UNIVERSITY OF WESTERN MACEDONIA
SCHOOL OF EXACT SCIENCES

DEPARTMENT OF MATHEMATICS

STUDY GUIDE
ACADEMIC YEAR
2023-2024




TABLE OF CONTENTS

Abstract

The Department of Mathematics of the University of Western Macedonia was founded in 2019 by the Law 4610/07.05.2019 together with the Department of Informatics in the School of Exact Sciences in the city of Kastoria. It is housed in the University's state-of-the-art facilities in Kastoria.

The aim of the Department is to provide high-level education to its students in the science of mathematics. To have an active role in the local community by organizing workshops, lectures, seminars and to achieve this goal it collaborates with the local branch of the Hellenic Mathematical Society in Kastoria. The Department's vision is also its presence in the international research community through participation of faculty members in international scientific conferences, publication of articles in prestigious international scientific journals and participation of faculty members in editorial committees of such journals.

The Department conducts research in the areas of Statistical & Operational Research, Numerical Analysis, Mathematical Analysis, Geometry and Mathematics Education. The lecturers have more than 50 publications in authoritative international journals included in the scopus and ZentralblattMath. bases, they have more than 100 participations in International Conferences in the proceedings of which more than 70 articles have been published.The total number of citations in their scientific work exceeds 2000 (according to scopus). They are members of the Editorial Board of prestigious scientific journals of the publishers Elsevier and Wiley such as Applied Mathematics and Computation, Mathematical Methods in the Applied Sciences. They are also reviewers of articles in journals of international publishiers Elsevier, Springer, Wiley and Hindawi.

The course of development of the Department is very promising and it is hoped to attract and be staffed with scientists of international scope who will make it a pole of excellence.






ΒΙΒΛΙΟΘΗΚΗ


The University of Western Macedonia

The History of the University

The University of Western Macedonia (U.W.M.) was founded with the P.D. 92/2003 (F.83/11-4-2003) with headquarters in Kozani. The first Departments of U.W.M. were the four Departments that were already operating in Western Macedonia as Branches of the Aristotle University of Thessaloniki (A.U.Th.), of which only one, i.e. the Department of Balkan Studies, was not independent. It was about, a) the Pedagogical Department of Primary Education that had been established with the P.D. 544/1989 in Florina and operated as an annex of the A.U.Th. from the academic year 1990-1991, b) the Pedagogical Department for Kindergarten Teachers established with the P.D. 99/1993 in Florina and operated from the academic year 1993-1994, while with the same decree the Faculty of Education was founded and operated as the Faculty of the University of A.U.Th., c) the Department of Engineering for the Management of Energy Resources of Western Macedonia which was founded in Kozani with Official Gazette 179/6.9. 1999 "Establishment of Departments at the Aristotle University of Thessaloniki", block A, and operated in Kozani from the academic year 1999-2000 as a Department of the University of A.U.Th., d) the Department of Balkan Studies which was also established with the Official Gazette 179/ 6.9. 1999, block A, and operated in Florina from the academic year 1999-2000 as a Department of the A.U.Th. From 1-1-2004 with the Official Gazette 134881 a/B1/23.12.2003, Official Gazette 1975/31.12.2003, the staff was transferred, i.e. the Faculty Members, the administrative staff of the Departments of A.U.Th. mentioned above, at the newly founded University of Western Macedonia. Also, with the decision Φ.120.61/132/61865/ Β 2/25.6.2003 of the Minister of National Education and Religious Affairs, the first Members of the Temporary Steering Committee were appointed, whose chairman was Professor Christos Massalas.

The University of Western Macedonia with the aforementioned structure was not self-governing and therefore the Faculty Members could not elect a rector, since, in order for a University to become self-governing, all its departments had to become self-governing. In 2005, the Department of Informatics and Communications Engineering, based in Kozani, was established by Official Gazette 192/20.5.2005, which began its operation in the academic year 2005-2006. The Polytechnic School of the University of Western Macedonia was thus created, which consisted of the Department of Energy Management Engineering of Western Macedonia and the Department of Information Technology and Communications Engineering.With the P.D. 181/August 31, 2006 the School of Visual and Applied Arts was founded in Florina. The School began its operation in the academic year 2006-2007. In 2009 with the P.D. 47, Official Gazette 61/27-04-2009, block A, the Department of Energy Resources Management Engineering was renamed the Department of Mechanical Engineering. In the academic year 2015-2016, the Department of Environmental Engineering operated in Kozani.

In 2015, the first elections were held to appoint a Rector, verifying the self-governing operation of the University of Western Macedonia. Professor Antonis Tourlidakis was elected as the first rector of the University of Western Macedonia. In its original form, the University of Western Macedonia operated in two cities, in Kozani and in Florina, with 3 Faculties, 1) the Faculty of Education in Florina with two Departments:The Pedagogical Department of Elementary Education and the Pedagogical Department of Kindergarten Teachers and 2) the Polytechnic School in Kozani with 3 Departments: a) the Department

of Environmental Engineering, b) the Department of Information Technology and Telecommunications Engineering, c) the Department of Mechanical Engineering and 3) the School of Fine Arts of Arts with 1 Department of Visual and Applied Arts in Florina.

Also, the Technological Educational Institute of Western Macedonia (TEI) operated in Western Macedonia. The TEI initially operated as a Center for Higher Technological Education after the post-colonization, in the context of the educational reform of 1976-77, with the Law 576/77 "On the organization and administration of Secondary and Higher Technical and Vocational Education" (Government Gazette 102 /A'/13.4.1977), which replaced the Higher Technical Education Centers, which were established by the Compulsory Law 652/1970. The Law 576/77 then created the institutional framework for higher technical vocational education. In 1983 with the Law 1404/FEKA/173/24.11.1983 "Structure and operation of Technological Educational Institutions" the Centers for Higher Technological Education were abolished and replaced by Technological Educational Institutions (TEI). The Technological Educational Institution of Kozani was thus founded, which in 1999 was renamed the Technological Educational Institution of Western Macedonia. The Foundation consisted of 5 Schools and 11 Departments, in 5 cities of the Region of Western Macedonia. The center of the Foundation was Kozani, in the Koila region, where the central University Campus is now located. The formation of the Schools of the Foundation was determined by the P.D. 90/2013/Government Gazette 130/A/5-6-2013 "Renaming of School and Departments-Merger of Departments-Abolition of Branches and Departments-Establishment of School Establishment of Schools of T.E.I. of Western Macedonia".

By the Law 4610/ 7.5.2019, the University of Western Macedonia merged with the Technological Educational Institute of Western Macedonia. With this Law, the following Faculties were established at the University of Western Macedonia: a) Polytechnic, with headquarters in Kozani, b) Economics, with headquarters in Kozani, c) Fine Arts, with headquarters in Florina, d) Agricultural Sciences, with headquarters in Florina, e) Social and Human Sciences, with headquarters in Florina, f) Health Sciences, with headquarters in Ptolemaida, g) Exact Sciences, with headquarters in Kastoria. In addition, the following Departments were established at the University of Western Macedonia a) Mineral Resources Engineering, based in Kozani, which joined the Polytechnic School, b) Product and Systems Design Engineering, based in Kozani, which joined the Polytechnic School, c) Regional and Cross-Border Development, based in Kozani, which joined the School of Economic Sciences, d) Administrative Science and Technology, based in Kozani, which joined the School of Economics, e) Accounting and Finance, based in Kozani, which joined the School of Economics, f) Organization and Business Administration, based in Grevena, which joined the School of Economics, g) Statistics and Insurance Science, based in Grevena, which joined the School of Economic Sciences, h) Economics, based in Kastoria, which joined the School of Economics, i) International and European Economic Studies, based in Kozani, which joined the School of Economics, j) Psychology, based in Florina, which joined the School of Social Sciences and Humanities, k) Communication and Digital Media, based in Kastoria, which joined the School of Social Sciences and Humanities, l) Midwifery, based in Ptolemaida, which joined the School of Health Sciences, m) Informatics, based in Kastoria, which joined the Faculty of Science, n) Mathematics, based in Kastoria, which joined the School of Positive Sciences, r) Agriculture, based in Florina, which joined the School of Agricultural Sciences, p) Occupational Therapy, based in Ptolemaida, which joined the School of Health Sciences. In addition, the Department of Environmental Engineering of the Polytechnic School was renamed the Department of Chemical Engineering, the Department of Information Technology and Telecommunications Engineering of the Polytechnic School was renamed the Department of Electrical and Computer Engineering, and the School of Education was renamed the School of Social Sciences and Humanities. Therefore, in its

new form, the University of Western Macedonia consists of 7 Schools and 22 Departments, located in various cities of the Region of Western Macedonia, specifically in Kozani, Ptolemaida, Grevena, Kastoria and Florina.

Administrative bodies of the University

■ University Board

A) Internal Members

1) Theodoulidis Theodoros
Professor of the Mechanical Engineering Department of the Polytechnic School of U.W.M.
2) Konteos Georgios
Professor of the Department of Organization and Business Administration of the Faculty of Economics of U.W.M.
3) George Iordanidis
Professor of the Pedagogical Department of Elementary Education of the School of Social Sciences & Humanities of the U.W.M.
4) Kalogiratou Zacharoula
Professor of the Mathematics Department of the Faculty of Science of U.W.M.
5) Melfou Aikaterini
Professor of the Department of Agriculture of the Faculty of Agricultural Sciences of U.W.M.
6) Bouzas Vassilios
Professor of the Department of Visual and Applied Arts of the School of Fine Arts of P.D.M.

B) External members

1) Leonidas Kyriakidis
Professor of the Department of Educational Sciences of the University of Cyprus
2) Mousouroulis Konstantinos
Economist, former executive of the European Commission
3) Mpessiu Maria
Professor and Dean of Research at Kühne Logistics University, Hamburg, German
4) Stavridou Nausika
Dr. Civil Engineer, National Expert at the European Research Council
5) Tasioulas Leandros
Professor of the Department of Electrical Engineering, Yale University, USA.

■ Rectoral Authorities

Rector
Theodoulidis Theodoros
Professor of the Mechanical Engineering Department of the Polytechnic School of U.W.M.

Vice Rector for Academic Affairs and Quality Assurance
Sariannidis Nikolaos
Professor of the Accounting and Finance Department of the School of Economics

Vice Rector for Research and Innovation
Maropoulos Stergios
Professor of the Mechanical Engineering Department of the Polytechnic School

Vice Rector for Administrative Affairs and Holistic Care
Spirtou Anna
Professor of the Pedagogical Department of Elementary Education of the School of Social Sciences and Humanities

Vice Rector of International Relations, Outreach and Lifelong Learning
Griva Eleni
Professor of the Pedagogical Department of Elementary Education of the School of Social Sciences and Humanities

■ University council

The University council consists of:
a) the Rector,
b) the Deans of Schools,
c) the Presidents of the Departments.
d) one (1) representative from each category of members of Special Educational Staff (S.E.S.), Laboratory Teaching Staff (L.T.S.), and Special Technical Laboratory Staff (S.T.L.S.) of the Higher Educational Institution (H.E.I.),
d) the student representatives at a rate of 10% of all the members of the University council in cases a) to c).

The Vice-Rectors have the right to participate in the meetings of the Senate, without the right to vote.

The University council is formed and operates legally even if the representatives of the students, the members of the S.E.S., L.T.S. and S.T.L.S. of H.E.I. have not been elected.

The School of Exact Sciences

According to the Law 4957/2022, each Higher Educational Institution (HEI) is structured by academic units of two (2) levels:
a) the Schools and
b) the Departments.

Each School is structured as a minimum of two (2) Departments, covers one (1) module of related scientific areas and ensures the interdisciplinary approach to teaching and research between its Departments. The Faculty is responsible for the supervision and coordination of the operation of the Departments and the educational and research work produced by them, in accordance with the internal regulations of the H.E.I. The School has separate governing bodies from the H.E.I. Exceptionally, it is possible to establish and operate a single-departmental School, if deemed necessary for the development and cultivation of the science that heals.

There are two departments at the Faculty of Exact Sciences of UWM:

- Informatics Department,
- Department of Mathematics.

Administrative bodies of the School

The School has the following govering bodies:
a) the Dean,
b) the Deanery

The **Deanery** consists of:
a) the dean of the School,
b) the presidents of School's Departments,
c) one (1) representative from each category of members of Special Educational Staff (S.E.S.), Laboratory Teaching Staff (L.T.S.), and Special Technical Laboratory Staff (S.T.L.S.) of the Higher Educational Institution (H.E.I.),
d) the student representatives at a rate of 10% of all the members of the Faculty General Assembly in cases a and b, who are selected among the student representatives at the Department Assemblies with a minimum representation of one (1) student per study cycle, provided that the Departments of the School organize study programs for all three cycles.

If the School has only two (2) Departments, the Deanery is composed of the Dean, the Chairs of the Departments, the Directors of the Departments and the representatives of the S.E.S., L.T.S. members. and S.T.L.S. and the students who are represented according to the previous paragraph.

The **Deanery of the School of Exact Sciences of U.W.M.** consists of the following:

- Doris Michael, Dean, Professor of the Department of Informatics
- Vergados Dimitrios, Chair of the Department of Informatics, Associate Professor of the Department of Informatics
- Bisbas Antonios, Chair of the Department of Mathematics, Professor of the Department of Electrical and Computer Engineering
- Aggelis Stylianos, member of S.T.L.S. of the Department of Informatics
- Dimitriadis Alexandros, student representative.

Athina Touliou, a permanent employee of the Administrative Finance category of the Secretariat of the Deanery of the Faculty of Arts, is appointed secretary of the General Assembly of the Faculty of Exact Sciences.

The Department of Mathematics

The aim of the Department's Study Program is to offer a modern course program covering the science of mathematics. The students of the department should have acquired the necessary scientific background to meet the needs of education and research.

As the only Department of Mathematics in Western Macedonia, its educational and research activity is also closely connected with the local community. As part of this action, the department works closely with the local branch of the Hellenic Mathematical Society, with the aim of the students' interaction with the mathematical community.

The mission of the Department

The subject of the Program is Mathematical Science, and it lasts 8 semesters. In particular, its aim is twofold. On the one hand, to properly train students who wish to teach Mathematics in Secondary Education, on the other hand, to properly train students who wish to continue their studies inside or outside Greece at a postgraduate/doctoral level and to engage in research in the field of of Mathematical Sciences, equipping them with the necessary knowledge and offering them the appropriate undergraduate background.

The mission of the Department is to cultivate and promote Mathematical Science with academic and applied teaching, research and search in a way that meets the demands of science and the real needs of modern society.

The above mission is completed as the Department provides, to its graduates, opportunities to access Master's Degrees as well as Doctoral Studies at Greek or international universities.

Learning Outcomes of the Undergraduate Study Program

With the completion of the Undergraduate Studies Program of the department, the graduates:

- ✓will have acquired a strong mathematical background,
- ✓will have acquired analytical, critical, creative and inductive thinking skills,
- ✓will have specialized in a field of mathematics such as Mathematical Analysis, Algebra, Geometry, Statistics & Operations Research, Computational Mathematics and Astronomy,
- ✓will be able to apply mathematical methods to solve science and technology problems,
- ✓will have acquired pedagogical knowledge so that they can be employed as teachers in secondary and post-secondary education,
- ✓will have developed knowledge acquisition skills to be able to continue their studies at postgraduate level.

