Πανεπιστήμιο Κύπρου
University of Cyprus

**SCHOOL OF ECONOMICS
AND
MANAGEMENT**

DEPARTMENT OF ECONOMICS

UNDERGRADUATE PROSPECTUS

**ACADEMIC YEAR
2019-20**

CONTENTS

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INTRODUCTION

Economics is important because it deals with the behaviour of human beings both as individuals and as organised society. As individuals, we continuously face economic problems, such as whether and how much to save, what goods and services to purchase, and how to increase and use our income to satisfy the multitude of our economic needs. Also every society faces a continuously changing international economic problems at home such as inflation, unemployment and balance-of-payments disequilibrium. A nation's effective solution to these problems determines its standard of living and consequently it's ranking in the international community.

Understanding the economic behaviour of the individual and the basic principles that govern the functioning of a modern economy enables the economist to evaluate economic indicators and information correctly and to make rational decisions. With such knowledge the economics graduate can pursue a career in civil service, banking, education, or research and earn an important position in the public or private sector.

With the contemporary, high quality economics program offered by the Department, its graduates are in a position to compete effectively with the graduates of any other university. In addition, they have the necessary prerequisites for pursuing graduate studies either at the University of Cyprus or at foreign universities of international reputation. Many of our graduates have been admitted to prestigious graduate programs in the UK and the USA some with very generous scholarships. Upon graduation from doctoral programs, several of these students have been able to obtain academic positions abroad.

The following pages describe the aim of the Department as well as the Program of Studies leading to a degree in economics. They also give information about graduate studies and the academic staff of the Department.

1. AIM OF THE DEPARTMENT

The aim of the department is to advance economic discourse at the national and international level and to promote knowledge in the field of International and European Economic relations. In particular, the objective of the Department is to:

(a)   Equip students with qualifications acceptable to employers in Cyprus and the European Union and comparable to those of the best universities abroad.

(b)   Prepare students for graduate studies and research in Cyprus and at top universities abroad.

(c)   Engage in research with a view to producing results of high international academic standard.

(d)   Set the standards for the discussion of European and international economic issues and appropriate economic policy decisions.

The Department's teaching philosophy is to encourage students to study economic and

European economic relations issues in depth and with independence of mind. For this reason the emphasis in the teaching program is to help students develop strong analytical skills and acquire the ability to critically assess economic arguments.

2. ADMINISTRATIVE STRUCTURE

The Department of Economics is part of the School of Economics and Management. It is run by the Board of the Department. The Board elECTS the Chair of the Department every two years.

The Department is located in 1 Panepistimiou Avenue, FEB02 Building,1st floor. Students can communicate with the teaching staff during office hours which are announced on the notice board located in the lobby of the Departmental building. Students are strongly advised to consult with the Departmental notice board regularly as many announcements about changes in their teaching and examination schedules and other important information are communicated to them in this way or by electronic mail.

3. ADMISSIONS AND REGISTRATION

The academic year consists of two semesters and student registration takes place during the first week of each semester. Uninterrupted attendance is compulsory for all courses. Students are expected to complete their undergraduate studies in eight semesters but this can be extended to a maximum of twelve semesters in exceptional circumstances. Also in exceptional circumstances students can be eligible for leave of absence for a maximum of two semesters. Students are not granted leave of absence to prepare for the University entrance examinations in order to change to another degree course. Also students applying for leave of absence 'for personal reasons' must consult with the Academic Affairs and Students Welfare Service.

Student wishing to change from one degree course to another within the Department can do so provided that this does not violate Departmental regulations (see degree requirements below). Students wishing to transfer to another Department of the University must apply during the second semester of their studies. Such transfers are subject to the approval of the Board of the admitting Department.

Each student of the Department has a member of the teaching staff as her/his academic advisor. Academic advisors provide students with advice on all matters related to their academic studies. They also follow the academic progress of their students and examine whether the courses chosen satisfy the degree requirements. Students are expected to consult with their academic advisor regularly throughout their studies and keep her/him informed about their academic progress.

Each semester students are required to attend 27-30 course units (ECTS). Students can apply to the Board of the Department for permission to enrol to courses adding to more than 30 ECTS in one semester. The policy of the Department is to discourage students from over- burdening their studies in any one semester.

Students are responsible for selecting their semester courses and for consulting their advisor to confirm that their selection satisfies the formal degree requirements. Students can withdraw from a course and/or select more courses during the first three weeks of the semester. Withdrawal from a course before the seventh week of the semester is also possible; in this case however this will appear in the course transcript.

4. GRADING SYSTEM

The grading of students for a given course is based on written and/or oral final examinations, mid-term examinations, written or other assignments, class work and class participation and other methods decided by the instructor and approved by the Board of the Department. The particular combination and weighting of the grading methods applied to each course are defined in the course description handed to the students during the first week of the semester. The dates of the mid-term examinations are also announced in the course description.

The grading is on a scale 0-10 with .5 intervals. The lowest pass mark is 5. Marks between 5 and 5.49 are graded 'satisfactory', between 5.5 and 6.49 'good', between 6.5 and 8.49 'very good', between 8.5 and 9.49 'excellent' and between 9.5 and 10 'distinction´. The degree award is on the basis of the weighted average grade achieved in all courses. The marks obtained in each course are given in the course transcript. The weight given to each course in grading the degree award is described below.

A student can be given an 'incomplete mark' in a course only under substantiated exceptional circumstances (e.g. illness). The procedure for a mark to be deemed incomplete is as follows: (i) the instructor of the course, after obtaining the approval of the Head of Department, must complete and submit to the Board of the Department and the University the incomplete mark form and (ii) there must be provisions for completing the mark before the end of the following semester. If the mark is not completed by the time agreed then the incomplete mark is changed to '0' and this becomes the final mark for the course.

Students must repeat compulsory courses they have failed. Students who failed an optional course are allowed to repeat the same course or choose another optional course. All course failures are reported in the student's academic transcript. Students wishing to attend a course for which there is a prerequisite that they failed must have the permission of the instructor of the course.

