbert Space Methods. Dover, New York.
3. Hirsch M., Smale S. (1974), Differential Equations, Dynamical Systems and Linear Algebra. Academic Press, London.
4. Hormander Lars, The Analysis of Linear Partial Differential Operators:
   Vol.1 : Distribution Theory and Fourier Analysis. Springer (1990).
   Vol.2 : Differential Operators with Constant Coefficients. Springer (1999).
   Vol.3 : Pseudo-Differential Operators. Springer (1985).
   Vol.4 : Fourier Integral Operators. Springer (1994)
5. Kalman R. (1968), On the Mathematics of Model Building, in "Neural Networks". ed. by E. Caianelo, Springer New York.
6. Kulesovic M.R.S., Merino O. (2002), Discrete Dynamical Systems and Difference Equations with Mathematicα. CRC Press.
7. Kyventidis Th. (2001), Differential Equations I, II, III. Ziti,Thessaloniki.(in Greek)
8. Kyventidis Th. (2001), Difference Equations and Discrete Systems. Ziti, Thessaloniki. (in Greek).
9. Kyventidis Th. (2001), Dynamic of Populations. Discrete Models. Ziti, Thessaloniki. (in Greek).
10. Polyanin A.D., Zaitsev V.F. (2002), Handbook of Exact Solutions for Ordinary Differential Equations, CRC Press.
11. Siafarias P. (2000), Applications of Differential Equations I, II . Patra. (in Greek).
12. Sobolev S. (1989), Partial Differential Equations of Mathematical Physics.

Dover, New York.
13. Wolfram S. (2002), A New Kind of Science. Wolfram Media, Champaign, Illinois.
14. Vesdsnsky D. (1992), Partial Differential Equations with Mathematica. Addison Wesley, New York.

Instructor: I. Antoniou.

SM.19. Quantic Information and Computation
G-MSc-UD1 QIC – 0751
3h/w, 13 weeks, written exams, credits: 10
Elective

Description: Introduction to Quantum Mechanics: Mathematical introduction (Hilbert spaces - Spectrum of autoadjoint and unitary operators-Lie group U(N) - control theory of groups) - Quantum states and observables - the state space of Hilbert space - The state space as a set of definite operators.
Quantum information theory: Quantum computer structure - quantum hits and registers, -quantum gates - Toffoli theorem - invertible gates - quantum circuits and networks - Deutsch theory of elementary gates - decomposition in elementary gates - quantum codes - error correction and decoherence.
Quantum algorithmes: Shannon entropy - Qnantum entropy - Quantum transportation - Qnantum cryptography.

References

1. Alicki R., Fannes M., Quantum Dynamical Systems, Oxford University Press, Oxford U.K.
2. Bohm A. (1993), Quantum Mechanics, Foundations and Applications, 3d ed, Springer, Berlin.
3. Fock V.A. (1986), Fundamentals of Quantum Mechanics Mir Publishers, Moscow.
4. Jammer M. (1974), The philosophy of Quantum Mechanics, Wiley, New-York.
5. Jauch J.M. (1973), Foundations of Quantum Mechanics, Addison-Wesley, Reading, Massatussetts.
6. Mackey G.W. (1957), Quantum Mechanics and Hilbert Space, American Mathematical Monthly 64, 45-57.
7. Mackey G.W. (1963), The Mathematical Foundations of Quantum Mechanics, Benjamin, New York.
8. Prugovecki E. (1981), Quantum Mechanics in Hilbert Space, Academic Press, New York.
9. Von Neumann J. (1932), Mathematical Foundation of Quantum Mechanics. Princeton Univ. Press, New Jersey.
10. Benenti G. , Casati G. , Strini G. (2005), Principles of Quantum Computation and Information.
11. Vol I: Basic Concepts. World Scientific, Singapore.
12. Vol II: Basic Tools and Special Topics. World Scientific, Singapore.
13. Bernstein E., Vazirani U. (1997), Quantum Complexity Theory. SIAM J.

Comput. 26, 1411-1473.
14. Chen G., Brylinsky R. , editors (2002), Mathematics of Quantum Computation, Chapman and Hall/VRC, Florida, USA.
15. Feynman R.P. (1967), Quantum Mechanical Computers. Foundations of Physics, 16, 507-531.
16. Ingarden R.S. (1976), Quantum Information Theory. Rep. Math. Physics 10, 43-72.
17. Nielsen A.M., Chuang I.L. (2000), Quantum Computation and Quantum Information. Cambridge University Press, Cambridge UK.
18. Ohya M., Petz D. (2004), Quantum Entropy and its Use. 2nd Printing, Springer, Berlin.
19. Vitanyi P. M. B. (2001), Quantum Kolmogorov Complexity based on Classical Descriptions. IEEE Transactions on Information Theory 47, 2464-2479.