Professional Rights of the Department

Graduates of the Department of Mathematics have the right to:

- ✓be appointed as mathematics teachers in secondary education branch PE-03.
- ✓participate in announcements of Hellenic entities for appointment to the Public Services and Local Authorities.

Administrative bodies of the Department

The composition of the administrative bodies of the Department of Mathematics is as follows:

President: Bisbas Antonios, Professor
Deputy President: Michalas Angelos, Professor
Members of the Provisional Assembly:

- Kalogiratou Zaharoula, Professor of the Department of Mathematics
- Bisbas Antonios, Professor of the Department of Electrical and Computer Engineering
- Michalas Angelos, Professor of the Department of Electrical and Computer Engineering
- Georgios Vassiliadis, Assistant Professor of the Department of Mathematics
- Marcellos Michael, Assistant Professor of the Department of Mathematics
- Georgios Psaradakis, Assistant Professor of the Department of Mathematics

Teachers of the Department

During the academic year 2023-24 the following will teach in the Department:

- Kalogiratou Zaharoula, Professor of the Department of Mathematics
- Monovasilis Theodoros, Professor of the Department of Economic Sciences
- Tsounis Nikolaos, Professor of the Department of Economic Sciences
- Sinatkas Ioannis, Professor of the Department of Informatics
- Georgios Vassiliadis, Assistant Professor of the Department of Mathematics
- Georgios Psaradakis, Assistant Professor of the Department of Mathematics
- Marcellos Michael, Assistant Professor of the Department of Mathematics
- Dritsaki Melina, Assistant Professor of the Department of Economic Sciences
- Tsitouras Antonis, Assistant Professor of the Department of Economic Sciences
- Dimokas Nikolaos, Assistant Professor of the Department of Informatics
- Fotiadis Dimitrios, Assistant Professor of the Department of Informatics
- Dimou Spyridon, Professor of Secondary Education, seconded to the Department of Mathematics
- Konstantinidis Georgios, Contractory Teacher of the Department of Mathematics
- Sereti Fotini, Contractory Teacher of the Department of Mathematics
- Xanthopoulos Anastasios, Contractory Teacher of the Department of Mathematics

Secretary of the Department

Natsi Christina
Secretary Tel. 2467440000, Fax 24670 87063
Address: University Campus of Kastoria, Fourka, Kastoria, 52100
E-mail: math@uowm.gr and website: https://math.uowm.gr

Committees of the Department and Representatives in the collective bodies of U.W.M.

The committees that are established and operate in the Department of Mathematics are the following:

- **Internal Assessment Team (IAG)**

1. Bisbas Antonios, Professor of the Department of Electrical and Computer Engineering, as president.
2. Vassiliadis Georgios, Assistant Professor of the Department of Mathematics, as a member.
3. Georgios Psaradakis, Assistant Professor of the Department of Mathematics, as a member.
4. Markellos Michael, Assistant Professor of the Department of Mathematics, as a member.
5. Paliouri Maria, student of the Department of Mathematics, as a member.

- **Seven-member Ranking Committee for Graduates of Higher Education**

1. Bisbas Antonios, Professor of the Department of Electrical and Computer Engineering, as president.
2. Kalogiratou Zaharoula, Professor of the Department of Mathematics, as a member.
3. Vassiliadis Georgios, Assistant Professor of the Department of Mathematics, as a member.
4. Psaradakis Georgios, Assistant Professor of the Department of Mathematics, as a member.
5. Monovasilis Theodoros, Professor, Department of Economic Sciences, as a member.
6. Tsounis Nikolaos, Professor of the Department of Economic Sciences, as a member.
7. Michalas Angelos, Professor of the Department of Electrical and Computer Engineering, as a member.

- **Responsible for the Department's Website**

Markopoulos Lazaros, S.T.L.S. of the Department of Economic Sciences.

Academic Advisor

For each first-year student, the Assembly of each Department assigns Academic Advisor duties to the Department's faculty members, no later than November 30 of each academic year. The number of first-year students is equally distributed among the faculty members and the selection is done randomly. A student's Academic Advisor remains the same until the completion of his/her studies. In case of absence of the Academic Advisor for a long period of time (e.g. educational leave, health problem, retirement), the Assembly assigns the students of this Advisor to another faculty member. Departments with fewer than 10 faculty members may appoint Academic Advisors from the temporary teaching staff (P.D. 407/80, academic scholarships). In case of non-renewal of the temporary teaching staff contract, the Assembly assigns the students to another Academic Advisor. Upon the entry into force of this, for former students, the Assembly of each Department assigns the duties of Academic Advisor to faculty members by random selection.

Regarding the admission of students with special diseases or other specialists categories (e.g. athletes, children of Greeks abroad, transferees, from qualifying exams), who are

registered later in the Departments, the process is repeated after the completion of these registrations. In exceptional cases and after a documented request of the student or the Academic Advisor, a new Academic Advisor may be appointed. The coordination of the Academic Advisors of each Department is done by him/her President of the Department.

Research project-Research Policy of the Department

The Department's perception of research does not differ from that of corresponding internal and external Departments and is summarized in: (a) production of new knowledge (research) and the transfer of this knowledge (teaching), (b) research aimed at the advancement of of mathematics for the benefit of society, (c) conducting research in conditions of transparency and academic freedom and any resulting results to be evaluated based on the applicable international criteria and made public to the scientific community, (d) research activity of the Department aimed at education and highlighting new researchers.

The teachers of the Department of Mathematics actively participate in the international research field by conducting research and presenting the results with presentations at International Scientific Conferences and with publications in International Scientific Journals with a referee system.

Lectures

During the first three years of the Department's operation, the students of the Department of Mathematics had the opportunity to attend seminars/lectures held at the Faculty of Exact Sciences. For example, we mention the following:

- **"Chaos and complexity: a new mathematical view of the world"**

Speaker: Dr. Tefkros Michaelidis, Mathematician, Author.(10/12/2021)

- "**Specific modeling of seismogenesis in Greece: Applications in seismic risk assessment"**

Speaker: Dr. Ourania Maggira, Mathematician, PhD in Statistical Seismology, Aristotle University of Thessaloniki. (17/01/2022)

- **“Number Theory: Its Development and Consolidation in Mathematical Science”**

Speaker: Fotini Sereti, Doctor of the Department of Mathematics of the University of Patras, Teacher in the Department of Mathematics of the University of Western Macedonia.(14/3/2022)

- **"The creation of our Solar System and an educational presentation of the assurance that we are indeed made of stardust (for children from 5 to 105 years old)"**

Speaker: Stavros Avgoloupis, Emeritus Professor of Astronomy at the Physics Department of the Aristotle University of Thessaloniki. (21/3/2022)

- **Seminar on: "Thoughtful Modeling"** (25/11/2022)

Speaker: Georgios Tsaklidis, Professor of the Mathematics Department of the University of Athens.

- “**The homogeneous discrete-time Markovian system with random capacities. Application to Queuing Study with Random Number of Servers”**

Speaker: Georgios Vassiliadis, Assistant Professor of the Department of Mathematics PDM.

- **"Hidden Homogeneous Markovian Systems - Representation with a state space model"**

Speaker: Lykou Rodi, External Associate of the Department of Mathematics P.D.M., Postdoctoral Researcher of the Department of Mathematics A.U.

- **“A Stochastic Extended Epidemiological Model for Predicting the Spread of Infectious Diseases. Application to the COVID-19 data in France”**

Speaker: Papageorgiou Vassilios, PhD Candidate, Department of Mathematics, A.U.Th.

- **"Equivalent Sets and problems of Dimension Theory in the Theory of Frames"**

Speaker: Georgiou Dimitrios, Professor of the Department of Mathematics, University of Patras. (8/12/2022)

- **“Why knot?”**

Speaker: Sophia Lampropoulou, Professor of the School of Applied Mathematics and Natural Sciences of the National Technical University of Athens. (12/5/2023).

During the Academic Year 2023-24, in collaboration with the local branch of the Hellenic Mathematical Society in Kastoria, the Department will organize Seminars/Lectures of general interest with the participation of both Faculty Members and collaborators of the Faculty of Exact Science of U.W.M. and other Universities .

Academic calendar of the academic year 2023-2024

Winter semester (13 weeks of lessons)	02/10/2023-22/12/2023 08/01/2024 -12/01/2024
Examination period of the winter semester (including the examination for degree students)	22/01/2024-09/02/2024
Spring semester (13 weeks of lessons)	19/02/2024-26/04/2024 13/05/2024-31/05/2024
Examination period of the spring semester (including the examination for degree students)	10/06/2024-28/06/2024
Repeat Examination period of September 2024	02/09/2024-27/09/2024

Note:

- After the end of the winter semester and before the start of the examination period there is 1 (one) empty week (15/01/2024-19/01/2024).
- After the examination period of the winter semester and before the start of the spring semester there is 1 (one) empty week (12/02/2024-16/02/2024).
- After the end of the spring semester and before the start of the examination period there is 1 (one) empty week (03/06/2024-07/06/2024).

HOLIDAYS

- National holiday: Saturday 28 October 2023
- Day of Liberation of the city of Kastoria: Saturday 11 November 2023
- Anniversary of the Polytechnic Uprising: Friday 17 November 2023
- Christmas Holidays: 23 December 2023 to 7 January 2024
- Three Hierarchs: Tuesday 30 January 30 2024
- Halloween Friday: 15 March 15 2024
- “Clean” Monday: 18 March 2024
- National holiday: Monday 25 March 2024
- Easter holidays: 27 April to 12 May 2024
- May Day

- Holy Spirit: 24 June 2024
- Student election day

Undergraduate Study Program

The studying at the Department of Mathematics lasts 8 semesters. The degree awarded is at the 6th qualification level of the National Qualifications Framework, the European Qualifications Framework for Lifelong Learning and the Qualifications Framework of the European Higher Education Area.

The studies in the first years are aimed at deepening the knowledge subject, as well as preparing the choice of direction in the third year. In the following the student can choose from a wide range of courses.

The compulsory courses of the study program are 20 and offer the basic methodological tools, knowledge and frame of reference of mathematical science. From the 3rd year of study, students can choose courses from a set of courses in order to shape their individual program study.

The first 4 semesters each have four compulsory courses. In the 5th and 6th semesters of study there are 2 compulsory courses and 3courses of choice to complete the required credits. In the 7th and 8th semesters of study, students choose 5 courses from the courses offered to complete the required credits.

In order to receive a degree, the student must simultaneously fulfill the following:

- have been successfully examined in all compulsory courses,
- be successfully examined in at least 36 courses (compulsory and choice) or 35 courses (compulsory and choice) and prepare a graduate thesis,
- have accumulated in each semester at least 30 credits (ECTS European Credit Transfer System),
- have accumulated a total of at least 240 credits (ECTS European Credit Transfer System).

Declaration of Courses

At the beginning of the semester, students fill out an electronic declaration containing the courses of the study program, which they wish to attend during the specific academic semester.

Students can register and attend courses offered in their semester of study or in a shorter semester. The maximum number of declared courses per semester is as follows:

1st - 2nd semester: four (4),
3rd - 4th semester: six (6),
5th - 6th semester: seven (7),
7th - 8th semester: eight (8),
greater than 8th semester: eight (8).

Examination is only done in a course that has been declared, according to the above, during the specific semester. Students who have not made an electronic declaration within the dates announced by the secretaryt, do not have the right to be examined in any course for the given semester.

Detailed information on how the Department operates is given in the Department's Operating Regulations available on the website.

Partial reform of the Undergraduate Study Program for the academic year 2023-2024

By the decision of the Temporary Assembly of the Department (15th/13-7-2023) which was approved by the Senate of the University of Western Macedonia in its Β2/Σ190/ 20-07-2023 meeting, for the academic year 2023-2024 the new Undergraduate Study Program holds. For students admitted during the academic years 2019-20 to 2022-23, the following transitional provisions are applied.

Transitional provisions

Students admitted during the academic years 2019-20 to 2022-23 who have not completed their studies, retain ECTS credits for all courses successfully taken. For the compulsory courses of the old study program that have not been successfully examined and are not present in the new one, they are replaced by the compulsory courses of the new study program. In addition, the following special transitional provisions are applied:

- Those who have successfully passed the Mathematical Modeling I course (old program, compulsory course of 5th semester) do not have the right to choose the Mathematical Modeling course (new program, course of choice of 8th semester).
- For those who had passed one of the courses Analytical Geometry I or Analytical Geometry II (old program), this course is assigned to the course Analytical Geometry (new program), the grade is transferred to the new course and they must pass the course Introduction to Computers (new program).
- Those who have passed the course Operational Research (course of choice of 6th semester, old program) and have not passed the course Mathematical Modeling I (compulsory course of 5th semester, old program), their grade is transferred to the course Operational Research (compulsory course of 5th semester, new program) and should choose another course of choice from the 6th semester offered courses.