A student can appeal to the Department for her/his final course mark, requesting for his examination paper to be re-marked. This request has to be made in writing to the Chair of the Department. The instructor of the course re-examines the paper and makes a recommendation to the Board of the Department which communicates to the student its decision on her/her final mark for the course. The new mark awarded can be the same, higher or lower than the previous mark.

Students are expected to know of and abide by the University regulations. Plagiarism or other forms of examination deceit and attempts to influence in any way the instructor to

secure a higher mark are considered punishable offences and will be referred to the University Disciplinary Committee for further action. The University regulations are available from the Student Affairs Office of the University.

Deferral of Academic Studies
Students who wish to defer their studies have to apply to the Board of the Department which decides whether to approve or disapprove the application with simple majority. The Chair of the Department informs the student in writing about the decision of the Board and also sends this information to the Academic Affairs and Students Welfare Service.

The process of granting deferral of studies should be completed by the end of the first week of classes. The total period of deferral of studies should not exceed two academic semesters. The academic semester(s) that the student deferred her/his studies does not count in the duration of her/his academic studies.

Temporary Interruption of Academic Studies
A student can apply for temporary interruption of her/his studies during the semester due to serious medical reasons. The application must be submitted to the Board of the Department and also send to the Academic and Students Welfare Service. The duration of the interruption of studies can be up to two academic semesters and afterwards the situation is re-examined. The academic semester(s) that the student interrupted her/his studies does not count in the duration of her/his academic studies.

5. PRIZES

The Department awards a number of prizes to the best students. The awards are made by the Board of the Department purely on the basis of academic merit.

6. UNDEGRADUATE DEGREE PROGRAMMES

The Department of Economics offers undergraduate studies leading to a degree in Economics and a degree in International, European and Economic Studies. The programmes includes basic courses in economic theory, statistics and econometrics, mathematical economics and a variety of field courses in economics and European economics. An essential prerequisite for admission to the department is satisfactory knowledge of English and mathematics.

The Department in collaboration with the Department of Mathematics and Statistics offers an interdepartmental undergraduate degree in Mathematics and Economics.

The Department also offers a minor in Economics.

DEGREE IN ECONOMICS

Degree Requirements:
To graduate in Economics students must complete at least **240*** ECTS. In addition, the following requirements must be fulfilled:

1.   At least 150 ECTS must be in the Department of Economics (courses with code ECO) and concern compulsory ECO courses and restricted elective ECO courses.

2.   At least 32 ECTS must come from a list of restricted elective courses approved by the Department from other Department or the Department of Economics (in addition to those included in the 150 ECTS mentioned in (a) above.

3.   At least 20 ECTS must be elective courses taken from at least three different faculties of the University.
Students are entitled to attend Sport courses up to 6 ECTS.

4.   18 ECTS from the courses MAS 001, MAS 061 and CS 003, which the students attend during their first year of studies.

5.   15 ECTS must be from the English Language

* ***The sum of the minimum ECTS of requirements 1-5 is 235 ECTS. Therefore, one more course would have to be taken from requirements 1-3 to complete at least 240 ECTS that are required for the degree.***

Academic Programme in Economics per Semester
This section presents the Academic Program leading to the degree in Economics. The program is laid out by semester, and courses offered by the Department of Economics are coded "ECO". The courses, which students will have to take from other Departments, have analogous codes.
1ˢᵗ Year

Semester I		ECTS
ECO 111	Principles of Microeconomics	7
MAS 001	Mathematics I	6
MAS 061	Statistical Analysis I	6
CS 003	Introduction to Computer Science	6
LAN 100	General Advanced English	5

Semester II		
ECO 121	Principles of Macroeconomics	7
ECO 212	Application of Quantitative Methods in Economics (MAS 061)	7
ECO 213	Mathematics for Economists I (MAS 001)	7
LAN 101	Academic English	5
Elective course		5

2nd Year

Semester III

ECO 211	Microeconomic Theory (ECO 111)	7
ECO 221	Macroeconomic Theory (ECO 121)	7
ECO 222	Introduction to Econometrics (ECO 212)	7
ECO 223	Mathematics for Economists II (ECO 213)	7

Semester IV

ECO 301	Topics in Microeconomics (ECO 211)	7
ECO 302	Topics in Macroeconomics (ECO 221)	7
LAN 209	Advance English for Global Communication	5
Restricted Elective course		7
Elective course		5

3rd Year

Semester V

5 Restricted Elective courses (5 X 6)	30

Semester VI

5 Restricted Elective courses (5 X 6)	30

4th Year

Semester VII

ECO397 Research Methods in Applied Economics I (ECO211, ECO212, ECO221)	6
Elective course	5
3 Restricted Elective courses (3 X 6)	18

Semester VIII

ECO 497 Research Methods in Applied Economics II (ECO 397)	8
Elective course	5
3 Restricted Elective courses (3 X 6)	18

Note: The courses in brackets are prerequisites

Restricted Electives from the Department

Students must take at least **11** courses from the list of restricted elective courses of the Department.