Instructors: I. Antoniou, C. Daskaloyiannis, C. Panos

Semester: B

SM.01. Probabilistic Simulation and Graphs
G-MScUD2 PSTH-0745
3h/w, 13 weeks, written exams, credits: 10
Elective

Description: Axiomatic Foundation of the Probability - Measure theory - Conditional expectation – Generators - General Theory of Random Variables - Characteristic Functions - Laws of Large Numbers - Limit Theorems.
Simulation and Probability: Generation of Discrete and Continuous random variable by Simulation - Basic Counting Principles - Recurrent Relations and Generating Functions - The Include-Exclude Principle.
Graphs: Basic notions, connectivity, special graphs, planar graphs, coloring and coloring polynomials, combinatorial optimization.

References

1. Cameron P.J. (1994). Combinatorics: Topics, Techniques, Algorithms. Cambri-dge University Press.
2. Hall M. (1986). Combinatorial Theory. 2nd edition. John Wiley and Sons; N. York.
3. Harris J.M., J.L. Hirst and M.J. Mossinghoff (2000). Combinatorics and Graph Theory. Springer-Verlag; New York.
4. Liu C.L. (1977). Elements of Discrete Mathematics (Mcgraw Hill Computer Science Series).

Instructor: P. Moyssiadis.

SM.02. Stochastic Methods
G-MScUD2 STOPT-0746
3h/w, 13 weeks, written exams, credits 10
Elective

Description: Renewal theory – Martingales - Brownian motion**.**

References

1. Howard R.A. (1971). Dynamic Probabilistic Systems. Volumes I and II. John Wiley and Sons; New York.
2. Ross S.M. (1995). Stochastic Processes. John Wiley and Sons; New York.
3. Ross S.M. (2000). Introduction to Probability Models. 7th edition. John Wiley and Sons; New York.

Instructors : A. Papadopoulou, G. Tsaklidis, P.C. Vassiliou.

SM.07. Sampling and Statistical Processing
G-MScUD2 PRTH-0748
3h/w, 13 weeks, written exams, credits: 10
Elective

Description: *Part 1*: Sampling and its applications in Social and Economical Issues- Methods and Techniques of Sampling - About Surveys in from A to Z in details.

Part 2: Designing Sample Surveys - Preparation of structured questionnaires - checking the reliability and usefulness of them in collaboration with specialist of several disciplines - Question forms and specialization of their use - Questions and random variables coming out of them - Coding data from questionnaires - Use of Computer in storing the data from questionnaires to files and to analyze then via statistical methods - Manipulation of outputs and ethics.

Part 3: Special issues on Sampling, like: "Looking for linear trends of data" - "Mining (latent) periodicities from data" - "About 2nd degree pdf from 2-dimensional domains - Low budget surveys" - "Coefficient of Variation (Cv) and its applications: e.g. scaling continuous random variables"

References

1. Farmakis N. (2009), Introduction to Sampling, Christodoulidis, Thessaloniki.(in Greek).
2. Farmakis N. (2009), Survey and Ethics, Christodoulidis, Thessaloniki.(in Greek).

Instructor: N. Farmakis

Semester : C

Master's Degree Dissertation
13 weeks, credits: 30.

M. Sc. Course on

« Theoretical Information and Theory of Control and Systems »

Semester: A

A.7. Cryptography
A.9. Quantic Information and Computation
A.11. Special Topics I (Automata ans Semirings)
B.3 Numerical Methods with Applications in Control Theory
B.8. Discrete Time Systems and Computer Controlled Systems

Semester: B

A.6. Formal Language Theory
B.1. Computer Aided Control Systems Analysis and Design
B.4. Intelligent Control System
B.6. Linear Multivariable Control
B.2 Numerical Methods with Applications in Differential Equations

Semester: C

Master's Degree Dissertation

Semester: A

A.9. Quantum Information and Computation
G-MSc-UD1 QIC – 0751
3h/w, 13 weeks, written exams, credits: 10
Elective
Description: Mathematical Foundation of Quantum Theory.Quantum Information and Von Neumann Entropy.Boole Algebras and Classical Gates.Quantum Logic and Quantum Gates.Quantum Algorithms.Quantum Teleportation and Cryptography.Realization of Quantum Computers.Perspectives of Quantum Information.
References:

Selective References on Quantum Theory:

1. Alicki R., Fannes M., Quantum Dynamical Systems, Oxford University Press, Oxford U.K.
2. Bohm A. 1993, Quantum Mechanics, Foundations and Applications, 3d ed, Springer, Berlin.
3. Fock V.A. 1986, Fundamentals of Quantum Mechanics Mir Publishers, Moscow.
4. Jammer M. 1974, The philosophy of Quantum Mechanics, Wiley, New-York.
5. Jauch J.M. 1973, Foundations of Quantum Mechanics, Addison-Wesley, Reading,Massachussetts

6. Mackey G.W. 1957, Quantum Mechanics and Hilbert Space, American Mathematical Monthly 64, 45-57.
7. Mackey G.W. 1963, The Mathematical Foundations of Quantum Mechanics, Benjamin, New York.
8. Prugovecki E. 1981, Quantum Mechanics in Hilbert Space, Academic Press, New York.
9. Von Neumann J. 1932, Mathematical Foundation of Quantum Mechanics, Princeton Univ. Press, New Jersey.