Courses per semester

SEMESTER A

S/N	COMPULSORY COURSES	Th	Tu	To	ECTS
CC11	Infinite Calculus I	3	2	5	8
CC12	Linear Algebra I	2	2	4	7
CC13	Introduction to Computers	2	2	4	7
CC14	Fundamental Notions of Mathematics	3	2	5	8

SEMESTER B

S/N	COMPULSORY COURSES	Th	Tu	To	ECTS
CC21	Infinite Calculus II	3	2	5	8
CC22	Linear Algebra II	2	2	4	7
CC23	Analytic Geometry	3	2	5	7
CC24	Introduction to Programming	3	2	5	8

SEMESTER C

S/N	COMPULSORY COURSES	Th	Tu	To	ECTS
CC31	Infinite Calculus III	3	2	5	8
CC32	Introduction to Numerical Analysis	2	2	4	7
CC33	Ordinary Differential Equations	2	2	4	7
CC34	Propabilities I	3	2	5	8

SEMESTER D

S/N	COMPULSORY COURSES	Th	Tu	To	ECTS
CC41	Infinite Calculus IV	3	2	5	8
CC42	Real Analysis	3	2	5	7
CC43	Algebra I	3	2	5	8
CC44	Statistics I	3	2	5	7

SEMESTER E

S/N	COMPULSORY COURSES	Th	Tu	To	ECTS
CC51	Algebra II	3	2	5	8
CC52	Operational Research	2	2	4	7
S/N	**ELECTIVE COURSES**	**Th**	**Tu**	**To**	**ECTS**
CE51	Numerical Linear Algebra	4		4	5
CE52	Number Theory	4		4	5
CE53	Propabilities II	4		4	5
CE54	Classical Mechanics	4		4	5
CE55	Computer Programming with C	4		4	5
CE56	Fourier Analysis	4		4	5
CE57	Topology	4		4	5
CE58	Discrete Mathematics	4		4	5
CE59	Partial Differential Equations	4		4	5

SEMESTER F

S/N	COMPULSORY COURSES	Th	Tu	To	ECTS
CC61	Complex Analysis	5		5	8
CC62	Differential Geometry I	4		4	7
S/N	**ELECTIVE COURSES**	**Th**	**Tu**	**To**	**ECTS**
CE61	Numerical Solving of Differential Equations I	4		4	5
CE62	Stochastic Processes	4		4	5
CE63	Data Bases	4		4	5
CE64	Data Structures	4		4	5
CE65	Computational Statistics	4		4	5
CE66	Astronomy I	4		4	5
CE67	Measure Theory	4		4	5
CE68	Galois Theory	4		4	5
CE69	Combinational and Graph Theory	4		4	5
	Free Elective Course (Institutional Course Catalog)				

SEMESTER G					
S/N	**ELECTIVE COURSES**	**Th**	**Tu**	**To**	**ECTS**
CE71	Mathematical Physics	4		4	6
CE72	Numerical Solving of Differential Equations II	4		4	6
CE73	Mathematical Programming	4		4	6
CE74	Symbolic Programming Languages	4		4	6
CE75	Statistical Data Analysis	4		4	6
CE76	Set Theory	4		4	6
CE77	Differential Geometry II	4		4	6
CE78	Function Analysis	4		4	6
CE79	Artificial Intelligence	4		4	6
CE710	Special Math Subjects I	4		4	6
CE711	Theory of automata and formal languages	4		4	6
CE712	Econometrics	4		4	6
CE713	Introduction to Macroeconomic Theory	4		4	6
CE714	Astronomy II	4		4	6

SEMESTER H

S/N	ELECTIVE COURSES	Th	L	To	ECTS
CE81	Mathematical Modelling	4		4	6
CE82	Queuing Systems	4		4	6
CE83	Statistics II	4		4	6
CE84	Mathematical Logic	4		4	6
CE85	Operator Theory	4		4	6
CE86	Algebraic Geometry	4		4	6
CE87	Special Math Subjects II	4		4	6
CE88	Multimedia Technology	4		4	6
CE89	Computer Graphics	4		4	6
CE810	Digital Signal Processing	4		4	6
CE811	Time Series Analysis	4		4	6
CE812	Microeconomic Analysis	4		4	6
CE813	Celestial Mechanics	4		4	6
CE814	General Theory of Relativity	4		4	6
CE815	Graduate Thesis				12

Courses of choice from other Departments

Table 1 and Table 2 present courses of the study program offered by other Departments of the University of Western Macedonia (Department of Informatics, Department of Economic Sciences). From all of these courses, the student can choose a maximum of 4 courses.

Table 1. Elective courses from the Department of Informatics

1	Data Bases
2	Multimedia Technology
3	Computer Graphics
4	Digital Signal Processing

Table 2. Elective courses from the Department of Economic Sciences

1	Microeconomic Analysis
2	Introduction to Macroeconomic Theory
3	Econometrics
4	Time Series Analysis

Free elective course from the Institutional Course Catalog

Exclusively, only the students who will be admitted to the Department from the academic year 2023-2024 onwards, may choose, attend and be evaluated in courses of Undergraduate Studies Programs of other Departments of the University of Western Macedonia that are included in the institutional list.

The course of free choice that students can attend and evaluate and which in the new program of the Department will be included in the 6th semester with the same ECTS that appears in the institutional catalog is the following:

School	Department that offers the course	Course	Εξάμηνο	ECTS
Exact Sciences	Informatics	Topics of Numerical Analysis (Π-F-09)	6	6

Acquisition of Pedagogical-Teaching Sufficiency by active students

From the academic year 2021-2022, the students of the Department have started to be provided with a special study program that will grant Pedagogical and Teaching Sufficiency as follows:

A group of courses that will be offered as part of a special study program is added, which only active undergraduate students of the Department who wish to acquire Pedagogical and Teaching Sufficiency will have the right to attend.

The courses of the special study program for the acquisition of Pedagogical and Teaching Sufficiency will be offered free of charge to the active students of the Department and can be chosen in the 2nd, 3rd and 4th year of their study.

The certificate of Pedagogical and Teaching Sufficiency will be granted upon successful completion of the special study program for the acquisition of Pedagogical and Teaching Sufficiency and only when the student will have completed all his obligations to obtain the degree.

Graduates of the Department will not have the right to attend the special study program for the acquisition of Pedagogical and Teaching Sufficiency and they will not be granted a certificate of Pedagogical and Teaching Sufficiency.

The special study program for the acquisition of Pedagogical and Teaching Sufficiency will include the currently applicable study program of the Department and in addition the mandatory attendance and successful examination of the following courses which will not be taken into account in the formation of the degree grade:

S/N	Courses for the Pedagogical Sufficiency	Semester	Hours	ECTS
1	Introduction to Pedagogy	Winter	3	5
2	Educational Psychology	Spring	3	5
3	Teaching Methodology	Winter	3	5
4	Teaching of Mathematics	Spring	3	5
5	History of Mathematics	Winter	3	5
6	Practice	Spring	3	5

In order for students to have the right to declare Pedagogical Sufficiency courses, they must submit an application exclusively through the electronic secretariat at the link https://students.uowm.gr/login.asp and then in the Menu: Applications->New Application in the Subject field select Other and fill in the word PES and in the Notes field fill in the following text: *I request to join in the special study program for the acquisition of Pedagogical and Teaching Sufficiency.*

Note: According to the Law 4957/2022, the above program will not be offered after the academic year 2025-26. Therefore, those students who wish to complete the program should attend and be successfully examined in all the courses of the program by the end

of the academic year 2025-26.

Practice

Students who are in their 5th or upper semester of their study can carry out a practice program according to the conditions described in the Practice Program Regulations. The practice is optional as an elective course, does not count towards the degree, does not replace another course, is listed in the diploma annex and receives 3 ECTS.

Graduate Thesis

Students have the option of preparing a Graduate Thesis. The Graduate Thesis can be chosen as an elective course in the 8th semester of studies, according to the conditions described in the Graduate Thesis Regulations, and is equivalent to two elective courses (12 ECTS).

Certificate of computer knowledge

A certificate for the knowledge in the use of Computers (PC) is granted to graduates who have been successfully examined in at least 4 courses that are included in the area of Informatics and computer operation. By the decision of the Temporary Assembly of the Department of Mathematics, a certificate of computer knowledge and H/Y operation is granted to graduates of the Department who have successfully passed at least four of the following courses:

- Introduction to Algorithms and Programming (Old Program)
- Introduction to Numerical Analysis
- Numerical Linear Algebra
- Computer Programming with C
- Numerical Solving of Differential Equations I
- Data Bases
- Data Structures
- Computational Statistics
- Numerical Solving of Differential Equations II
- Multimedia Technology
- Graphics with Computers
- Digital Signal Processing
- Symbolic programming languages
- Introduction to Computers (New Program)
- Introduction to Programming (New Program)

Evaluation of students

Students are evaluated for their performance in each course throughout the academic year. The final grade in each course may consist of two parts: the first part, which evaluates the student's performance during the semester and the grade results from the grading of exercises, subjects or even from an intermediate written exam, at the discretion of the teacher, and the second part, which evaluates the student's performance in the final

exams of the course.

The final grade in each course is expressed on a scale of 0-10 using half a point (0.5). A grade of five (5) is the basis for success. The degree grade is calculated as the average of all the grades of the courses that meet the requirements for obtaining a degree, as declared by the student during his/her swearing-in application (if he/she has passed additional courses than those required to obtain the degree, he/she must reserve those he/she wishes for not count towards the average). The graduation grade is accompanied by a verbal designation according to its height: graduation grades from 8.51 to 10 are referred to as Excellent, grades from 6.51 to 8.50 are referred to as Very Good, and grades from 5.00 to 6 .50 are listed as Good.

Final exams are held exclusively after the end of the winter and spring semesters for the courses taught in those semesters. The student is entitled to be examined in the courses of both semesters (repeated examination in September) before the start of the winter semester. Special care is taken for the oral examination of students with proven health issues or with special needs following the procedure provided for in the Institution's Internal Regulations. Also, in some courses there is also an intermediate (optional) examination of the students.

The appropriate ways of evaluating students are: (a) written exam at the end of the semester, (b) progress (interim- optional exam), (c) homework and oral presentation - supporting the work, (d)) monitoring and execution of laboratory exercises. The grading method (weighting factors) in each course is determined by the teacher at the beginning of each semester and is announced to the students with the content of the course. The teacher may organize, when it is possible, oral exams (special cases).

Description of offered courses for the academic year 2023-2024

The courses per semester that will be taught during the academic year 2023-24 are described below.

Semester A

Course: Infinite Calculus I (Compulsory)
Teaching Hours (ECTS): 5 hours/week. (8)
Teacher: Psaradakis G.
Content of the course:
Natural and real numbers, the principle of mathematical induction, classical inequalities.
Sequences of real numbers: definition, monotonicity of sequence, bounded sequence, Cauchy sequence, convergence of sequence.
The meaning of series, basic properties of series, criteria for convergence.
Functions of a single real variable: limits, continuity, uniform continuity, differentation and reversibility.
Rules of differentation, intermediate value theorem, Bolzano theorem, Rolle theorem, Monotonicity, extreme values, convexity, asymptotes, graphs of functions.

Bibliography:

1. Spivak M, Differential and Integral Calculus, Crete Un. Press, 2010. (Greek)
2. Ntougias S, Calculus vol A, Leader Books, 2007. (Greek)
3. Apostol T, Differential and Integral Calculus, Atlantis Press, 2007. (Greek)

Course: Linear Algebra I (Compulsory)
Teaching Hours (ECTS): 4 hours/week (7)
Teacher: Dimou S.
Content of the course:
Matrices. Special types of matrices. Operations with matrices. Inverse matrix.
Calculation of the determinant of a square matrix, properties of determinants.
Linear systems of equations, the Gauss method of elimination.
Vector spaces, subspaces, linear span. Linear Independence and Dependence. Bases and dimension.
Linear transformations. Kernel, image, matrix of linear mapping
Isomorphic vector spaces.

Bibliography:

1. Linear Algebra, Theochari-Apostolidi Theodora, Charalambous Chara, Vavatsoulas Charilaos, Publications Tziola & Sons S.A. (2017). (Greek)
2. An Introduction to Linear Algebra, Varsos Dimitris, Deriziotis Dimitris, Emmanouil Giannis, Maliakas Michalis, Melas Antonis, Talelli Olympia, Publications Sophia (2012). (Greek)
3. Linear algebra, Donatos Georgios, Adam Maria., Publications G. Dardanos-K. Dardanos O.E. (2008). (Greek)
4. Linear Algebra and Applications, Gilbert Strang, Publications University Publications of Crete (2021). (Greek)
5. Introduction to Linear Algebra, Papistas Athanasios, Publications Tziola & Sons S.A. (2019). (Greek)

Course: Introduction to Computers (Compulsory)
Teaching Hours (ECTS): 4 hours/week (7)
Teacher: Fotiadis D.
Content of the course:
Basic notions, the meaning of information, calculations and auxiliary means, historical development of Computer Science, numbering systems, coding of information, introduction to algebra Boole and basic logic circuits, the computer hardware, description and analysis of various structural elements that make up a computer, computer peripherals, computer organization, computer arithmetic, processor structure and function, computer memory and its organization. Algorithms, programs and programming, operating systems, data processing, computer networks, internet, information systems and applications. In detail, the sections are:

- Introduction to numerical systems.
- Number representation and codes.
- Arithmetic on the computer.
- Boolean algebra, logic gates.
- Functional structure of computer, basic unit.
- Memory in the computer, memory organization, peripheral memory.
- Computer assembly.
- Peripheral devices.

Bibliography:

1. Garmpis Aristogiannis & Fotiadis Dimitrios. (2015). Introduction to Computers and Informatics. Publications Arakynthos. (Greek)
2. Evans, Alan, & Kendall, Martin & Poatsy, Mary Anne. (2018). Introduction to Informatics (2nd edition). Publications Kritiki S.A. (Greek)

Course: Fundamental Notions of Mathematics (Compulsory)
Teaching Hours (ECTS): 5 hours/week (8)
Teacher: Konstantinidis G.
Content of the course:
Elementary set theory. Union, intersection,. difference, symmetric difference of sets and related properties. Powerset and complement of a set, Cartesian product, set of sets. cover and partition of a set.
Relations and their properties. Composition of relations. Equivalencies, classes of equivalence. Orders. Bounds and bounded sets. Supremum, infimum. Well ordered sets.
Functions, basic concepts. One-to-one, onto, bijective functions. Inverse function. Composite function. Image and inverse image of a set through a function. Functions and ordered sets. Bounds. Monotonicity.
Elementary notions of propositional calculus. Logical operations. Tautologies.
Mathematical induction. Mathematical induction and well ordering. Full induction.
The sets of natural numbers and integers. Dividability. The set of of rational numbers. Construction of real numbers through Dedekind cuts. The set of of irrational numbers. Completeness theorem in the set of real numbers.
Complex numbers. Second degree equations in the set of complex numbers. Trigonometric form. Equation de Moivre. ν-th roots of a complex number. Fundamental Theorem of Algebra. Triangular inequality.

Bibliography:

1. Tsolomitis A., Sets and Numbers, Publications Leader Books, 2004. (Greek)

2. Tsamatos P., Fundamental Notions of Mathematical Analysis, Publications Tziola, 2009. (Greek)
3. Stewart I., Tall I., The Foundations of Mathematics, Oxford Univ. Press, 2015.

Semester B

Course: Infinite Calculus II (Compulsory)
Teaching Hours (ECTS): 5 hours/week (8)
Teacher: Contractor
Content of the course:
Factor and indefinite integral. Definition of indefinite integral, basic properties, integration by change of variable, integration by factors, integration of explicit functions, integration of basic types of functions.
Definite integral (Riemann integral). Definition, properties, integrability criteria, mean value theorem for definite integrals, inequalities between definite integrals, Fundamental Theorem of Infinite Calculus for computing definite integral, change of variable in definite integral. Applications of definite integrals. Calculation of the area of a region, the volume of a solid by rotation and the length of an arc.
Generalized integrals. Types of generalized integrals and their calculation, basic properties, convergence criteria of generalized integrals of non-negative functions (comparison criterion, limit criterion, etc.), absolute convergence of generalized integrals, change of variable in the generalized integral.

Bibliography:
1. THOMAS INFINITE CALCULUS, [George B. Thomas], Jr., Joel Hass, Christopher Heil, Maurice D. Weir. (Greek)
2. DIFFERENTIAL AND INTEGRAL CALCULUS, SPIVAK MICHAEL. (Greek)
3. General Mathematics - Infinite Calculus, volume I, Athanasiadis Ch. E. Giannakoulias E. Giotopoulos S. Ch. (Greek)
4. Infinite calculus, Briggs William, Cochran Lyle, Gillett Bernard. (Greek)
5. Mathematics I, Petrakis L. Andreas, Petraki A. Dorothea, Petrakis A. Leonidas. (Greek)

Course: Linear Algebra II (Compulsory)
Teaching Hours (ECTS): 4 hours/week (7)
Teacher: Contractor
Content of the course:
Eigenvalues. Eigenvectors. Eigenspaces. Diagonalization. Cayley-Hamilton theorem.
Euclidean spaces. Orthogonality. Gram-Schmidt normalization.
Orthogonal matrices.
Endomorphisms. Symmetric matrices. Spectral theorem.
Isometries. Quadratic forms. Main axes. Measure of a matrix.