ECO 303	Econometrics (ECO 222)	7
ECO 305	International Trade (ECO 211)	6
ECO 306	International Finance (ECO 221)	6
ECO 308	Economic Development (ECO 221)	6
ECO 309	Economic Growth (ECO 221)	6
ECO 310	Money, Banking and Financial Markets (ECO 221)	6
ECO 311	Labour Economics (ECO 211)	6
ECO 312	Industrial Organisation (ECO 211)	6

ECO 313	Public Economics (ECO 211)	6
ECO 315	International Taxation and National Tax Policy (ECO 211)	6
ECO 316	Economics of the European Union (ECO 111)	6
ECO 317	Topics in European Economics Integration (ECO 221)	6
ECO 320	History of Economic Thought	6
ECO 324	Introduction to Political Economy and Public Policy (ECO 211)	6
ECO 326	Urban and Regional Economics (ECO 211)	6
ECO 327	Environmental Economics (ECO 211)	6
ECO 331	Productivity and Technology (ECO 211)	6
ECO 355	Topics in International Economics (ECO 211)	6
ECO 362	Structure and Strategy of Firms (ECO 312)	6
ECO 363	Regulation Theory and Policy (ECO 211)	6
ECO 370	Topics in Financial and Monetary Economics (ECO 111, ECO 221)	6
ECO 398	Topics on the Cyprus Economy (ECO 211, ECO 221)	6
ECO 415	Game Theory (ECO 301)	6
ECO 473	Applied Econometrics (ECO 303)	6

Note: The courses in brackets are prerequisites

Restricted Electives from other Departments
-   All the electives offered by the Department of Accounting and Finance, and by the Department of Business and Public Administration. Certain courses carry prerequisites.

-   The following courses from the Department of Mathematics and Statistics:

MAS 007	History of Mathematics	5
MAS 101	Calculus I	8
MAS 102	Calculus II	8
MAS 121	Linear Algebra I	8
MAS 131	Basic Mathematics	8
MAS 261	Probability I (MAS 101, MAS 102)	8
MAS 262	Statistics I	8
MAS 271	Numerical Analysis I	8

Notes:

a. The Department may withdraw courses due to staff shortages or insufficient number of students registering for a course.

b. Students who take a course without taking the prerequisites will be punished by NOT crediting them with the ECTS of the above course.

c. *Restricted elective* courses include all courses offered by the Department and selected courses from other departments of the University.

   Free Elective course can be any course offered by any other departments of the University.
   Students are free to decide when to take restricted or free elective courses based on their programme.

d.   Undergraduate students of the Department can enrol in a maximum of <u>two</u> of the following four graduate courses given that they have an overall grade at least 7,5:

    ECO 651 Microeconomic Analysis II (7,5 ECTS)
    ECO 652 Macroeconomic Analysis II (7,5 ECTS)
    ECO 653 Statistics and Econometrics II (7,5 ECTS)
    ECO 673 Applied Microeconometrics (7,5 ECTS)

DEGREE IN INTERNATIONAL, EUROPEAN AND ECONOMIC STUDIES
<u>Degree Requirements</u>:

To graduate with a degree in International, European and Economic Studies, students must complete at least **240*** ECTS. In addition, the following requirements must be fulfilled:

1. At least 111 ECTS must be from the Department of Economics (course codes ECO) from which 63 ECTS refer to compulsory courses.

2. At least 20 ECTS as free electives. These courses have to be taken in at least three different Schools of the University.
Students are entitled to attend Sport courses up to 6 ECTS.

3. At least 24 ECTS must be from the Department of Accounting and Finance (course codes AFN) or/ and from Department of Business and Public Administration (course codes BPA).

4. At least 12 ECTS must be from a list of specific courses from the Department of Social and Political Sciences (course codes SPS).

5. At least 12 ECTS must be from a list of specific courses from the Department of Law (course codes LAW).

6. At least 10 ECTS must be from a list of specific courses from the Department of History and Archaeology (course codes HIS).

7. 18 ECTS from compulsory courses offered from other departments.

8. At least 15 ECTS as English language courses and

9. At least 15 ECTS as course from another foreign language (3 levels required).

    * The sum of the minimum ECTS of requirements 1-9 is 237 ECTS. Therefore, one more course would have to be taken from requirements 1-3 to complete at least 240 ECTS that are required for the degree.

Academic Programme in International, European and Economic Studies per Semester

1st Year

Semester I	ECTS
ECO 111 Principles of Microeconomics	7
MAS 001 Mathematics I	6
MAS 061 Statistical Analysis I	6
CS 003 Introduction to Computer Science	6
LAN 100 General Advanced English	5

Semester II	
ECO 121 Principles of Macroeconomics	7
ECO 212 Applications of Quantitative Methods in Economics (MAS 061)	7
ECO 213 Mathematics for Economists I (MAS 001)	7
LAN 101 Academic English	5
LAN Second European Language (1st level)	5

2nd Year

Semester III	
ECO 211 Microeconomic Theory (ECO 111)	7
ECO 221 Macroeconomic Theory (ECO 121)	7
ECO 222 Introduction to Econometrics (ECO 212)	7
HIS (see list of courses below)	5
Elective	6

(Students who wish to pursue the courses LAW201 and LAW202 in the third year are encouraged to take the introductory course *LAW101 Introduction to Legal Method and the Study of Law* -6 ECTS, See list below).

Semester IV	
HIS (see list of courses below)	5
LAN 209 Advance English for Global Communication	5
LAN Second European Language (2nd level)	5
SPS (see list of courses below)	6
AFN/ BPA	6+

3rd Year

Semester V	
LAN Second European Language (3rd level)	5
ECO	6
ECO	6
SPS	6
LAW	6

ECO	6
ECO	6
LAW	6
AFN/ BPA	6+
Elective One course	5+

4th Year

Semester VII

ECO397 Research Methods in Applied Economics I (ECO211, ECO212, ECO221)	6
ECO	6
ECO	6
AFN/ BPA	6
Elective One course	5

Semester VIII

ECO 497 Research Methods in Applied Economics II (ECO 397)	8
ECO	6
ECO	6
AFN/ BPA	6
Elective One course	5+

RESTRICTED ELECTIVES

Department of Economics: Compulsory courses offered by the Department for the Degree in International, European and Economics Studies:

ECO 305 International Trade (ECO 211)	6
ECO 306 International Finance (ECO 221)	6
ECO 315 International Taxation and National Tax Policy (ECO 211)	6
ECO 316 Economics of the European Union (ECO 111)	6
ECO 317 Topics in European Economics Integration (ECO 221)	6

Department of Economics: Selection of **three** courses from:

ECO 301 Topics in Microeconomics (ECO 211) *	7
ECO 302 Topics in Macroeconomics (ECO 221) *	7
ECO 303 Econometrics (ECO 222) *	7
ECO 310 Money, Banking and Financial Markets (ECO 221)	6
ECO 311 Labour Economics (ECO 211)	6
ECO 312 Industrial Organisation (ECO 211)	6
ECO 313 Public Economics (ECO 211)	6
ECO 327 Environmental Economics (ECO 211)	6
ECO 355 Topics in International Economics (ECO 211)	6
ECO 363 Regulation Theory and Policy (ECO 211)	6

* Students who intend to attend graduate programs in economics are encouraged

to take all three courses ECO 301, 302 and 303.