Selective References on Quantum Theory Information and Quantum Computing:

10. Benenti G. ,Casati G. , Strini G. 2005, Principles of Quantum Computation and Information
11. VolI: Basic Concepts, World Scientific, Singapore.
12. Benenti G. ,Casati G. , Strini G. 2005, Principles of Quantum Computation and Information
13. VolII: Basic Tools and Special Topics, World Scientific, Singapore.
14. Bernstein E., Vazirani U. 1997, Quantum Complexity Theory, SIAM J. Comput. 26, 1411-1473.
15. Chen G., Brylinsky R. , editors 2002, Mathematics of Quantum Computation, Chapman and Hall/VRC, Florida, USA.
16. Feynman R.P. 1967, Quantum Mechanical Computers,
17. Foundations of Physics, 16, 507-531.
18. Ingarden R.S. 1976, Quantum Information Theory, Rep. Math. Physics 10, 43-72.
19. Nielsen A.M. , Chuang I.L. 2000, Quantum Computation and Quantum Information, Cambridge University Press, Cambridge UK.
20. Ohya M. ,Petz D. 2004, Quantum Entropy and its Use, 2nd Printing, Springer, Berlin.
21. Vedral V. 2010 Decoding Reality. The Universe as Quantum Information, Oxford University Press, Oxford, UK
22. Vitanyi P. M. B. 2001, Quantum Kolmogorov Complexity based onClassical Descriptions,
23. IEEE Transactions on Information Theory 47, 2464-2479.

Instructors: I. Antoniou, C. Daskalogiannis, C. Panos

A.11. Special Topics I (Automata over Semirings)

G-MScUD1 AS

3h/w, 13 weeks, written exams, credits: 10

Elective

Description: Semirings, weighted automata over semirings. Recognizable series. Properties of recognizable series. The problem of determinization. Decidability problems. Applications: Fuzzy languages. Digital image compression.

Reference:

M. Droste, W. Kuich, and H. Vogler, eds., Handbook of Weighted Automata, EATCS Monographs in Theoretical Computer Science, Springer, 2009.

Instructor: G. Rachonis

A.7. Cryptography
G-MScUD1 CRYP-0840
3h/w, 13 weeks, written exams, credits: 10
Elective
Description: Classical Cryptosystems - Perfect Security - Feedback Shift Register - Basic Computational Number Theory - RSA Cryptosystem - Rabin Cryptosystem - Primality Testing - Factorization Methods - Discrete Logarithm - Diffie-Hellman Protocol - ElGamal Cryptosystem - Okamoto-Uchiyama Cryptosystem - Digital Signatures - Cryptographic Protocols.
Remark: The basic concepts of Linear Algebra, Algebraic Structures and Number Theory are needed for the aforementioned course.
References

1. D. Stinson, Cryptography – Theory and Practice, Boca Raton, Florida, CRC Press (2002).
2. G. Zémor, Cours de Cryptographie, Paris, Cassini (2002).
3. B. Schneier, Applied Cryptography, J. Wiley and Sons (1996).
4. N. Koblitz, A course in Number Theory and Cryptography, New-York, Berlin, Heidelberg, Springer-Verlag (1987).
5. J. A. Buchmann, Introduction to Cryptography, New-York, Berlin, Heidelberg, Springer-Verlag (2001).
6. N. P. Smart, Cryptography, McGraw Hill; Boston (2003).
7. E. Bach, J. Shallit, Algorithmic Number Theory, Vol 1, The MIT Press (1997).
8. S.Y.Yan, Number Theory for Computing, Berlin, Heidelberg, Springer-Verlag(2002).

Instructor: D. Poulakis.

B. 8. Discrete Time Systems and Computer Controlled Systems
G-MScUD1 DTSYCCS-0845
3h/w, 13 weeks, written exams, credits: 10
Elective
Description: Introduction to Discrete-Time Control Systems - The z-Transform - z- Plane Analysis of Discrete-Time Systems - Design of Discrete-Time Control Systems by Conventional Methods - State Space Analysis - Pole Placement and Observer Design - Polynomial Equations Approach to Control Systems Design.
References

1. 1.Franklin G.F., D.J. Powell, M.L. Workman and D. Powell (1997). *Digital Control of Dynamic Systems*. 3rd edition. Addison-Wesley.
2. Kuo B.C. (1980). Digital Control Systems. HBJ College & School Division.
3. Ogata K. (1994). Discrete-Time Control Systems. 2nd edition. Prentice-Hall.

4. Phillips C.L., H.T. Nagle and T.H. Nagle (1994). Digital Control System Analysis and Design. 3rd edition. Prentice-Hall; London.
5. Wittenmark B. and K.J. Astrom (1997). Computer Controlled Systems. 3rd edi-tion. Prentice-Hall; London.