Bibliography:
1. Papistas A., Introduction to Linear Algebra, Tziola Publications, 2019. (Greek)
2. Donatos G., Adam M., Linear Algebra, Gutenberg Publications, 2008. (Greek)
3. Theohari Th., et.al, Linear Algebra, Tziola Publications, 2017. (Greek)
4. Varsos D., et.al, An Introduction to Algebra, 3rd edition, Sofia Publications, 2020. (Greek)
5. Linear Algebra and Analytic Geometry, Mylonas N.-Papadopoulos V. (Greek)
6. Linear Algebra and Applications, Gilbert Strang Approach, Prentice Hall. (Greek)

Course: Analytic Geometry (Compulsory)
Teaching Hours (ECTS): 5 hours/week (7)
Teacher: Markellos M.
Content of the course:
Vector Calculus: Vectors and operations, linear independence, bases, coordinates, inner, outer, mixed and double outer product. Geometric Interpretation of the products. Coordinate systems in the plane and in space (general, orthonormal and polar). Coordinate system transformations.
Analytic geometry in space: Lines and planes in space (parametric equations, vector equation, Cartesian plane equation). Distance of a point from a line and plane. Relative positions of lines and planes in space.
Quadratic curves and surfaces in space.

Bibliography:

1. Ch. Stefanidis, Introduction to Geometry, Publications Ziti. (Greek)
2. Th. Chrisakis, Linear Algebra and Analytic Geometry, Publications Tsotras. (Greek)
3. D. Georgiou, S. Iliadis, Analytic Geometry with elements of Linear Algebra, Publications Tziola. (Greek)
4. Linear Algebra and Analytic Geometry, 2nd edition, Mylonas N.-Papadopoulos V. (Greek)
5. N. Kadianakis, S. Karanasios, Linear Algebra, Analytic Geometry and Applications, Publications Tsotras, 2017. (Greek)
6. A. Petrakis, D. Petrakis, L. Petrakis, Analytic Geometry with elements of matrix theory, Publications Thalis. (Greek)

Course: Introduction to Programming (Compulsory)
Teaching Hours (ECTS): 5 hours/week (8)
Teacher: Kalogiratou Z.
Content of the course:
Algorithmic problem solving and programming with MATLAB.
Basic concepts of computers and algorithms.
Computational representation of numbers.
Variables, operators/expressions, assignments, input/output.
Check and repeat commands.
Arrays and vectors and basic data structures. Search/Sort.
Introduction to LaTeX.

Bibliography:

1. Stormy Attaway, MATLAB: a practical introduction to programming and problem solving, Publications Kleidarithmos. (Greek)
2. Charles F. Van Loan & K-Y Daisy Fan, The MATLAB in the Computing Science and Technology, DA VINCI M.E.Π.E. (Greek)
3. D. Higham, N. Higham, Matlab Guide, SIAM.
4. Van Loan, Introduction to Scientific Computing, A Vector, Matrix Approach, Prentice Hall.

Semester C

Course: Infinite Calculus III (Compulsory)
Teaching Hours (ECTS): 5 hours/week (8)
Teacher: Markellos M.

Content of the course:
Calculus of many variables. Limits, Continuity, Partial derivatives and geometric interpretation. Formulas and theorems of partial derivatives. Extrema of functions of many variables. Limits of functions of several variables with constraints. The concept of Total Differential. Partial higher order derivatives. Distance of points, open and closed sets of R^n, boundary of a set.

Bibliography:

1. Vector Calculus, Jerrold E. Marsden, Anthony Tromba. (Greek)
2. THOMAS Infinite Calculus, [George B. Thomas], Jr., Joel Hass, Christopher Heil, Maurice D. Weir. (Greek)
3. W. Briggs, L. Cochran, B. Gillett, Infinite Calculus, Publications Kritiki. (Greek)
4. L. Tsitsas, Applied Vector Infinite Calculus, Publications Symmetria. (Greek)
5. Chatziafratis T, Calculus of Functions of Many Variables, Symmetria Press (Greek).
6. Mathematics II, Petrakis L. Andreas, Petraki A. Dorothea, Petrakis A. Leonidas. (Greek)

Course: Introduction to Numerical Analysis (Compulsory)
Teaching Hours (ECTS): 4 hours/week (7)
Teacher: Kalogiratou Z.
Content of the course:
Computer arithmetic. Polynomial interpolation. Lagrange interference. Difference theory. Divided and Finite Differences. Interference against Newton. Hermite interference.
Numerical derivation. Numerical integration. Simple and complex types of rectangle, trapezium, Simpson, 3/8. Custom numerical integration. Gaussian integration.
Numerical solution of non-linear equations. Bisection methods and regula falsi. Iterative fixed point methods, convergence. The Newton-Raphson method, the intersection method, the Halley method.
Numerical solution of Linear Systems: Direct methods (Gauss Elimination, LU factorization), Iterative methods (Jacobi, Gauss-Seidel).

Bibliography:

1. G. Papageorgiou, Ch. Tsitouras, Numerical Analysis with applications to MATLAB and MATHEMATICA, Publications Symeon. (Greek)
2. A. Petrakis, D. Petraki, L. Petrakis, Numerical Analysis, Publications THALIS. (Greek)
3. G. Avdelas, Th. Simos, Numerical Analysis, Publications Symeon. (Greek)
4. G.D. Akrivis-V.A. Dougalis, Introduction to numerical analysis, University Publications of Crete.
5. M.N. Vrachatis, Numerical Analysis, Publications Greek Letters. (Greek)
6. G.E. Forsythe, M.A.Malcolm, C.B. Moler, Numerical Analysis and software for mathematical computations, University Publications of Crete.
7. D. Higham, N. Higham, Matlab Guide, SIAM, 2000.
8. C.F. Van Loan, Introduction to Scientific Computing, A Vector, Matrix Approach, Prentice Hall.
9. G.A. Evans, Practical Numerical Analysis, Wiley.

Course: Ordinary Differential Equations (Compulsory)
Teaching Hours (ECTS): 4 hours/week (7)
Teacher: Dimou S.
Content of the course:

Classification of Ordinary Differential Equations (ODE). Separable variable ODE, homogeneous ODE. Complete ODE, Euler multipliers. 1st order linears, Bernoulli and Riccati ODE. Picard theorem. Linear ODE of order n>1 - Basic Theorems.
Solving linear homogeneous ODE with fixed coefficients. Methods of finding a solution of non-homogeneous ODE. Euler's ODE. Solving techniques for 2nd order linear ODE with non-constant coefficients. ODE systems.

Bibliography:

1. Differential Equations, Transformations and Complex Functions, Mylonas Nikos - Schinas Christos.Publications GIOLA & SONS S.A. (2015). (Greek)
2. Differential Equations, Kyventidis Thomas A. Publications ZITI (2012). (Greek)
3. Elementary Differential Equations and Boundary Value Problems, W.E. Boyce - R.C. Di Prima. Publications NATIONAL TECHNICAL UNIVERSITY OF ATHENS OE (2015). (Greek)
4. Introduction to Differential Equations, Logan David. LIBERAL BOOKS Publications (2014). (Greek)
5. Ordinary differential equations (2nd edition), Nikolaos Alikakos, Grigoris Kalogeropoulos. Publications SYCHRONI EDTOTIKI (2019). (Greek)

Course: Propabilities I (Compulsory)
Teaching Hours (ECTS): 5 hours/week (8)
Teacher: Vasiliadis G.
Content of the course:
Random phenomena. Sample space- event space- event operations. Classical probability definition, statistical regularity, geometric probability, axiomatic definition.
Conditional probability. Total probability theorem- Bayes formula, independence.
Basic combinatorial analysis, Permutations, Combinations. Stirling formula. Discrete and continuous random variables. Probability distribution function. Properties of probability distribution function. Functions of random variables.
Mean value, variance, standard deviation, moments, probability generating functions, moment generating functions.
Basic univariate discrete probability distributions (uniform, Bernoulli, binomial, geometric, hyper-geometric, Poisson, negative binomial).
Basic univariate continuous probability distributions (uniform, exponential, normal, Gamma).
Multi-dimensional random variables- multi-dimensional probability distributions.

Bibliography:

1. Kounias E. and Moysiadis P., Probability theory I , Ziti Publications 1995. (Greek)
2. Haralampidis C. A., Probability theory and applications, S. Athanasopoulos Publications, 2009. (Greek)
3. BASIC PRINCIPLES OF PROBABILITY THEORY, SHELDON ROSS, Publications KLEIDARITMOS 2011.
4. Introduction to Probability Theory and Applications, Koutras M., TSIOTRAS Publications ATH. 2018.

Semester D

Course: Infinite Calculus IV (Compulsory)
Teaching Hours (ECTS): 5 hours/week (8)
Teacher: Psaradakis G.
Content of the course:

Multiple Integrals: integration over closed rectangles, definition and examples. Integrality criteria, integral properties. Integration over measurable passages. Mean Value Theorem, Fubini's Theorem. Changing variables to integrals. Calculations in examples.
Curved Integrals: definition and first examples of integrals of the first and second kind. Properties. Vortex vector fields and gradient fields. Computation of potential as a circumscribed integral. Green's theorem. Calculations.
Surface Integrals: Surfaces and vertical vectors. Surface integrals of the first and second kind, definition and examples. Surface area and vector field flux. Gauss theorem and Stokes theorem. Calculations.

Bibliography:

1. Marsden J and Tromba A, Vector Calculus, Crete Un.Press. (Greek)
2. Thomas G, Finney R, Vector Calculus, Crete Un.Press. (Greek)

Course: Real Analysis (Compulsory)
Teaching Hours (ECTS): 5 hours/week (7)
Teacher: Contractor
Content of the course:
Basic notions of Set Theory: countable and non-countable sets, examples, the countability of the set of rational numbers and the non-countability of the set of real numbers.
Metric spaces: notions, examples, basic properties, topological notions, equivalent metrics.
Sequences: convergence and Cauchy sequences.
Continuous mappings in metric spaces: pointed (local) continuous mappings, continuous mapping in the whole space, properties, homeomorphisms, isometries.
Compete metric spaces: notion, basic properties, examples, theorems of fixed points, Cantor and Baire theorem, applications.
Compactness: notions (through open covers), basic properties, continuous mappings and compactness, characterizations of compactness through the Bolzano-Weierstrass property and the meaning of bounded set, finite (Cartesian) product of compact metric spaces.
Separable metric spaces.
Connectedness: Connected subsets of metric spaces, images through continuous mappings, characterizations of connected subsets of the set of real numbers.
Study of the main theorems and applications that are related to Real Analysis.

Bibliography:

1. D. Georgiou, S. Iliadis, General Topology, Publications Tziola, 2017 (Greek).
2. M. Anousis, A. Tsolomytis, V. Felouzis, Real Analysis, Publications Symmetria, 2014 (Greek).
3. W. Rudin, Principles of Mathematical Analysis, Second version, Publications LIBERAL BOOKS, 2014 (Greek).
4. S. Negrepontis, Th.. Zachariadis, N. Kalamidas, V. Farmaki, General Topology and Function Analysis, Publications Symmetria, 1997 (Greek).

Course: Algebra I (Compulsory)
Teaching Hours (ECTS): 5 hours/week (8)
Teacher: Contractor
Content of the course:
Set, subset, powerset, operations between sets, Cartesian product, equivalence relations, equivalence classes, partitions, quotient-set, order relations, functions, the notion of countable set and the set of real numbers as a non-countable set. Groups, subgroups, normal subgroups, symmetric groups, cycle groups, order of an element, homomorphisms

and isomorphisms, kernel and image of a homomorphism, basic theorems of isomorphism in Algebra. Rings and fields: notions and basic properties.

Bibliography:

1. John B. Fraleigh, Introduction to Algebra, University Publications Crete. (Greek)
2. Mark Antony Amstrong, Groups and Symmetry, Publications Leader Books. (Greek)
3. D. Georgiou, S. Iliadis, Set Theory, Second version, Publications Tziola, 2017. (Greek)
4. D. Stratigopoulos, Modern Algebra, Publications Symmetria, 1997. (Greek)
5. K. Kalfa, Axiomatic Set Theory, Publications Ziti, 1990.

Course: Statistics I (Compulsory)
Teaching Hours (ECTS): 5 hours/week (7)
Teacher: Vasiliadis G.
Content of the course:
Population, sample. Types of variables, frequency distribution, grouping data.
Graphs (bar charts, histograms, pie charts, stem and leaf plot, boxplot, time series chart, variance chart).
Measures of location and dispersion, calculations from simple or grouped frequency tables.
Use of R programming language for data representation.
Sampling distributions, distribution of random variable sums, the central limit theorem and its consequences in statistics.
Point and interval estimators, unbiasedness and efficiency. Unbiased minimum variance estimators, moment and maximum likelihood methods.
Confidence intervals and hypothesis testing for one and two samples (independent or paired) for the mean value and the variance. Confidence intervals and hypothesis tests for proportions. X^2 test (goodness of fit, independence and homogeneity).
Simple linear regression and correlation.
Non-parametric tests (runs test, randomization test, Kolmogorov-Smirnov test, Mann-Whitney test, Wilcoxon test, McNemar test, Kruskal-Wallis test, Friedman test, median test), Spearman correlation coefficient.

Bibliography:

1. Kolyva-Mahera F., Mpora-Senta E., Mpratsas H., Statistics, Ziti Publications, 2018 (Greek).
2. Papaioannou T., Loukas S. B., Introduction to Statistics, Stamouli Publications, 2002 (Greek).
3. Kounias E., Kolyva-Mahera F., Mpagiatis K., Mpora-Senta E.,Introduction to Statistics, Kyriakidis bros Publications, 2016 (Greek).
4. Damianou C., Koutras M., Introduction to Statistics, Vol. I, Tsiotras Athanasios Publications, 2021 (Greek).

Semester E

Course: Algebra II (Compulsory)
Teaching Hours (ECTS): 5 hours/week (8)
Teacher: Sereti F.
Content of the course:
Rings and fields, integral domains, homomorphisms-isomorphisms of rings. The body of fractions of an integral domain. Rings of polynomials. Analysis of polynomials over a field, reduced polynomials. First, maximal and main ideals. Quotient-Rings.

Extensions of fields and classical geometric constructions. Major rings and rings of unique analysis. Euclidean rings.

Bibliography:

1. Varsos Dimitrios A., Deriziotis Dimitrios I., Emmanuel Ioannis P., Maliakas Michael P. and Talelli Olympia P., An Introduction to Algebra, 3rd Edition, Sofia Publications, 2011.
2. Fraleigh John, Introduction to Algebra, ITE Publications - University Press of Crete, 2010.

Course: Operational Research (Compulsory)
Teaching Hours (ECTS): 4 hours/week (7)
Teacher: Vasiliadis G.
Content of the course:
Linear programming problem modelling. Basic notions of Linear Programming. Graphical solution of linear programming problems in the two-dimensional space. Graphical sensitivity analysis of the linear model. Simplex algorithm. Big M method. Duality theory. Sensitivity analysis. The transportation problem. The assignment problem.