Department of Accounting and Finance and Business and Public Administration:

Selection of **four** courses from all the electives offered by the Department of Accounting and Finance, and by the Department of Business and Public Administration. Certain courses carry prerequisites.

Department of History and Archaeology: Selection of **two** courses from:

HIS 181 Introduction to European History (1789-1918)	5
HIS 281 European diplomatic History, 20th Century	5
HIS 283 European History 1945-1989 (HIS 181)	5
HIS 285 Europe 1918-1945: From Versaille to the fall of Nazi Germany (HIS 181)	5
HIS 290 Institutions of Medieval Europe	5

Department of Social and Political Sciences: Selection of **two** courses from:

SPS 152 Comparative Politics	6
SPS 153 International Relations	6
SPS 156 European Integration	6
SPS 266 Political System of the European Union	6
SPS 361 Cyprus and the European Union	6
SPS 362 Politics of the European Union	6

Department of Law: Selection of **two** courses from following combinations:

LAW 201 European Union Law I*	6
LAW 202 European Union Law II*	6
or	
LAW 205 Public International Law I	6
LAW 206 Public International Law II	6

*Students who wish to pursue the course combination LAW201 and LAW202 in the third year are encouraged to take the introductory course LAW101 *Introduction to Legal Method and the Study of Law* (6ECTS).

Elective Courses: Free elective courses should be taken from three different schools whose ECTS add up to at least 20 ECTS.

The courses in brackets are prerequisites

Notes:
   a. *Restricted elective* courses include all courses offered by our department and selected courses from other departments of the University.

   Free Elective course can be any course offered by any other departments of the University.

Students are free to decide when to take restricted or free elective courses based on their programme.

Courses that have more credits than those mentioned are acceptable provided that the total number of credits taken does not exceed the permissible limits per semester.

b. Undergraduate students of the Department can enrol in a maximum of <u>two</u> of the following four graduate courses given that they have an overall grade at least 7,5:

ECO 651 Microeconomic Analysis II (7,5 ECTS)
ECO 652 Macroeconomic Analysis II (7,5 ECTS)
ECO 653 Statistics and Econometrics II (7,5 ECTS)
ECO 673 Applied Microeconometrics (7,5 ECTS)

DEGREE IN MATHEMATICS AND ECONOMICS
Degree Requirements:

To graduate with a degree in **Mathematics and Economics**, students must complete at least **240*** ECTS. In addition, the following requirements must be fulfilled:

1. At least 173 ECTS must be from compulsory courses of the Department of Mathematics and Statistics and the Department of Economics.

2. At least 32 ECTS must be from restricted elective courses from the Department of Mathematics and Statistics and the Department of Economics (in addition to those included in the 173 ECTS in (1) above.

3. At least 15 ECTS must be elective courses taken from at least two different Faculties of the University.
Students are entitled to attend Sport courses up to 6 ECTS.

4. 15 ECTS must be from the English Language.

* The sum of the minimum ECTS of requirements 1-4 is 235 ECTS. Therefore, one more course would have to be taken from requirements 1-3 to complete at least 240 ECTS that are required for the degree.

Program of studies in Mathematics and Economics by Semester

1ST YEAR

Semester I   ECTS

MAS 133	Sets and Algebraic Structures	7
MAS 131	Basic Mathematics I	7
ECO 111	Principles of Microeconomics	7
LAN 100	General Advanced English	5
	Elective Course	5

Semester II

MAS 101	Calculus I	8
MAS 132	Basic Mathematics II (MAS 131)	7
ECO 213	Mathematics for Economists	7
ECO 121	Principles of Macroeconomics	7

2nd YEAR

Semester III

MAS102	Calculus II (MAS 101)	8
MAS 121	Linear Algebra I	8
MAS 261	Probability I (MAS101, MAS 102)	7
ECO 211	Microeconomic Theory (ECO 111)	7

Semester IV

MAS 202	Multivariable Integral calculus	7
LAN 101	Academic English	5
MAS 262	Statistics I	7
ECO 301	Topics in Microeconomics (ECO 211)	7
	Elective Course	4

3rd YEAR

Semester V

MAS/ CS /ECO	Option A1 (ή B)	7
MAS/ CS /ECO	Option A1 (ή B)	7
ECO 212	Application of Quantitative Methods in Economics (MAS 261)	7
ECO 221	Macroeconomic Theory	7

Semester VI

ECO 302	Topics in Macroeconomics (ECO 221)	7
ECO 303	Econometrics (ECO 212)	7
MAS 122	Linear Algebra II	8
MAS 203	Ordinary Differential Equations	7
	Elective Course	3

4th YEAR

Semester VII

MAS 350	Stochastic Processes (MAS261)	7
MAS 301	Real Analysis	8
ECO 397	Research Methods in Applied Economics I	6
ECO	Option B	6
	Elective Course	3

Semester VIII

ECO 497	Research Methods in Applied Economics II	8
ECO/MAS	Option B (ή A2)	6
ECO/MAS	Option B (ή A2)	6
	Elective Course	5
LAN 209	Advance English for Global Communication	5

Option A1

MAS 191	Mathematics with computers	8
MAS 302	Complex Analysis I	8
MAS 303	Partial Differential Equations	7
MAS 304	Functional Analysis	7