Instructor: A.-I. Vardoulakis

B.3. Numerical Methods with Applications in Control Theory

G-MScUD1 NMEACTH-0847

3h/w, 13 weeks, written exam., credits 10

Elective

Description: PART 1. Numerical matrix computations: Numerical stability and conditioning, Elementary orthogonal transformations, QR decomposition and least square solutions, The eigenvalue problem, Computing the Schur and Jordan forms, The generalized eigenvalue problem, The singular value decomposition. PART 2. Solution of State-Space equations: Sensitivity of matrix exponentials, Series methods, Ordinary differential equations methods, Matrix decomposition methods, Errors in the solution of state equations, Discretization of continuous time-systems. PART 3. Solution of matrix Riccati equations: Conditioning of matrix Riccati equations, Newton's method, Matrix sign function method, The eigensystem approach, The generalized eigensystem approach. PART 4. Solution of Lyapunov and Sylvester equations: A perturbation analysis, The Bartels-Stewart method, The Hessenberg-Schur algorithm, Solving the Lyapunov equation for the Cholesky factor. PART 5. Applications to control theory: Robust stability analysis by the second method of Lyapunov and the Gershgorin theorem, Controllability\observability analysis, Orthogonal reduction to canonical form, Schur methods for pole assignment, Determining a stabilizing feedback matrix for a continuous-discrete time using the second method of Lyapunov, Computing the Kalman decomposition of a linear system.

References

1. R.V. Patel, A.J. Laub and P. Van Dooren (Editors), Numerical Linear Algebra Techniques for Systems and Control, Reprint Book Series, IEEE Press, New York, under the sponsorship of the IEEE Control Systems Society, 1994; 724 pages.
2. Petkov, P. Hr., , Computational methods for linear control systems, New York : Prentice Hall, 1991.
3. Elia, Nicola, Computational methods for controller design, New York : Springer, 1998.
4. Mufti, I. H., Computational methods in optimal control problems, Berlin, New York, Springer-Verlag, 1970.
5. B. Datta, 2004, Numerical Methods for Linear Control Systems Design and Analysis, Elsevier Academic Press.

Instructor: M. Gousidou-Koutita

Semester : B

A.6. Formal Language Theory
G-MScUD2 FLTH-0838
3h/w, 13 weeks, written exams, credits: 10
Elective
Description: Infinite words and ω-languages. Automata over infinite words: Buchi and Muller recognizability conditions. ω-Recognizable languages and their properties. The problem of complementation. MSO logic. Equivalence of MSO sentences and languages of automata over infinite words. Application of automata over infinite words in model-checking.
References

1. C. Baier, J.-P Katoen, Principles in model checking, MIT Press, 2008.
2. B. Khoussainov, A. Nerode, Automata Theory and its Applications, Birkhauser, Boston, 2001.
3. W. Thomas, Automata on infinite objects, in: Handbook of Theoretical Computer Science, vol. B (J. v. Leeuwen, ed.) Elsevier Science Publishers, Amsterdam 1990, pp.135-191.
4. W. Thomas, Languages, Automata and logic: in Handbook of Formal Languages vol 3 (G. Rozenberg, A. Salomaa, eds.), Springer 1997, pp. 389-485.
5. Q. Yan, Lower bounds for complementation of omega-automata via the full automata technique, Logical Methods in Computer Science 4(2005), 1-20.

Instructor: G. Rahonis.

B.1. Computer Aided Control Systems Analysis and Design
G-MScUD2 CACSYAD - 0846
3h/w, 13 weeks, written exams, credits: 10
Elective
Description: Introduction to MATLAB - programming in MATLAB - introduction to SIMULINK - frequency domain analysis - state-space analysis - classical design - state-space design - digital control - linear quadratic control - Riccati equations - robust control - analysis and design of linear time invariant multivariable systems with Control Systems Professional/Mathematica.
References:

1. Norman Nise, 2011, Control Systems Engineering, Sixth Edition, Willey and Sons Inc.
2. Hanselman D.C. and B.C. Kuo (1995), Matlab Tools for Control System Analysis and Design. Prentice-Hall; London.
3. Ogata K. (2002). Modern Control Engineering, 4rth Edition, Pearson Education, Prentice-Hall; London.
4. Shahian B. and M. Hassul (1993). Control System Design Using Matlab. Prenti-ce-Hall; London.