Bibliography:

1. Vassiliou P. and Tsantas N., Introduction to operational research, Ziti publications, 2000 (Greek).
2. Koletsos I. and Stogiannis D., Operational Research, Symeon publications, Athens, 2021 (Greek).
3. Kounias S. and Fakinos D., Linear Programming, Ziti publications, Thessaloniki, 1999 (Greek).
4. Siskos G., Linear Programming, New Technologies Publications, Athens, 1998 (Greek).
5. Taha H., Operational research An introduction, Pearson, (10th ed), 2017.
6. Bertsimas D. and Tsitsiklis J. N., Introduction to Linear Optimization, Athena Scientific 1997.

Course: Number Theory (Elective)
Teaching Hours (ECTS): 4 hours/week (5)
Teacher: Contractor
Content of the course:
The notion of divisibility in the set of integers numbers, highest common factor and least common multiple, Euclidean division. Prime numbers, Fundamental Theorem of Arithmetic. Arithmetic modulo n. Diofantic equations. Numerical functions. Fermat and Euler Theorems. Polynomial and linear congruences. Quadratic residue, quadratic fields of numbers, solving quadratic congruences. Quadratic Reciprocity Law, symbols of Legendre and Jacobi.

Bibliography:

1. Deriziotis D., An introduction to Number Theory, Publications Sophia, second version, 2012 (Grrek).
2. Tsagaris P. G., Number Theory, Publications Symmetria, third version, 2010 (Greek).
3. Poulakis D. M., Number Theory, Publications Ziti, 1997 (Greek).
4. Tzanakis N.K., Fundamental Number Theory, Department of Mathematics, University of Crete, 2019 (Greek).

Course: Propabilities II (Elective)
Teaching Hours (ECTS): 4 hours/week (5)
Teacher: Contractor
Content of the course:
Axiomatic definition of probabilities. Definition of a random variable and a random vector. Probability distribution and density functions. Multi-dimensional random variables (discrete and continuous ones). Multi-dimensional distributions. Radon-Nikodym theorem. Useful multi-dimensional distributions. Properties of multi-dimensional random variables (multi-dimensional mean values, variance-covariance matrices etc.). Conditional probability distributions. Ordered random variables. Characteristic functions of multi-dimensional random variables. Moment and probability generating functions of multi-dimensional random variables. Applications of multi-dimensional random variables, Convergence of sequences of random variables- convergence classification. Limit Theorems (laws of large numbers, Central limit theorems etc.)

Bibliography:

1. Kounias E. and Kalpazidou S., Probabilities II Theory and Exercises, Ziti Publications 1991 (Greek).
2. Charalampidis C. A., Probability theory and applications, S. Athanasopoulos Publications, 2009 (Greek).
3. Sheldon R., A first course in probability, Pearson Prentice Hall.
4. Feller W. An Introduction to Probability Theory and its applications, Vol. 1, John Wiley & Sons Inc.

Course: Classical Mechanics (Elective)
Teaching Hours (ECTS): 4 hours/week (5)
Teacher: Contractor
Content of the course:
Newton's equation for point mass system, conservative forces, conservation laws (energy, angular momentum, linear momentum) and Galilean transformations. Elements of theory of variations. Lagrange Mechanics: Generalized positions and velocities, Lagrangian function and integral of action, D'Alembert's principle, Hamilton's principle, Euler-Lagrange equations.

Bibliography:

1. Modern Theoretical Mechanics, K. Tsiganos, Stamouli Publications. (Greek)
2. Theoretical Mechanics, Petros Ioannou, Theoharis Apostolatos, University of Athens Property Development and Management Company. (Greek)

Course: Computer Programming with C (Elective)
Teaching Hours (ECTS): 4 hours/week (5)
Teacher: Contractor
Content of the course:
Section 1: The basic structure of a program in C. Introduction to the development environment of Visual Studio 2019. Introduction to the concept of variables of various types and classes. Limits and capabilities of ready-made data types. Operations with variables.
Section 2: Creating new, complex data types. Accessing the variable fields of complex types. Location of fields and/or sub-fields in memory.
Section 3: Selection structures (if and switch), as well as a comparison between them.

Extensive examples of their use.
Section 4: Repetition structures (for, while, do-while), as well as a comparison between them. A summary description of them, with the aim of making the best choice for the student, depending on each case. Convert between them, as well as referencing the basic iteration loop.
Section 5: Introduction to functions, using their parameters for input and output, and the optional return value.
Section 6: Static (stack) and dynamic memory (heap). Pointer declaration, dynamic memory allocation for ready or complex types.
Section 7: Statically and dynamically declared 1, 2, 3, 4 and 5 dimensional arrays. Passing arrays to functions for input and output.
Section 8: Use appropriate recurrence structures and functions to solve various basic mathematical problems. Practical application of C programming to solve complex problems.
Section 9: Demonstration of the use of the material of the previous sections in iterative methods (Conjugate Gradient and Jacobi-Accelerated Preconditioned Conjugate Gradient) of solving large-scale numerical systems. Solving integrals with the trapezium method, matrix operations, problems limited by memory or processor. Accurate timing of the above. Examples of parallel code in math problems.
Section 10: Introduction to basic concepts of object oriented programming with C++.
Section 11: Standard functions.

Bibliography:

1. Cheng H. (2012) C for scientists and engineers. 1st Edition. Tziola Publications. (Greek)
2. Tan H and D' Orazio T. (2000) C for engineers. 1st Edition. Tziola Publications.(Greek)
3. Tselikis GS and Tselikas ND. (2016) C: From theory to practice. 3rd Edition. Publisher: Tselikis Georgios.(Greek)
4. Hanly Jeri R. and Koffman Elliot B. (2021) Principles and Techniques of Programming with the C Language. 1st Edition. Kritiki Publications S.A. (Greek)
5. Hatzigiannakis NM. (2017) The C language in depth. 5th Edition. Kleidaritmos S.A. Publications.(Greek)
6. Paul Deitel, Harvey Deitel. (2014) A Programmer's Guide to C. 1st Edition. Ch Giourda & Co Publications S.A. (Greek)
7. Abbey Deitel, Harvey Deitel. (2014) C Programming. 7th Edition. Ch Giourda & Co Publications SA. (Greek)
8. Karolidis Dimitrios A. (2021) Learn C easily. 2nd Edition. Pinelopi Xarhakou Publications. (Greek)

Course: Topology (Elective)
Teaching Hours (ECTS): 4 hours/week (5)
Teacher: Sereti F.
Content of the course:
Metric spaces: Notion of metric space, examples of metric spaces, basic notions of metric spaces such as open and closed sets, closure, interior and boundary of a set.
Topological spaces: Notion of topology and examples of topological spaces,basic notions of topological spaces like open and closed sets, closure, interior, boundary, subspace, base and subbase of topology.
Separation axioms: T_0-space, T_1-space, T_2-space (or Hausdorff space), regular spaces, completely regular spaces, normal spaces.
Mappings and Moore-Smoth sequences: Continuous mappings, homeomorphisms, open

and closed mappings, examples of mappings between topological spaces, Moore-Smith sequences.
Product of topological spaces: Product of finite and infinite family of topological spaces, properties of the product of topological spaces.
Compact topological spaces: The meaning of the compact topological space, examples of compact topological spaces, continuous mappings and compact topological spaces, local compact topological spaces, compactification.
Connected topological spaces: The meaning of the connected topological space, examples of connected topological spaces, continuous mappings and connected topological spaces, connected components, local connected topological spaces, path connected topological spaces.
Applications of Topology in branches of Mathematics.

Bibliography:

1. D. Georgiou, S. Iliadis, General Topology, Publications Tziola, 2017 (Greek).
2. S. Negrepontis, Th.. Zachariadis, N. Kalamidas, V. Farmaki, General Topology and Function Analysis, Publications Symmetria, 1997 (Greek).

Course: Partial Differential Equations (Elective)
Teaching Hours (ECTS): 4 hours/week (5)
Teacher: Psaradakis G.
Content of the course:
POE of first order, linear and almost-linear equations, Cauchy's problem, Monge cones-characteristic strips, Solving linear POE of α order with the method of transformations, total differential equations, Charpit method. Classification of second-order differential equations, normal forms, D' Alembert-type wave equation, propagation of discontinuities, wave reflections, separation of variables method, wave equation, diffusion equation, Laplace equation, initial and boundary value problems of Dirichlet, Neumann, Robin types, Fourier series, orthogonal functions, Sturm-Liouville eigenvalue problems, generalized functions or distributions, finding fundamental solutions with Fourier and Laplace transforms.

Bibliography:

1. Partial Differential Equations, Akrivis G., Alikakos N. (Greek)
2. Walter A. Strauss, Partial Differential Equations: An Introduction, 2nd edition, Wiley, 2008.

Semester F

Course: Complex Analysis (Compulsory)
Teaching Hours (ECTS): 5 hours/week (8)
Teacher: Contractor
Content of the course:
Complex plane and operations with complex numbers. N-th root, definition of exponential function and branches of logarithm. Topology of the complex plane (open, closed, coherent and simply coherent sets, sequences, series). Continuous and uniform functions. Complex integration: definition, Cauchy's theorem for triangles, Cauchy's formula for simple closed curves. Taylor expansion, calculus of integrals. Liouville theorem, maximum/minimum principles. Cauchy's formula on a ring. Laurent development. Theorem of integral balances, calculation of curves and real integrals.

Bibliography:

1. Negrepontis S, Theory of Functions of a Complex Variable, Symmetria Press (Greek).
2. Merkourakis S and Chatziafratis T, Introduction to Complex Analysis, Symmetria Press (Greek).
3. Marsden J, Hoffman M, Basic Complex Analysis, Symmetria Press (Greek).

Course: Differential Equations I (Compulsory)
Teaching Hours (ECTS): 4 hours/week (7)
Teacher: Markellos M.
Content of the course:
Curves in the plane and in space: tangent of a normal curve, arc length-physical parameter, accompanying Frenet trihedron, curvature and torsion, fundamental theorem of curves, the isoperimetric inequality.
Normal Surfaces: Complex Function Theorem and normal surfaces, tangent plane, first and second fundamental form, Gauss mapping, shape operator, vertical and mean curvature, principal curvatures, Gauss curvature, the "Marvelous" Theorem (Theorema Egregium).

Bibliography:
1. Barett O'Neil, Elementary Differential Geometry, Crete Un. Press (Greek).
2. Pressley A, Elementary Differential Geometry, Crete Un. Press (Greek).
3. Arvanitogeorgos A, Elementary Differential Geometry, e-book, Kallipos Repository (Greek).

Course: Numerical Solving of Differential Equations I (Elective)
Teaching Hours (ECTS): 4 hours/week (7)
Teacher: Kalogiratou Z.
Content of the course:
Numerical Solving of Differential Equations.
Introduction to the numerical solving of differential equations, the Euler, Heun, Numerov methods.
Single step methods. Runge-Kutta, Runge-Kutta-Nystrom methods.
Class conditions, method construction.
Adams-Multon Multistep Methods, Adams Bashforth.
Implementation with MATLAB.

Bibliography:
1. M.N. Vrachatis, Numerical Solution of Differential Equations, Greek Letters Publications. (Greek)

Course: Stochastic Processes (Elective)
Teaching Hours (ECTS): 4 hours/week (5)
Teacher: Contractor
Content of the course:
Introduction to Stochastic Processes, discrete-time Markov Chains, Chapman-Kolmogorov equations. Classification of states. Description of the evolution of a Markov Chain. Hitting time. Distributions of sojourn time. Asymptotic results, stationary distribution. Continuous-time Markov Chains. Poisson process and generalizations. Introduction to Queuing Theory.

Bibliography:
1. Vassiliou P.-C., Stochastic Methods in Operations research, Publications Ziti, 2000

(Greek).
2. Fakinos D., Stochastic models in Operations research: Theory and applications, Symmetria, 2007 (Greek).
3. Daras T. and Sypsas P., Stochastic processes, Theory and applications, Publications Ziti, 2003 (Greek).
4. Loulakis M., Stochastic processes, Hellenic Academic EBooks-“Kallipos” repository, 2016 (Greek).

Course: Data Bases (Elective)
Teaching Hours (ECTS): 4 hours/week (5)
Teacher: Dimokas N.
Content of the course:
Introduction to the basic concepts of data storage and management using DBMS (Data Base Management Systems).
Comparison of Relational Data Storage Model with traditional file organization.
Refer to database models.
Introduction to relational database systems.
Design relational databases applying the principles of the entity-relationship model.
The SQL relational language.
Relational algebra.

Bibliography:
1. Database Systems, Abraham Silberschatz, Henry F. Korth, S. Sudarshan, X. GKIOURDA & Co EE. (Greek)
2. Fundamentals of Database Systems, Elmasri Ramez, Navathe Shamkant B.
3. INTRODUCTION TO DATABASE SYSTEMS, VOLUME A DATE C. J., Kleidaritmos Publications.
4. Database System Concepts, Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill Science/Engineering/Math Publishing.

Course: Data Structures (Elective)
Teaching Hours (ECTS): 4 hours/week (5)
Teacher: Sinatkas I.
Content of the course:
Introduction to Data Structures Necessity-Usefulness.
The table structure. Evaluation of the array structure.
The structure of the Stack (Static and dynamic).
The structure of the Queue (Static and dynamic).
The structure of the Priority List and Queue.
The Linked List structure single & double.
The structure of the Tree. Binary Search Tree.
The structure of the red-black Tree. 2-3-4 Tree.
The structure of the Hash Table.
The Heap structure.
The structure of the Scripture.
The classification algorithms.
Recap and compare structures.

Bibliography:
1. Data Structures & Algorithms in Java, Lafore Robert EDITIONS CH. GKIOURDA & Co EE. (Greek)
2. Data structures, algorithms and C++ applications, Sahnii Sartaj PUBLICATIONS A.

TZIOLA & SONS S.A. (Greek)
3. Data structures, Bozanis Panagiotis D. EDITIONS A. TZIOLA & SONS S.A. (Greek)
4. Data structures & file organizations Ch. Koilias, Eleni Galiotou, Giorgos Mpardis, Publications of New Technologies. (Greek)
5. Data Structures and Algorithms with Object Oriented Design Patterns in C++, BrunoR. Preiss, Epist. Ed. Kostas Kontogiannis.
6. Data Structures and Algorithms in JAVA, Michael T. Goodrich, Roberto Tamassia.
7. Data Structures with C, Nikolaos Misyrlis.

Course: Computational Statistics (Elective)
Teaching Hours (ECTS): 4 hours/week (5)
Teacher: Contractor
Content of the course:
R language is used. Introduction to R software environment. Variables-data. Data base connections. Programming with R language. Descriptive Statistics. Graphical Methods for data presentation. Hypothesis testing by use of R. Simulations. Generations of random numbers from discrete and continuous probability distributions. Monte Carlo integration. Visualization of classical results of statistical inference through simulating samples (e.g. asymptotic normality of sample mean, (1-α)100% CI, significance and p-value of a statistical test).