MAS 321	Introduction to Algebra	7
MAS 361	Probability Theory	8
MAS 371	Numerical Analysis II	7
MAS 401	Measure theory and Integration	7
MAS 451	Linear Models I	7
MAS 456	Time Series	7
ECO 604	Analytical Methods in Economics	7,5
CS 031	Introduction to programming	7

Option A2

MAS 191	Mathematics with computers	8
MAS 303	Partial Differential Equations	7
MAS 304	Functional Analysis	7
MAS 321	Introduction to Algebra	7
MAS 331	Classical Differential Geometry	8
MAS 361	Probability Theory	8
MAS 362	Statistical Theory	7
MAS 371	Numerical Analysis II	7
MAS 401	Measure Theory and Integration	7
MAS 402	Complex Analysis II	7
MAS 418	Introduction to Fourier Analysis	7
MAS 425	Theory of Groups	7
MAS 431	Introduction to Differentiable Manifolds	7
MAS 451	Linear Models I	7
MAS 452	Linear Models II (ΜΑΣ 451)	7
MAS 456	Time Series	7
CS 031	Introduction to programming	7

Option B

ECO 305	International Trade (ECO 211)	6
ECO 306	International Finance (ECO 221)	6
ECO 308	Economic Development (ECO 221)	6
ECO 309	Economic Growth (ECO 221)	6
ECO 310	Money, Banking and Financial Markets (ECO 221)	6
ECO 311	Labour Economics (ECO 211)	6
ECO 312	Industrial Organisation (ECO 211)	6
ECO 313	Public Economics (ECO 211)	6
ECO 315	International Taxation and National Tax Policy (ECO 211)	6
ECO 316	Economics of the European Union (ECO 111)	6
ECO 317	Topics in European Economics Integration (ECO 221)	6
ECO 320	History of Economic Thought	6
ECO 324	Introduction to Political Economy and Public Policy (ECO 211)	6
ECO 326	Urban and Regional Economics (ECO 211)	6
ECO 327	Environmental Economics (ECO 211)	6
ECO 331	Productivity and Technology (ECO 211)	6
ECO 355	Topics in International Economics (ECO 211)	6
ECO 362	Structure and Strategy of Firms (ECO 312)	6
ECO 363	Regulation Theory and Policy (ECO 211)	6
ECO 370	Topics in Financial and Monetary Economics (ECO 111,	

	ECO 221)	6
ECO 398	Topics on the Cyprus Economy (ECO 211, ECO 221)	6
ECO 415	Game Theory (ECO 301)	6
ECO 473	Applied Econometrics (ECO 303)	6
ECO 503	Statistics and Econometrics I (ECO 303)	7.5

Notes:

a. Students may substitute up to two choices in economics with courses from the graduate program of the Department of Economics upon approval of the Chairman of the Department.

b. The courses in brackets are prerequisites.

c. Students are advised to take MAS 191 Mathematics with Computers (8 ECTS) as a free elective course. Taking any other free elective course with 8 ECTS and another free elective course with 7 ECTS will satisfy the requirements of 15 ECTS from free elective courses given that the courses are from two different schools.

d. Required courses knowledge for courses in Mathematics and Statistics:

MAS 102 Calculus II
(Required essential knowledge: MAS101)

MAS 122 Linear Algebra II
(Required essential knowledge: MAS121)

MAS261 Introduction to Probability
(Required essential knowledge: MAS101, MAS102)

MAS350 Stochastic Processes
(Required essential knowledge: MAS261)

MAS452 Linear Models II
(Required essential knowledge: MAS451)

7.   MINOR IN ECONOMICS
Requirements for a Minor in Economics (42 ECTS)

Students in other departments of the University wishing to obtain a Minor in Economics have to submit an application to the Department. The successful applicants will be awarded a Minor in Economics upon successful completion of the following courses:

Compulsory courses (42 ECTS)

ECO 111	Principles of Microeconomics	7
ECO 121	Principles of Macroeconomics	7
ECO 211	Microeconomic Theory (ECO 111)	7
ECO 212	Application of Quantitative Methods in Economics (MAS 061)	7
ECO 221	Macroeconomic Theory (ECO 121)	7
ECO 222	Introduction to Econometrics (ECO 212)	7

Optional courses (at least 18 ECTS)

ECO 305	International Trade (ECO 211)	6
ECO 306	International Finance (ECO 221)	6
ECO 308	Economic Development (ECO 221)	6
ECO 309	Economic Growth (ECO 221)	6
ECO 310	Money, Banking and Financial Markets (ECO 221)	6
ECO 311	Labour Economics (ECO 211)	6
ECO 312	Industrial Organisation (ECO 211)	6
ECO 313	Public Economics (ECO 211)	6
ECO 315	International Taxation and National Tax Policy (ECO 211)	6
ECO 316	Economics of the European Union (ECO 111)	6
ECO 317	Topics in European Economics Integration (ECO 221)	6
ECO 320	History of Economic Thought	6
ECO 324	Introduction to Political Economy and Public Policy (ECO 211)	6
ECO 326	Urban and Regional Economics (ECO 211)	6
ECO 327	Environmental Economics (ECO 211)	6
ECO 331	Productivity and Technology (ECO 211)	6
ECO 355	Topics in International Economics (ECO 211)	6
ECO 362	Structure and Strategy of Firms (ECO 312)	6
ECO 363	Regulation Theory and Policy (ECO 211)	6
ECO 370	Topics in Financial and Monetary Economics (ECO 111, ECO 221)	6
ECO 398	Topics on the Cyprus Economy (ECO 211, ECO 221)	6
ECO 415	Game Theory (ECO 301)	6
ECO 473	Applied Econometrics (ECO 303)	6

Note: The courses in brackets are prerequisites

8. BRIEF DESCRIPTION OF COURSES

ECO 101   INTRODUCTION TO ECONOMICS (6 ECTS)
Instructor: Bozani Vasiliki
This course aims at introducing students to basic economic concepts. The first part of the course introduces microeconomic concepts such as the circular flow of money, the production possibility frontier, comparative advantage and trade, consumer demand and production function, price and income elasticity, consumer surplus, the functioning of markets, economic policy and welfare and economics of the public sector. The second part of the course covers macroeconomic concepts and includes the measurement of national income and cost of living, various types of unemployment, role of minimum income and trade unions, measurement, causes and effECTS of inflation and aggregate demand and aggregate supply.