5. J. B. Dabney, T. L. Harman, 2001, Mastering Simulink 4, Prentice Hall.
6. Richard C. Dorf, Robert H. Bishop, 2003, Σύγχρονα Συστήματα Αυτομάτου Ελέγχου, Εκδόσεις Τζιόλα.
7. E. B. Magrab, S. Azarm, B. Balachandran, J. H. Duncan, K.E. Herold, G.C. Walsh, 2005, An engineer's guide to Matlab with applications from Mechanecal, Aerospace, Electrical and Civil Engineering, 2nd Ed., Pearson Education Inc., Prentice-Hall; London.
Instructor: N.P.Karampetakis

B.2 Numerical Methods with Applications to Ordinary Differential Equations
G-MScUD2 MADE-0853
3h/w, 13 weeks, written exam., credits 10
Description: Initial and boundary value problems. Numerical methods for the solution of ordinary differential equations with initial and boundary conditions. Methods of single step and multiple step, stability, predictor-corrector methods, stiff ODE. Linear and non-linear methods Shooting. Linear and non-linear methods of finite differences. Variational techniques. Finite difference methods for elliptic, parabolic and hyperbolic problems. Introduction to finite elements method.
References
1. Faires J. Douglas & Burden L. Richard, (1993). ―Numerical Methods―, PWS-KENT Publ. Comp.
2. Lapidus Leon, Seinfeld H. John, (1971). ―Numerical Solution of Ordinary Differ-ential Equations― Academic Press Inc.
3. Smith G.D., (1965, 1969, 1974). ―Numerical Solution of Partial Differential Equations―, Oxford Univ. Press.
4. Mitcell A.R. & Griffiths D.F., (1980). ―The Finite Difference Method in Partial Dif-ferential Equations―, by John Wiley & Sons
Instructor: M. Gousidou- Koutita

B. 4. Intelligent Control Systems
G-MscUD2 INCOSYS-0849
3h/w, 13 weeks, written exams, credits: 10
Elective
Description: Foundations of Fuzzy Systems - Fuzzy Relations – Properties - Operations and Composition - Fuzzy Linguistic Descriptions - Implication Relations - Fuzzy Inference and Composition - Fuzzy Algorithms - Fuzzy Linguistic Controllers - Defuzzification Methods - Fuzzy Controller Design Issues - Fuzzy Controller - Application Examples in Industry - Implementation of Fuzzy Controllers using MatLab's Fuzzy Logic Toolbox and Simulink - Fundamentals of Neural Networks – Architectures - Training Algorithms - Windrow-Hoff Delta Learning Rule - Backpropagation training of Multilayer Neural Networks - Autoassociative neural networks - Recurrent Neural Networks - Competitive Learning: Kohonen Self-organizing Systems - Dynamic Systems and Neural Control - System Identification - Design of Neural Controllers - Data Representation - Scaling and Normalization - Data Selection for Training and Testing - Implementation Examples of neural Controllers using MatLab's Neural

Networks Toolbox and Simulink - Hybrid Neuro-Fuzzy systems - Fuzzy methods in Neural networks - Neural Methods in Fuzzy systems - Neurofuzzy Control Applications - Expert Systems in Neuro-Fuzzy systems - Introduction to Evolutionary and Genetic Algorithms - Representations of Chromosomes - Objective Function Fitness Function - Crossover and Mutation - Selection Techniques - Applications of Evolutionary algorithms to control problems.

References

1. Kosko, B. (1997). Fuzzy Engineering. London. U.K., Prentice Hall International.
2. Haykin S. (1998). Neural Networks, a Comprehensive Foundation, Macmillan College Publishing Co. N.Y. 2nd Ed.
3. Antsaklis P.J., Passino K.M., eds., An Introduction to Intelligent and Autonomous Control.
4. Υπολογιστική νοημοσύνη στον έλεγχο συστημάτων. Ρ. Κινγκ (Greek Literature)

Instructor: P. Tzionas

B. 6. Linear Multivariable Control .
G-MscUD2 MUSYTH-0843
3h/w, 13 weeks, written exams, credits: 10
Elective

Description: Real rational vector spaces and rational matrices - polynomial matrix models of linear multivariable systems - pole and zero structure of rational matrices at infinity - dynamics of polynomial matrix models - proper and Ω-stable rational functions and matrices - feedback system stability and stabilization - some algebraic design problems.

References

1. Callier F.M. and Desoer C.A., (1982), Multivariable feedback systems, Springer-Verlag, New York.
2. Gohberg I., Lancaster P. and Rodman L., (1982), Matrix Polynomials, Academic Press, New York.
3. Kucera V., Analysis and Design of Discrete Linear Control Systems, Prentice Hall International Series in Systems and Control Engineering.
4. Rosenbrock H.H., (1970), State-space and Multivariable Theory, Nelson-Wiley.
5. A. I. Vardulakis, (1991), Linear Multivariable Control: Algebraic Analysis and Synthesis Methods, Wiley.

Instructor: A-I. Vardoulakis.

B.9 Special Topics I (Robust Control)
G-MscUD2 ROCO-0848
3h/w, 13 weeks, written exam., credits 10
Elective
Elective

Description: The main objective of this course is the analysis of systems where the parameters are not known exactly but are within known intervals. One of the most useful qualities of a properly designed feedback control system is robustness, i.e., the ability of the closed-loop system to continue performing satisfactorily despite large variations in the (open-loop) plant dynamics. The aim of the course is to teach the student how to analyze and design a robust control system. Topics covered: paradigms for robust control; robust stability and measures of robust performance; analysis of robust stability and performance; design for robust stability and performance.