Bibliography:
1. Ntzoufras I., Karlis D., Introduction to programming and statistical analysis with R, Hellenic Academi EBooks-"Kallipos" repository, 2015 (Greek). Available at: http://hdl.handle.net/11419/2601
2. Fouskakis D., Data analysis by use of R, Tsotras publications, 2013 (Greek).
3. Tsantas N., Moysiadis P. Mpagiatis K., Xantzipantelis T., Data analysis with the help of statistical software, Ziti publications, 1999 (Greek).

Course: Astronomy I (Elective)
Teaching Hours (ECTS): 4 hours/week (5)
Teacher: Contractor
Content of the course:
Basic concepts of Astronomy. Movements of the Earth-planets. Astronomical coordinate systems, Stellar magnitudes and distances. Elements of Spherical Trigonometry. Time (counting and calendars). Solar system. Kepler's Laws, N-body Problems in Dynamical Astronomy and especially in Celestial Mechanics. Problems of Dynamical Astronomy. Final stages: white dwarfs, neutron stars and black holes. Overview of the Sun. Solar system. Variable and idiosyncratic stars. Star groups and clusters. Interstellar matter. Our galaxy. The other galaxies. Cosmology.

Bibliography:
1. The universe that I loved, S. Theodosiou, Em. Danezis, Diavlos Publications. (Greek)
2. Astrophysics, Volumes I and II, F. Shu, Foundation for Technology and Research University Press of Crete. (Greek)

Course: Galois Theory (Elective)
Teaching Hours (ECTS): 4 hours/week (5)
Teacher: Contractor
Content of the course:
Rings, ideals, rings of polynomials, irreducible polynomials, Lemma of Gauss, criteria

of irreducible polynomials. Fields, extensions of fields, simple extensions, algebraic and transcendental extensions, constructions using ruler and compasses. Galois group, field of roots of polynomials, finite extensions and isomorphisms, Fundamental Theorem of Galois Theory. Cyclotomic polynomials, solvable groups, solving equations with radicals, regular polygons, Fundamental Theorem of Algebra.

Bibliography:

1. John B. Fraleigh, Introduction to Algebra, University Publications Crete (Greek).
2. Rotman J., Galois Theory, Publications Leader Books, 2000 (Greek).
3. Andreadakis S., Galois Theory, Publications Symmetria, 1999 (Greek).

Semester G

Course: Mathematical Physics (Elective)
Teaching Hours (ECTS): 4 hours/week (6)
Teacher: Contractor
Content of the course:
Basic introductory concepts in programming with symbolic programming languages. Basic operations and commands, functions, integrals, lists, diagrams. Introduction to Complex Analysis. Vector Spaces, Hilbert Spaces, Operators, Integral Transformations. Special Functions of Mathematics and Physics (Gamma function, Theta function, Zeta function). Differential Equations and their solution with a computer. Non-homogeneous Differential Equations. Green's method. Applications in Physics.

Bibliography:

1. Vergados J., Mathematical Methods of Physics, Vol. I, Crete University Press, 2004. (Greek)
2. Chow T., Mathematical Methods for Physicists: A concise introduction, Kleidarithmos Publications, 2018. (Greek)
3. Mathematical Methods of Physics, Volume A, Complex Functions, Fourier Analysis, S. Masen, M. Grypaios, Charalambos Publications Nik. Aivazis. (Greek)

Course: Numerical Solving of Differential Equations II (Elective)
Teaching Hours (ECTS): 4 hours/week (6)
Teachers: Kalogiratou Z. - Monovasilis Th.
Content of the course:
Numerical Solving of Differential Equations.
Single step methods. Runge-Kutta, Runge-Kutta-Nystrom, Partitioned Runge-Kutta methods. Butcher's theory: class conditions. trees, construction methods. Stability of methods.
Methods for solving problems with specific properties of the solution: exponentially and trigonometrically fitted methods, methods with minimum phase lag, with minimum magnification error.
Two-step hybrid methods, second derivative methods.
Implementation with MATLAB.

Bibliography:

1. M.N. Vrachatis, Numerical Solution of Differential Equations, Greek Letters Publications. (Greek)

Course: Mathematical Programming (Elective)
Teaching Hours (ECTS): 4 hours/week (6)

Teacher: Contractor

Content of the course:

Integer linear programming, integer programming problem modelling, integer programming algorithms, dynamic programming, deterministic path problems, equipment replacement, stochastic path problems, stochastic equipment replacement problems, the knapsack problem, the travelling salesperson problem.

Bibliography:

1. Vassiliou P.-C. G., Applied Mathematical Programming, Ziti Publications, 2001 (Greek).
2. Taha H., Operations research An introduction, Pearson, (10th ed), 2017.
3. Ypsilantis P. Operations research: Methods and techniques in decision making, Propompos publications, (5th ed), 2015 (Greek).

Course: Symbolic Programming Languages (Elective)

Teaching Hours (ECTS): 4 hours/week (6)

Teacher: Contractor

Content of the course:

An introduction to the use of informatics concepts suitable for presentations to junior high school students. Required laboratory course of a large number of compulsory courses. Introduction to systems of symbolic mathematical manipulations. The Mathematica language. Representation of symbolic mathematical expressions. Numerical calculations. Symbolic calculations. Symbolic manipulation of mathematical expressions. Basic functions. List and list manipulation. Functions, program flow control structures. Programming. Introduction to using additional packages. Create new packages. Study and didactic approach to the understanding of special topics from the areas of Algebra (expansion-factorization of expressions, simplification-transformation of expressions into equivalent simpler forms, tables, sets), Analysis (exact and numerical solutions of equations and systems of algebraic equations, differentiation, Taylor series, limits, integration, series) and Geometry (second order curves and surfaces, static and moving graphs). Use of other symbolic languages such as Maple, Reduce, Macsyma, Matlab. Comparison.

Bibliography:

1. Karampetakis Nikolaos, Stamatakis Stylianos, Psomopoulos Evangelos, 2004, Mathematics and Programming in Mathematica, Ziti Publications. (Greek)
2. Papadakis Konstantinos E., 2010, Introduction to Mathematica, Tziola Publications. (Greek)
3. Stefanos Trahanas, 2004, Mathematica and applications, University Press of Crete. (Greek)
4. N. Glynou, Introduction to symbolic calculations with Mathematica, Ioannina 2002. (Greek)
5. S. Trachanas, 2001, Mathematica and Applications: For Mathematicians, Physicists and Engineers, University Press of Crete. (Greek)
6. John W. Gray, 1997, Mastering Mathematica: Programming methods and applications, Academic Press.
7. R.J. Gaylord, S.N. Kamin and P.R. Wellin, 1993, Introduction to Programming with Mathematica, Springer-Verlag.
8. Roman Maeder, 1991, Programming in Mathematica, Addison-Wesley Publishing Co., Second Edition

Course: Statistical Data Analysis (Elective)

Teaching Hours (ECTS): 4 hours/week (6)
Teacher: Contractor
Content of the course:
In this course, the statistical theory developed in "Statistics I" is applied, with the help of the computer and the use of the statistical program SPSS. More specifically, it is applied to hypothesis testing concerning the mean value of a population, the mean values of two populations with dependent and independent samples, simple and multiple linear regression, as well as analysis of variance by one factor.

Bibliography:

1. Exploring Statistics Using IBM SPSS, Andy Field.
2. A GUIDE TO DATA ANALYSIS WITH IBM SPSS 19, MARIJA J. NORUSIS.

Course: Set Theory (Elective)
Teaching Hours (ECTS): 4 hours/week (6)
Teacher: Sereti F.
Content of the course:
Set, subset, powerset, operations between sets, like union and intersection, properties of these operations.
Equivalence relations, equivalence classes, order relations, functions.
Axiomatic Foundation of Set Theory by Zermelo-Fraenkel.
Foundation of natural, integers and rational numbers, operations between these numbers, the order relation on the sets of natural, integers and rational numbers.
Study of the set of real numbers through Dedekind cuts and Cauchy sequences of rational numbers, operations between these numbers, order relation on the set of real numbers.
Countable and non-countable sets.
Cardinal numbers, Cantor-Berstein theorem, operations between cardinal numbers, order between cardinal numbers, the continuum hypothesis.
Ordinal types and ordinal numbers, operations between ordinal types and ordinal numbers, order between them.
Important subsets of the set of real numbers, like the Cantor set, Borel sets and Baire sets.
Applications of Set Theory in branches of Mathematics.

Bibliography:

1. D. Georgiou, S. Iliadis, Set Theory, Publications Tziola, 2017 (Greek).
2. K. Kalfa, Axiomatic Set Theory, Publications Ziti, 1990 (Greek).

Course: Differential Geometry II (Elective)
Teaching Hours (ECTS): 4 hours/week (6)
Teacher: Markellos M.
Content of the course:
Maps, local coordinate systems and manifold atlases. Basic examples.
Differentiable mappings between manifolds, differential mapping.
Vector fields, parallel transport, reciprocal derivative.
Function of length, geodesic curves, definition and examples.
Gauss-Bonnet theorem.
Surfaces of constant curvature.

Bibliography:

1. Elementary Differential Geometry, Barrett O'Neil, University Press of Crete, 2005. (Greek)
2. Elementary Differential Geometry, A Pressley, University Press of Crete, 2011.

(Greek)
3. Elementary Differential Geometry, A. Arvanitogeorgos, Association of Greek Academic Libraries, 2015. (Greek)

Course: Artificial Intelligence (Elective)
Teaching Hours (ECTS): 4 hours/week (6)
Teacher: Contractor
Content of the course:
Basic concepts. Historical data. Representation of problems. Algorithms (blind and directed) search. Knowledge, knowledge representation (logic, structured rules). Alternative reasoning (with uncertainty, with ambiguity). Knowledge systems. Action planning. Autonomous programs (agents) and distributed informatic systems. Non-symbolic logic (genetic algorithms, neural networks). Applications (natural language processing, machine vision, robotics).

Bibliography:
1. Vlachavas I., Kefalas P., Vasiliadis N., Kokkoras F., Sakellariou H., Artificial Intelligence. (Greek)
2. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach. (Greek)

Course: Function Analysis (Elective)
Teaching Hours (ECTS): 4 hours/week (6)
Teacher: Contractor
Content of the course:
Spaces with norm. Basic topological notions (continuity of norm, open and closed sets, closure and interior, density of subspaces, separability, convergence of sequences), paying attention on interaction with linear structure. Completeness. Banach spaces and basic properties (completeness of closed subspaces, characterization trough series). Examples of non complete spaces with norm. Banach spaces (spaces of summable, convergent and bounded sequences, spaces of continuous functions) and basic properties (for example, separability and dense subspaces). Characterization of spaces with norm of finite dimension. Equivalence of norms. Riesz Lemma. Bounded and linear operators. Isomorphisms and isometries. Norm of operator. The space of bounded operators as a Banach space. Extension of bounded operators defined on dense subspace. Bounded linear functionals. The binary space as a Banach space. Comparison with the algebraic binary space. Comparison with the space of finite dimension.

Spaces with inner product. The notion of orthogonality. Rectangular complements. Hilbert spaces. Bounded and linear functionals on Hilbert spaces. The Riesz Representation Theorem. Orthonormal bases. Orthonormalization. Bessel inequality. Parseval identity. Abstract Fourier coefficients. The universality of the space $\ell 2(A)$. Hahn-Banach Theorem and some applications (determination of the norm of an element through functionals, separability of a space with separable binary, embedding on the second binary). Theorem of open mapping. Theorem of closed graph and Principle of uniform bound with some applications (pointwise convergence of sequences of bounded operators, inverse mapping theorem, equivalence of norms in Banach spaces).

Bibliography:
1. S. Negrepontis, Th.. Zachariadis, N. Kalamidas, V. Farmaki, General Topology and Function Analysis, Publications Symmetria, 1997 (Greek).
2. E. Kreyszig. *I*ntroductory Functional Analysis. Wiley, 1989.

3. G. F. Simmons. Introduction to Topology and Modern Analysis. Krieger Publishing Company, 2003.

Course: Econometrics (Elective)
Teaching Hours (ECTS): 4 hours/week (6)
Teacher: Dritsaki M.
Content of the course:
Econometrics as a subject is based on the sciences of Economics, Statistics and Mathematics. Its purpose is the measurement and empirical control of economic relationships. The course aims to familiarize students with the use of econometric techniques to estimate economic models using econometric software packages (eg E-Views).
Suggested course material:

- Introduction to econometrics.
- Single equation regression models.
  - Bi-variate regression model: Basic ideas, model estimation, the method of least squares (OLS), coefficient of determination.
  - Classical normal linear regression model (CNLRM).
  - Bi-variate regression: interval estimation and hypothesis testing.
  - Extensions of the Bi-variate Linear Regression Model.
  - Multiple regression analysis: The problem of estimation, The problem of induction.
  - The use of dummy variables.
- Violation of assumptions of the classical model and residual diagnostic tests.
  - Normality.
  - Multicollinearity.
  - Heteroscattering.

Autocorrelation.

Bibliography:

1. Gujarati D., (2012), Econometrics, Principles and Applications, A. TZIOLA & SONS PUBLICATIONS S.A. (Greek)
2. Dritsaki, Ch., and Dritsaki, M., (2013), Introduction to econometrics using EViews software, Publications KLEIDARITHMOS Ltd. (Greek)
3. Wooldridge J., (2011) Introduction to econometrics, A. PAPAZISIS PUBLICATIONS SOLE PRIVATE EQUITY COMPANY. (Greek)

Course: Introduction to Macroeconomic Theory (Elective)
Teaching Hours (ECTS): 4 hours/week (6)
Teacher: Tsitouras A.
Content of the course:

- Basic concepts of macroeconomics. The aims and means of macroeconomics.
- Measurement of economic activity: gross domestic product, real and nominal GDP, price indices and inflation.
- Consumption, income, and saving. The consumption and saving functions, the marginal propensity to consume and save. The determinants of investment. The demand function for investment.
- The basic model of the income multiplier. The determination of output, with saving and investment, determination of output from consumption and investment, analysis of the income multiplier model. Fiscal policy, in the multiplier model. How government fiscal policies affect output and the fiscal policy multiplier.
- Money and interest.

- The operation of the central bank.
- The total offer.
- Inflation and unemployment.
- Macroeconomic policies.

Bibliography:

1. Papadogonas Th., (2019), Introduction to Macroeconomic Analysis and Policy, Athens: Tsotras. (Greek)
2. Katseli Louka T., Magoula Chara M., (2005), Macroeconomic analysis and the Greek economy, Athens: Dardanos. (Greek)

Semester H

Course: Queuing Systems (Elective)
Teaching Hours (ECTS): 4 hours/week (6)
Teacher: Contractor
Content of the course:
Description of queuing systems, basic notions and general results. Simple Markov systems. M/M/1 system: System states, waiting time, busy periods, departure process. Other Markov Systems: M/M/m/k, M/M/∞/∞, Erlang systems, bulk queues. M/G/1 system: system states, waiting time, busy period. Applications for optimal decision making.

Bibliography:

1. Fakinos D., Stochastic Models in Operations Research: Theory and Applications, Symmetria, 2007 (Greek).
2. Hillier F. S. & Lieberman G. J. Introduction to operations research (7th ed.). McGraw-Hill, 2001.
3. Stafylopatis A.-G. Performance analysis of computational systems, Hellenic Academic Ebooks- "Kallipos" repository, 2016 (Greek).
4. Fakinos D., Queuing systems, Symmetria, 2008 (Greek).