ECO 111   PRINCIPLES OF MICROECONOMICS (7 ECTS)
Instructor: Mamuneas Theofanis / Louis Philippos
The course introduces the basic principles of individual decision making of consumers, firms as well as the government.   After a short introduction of the basic concepts needed for understanding and analysing economic problems, it examines the market forces of demand and supply and the calculation of elasticities. It then describes and analyses the impact of various government policies and explains how to evaluate the efficiency of market outcomes. The cost structure of firms and profit maximizing conditions, as well as, market structure is then analysed. Finally, it examines externalities and their impact on market outcomes and the gains from trade.

ECO 121   PRINCIPLES OF MACROECONOMICS   (7 ECTS)
Instructor: Hassapis Christis/ Michael Charalambos
This course provides an intensive introduction to the tools and concepts of macroeconomics. It focuses on the performance of national economies and policies instituted by governments and central banks that affect economic performance. The course builds upon the issues on economic growth, unemployment and inflation, money creation and determination of the interest rates.

ECO 211   MICROECONOMIC THEORY (7 ECTS)
(Prerequisite: ECO 111)
Instructor: Xefteris Dimitrios
Microeconomic theory analyzes the behavior of consumers and firms, examines the way they interact in the market, and evaluates the market's performance in the allocation of economic resources. The course focuses on the systematic analysis of consumer and producer theory and the operation of competitive and monopolistic markets, while also briefly introducing oligopoly theory.

ECO 212   APPLICATION OF QUANTITATIVE METHODS IN ECONOMICS (7ECTS)
(Prerequisite: MAS 061)
Instructor: Kourtellos Andros
Applied Quantitative Methods in Economics is the first course out of a series of courses in econometrics aiming at building the foundations for the empirical analysis of economic phenomena such the inflation, unemployment, economic growth, and inequality.
In this course we study the basic elements of probability theory and statistics, the

specification and estimation of the linear regression model, the properties of LS estimators in the linear regression model, inference (hypothesis testing and confidence intervals) in the linear regression model. We also study model selection and misspecifcation tests to assess the statistical adequacy of the model. Furthermore, we study the topic of heteroskedasticity, nonlinearity, and temporal dependence. Finally, we cover simple time-series models and prediction. One of the central goals of this course is to introduce the students to econometric software package STATA in the empirical applications of linear regression model using real observable economic data.

ECO 213   MATHEMATICS FOR ECONOMISTS I   (7 ECTS)
(Prerequisite: MAS 001)
Instructor: Ziros Nicholas
The aim of the course is to provide a firm foundation of the mathematical concepts and techniques used in economics. The core topics of the module are the fundamentals of mathematics, univariate and multivariate calculus, unconstrained and constrained optimization. Moreover, economic applications will be discussed for each topic

ECO 221   MACROECONOMIC THEORY (7 ECTS)
(Prerequisite: ECO 121)
Instructor: Chassamboulli Andri
The course begins with a short description of the main economic variables. Subsequently, the goods and money markets are analyzed separately, and then, the closed economy IS-LM model is presented in detail. The IS-LM model is then used for the analysis of fiscal and monetary policies. Next, the supply side of the economy is introduced. We analyze the labor market, the price setting and wage setting behavior of firms and the medium-run equilibrium. At this point, the goods, money, and labor markets have been examined in great detail. The AD-AS model that follows examines the simultaneous equilibrium in all markets, both in the short- and in the medium-run. Apart from the determination of the price level, nominal and real wages, interest rate and national income, the AD-AS is used for the analysis of fiscal and monetary policies, inflation rate and unemployment rate. The rest of the course extends the IS-LM model to include the role of expectations and topics on open economies.

ECO 222   INTRODUCTION TO ECONOMETRICS (7 ECTS)
(Prerequisite: ECO 212)
Instructor: Theodoropoulos Nikos
This course provides an introduction to linear regression analysis. It covers the estimation of the simple and multiple regressions with emphasis in the explanation of their results. Also it covers extensions of the models such as logarithms, nonlinearities and dummy variables. It includes hypothesis tests on the linear regression, including heteroskedasticity. It introduces the econometric software, stata, in order to carry out estimation and testing.

ECO 223   MATHEMATICS FOR ECONOMISTS II (7 ECTS)
(Prerequisite: ECO 213)
Instructor: Petrou Kyriakos
This course is a continuation of ECO 213 Mathematics for Economists I and its aim is to present some advanced mathematical topics used in static and dynamic economic problems. With the use of theory and exercises, emphasis will be placed in developing the abilities that are necessary for the core economics courses of the program of studies.

ECO 301   TOPICS IN MICROECONOMICS   (7 ECTS)
(Prerequisite: ECO 211)
Instructor: Tsakas Nikolaos

The course studies in detail general equilibrium and welfare economics. Also studies topics from consumer and producer behavior using duality techniques. Finally, covers topics from game theory, uncertainty and information economics, public goods and externalities.

ECO 302   TOPICS IN MACROECONOMICS (7 ECTS)
(Prerequisite: ECO 221)
Instructor: Tryphonides Andreas

The course provides students with a structured approach to selected topics of modern macroeconomic theory. The mathematical models will be presented and analyzed based on microeconomic principles of orderly rationality and individual optimization and empirical facts (stylized) that characterize the temporal performance of finances. Particular emphasis will be placed on general equilibrium theory within competitive markets and the theory of economic growth. Ta sub-topics to be covered include the relationship of competitive equilibrium with Pareto-efficiency, temporal substitution of consumption, savings and economic convergence.