Robust stability with a single parameter, Kharitonov's Theorem, the value set concept, polytopes of polynomials, the edge theorem, distinguished edges, the sixteen plant theorem, multilinear uncertainty structures, spherical polynomial families, and survey of design methods for robust control, application of design methods for unstructured and structured uncertainty on an example plant.

References:

1. Robust Control : The Parametric Approach/Book and Disk (Prentice Hall Information and System Sciences) by S.P. Bhattacharyya, H. Chapellat, L. H. Keel
2. J. Ackermann, 1993, Robust Control: Systems with uncertain physical parameters, Springer Verlag.
3. B. R. Barmish, 1994, New tools for robustness of linear systems, MacMillan Publishing Company.

Instructor: O. Kosmidou

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Semester : C

- **Master's Degree Dissertation**

13 weeks, credits: 30

M.Sc. Course on
« Web Science »

Semester : A

WS.01 Web Science Introduction
WS.04 Networks and Discrete Mathematics
WS.13 Web Languages and Technologies

Semester: B

WS.05 Statistical Analysis of Networks
WS.11 Knowledge Processing in the Web
WS.18 Special Topics: Biological Networks

Semester: C

Master's Degree Dissertation

WS.01 Web Science Introduction
G-MscUD1 WSI
36hours/semester, 13 weeks, written exam. And projects, credits: 8
Compulsory
Description: From Hyperlinks to Web Pages and the Semantic Web, Epistemology and Didactics of the Web. Research Methodology and Project Management, Web Economics and Business, Trust, Privacy, Security and Law. Web users Behaviour.
References:

1. Abelson, H., Ledeen, K., Lewis, H. 2008, Blown to bits: Your life, liberty, and happiness after the digital explosion, Upper Saddle River, NJ: Addison-Wesley. http://www.bitsbook.com/
2. Amarantidis E., Antoniou I., Vafopoulos M. 2010, Stochastic Modeling of Web evolution, in SMTDA 2010 Conference Proceedings.
3. Antoniou I., Vafopoulos M. 2010, Web as a Complex System, in GRID 2010 Conference Proceedings, Dubna, Russia.
4. Antoniou I., Moissiadis C., Vafopoulos M. 2010, Statistics and the Web, in ESI 2010 Proceedings.
5. Antoniou I., Reeve M., Stenning V. 2000, "Information Society as a Complex System", J. Univ. Comp. Sci. 6, 272-288.
6. Berners-Lee, T., Fischetti M. 1999. Weaving the Web: the original design and ultimate destiny of the World Wide Web by its inventor. San Francisco: Harper SanFrancisco.
7. Berners-Lee T., Hall W., Hendler J., Shadbolt N., Weitzner D. 2006, Creating a Science of the Web, Science, Vol. 313. no. 5788.
8. Berners-Lee T., Hall W., Hendler J., O'Hara K., Shadbolt N., Weitzner D. 2006, A Framework for Web Science. Foundations and Trends in Web Science", 1 (1). pp. 1-130; ΕλληνικήΜετάφραση Βαφόπουλος Μ. 2008, Το πλαίσιοτης επιστήμηςτου Web, εκδόσειςhyperconsult, ISBN 978-960-930361-3.
9. Berners-Lee T. 1996. "WWW: Past, Present, and Future". Computer. 29 (10): 69.

10. Bizer C., Heath T., Berners-Lee T. 2009, Linked Data - The Story So Far, International Journal on Semantic Web and Information Systems http://tomheath.com/papers/bizer-heath-berners-lee-ijswis-linked-data.pdf
11. Bizer C., Maynard D. 2010, The Semantic Web Challenge , In Press Journal of Web Semantics: Science, Services and Agents on the World Wide Web, Available online 2 July 2011
12. Castells, Manuel. 2004. The network society: a cross-cultural perspective. Cheltenham, UK: Edward Elgar Pub.
13. Castells M. 2007, "Communication, Power and Counter-power in the Network Society." International Journal of Communication, vol. 1, pages 238-266.
14. Golbeck, Jennifer. 2008. Trust on the World Wide Web: a survey. Hanover, MA: Now Publishers.
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16. D. Lazer, A. Pentland, L. Adamic, S. Aral, A.-L.Barabasi, D. Brewer, N. Christakis, etals 2009, Computational social science. Science 323:721-723, 2009.
17. Lessig L. 2004, Free culture: how big media uses technology and the law to lock down culture and control creativity. New York: Penguin Press.
18. Linked Data W3C http://www.w3.org/standards/semanticweb/data
19. Linked Data talks, Tom Heath, http://tomheath.com/talks/html
20. Shadbolt N., and Berners-Lee T. 2008, Web Science Emerges - Studying the Web will reveal better ways to exploit information, prevent identity theft, revolutionize industry and manage our ever growing online lives", Scientific American October, 76. http://eprints.ecs.soton.ac.uk/17143/1/Web_Science_Emerges.pdf
21. Easley D. , Kleinberg J. 2010, Networks, Crowds, and Markets: Reasoning about a Highly Connected World, Cambridge University Press http://www.cs.cornell.edu/home/kleinber/networks-book/
22. Rappa M., Managing the digital enterprise http://digitalenterprise.org/
23. Torrent-Sellens J. 2009, Knowledge, networks and economic activity: an analysis of the effects of the network on the knowledge-based economy http://www.uoc.edu/uocpapers/8/dt/eng/torrent.html

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Instructors: Antoniou I. , Bratsas C., Metakides G., Nouskalis G., Polychronis P., Varsakelis N.