Course: Statistics II (Elective)
Teaching Hours (ECTS): 4 hours/week (6)
Teacher: Contractor
Content of the course:
Estimation: Unbiased, efficient and consistent estimators. Exponential distribution family. Search for minimum variance estimators with Rao-Blackwell and Cramer-Rao methods. Estimation methods (maximum likelihood, moment method, Minimax and Bayes). Confidence Interval parameter estimates. Hypothesis testing: The fundamental Naymann-Pearson lemma. Simple and complex hypothesis testing, generalized likelihood ratio test.

Bibliography:

1. Iliopoulos G., Basic Methods of Parameter Estimation, Ath. Stamoulis Publications, 2006 (Greek).
2. Kourouklis S., Parametric statistical inference issues, Hellenic Academic EBooks- "Kallipos" repository, 2016 (Greek).
3. Papaioanou T. and Ferentinos K., Mathematical Statistics, Ath. Stamoulis Publications, 2000 (Greek).
4. Kolyva-Mahera F., Mathematical Statistics-Estimation, Ziti publications, 1998 (in Greek).

5. Kolyva-Mahera F. and Hatzopoulos S., Mathematical Statistics-Estimation, Hellenic Academic EBooks- “Kallipos” repository, 2016 (in Greek).
6. Rao, C. R. (2008). Linear Statistical Inference and its Applications, 2nd edition. Wiley Series on Probability and Statistics.
7. Rice, J. A.(1994). Mathematical Statistics and Data Analysis, 2nd edition. Duxbury Press.
8. Roussas, G. (2003). An Introduction to Probability and Statistical Inference. Academic Press. An imprint of Elsevier Science.

Course: Mathematical Logic (Elective)
Teaching Hours (ECTS): 4 hours/week (6)
Teacher: Contractor
Content of the course:

- The language of Propositional Logic, the truth values of propositions, corresponding truth-matrices, tautologies, contradictions, logic equivalence of propositions.
- Adequacy of logic connections, regular forms.
- Systems of typical proofs.
- Logic circuits, Algebra Boole.
- The language of Categorical Logic.
- The theorems of Compactness, Validity and Completeness in Categorical Logic.

Bibliography:

1. Margaris A. I., Introduction to Mathematical Logic, Publications Tziola, 2017 (Greek).
2. Tzouvaras Ath., Elements of Mathematical Logic, Publications Ziti, 1998 (Greek).
3. Georgiou D., Iliadis S., Set Theory, second edition, Publications Tziola, 2017 (Greek).
4. Cornelia Kalfa, Axiomatic Set Theory, Zetis Publications, 1990.
5. Enderton Herbert B., A Mathematical introduction to Logic, University Publications Crete, 2013 (Greek).

Course: Algebraic Geometry (Elective)
Teaching Hours (ECTS): 4 hours/week (6)
Teacher: Contractor
Content of the course:
Affine algebraic sets, the Zariski topology, ideals of affine algebraic sets.
Reducible affine algebraic sets, the resolution of an affine algebraic set into reduced affine algebraic sets.
Radical ideals, the Nullstellensatz theorem.
The projective space and the projective subspace, relations between affine and projective spaces, projective algebraic sets, ideals of projective algebraic sets.
Normal representations, coordinate rings.
Dimension of algebraic sets.
Affine, algebraic and projective varieties, the concept of dimension in affine varieties.
Tangent space and smooth points.
Bezout's Theorem and its applications.
Curves, degree and genus of projective curves.
The Riemann-Roch Theorem and its applications.

Bibliography:

1. Poulakis D., Algebraic Geometry, Ziti Publications, 2018. (Greek)
2. Perrin D., Algebraic Geometry, An introduction, Springer, 2008.

3. Shafarevich, Igor R., Basic algebraic geometry 1, Varieties in Projective Space, Springer, 2013

Course: Multimedia Technology (Elective)
Teaching Hours (ECTS): 4 hours/week (6)
Teacher: Contractor
Content of the course:
The course is an introduction to methods, tools and techniques for creating and manipulating multimedia content (text, hypertext, voice, sound, graphics, images and video), for content retrieval and for multimedia communications. It includes issues of algorithms, standards, and protocols underlying multimedia signal and multimedia information handling techniques and multimedia communications. It focuses on presenting the concepts and characteristics of multimedia systems, describes the media that make up multimedia applications, analyzes theories and techniques for transforming media into a digital format suitable for processing, and finally lists requirements and techniques for transitioning multimedia applications to the Internet. Subsequently, methodologies for designing, developing, and implementing multimedia applications, including digital games, are taught. Through laboratory exercises and practical exercises, as well as team work, the concepts of theory are applied in practice, which cover the material extensively.

Bibliography:
1. Multimedia Use and Programming, 3rd Edition, Yue-Ling Wong, Gkiourda Publications, Athens, 2018. (Greek)
2. Multimedia Technology: Modern Multimedia Tools, G. Styliaras, V. Dimou, D. Zeugolis, Tziola Publications, Thessaloniki, 2019. (Greek)
3. Multimedia Analytical Guide, 8th Edition, Tay Vaughan, Gkiourda Publications, Athens, 2012. (Greek)
4. Multimedia Systems, Algorithms, Standards & Applications, Parag Havaldar & Gerard Medioni, Broken Hill Publishers LTD, Nicosia, 2012.
5. Multimedia Technology: Theory and Practice, S.N. Dimitriadis, A.S. Pomportsis & E.G. Triantaphyllou, Tziola Publications, Thessaloniki, 2004. (Greek)
6. Multimedia Technology and Multimedia Communications, G.B. Xylomenos & G.K. Polyzos, Kleidarithmos Publications, Athens, 2009. (Greek)
7. Multimedia Technologies: Theory, Hardware, Software, F. Lazarinis, Kleidarithmos Publications, Athens, 2007. (Greek)

Course: Computer Graphics (Elective)
Teaching Hours (ECTS): 4 hours/week (6)
Teacher: Contractor
Content of the course:
The course presents fundamental concepts of graphics, both for 2 and 3 dimensions. Basic concepts of linear algebra and computational geometry are covered for modeling objects in 2D or 3D space. There is an extensive description of the techniques of applying basic transformations, as well as calculating the necessary elements for lighting and determining the visibility of objects. Lighting models are covered, combined with the visible surfaces. The various views used in practice are analyzed. Photorealistic rendering techniques are introduced, which are used both in motion graphics and now in original real-time form. In this context the concept of energy transfer in space is covered.

Bibliography:
1. Hearn D and Baker MP. 2018. Computer Graphics with OpenGL. 3rd Improved

Edition. Greece, Tziola Publications.
2. Akenine-Möller T, Haines E, Hoffman N. 2018. Real-Time Rendering. 4th ed. USA, A K Peters/CRC Press.
3. Hughes JF, van Dam A, McGuire M, Sklar DF, Foley JD, Feiner SK and Akeley K. 2013. Computer Graphics: Principles and Practice. 3rd ed. USA, Addison-Wesley.
4. Lengyel E. 2011. Mathematics for 3D Game Programming and Computer Graphics. 3rd ed. USA, Cengage Learning PTR.
5. Dunn F and Parberry I. 2011. 3D Math for Game Development. 2nd ed. USA, A K Peters/CRC Press.
6. Kessenich J, Sellers G and Shreiner D. 2016. OpenGL Programming Guide: The Official Guide to Learning OpenGL, Version 4.5 with SPIR-V. USA, Addison-Wesley.
7. Luna FD. 2016. 3D Game Programming with DirectX 12. USA, Mercury Learning & Information.
8. Haines E and Akenine-Möller T. 2019. Ray Tracing Gems: High-Quality and Real-Time Rendering with DXR and Other APIs. USA, APress.
9. Pharr M, Humphreys G and Jakob W. 2016. Physically Based Rendering: From Theory to Implementation. 3rd ed. USA, Morgan Kaufmann Publishers Inc.
10. Nystrom R. 2014. Game programming patterns. UK, Genever Benning.

Course: Digital Signal Processing (Elective)
Teaching Hours (ECTS): 4 hours/week (6)
Teacher: Contractor
Content of the course:

- Introduction to Signals.
- Digital signal processing tools.
- Fourier series and Fourier transform.
- Discrete time systems.
- System response-convolution.
- Sampling of Continuous Time signals.
- The Shannon-Nyquist Sampling Theorem.
- Discrete Fourier Transformation.
- Fast Fourier Transformation.
- Laplace transformation.
- Z transformation.
- Analog Filters.
- Digital Filters.

Bibliography:

1. Digital Signal Processing, Antoniou, A. Publications TZIOLA & SONS S.A. (Greek)
2. Digital Signal Analysis, Proakis J, Manolakis D. Ion Publications. (Greek)
3. Digital Signal Processing, A computer-based approach S.K. Mitra McGraw-Hill.
4. Theory and problems in digital signal processing, Monson H. Hayes Tziola Publications. (Greek)
5. Introduction to the theory of signals and systems, Theodoridis S. Berberidis K., Typothito Publications, Athens 2003. (Greek)
6. Introduction to digital signal processing Kogias, G. Synchroni Ekdtotiki 2010. (Greek)
7. Digital signal processing, Basic concepts and applications, Fotopoulos, Spyros Publisher Inspiration S.A. 2010. (Greek)
8. Signal Modulation and Transmission, Kottis P., Tziolas Publications, Thessaloniki 2008. (Greek)

Course: Time Series Analysis (Elective)
Teaching Hours (ECTS): 4 hours/week (6)
Teacher: Contractor
Content of the course:
This course focuses on time series analysis that constitute one of the important data types used in empirical analysis. The course aims to familiarize students in the Department of Economics with substantial statistical notions as well as the use of appropriate econometric techniques for the development of time series prediction models, by use of econometric software packages (e.g. E-views).
Suggested teaching sections:

- Introduction to time series
- Stochastic time series models and basic notions
- Autoregressive Models (AR)
- Moving Average Models (MA)
- ARMA Models
- ARIMA Models
- Diagnostic tests and model selection criteria
- Forecasting
- ARCH-GARCH models

Bibliography:

1. Dimeli S., Modern methods of time series analysis, AUEB Property Management & Development S.A., 2013. (Greek)
2. Asteriou D., Stephen H. Applied Econometrics, Propompos publications, Kimeris K. Thomas, 2018. (Greek)
3. Gujarati D., Basic econometrics, McGraw-Hill Higher Education 2003.

Course: Microeconomic Analysis (Elective)
Teaching Hours (ECTS): 4 hours/week (6)
Teacher: Tsounis N.
Content of the course:
Introduction-The Economic Problem. Consumer Theory: Consumer Behaviour, Consumer Equilibrium, Income and Substitution Effects-Slutsky's equation, consumer surplus, the demand curve. Production Theory: Production functions, production in the short run, break even cost curves, profit maximization of the firm, returns to scale, economies of scale, production in the long run. Cost theory: nature of cost, short-run and long-run cost curves and their relationships, cost minimization, business expansion path, sweet spot. Market Forms: perfect competition (competitive firm equilibrium, Pareto optimal and welfare analysis), monopoly (concept of Monopoly Power or Market Power, Natural Monopolies, Barriers to Entry, Price Discrimination, Social Welfare Losses due to Monopoly Power). Comparing perfect competition and monopoly in terms of social welfare.

Bibliography:

1. Polychronopoulos G., Tsounis. N. (2019) Microeconomic Analysis, Athens: Benou Publications. (Greek)
2. Pseiridou, A., Lianos, Th., 2015. Economic analysis & policy - Microeconomics. [elec. bibl.] Athens: Association of Greek Academic Libraries. (Greek)
3. Varian, H., (2011). Intermediate Micro-Economics, London: Norton.

Courses of the special study program for the acqusition of

Pedagogical and Teaching Sufficiency

Course: Introduction to Pedagogy
Teaching Hours (ECTS): 3 hours/week (5)
Teacher: Xanthopoulos A.
Content of the course:

- Clarification of basic pedagogical concepts.
- Aims, means and factors of treatment.
- Pedagogy as a Science (object, utility, scientific foundation).
- Research in Pedagogical Science.
- From Pedagogy to the Sciences of Education.
- Branches and modern trends of the Sciences of Education.
- Overview of the main pedagogical and educational currents from the 18th century to the middle of the 20th century.
- The pedagogical and educational currents during the second half of the 20th century: presentation and critical analysis.
- Modern developments (globalization, knowledge society, multiculturalism, European integration).
- Aspects and conditions of education: Aims and Objectives, School Institution, Educational Institution, Programs and Contents, Methods and Techniques, Evaluation, School place and Time, Relationship of School, Family, Society, Pedagogical Science and Learning.
- The Educational Practice: Fundamental Principles, Educational Relations, The Course, The School Textbooks-The Educational Material and the Pedagogy of Information. Modern Pedagogical Orientations and Applications.
- The role of the school and teachers in the modern era.
- Presentation of projects.

Bibliography:

1. Passias G., Flouris G. & Foteinos D. (2015). Pedagogy and Education. Athens: Publication Grigori. (Greek)
2. Androusou, A. & Tsafos, B. (2020). Educational Sciences: A dynamic interdisciplinary field. Athens: Gutenberg Publications. (Greek)
3. Brettos, I. (2005). Theories of Education, volume A. Athens: Gutenberg Publications. (Greek)
4. Krivas, S. (2002). Pedagogical science. Athens: Gutenberg Publications. (Greek)
5. Mialaret, G. (2002). Introduction to Educational Sciences. Athens: Typothito. (Greek)
6. Pyrgiotakis, I. (2011). Introduction to educational science. Athens: Publications Pedio. (Greek)

Course: Teaching Methodology
Teaching Hours (ECTS): 3 hours/week (5)
Teacher: Xanthopoulos A.
Content of the course:

- Teaching section.
- Analytical Programs.
- Social forms of teaching (face-to-face, cooperative, in groups of two, individualized).
- Design, organization and realization of teaching. Lesson plan. Teaching principles.
- Pedagogical relationship - pedagogical atmosphere - pedagogical interaction.

- The Analytical Program: definitions, approaches, development models.
- The goal-directed development model of Analytical Programs-The process model.
- The official and the False Analytical Program (or paraprogram).
- The teacher and the Analytical Program - The teacher as a reflective professional - Professional learning communities.
- Teaching Methods.
- The interdisciplinary approach to knowledge-Interdisciplinary Analytical Programs.
- Teaching Methods (continued) - Applications.
- Interdisciplinary and interdisciplinary approach to teaching.
- Teaching focused on the acquisition of knowledge, the cultivation of abilities and skills, the building of metacognition.
- Assessment in education.