ECO 303   ECONOMETRICS (7 ECTS)
(Prerequisite: ECO 222)
Instructor: Kasparis Ioannis

The Econometrics course (ECO 303) presupposes knowledge of the probability theory as covered in ECO 212, and builds upon the knowledge of the classical linear regression model and statistical inference techniques acquired in ECO 222. Topics covered include: Generalized least squares method; regression analysis for time series data and panel data; instrumental variable and two-stage least squares estimation; binary dependent variable models and simultaneous equation models. Emphasis is given to the application of theoretical concepts on practical economic issues through the extensive use of computer-based exercises in Stata. A major feature of this course is the development of the applied econometrics skills required for the successful completion of the undergraduate thesis.

ECO 305   INTERNATIONAL TRADE (6 ECTS)
(Prerequisite: ECO 211)
Instructor: Hadjiyiannis Costas

The course examines the various theories and the issues associated with trade policy. It examines absolute and comparative advantage, specific factors, the Heckscher-Ohlin model and the impact of external economies of scale and imperfect completion on trade.   It also analyses the various tools of trade policy, their impact on welfare as well as the political economy of trade. Finally, it examines trade policy in developing countries and trade agreements.

ECO 306   INTERNATIONAL FINANCE (6 ECTS)

(Prerequisite: ECO 221)

Instructor: Micahel Michael/Michael Charalambos

National income accounting and balance of payments. Foreign exchange market and exchange rate determination in the short run and long run. National income and exchange rate. Fixed exchange rates and foreign exchange intervention. International Monetary systems1870-present. Macroeconomic policy and coordination under flexible exchange rates. Optimum currency areas and the European case. The global capital market and the developing countries, growth, crisis and reform.

ECO 308   ECONOMIC DEVELOPMENT (6 ECTS)

(Prerequisite: ECO 221)

Instructor: Zachariadis Marios

This course provides an introduction to the study of the main economic problems faced by developing countries. Among the topics covered we present a broad picture of what characterizes underdeveloped economies, what are the potential causes underlying such underdevelopment, and discuss what policies can be adopted to improve the living conditions in these countries. We present a wide array of macro and microeconomic models together with relevant empirical evidence.

ECO 309   ECONOMIC GROWTH   (6 ECTS)

(Prerequisite: ECO 221)

Instructor: Kyrizi Andri/Assiotis Andreas

The course examines various models of economic growth. It starts with models of exogenous growth; it first examines the well-known Solow-Swan growth model and then it´s theoretical and empirical extensions. Later the course focuses on models of endogenous growth. These models attempt to explain the patterns of growth and development observed in historical data and to understand how various government policies can affect the long-run growth of a country.

ECO 310   MONEY, BANKING AND FINANCIAL MARKETS (6 ECTS)

(Prerequisite: ECO 221)

Instructor: Hassapis Christis

Money demand, money creation, instruments and targets of monetary policy, monetary transmission mechanism, banking system and financial markets, role of the central bank, structure of interest rates, portfolio selection.

ECO 311   LABOUR ECONOMICS (6 ECTS)

(Prerequisite: ECO 211)

Instructor: Theodoropoulos Nikos/Michaelides Marios

The course covers static and dynamic models of labour supply to analyze the decision to participate in the labour market, and how many hours to work. Then, it examines topics of labour demand, namely, the firm's decision to hire workers and determine the employment level. Further, it examines compensating wage differentials and human capital theory. Additional topics include the structure of wages, labour mobility, labour market discrimination, incentive pay, and unemployment.

ECO 312 INDUSTRIAL ORGANISATION (6 ECTS)

(Prerequisite: ECO 211)

Instructor: Clerides Sofronis

Industrial organization is the branch of economics that studies imperfectly competitive markets. The course will analyze the basic theoretical models of competition in oligopolistic markets with homogeneous or differentiated products, under price or quantity competition, and in the presence of price leadership and capacity constraints. The models will provide the toolbox for the analysis of topics such as the relationship between technology and market structure, collusion and cartels, predatory behavior and entry deterrence, and auctions.

ECO 313 PUBLIC ECONOMICS (6 ECTS)

(Prerequisite: ECO 211)

Instructor: Lyssiotou Panayiota

This course is an introduction of the microeconomics of the public sector. Initially, it examines the circumstances under which an economy without public sector achieves efficient allocation of resources. Subsequently it examines the problems that arise due to public goods, externalities and incomplete information and examines the means through which the government can intervene to lead to a more efficient allocation of resources.

Finally, it examines the impact the public expenditure and taxation on the supply of factors of production, the efficient allocation of resources and the equitable distribution of income.

ECO 315 INTERNATIONAL TAXATION AND NATIONAL POLICY (6 ECTS)

(Prerequisite: ECO 211)

Instructor: Lyssiotou Panayiota

This course presents the stylized facts and concepts and outlines the main issues of international taxation and the implications for the international movements of goods and capital. The first part of the course introduces students to basic taxation concepts and describes the principles of direct and indirect optimal taxation in a closed economy. The second part starts with how the optical tax rules are modified in an open economy and considers how national tax policies affect the allocation of capital in an international context, and considers issues of international tax competition and harmonization, the behaviour of multinational firms and the international allocation of savings, investment and production.

ECO 316 ECONOMICS OF THE EUROPEAN UNION (6 ECTS)

(Prerequisite: ECO 111)

Instructor: Michael Michael

We start with a historical review of the need for a creation of a union in Europe after the Second World War, the attempts that were made to create it, as well as its process of enlargement. We also examine the structure and the functioning of European Institutions such as the European Parliament, the European Council, and the European Court of Auditors. Then, we use basic micro- and macro - economic models to examine the following topics: economic integration, customs union and common market, economic growth, free capital and labour mobility. Additional topics include the common agricultural policy, the theory of comparative advantage and specialization, unemployment, economic geography and regional policy.