WS.04 Networks and Discrete Mathematics
G-MscUD1 NDM
64hours/semester, written exams and projects, credits: 14
Compulsory
Description: An Introduction to: Graphs and Networks as the Structure of the Web - Information as the Fundamental Quantity in the Web - Digital Processing and the Knowledge Society - The Symmetric and the Public-Key Cryptosystems – The Digital Signatures and Some Cryptographic Protocols used in the Internet.

References

1. Albert R., Barabasi A-L. (2002), *Statistical Mechanics of Complex Networks*, Rev. Mod. Physics 74, 47-97.
2. Barabasi A-L. (2002), Linked: How Everything Is Connected to Everything Else and What It Means for Business, Science, and Everyday Life, Plume, New York.
3. Batagelj V. (2003), Course on Social Network Analysis Graphs and Networks, Padova, April 10-11, http://vlado.fmf.uni-lj.si/pub/networks/course/networks.pdf .
4. Batagelj V. (2003), Course on Social Network Analysis Weights, April 10-11,
5. http://vlado.fmf.uni-lj.si/Pub/Networks/course/weights.pdf
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7. Bollobas B. (2001), Random Graphs. Cambridge University Press.
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14. Roberts F., Tesman (2004), Applied Combinatorics, Prentice Hall, New Jersey.
15. Rosen K. (1995), "Discrete Mathematics and Its Applications," McGraw-Hill, New York.
16. Watts, D. J., and S. H. Strogatz (1998), Collective Dynamics of Small World Networks, Nature 393, 393, 440-442. D. Stinson, Cryptography – Theory and Practice, Boca Raton, Florida, CRC Press (2002).
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20. J. A. Buchmann, Introduction to Cryptography, New-York, Berlin, Heidelberg, Springer-Verlag (2001).
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22. E. Bach, J. Shallit, Algorithmic Number Theory, Vol 1, The MIT Press (1997).
23. S. Y. Yan, Number Theory for Computing, Berlin, Heidelberg, Springer-Verlag (2002).

Coordinator: P. Moyssiadis

Instructors: I. Antoniou, V. Karagiannnis, P. Moyssiadis

WS.13 Web Languages and Technologies
G-MscUD1 WLT
36hours/semester, 13 weeks, written exam. and projects, credits: 8
Compulsory
Description: Web Technologies, Privacy and Trust .From Web 2.0 to Web 3.0 Technologies and Languages. Web Search and Retrieval, Web and Semantic Web Services and Architectures, Agents, Distributed and Cloud Computing. Future Internet
References:

1. Alonso G., Casati F., Kuno H., MachirajuV.. Web Services: Concepts, Architectures and Applications (Data-Centric Systems and Applications). Springer; Softcover reprint of hardcover 1st ed. 2004 edition (2010).
2. Corella MA, Castells P. Semi-automatic semantic-based Web service classification. Business Process Management Workshops (Lecture Notes in Computer Science, vol. 4103), Dustdar S, Fiadeiro JL, Sheth A (ed.). Springer: Berlin, 2006; 459-470. DOI: 10.1007/11837862_43.
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14. Nguyen K, Cao J, Liu C. Semantic-Enabled Organization of Web Services. APWeb 2008 (Lecture Notes in Computer Science, vol. 4976), Zhang Y. et al. (ed.). Springer-Verlag: Berlin, 2008; 511–521. DOI: 10.1007/978-3-540-78849-2_51.
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17. Wooldridge M. An Introduction to Multiagent Systems. J. Wileyand Sons, 2002.

Coordinators: I. Stamatiou, D. Kehagias
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Semester: B

WS.05 Statistical Analysis of Networks
G-MscUD2 STAN
68 hours/semester, 13weeks, written exam. and projects, credits: 15
Compulsory
Description: Statistical Methods in the Study of Web - Sampling Techniques - Inference on Network Data - Time series Techniques and Statistical Analysis for the Study and Monitoring the Behavior of the Web in Real Time - Statistical Models of Network Traffic – Development – Evolution. Games.
References:
Data Processig from Networks:

1. Aldenderfer M. 1984, Cluster Analysis, Sage publications, London.
2. Everitt B. 1977, Cluster Analysis, Heinenmann , London.
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4. Φαρμάκης Ν. 2009, Εισαγωγή στη Δειγματοληψία, Χριστοδουλίδης, Θεσσαλονίκη.
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Web Modeling:

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17. Prigogine I. and Antoniou I. 2001, "Science, Evolution and Complexity", p 21-36 in Genetics in Europe, Sommeteuropéen, Ed. Lombardo G., Merchetti M., Travagliati C., Ambasciatod'Italia – Brussels, QuaderniEuropei No 2.