Bibliography:

1. Kapsalis, A. & Nima, E. (2015). Modern Teaching. Athens: published by Kyriakidis. (Greek)
2. Katsarou, E. (2016). Educational research-action. Athens: Publications Kritiki. (Greek)
3. Matsangouras, H. (2011). Theory & Practice of Teaching (unified). Athens: Gutenberg. (Greek)
4. Bagakis, G. (2004). The teacher and the syllabus. Athens: Metaichmio. (Greek)
5. Passias G., Flouris G. & Foteinos D. (2015). Pedagogy and Education. Athens: Publications Grigori. (Greek)
6. Frydaki, E. (2009). Teaching at the intersection of modern and postmodern thought. Athens: Kritiki Publications S.A. (Greek)

Course: Educational Psychology
Teaching Hours (ECTS): 3 hours/week (5)
Teacher: Contractor
Content of the course:
Psychopedagogy-Educational Psychology: Key Notions, Definitions. Theories of Cognitive Development and Intelligence. Application of Psychology in Teaching. Theories of Development. Age Characteristics. Behavioral Theory of Learning. Distinguished Teachers. Socio-cultural Educational Factors. Learning motivations. Concepts of Self-perception, Self-esteem and their dimensions. Communication skills. The class as a group/social whole. Programs to improve interpersonal relationships. Psychopedagogical tools. Elements of social development of students in education.

Bibliography:

1. Eggen P. & Kauchak D. (2017). Educational psychology. New horizons in learning and teaching. Athens: Kritiki. (Greek)
2. Costaridou-Euklidis, A. (2011). Motivation in education. Athens: Pedio Fragos, Ch. (1984). Psychopedagogy. Athens: Gutenberg. (Greek)
3. Fragkos Ch. (1984). Psychopedagogy. Athens: Gutenberg. (Greek)
4. Elliot, S., Kratochwill, T., Littlefield-Cook, J., & Traver, J. (2008). Educational psychology. Athens: Gutenberg. (Greek)
5. Foulin, J.-N., & Mouchon, S. (2002). Educational psychology. Athens: Metaichmio. (Greek)
6. Woolfolk, A. (2007). Educational psychology. Athens: Greek.

Course: History of Mathematics
Teaching Hours (ECTS): 3 hours/week (5)

Teacher: Contractor

Content of the course:

The course concerns the evolution of Mathematics from antiquity to the 19th century with a special emphasis on the evolution of both Algebra and Geometry. In this effort the following sections will be covered: Egyptian and Babylonian mathematics, the famous problems of ancient Greek mathematics, Euclid's "Elements", the role of Euclid's "5th axiom" in Euclidean Geometry and the connection with the "discovery" of Hyperbolic Geometry in the 19th century and the axiomatic foundation of Geometries by Hilbert. Reference will also be made to the work of Archimedes and its connection with integral Calculus. We will also study elements from the History of Number Theory, the search for prime numbers and their utility in problems of our time (see cryptography), the solution of the third and forth degree polynomial equation, and the unsolvability of the fifth degree polynomial equation.

Bibliography:

1. HISTORY OF MATHEMATICS. AN INTRODUCTION, V. Katz, University Publications of Crete. (Greek)
2. THE HISTORY OF MATHEMATICS, Carl B. Boyer; Uta C. Merzbach, Pnevmatikos G. A. Publications. (Greek)
3. A BRIEF HISTORY OF MATHEMATICS, Dirk Struik, Daedalos Publications. (Greek)
4. THE MATHEMATICS (volumes I,II), E.T. Bell, University Publications of Crete. (Greek)

Course: Teaching of Mathematics

Teaching Hours (ECTS): 3 hours/week (5)

Teacher: Contractor

Content of the course:

Theories of learning and teaching Mathematics. Solving and creating mathematical problems (suggestions by G. Polya and A. Schoenfeld and younger researchers). Mathematical Proof (practice of using counterexamples to answer true-false questions, technique-method of a contradiction, method of proof of mathematical induction). Topics from the teaching of Algebra and Geometry (particular emphasis on elementary geometric constructions and their teaching feasibility as well as the use of geometric tools in solving geometric problems). Teaching topics of elementary Differential and Integral Calculus. Using electronic tools for teaching in the classroom. Topics from the History of Mathematics that help the teaching of Algebra, Geometry and Analysis.

Bibliography:

1. PROBLEM SOLVING IN MATHEMATICS. THE PROCESS OF THOUGHT WHEN SEARCHING FOR THE SOLUTION. Mamona Ioanna & Papadopoulos Ioannis (2017) . Pan. Publications of Crete. (Greek)
2. THE TEACHING OF EUCLIDEAN GEOMETRY. Thomaidis Ioannis & Poulos Andreas (2003). ZITI Publications, Thessaloniki. (Greek)
3. CONTEMPORARY TEACHING OF MATHEMATICS AND USE OF TPE IN HIGH SCHOOL AND HIGH SCHOOL. Collective project (2021). Grigoris Publications. (Greek)
4. TEACHING MATHEMATICS: TOWARD A SOUND ALTERNATIVE. Brent Davis (1996). Routledge.

Course: Practice

ECTS: 3

Teacher: Contractor

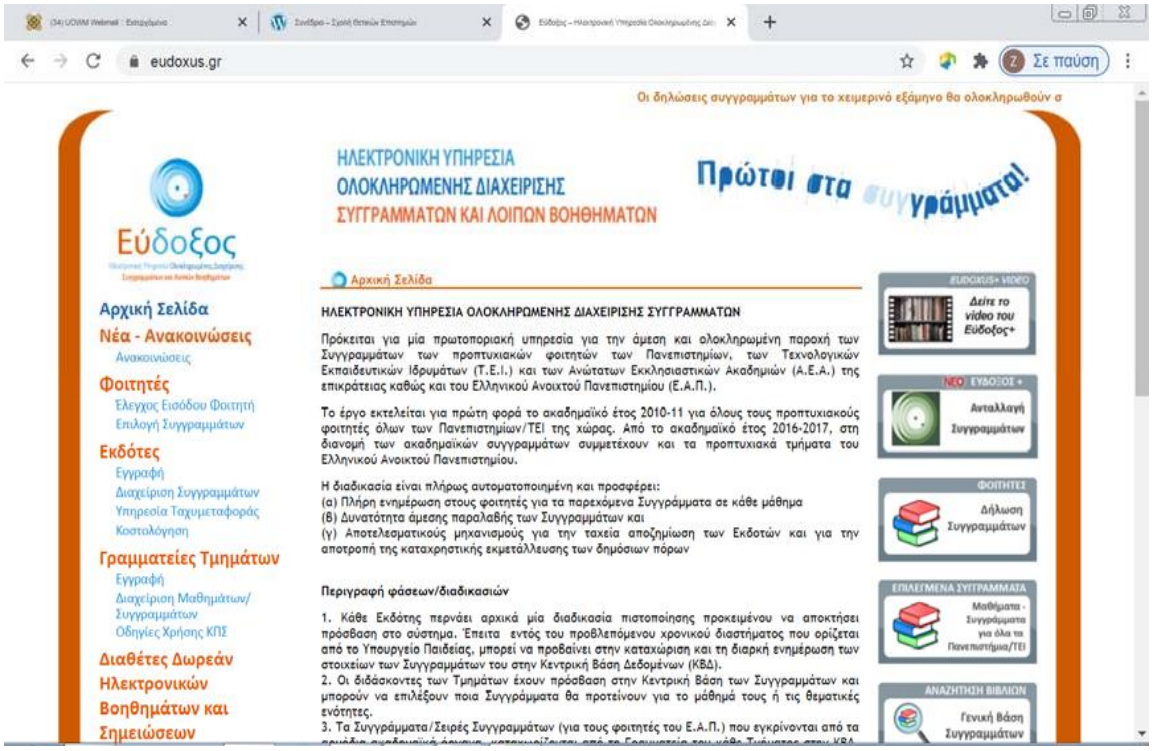
Content of the course:

The practice takes place in classrooms of the university in the form of a laboratory practice. It includes the participation of students who attend teachings from their fellow students. The attendance of the lectures as well as the discussion with the teacher of the course aim to the better “touch” of the students with the class in which they will teach in the future and to practice the pedagogic and teaching practices as fully as possible. During the practice, students apply the pedagogical and teaching techniques they learned during their studies.

Student Care

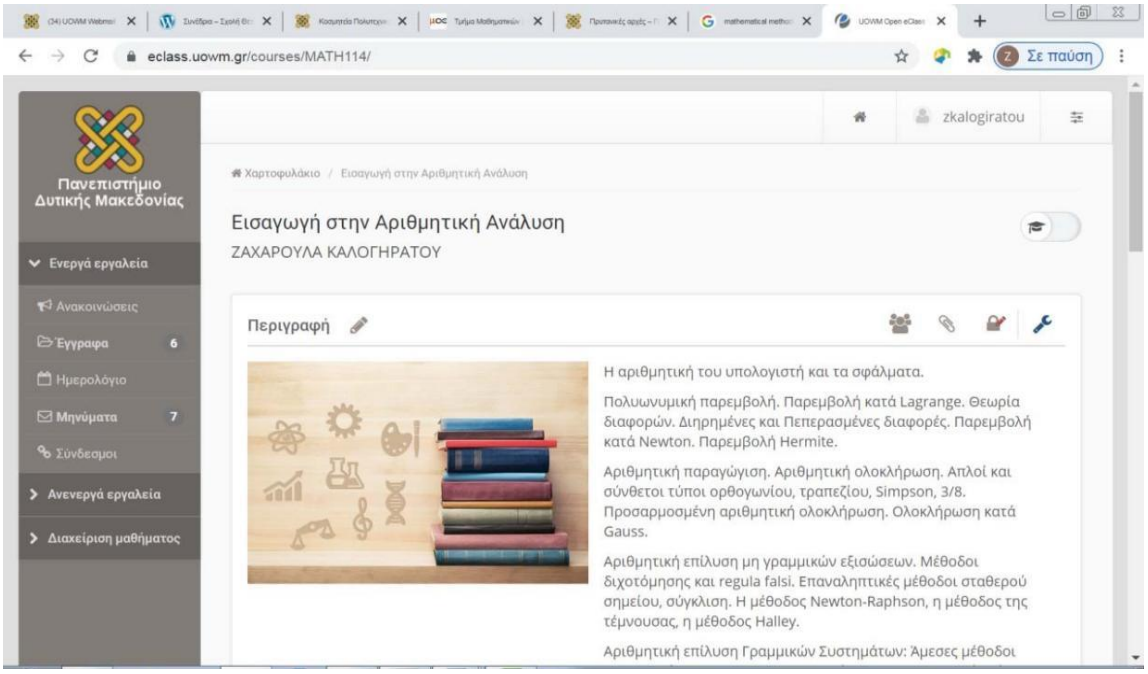
Books

Students are entitled to choose and obtain free of charge a number of textbooks equal to the total number of compulsory and elective courses required to obtain the degree. The declaration of the selected textbooks is made through the Electronic Service for the Integrated Management of Textbooks and Other Aids "EUDOXOS", of the Ministry of Education & Religious Affairs (https://eudoxus.gr/).



To select textbooks, the student must log in to the "Eudoxos" information system, where for each declared compulsory and elective course he/she must choose a textbook. At the same time with their choice, they must declare in the central information system that the textbook they have chosen corresponds to the course they have declared at the Department Secretariat, and those who are in the second semester or upper of their studies must also declare the number of courses for which they have received textbooks. For more information and to connect to the information system of "Eudoxos" you should visit the address: https://www.eudoxus.gr.

In addition, within the framework of a course, additional educational material posted on the eclass electronic platform may be given under the responsibility of the course teacher.



Library-Reading Room

In the city of Kastoria, there is a state-of-the-art library and electronic reading room.

It is housed in the specially designed premises of the Administration at the Foundation's facilities in Kastoria, occupying an area of 560 sq.m

The library's good architectural design, as well as the provision of high-quality equipment, have created a pleasant, attractive environment for its users.

The infrastructure of the library includes:

- Information desk. Qualified and willing staff are at the disposal of library users to provide support in searching for information material.
- Electronic reading room with a capacity of 50 seats.

In the electronic reading room, students of the Department have the opportunity to use the electronic services available in the library, as well as internet services.

Through the library's website, they can use the library's electronic catalog to search for

a book, a thesis, a printed journal. Also through the consortium of Greek academic libraries (Hellenic Academic Libraries Link – HEALLINK), students have full access to a fairly large number of scientific journals.

Through collaborative tools, such as the collective catalog of the Greek Academic Libraries, students of the Department have the opportunity to learn about the existence of material from other Academic Libraries and to have access to it either electronically or through the inter-lending network that has been developed between the Academic Libraries of our country.

In the electronic reading room, there is a multi-function machine for printing and scanning of printed material available for use by students. The library's reading room is a comfortable, well-lit room with natural lighting, with a capacity of 80 study seats. Here our students prepare their individual or group assignments as well as their good performance in progress exams and final exams of their semesters.

For each of its users, the library issues a loan card which facilitates their transactions with it, the borrowing, i.e. the return of the documents they have used.

The library is open to the local community in which the Foundation exists and develops its activities. It allows the use of its material by external users, organizes events in collaboration with other agencies and services of the city.

Library website: https://library.uowm.gr

Feeding

Very close (200 meters) from the administration buildings and the teaching building, there is a state-of-the-art and stylish restaurant that is accessible to all students and staff of the University. The students of the Department, based on economic and social criteria, are granted a meal card and are offered daily, 7 days a week, three meals a day, free of charge. The conditions for the free feeding as well as the dates for submitting applications are announced in good time by the department's secretary.

Academic Identity

After the registration, the student has the right to apply for the issuance of his/her Academic ID. The Academic ID is valid for as many years as the student status lasts, and covers multiple uses, in addition to the Student Ticket (Pass).

The Academic ID indicates the exact validity period of the right of the Student Ticket. If the student is not entitled to a Student Ticket, the Academic ID takes the place of a simple ID. By presenting this card and for as long as the right to the student ticket is valid, the student has a discount on public transport (City and Intercity Buses, ships, trains) in theater and cinema performances as well as in archaeological sites. The maximum duration of the student ticket right is 6 years.

The application for the issuance of the Academic ID is done electronically through a specially configured information system on the page of the Ministry of Education and Lifelong Learning.

For more information: http://academicid.minedu.gov.gr

Financial aid for students-Housing allowance

The students of the Department are granted an annual one-off rent subsidy of 1000 to 2000 euros. The amount is granted by the Ministry of Finance for as many years as the years of study of the school and for all undergraduate students if:

- ✓ they are Greek citizens or citizens of another European Union country,
- ✓ they live in a rented house due to their studies in a city other than that of their main residence,
- ✓ their annual family income of the previous year does not exceed the amount of 30,000 euros increased by 3,000 euros for each protected child beyond one,
- ✓ they are studying to obtain a first degree, regardless of how they are admitted to the department,
- ✓ they have passed at least a number of courses equal to half of the total number of courses of the previous year, of the standard curriculum of the department.

For first-year students, only their registration is sufficient. Students who wish to receive the allowance submit their applications together with the required supporting documents on the website https://stegastiko.minedu.gov.gr/

Counseling and psychological support center

The Student Support Unit for Vulnerable Groups aims to provide equal access to academic studies for students with different abilities, requirements, and needs. Its mission is to achieve in practice equal access to academic studies for students with different abilities, requirements, and needs through the provision of adaptations to the environment, Supportive Technologies of Informatics, Access Services, Counseling Services and Financial Aids. For more information you can visit the following link https://myfeo.uowm.gr/