Coordinator: I. Antoniou, N. Farmakis
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WS.11 Knowledge Processing in the Web
G-MscUD2 KPW
36 hours/semester, 13 weeks, written exams and projects, credits: 7.5
Compulsory
Description: Logic and Programming are the foundations of Ontologies and Semantic processing. Semantic Web and
Linked data, Trust and privacy, Ambient Intelligence and the Future Internet

References:

1. Antoniou G. , Van Harmelen F. 2008, A Semantic Web Primer 2nd ed., MIT Press.
2. Aarts, E., Harwig, R., and Schuurmans, M. 2001, Ambient Intelligence in The Invisible Future: The Seamless Integration of Technology into Everyday Life, McGraw-Hill, New York.
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5. Bizer C., Lehmann J., Kobilarov G., Auer S., Becker C., Cyganiak R., Hellmann S. 2009, DBpedia - A Crystallization Point for the Web of Data. Journal of Web Semantics: Science, Services and Agents on the World Wide Web 7, 154–165.
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14. Wilks Y. and Brewster C. 2009, "Natural Language Processing as a Foundation of the Semantic Web", Foundations and Trends in Web Science: Vol. 1: No 3–4, pp 199-327.

Coordinatos: G. Metakides, C. Bratsas .
Instructors: C. Bratsas , G. Metakides

WS.18 Special Topics (**Biological Networks)**
G-MscUD2 BIONET
36 hours/semester, 13 weeks, written exams and projects, credits: 7.5
Compulsory
Description: Biomedical Ontologies in the Web.Statistical Analysis of Biological data Life Networks Models, Metabolic and Phenotypic Networks. Brain Networks (Connectomics), and Semantic, Ecological networks. Web as Ecosystem
Reference:

1. Barrat A., Barthelemy M. , Vespignani A. (2008), Dynamical Processes on Complex Networks, Cambridge University Press, Cambridge, UK
2. Barrat A., Boccaletti S., Caldarelli G., Chessa A., Latora V. , Motter A. E. ed. (2008), Complex Networks: from Biology to Information Technology, J. Phys. A: Math. andTheor. 41, 220301
3. Barrett, C.L., Kim, T.Y., Kim, H.U., Palsson, B.Ø. & Lee, S.Y. (2006), "Systems biology as a foundation for genome-scale synthetic biology", Current opinion in biotechnology, Vol. 17, No. 5, pp. 488-492
4. Blow, N. (2009), "Systems biology: Untangling the protein web", Nature, Vol. 460, No. 7253, pp. 415-418.
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6. Bratsas C, Koutkias V, Kaimakamis E, Bamidis P, Maglaveras N. 2007, Ontology-based Vector Space Model, and Fuzzy Query Expansion to Retrieve Knowledge on Medical Computational Problem Solutions ConfProc IEEE Eng Med BiolSoc 1:3794-7.
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8. Bratsas C., Frantzidis C., Papadelis C., Pappas C., Bamidis P. 2009, Towards a semantic framework for an integrative description of neuroscience patterns and studies: a case for emotion related data, published in Book Series Studies in Health Technology and Informatics Volume 150, ISO Press, pp. 322-326, ISBN: 978-1-60750-044-5
9. Bratsas C., Bamidis P., Kehagias D., Kaimakamis E., Maglaveras N. 2011, "Dynamic Composition of Semantic Pathways for Medical Computational

Problem Solving by Means of Semantic Rules", IEEE Transactions on Information Technology in Biomedicice, Vol. 15, No. 2, pp. 334-343
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16. Noy N., Shah N., Whetzel P., Dai B., Dorf M., Griffith N., Joquet C., Rubin D., Storey M.-A., Chute C. Musen M. 2009,.BioPortal: ontologies and integrated data resources at the click of a mouse. Nucleic Acids Res. 37: W170-W173.
17. Petanidou Th., Kallimanis A., Tzanopoulos J, Sgardelis S.P, Pantis J.D. 2008, Long-term observation of a pollination network: fluctuation in species and interactions, relative invariance of network structure, and implications for estimates of specialization. Ecology Letters 11(6): 564-575.
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21. Yu A. 2006, Methods in biomedical ontology, Journal of Biomedical Informatics, Volume 39, Issue 3, Biomedical Ontologies, Pages 252-266, ISSN 1532-0464, DOI: 10.1016/j.jbi.2005.11.006.

Coordinator: S. Sgardelis
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Semester: C

- **Master's Degree Dissertation**

13 weeks, credits 30.