ECO 317   TOPICS IN EUROPEAN ECONOMIC INTEGRATION (6 ECTS)

(Prerequisite: ECO 221)

Instructor: Zachariadis Marios/Syrichas George

1. Similarities and differences between the Gold Standard and the Euro.
2. Exchange Rate Regimes.
3. Optimum Currency Areas.
4. EMS, EMU, the Euro, Banks, and Banking Union.
5. Fiscal Policy, the Stability Pact and Fiscal Union.
6. Assessing Integration: Price level convergence within the Eurozone.
7. The European (Fiscal) Crisis:
    (i)   relation to the Financial Crisis
    (ii)   relation to structural problems of the economy
    (iii)   the role of overconsumption, budget deficits, trade deficits, and long-term Growth.

ECO320   HISTORY OF ECONOMIC THOUGHT (6 ECTS)

Instructor: Clerides Sofronis

The course will trace the evolution of economic thought from antiquity to the present day. Emphasis will be given on specific key ideas rather than on comprehensive theories of economic systems, and on the linkages between economic thinking and other historical and social phenomena. The course is divided in three units. The first unit will trace the roots of key economic ideas in the writings of the ancients, the scholastics, the mercantilists and the physiocrats. The second unit will focus on the analysis of the market economy as developed by the classical economists and on the critique articulated by Marx and others. The third unit will examine important 20th century developments (institutionalism, Keynesianism, the Austrian school, monetarism, etc.) and will end with an assessment of the status of economic thinking today. The course is intended for a broad audience and does not require any prior knowledge of economics.

ECO324 INTRODUCTION TO POLITICAL ECONOMY AND PUBLIC POLICY 6ECTS)

(Prerequisite: ECO 211)

Instructor: Xefteris Dimitrios

This course is designed to provide students with an introduction to the economic approach to politics, also known as positive political theory or rational choice theory. Political economy seeks to understand and explain policy outcomes and political behaviour in an environment where political actors are rational and goal oriented. The course will focus on models of politics that build upon formal reasoning and mathematical expressions. Political outcomes are then explained by the interaction between these actors within the institutional particularities of their environment.

ECO 326   URBAN AND REGIONAL ECONOMICS (6 ECTS)

(Prerequisite: ECO 211)

This course is designed to familiarize students with the current knowledge about the causes of the observed differences in the pace of regional economic development across different countries. We will examine models of regional growth and development and how they formulate economic policy. Moreover, we will consider socioeconomic impact analysis to forecast sub-national economic changes.

ECO 327   ENVIRONMENTAL ECONOMICS (6 ECTS)
(Prerequisite: ECO 211)
Instructor: Empora Neophyta
The course uses economic concepts and analytical tools to examine the relationship between the economy and the environment. The course starts with a general overview on the topic. It then examines the problem of pollution and pollution externalities in a competitive market. Next it studies the economic efficiency of environmental regulatory measures, such as pollution standards, taxes, subsidies, and marketable pollution permits. Benefit-cost analysis and non-market valuation techniques are then investigated. Finally the course offers an overview of some main topics from the existing literature.

ECO 331   PRODUCTIVITY AND TECHNOLOGY (6 ECTS)
(Prerequisite: ECO 211)
Instructor: Mamuneas Theofanis
The objective of the course is the presentation of different methods measuring Productivity and Technological change. It requires knowledge of producer theory and basic econometrics.

ECO 355   TOPICS IN INTERNATIONAL ECONOMICS (6 ECTS)
(Prerequisite: ECO 211)
Instructor: Michael Charalambos
The class examines the International Economy and the environment in which Multinational Corporations operate. It analyzes the purpose and rules of the World Trade Organization, as well as other international organizations. Regional Trade Agreements, like the European Union and NAFTA, are also examined. In addition, the class analyzes Foreign Exchange Markets and the different strategies Multinational Corporations use to take advantage of the opportunities they are faced with.

ECO 362   STRUCTURE AND STRATEGY OF FIRMS (6 ECTS)
(Prerequisite: ECO 312)
The course seeks to develop students' understanding of firm organization and strategic decision making. The first part of the course will focus on structure. It will review the main theories of the firm, examining questions such as: what is a firm, what are its objectives, what factors determine its scale and scope? Topics in this part include bilateral monopoly, bargaining and principal-agent relationships. The second part will focus on firms' strategic choices in various markets. Examples include mergers and acquisitions, vertical integration, pricing strategies, quality choice, tying and bundling, research and development, and standard setting.

ECO 363   REGULATION THEORY AND POLICY (6 ECTS)
(Prerequisite: ECO 211)
The course analyzes the motivation, methods and implications of state intervention in the economy. What is the purpose of state intervention? What tools do governments have at their disposal? What are the consequences – intended or unintended – of

government intervention? The course examines the regulation of natural monopolies, methods of granting monopoly rights, and legal restrictions to market entry. The energy and telecommunications markets are examined as case studies. The role of competition policy – which is the broader policy that aims to promote competition in markets – in relation to regulation is also examined.

ECO 370   TOPICS IN FINANCIAL AND MONETARY ECONOMICS (6 ECTS)
(Prerequisite: ECO 111, ECO 221)
Instructor: Andreou Elena/Michael Charalambos
Topics in investment analysis, risk-return analysis performance, the Capital Asset Pricing Model (CAMP), efficient market hypothesis, prices and returns of stocks and bonds.
Also, the course will cover topic on monetary policy, supply and demand for money, money multiplier and Rules Taylor.

ECO 397   RESEARCH METHODS IN APPLIED ECONOMICS I (6 ECTS)
(Prerequisite: ECO 211, ECO 212, ECO 221)
Instructors: All faculty members
The course is an introduction to the fundamental tools necessary for research in economics or for work as a professional economist. The course covers different aspECTS of the research toolbox of modern economists such as Mathematics and Statistics, Academic Skills for Economists and Empirical Econometric Skills. The aim of these modules is to introduce or review the tools students need in order to master the material presented in the programme on the one hand and to enable progress towards independent research and for work as a professional economist on the other hand.
Each student is required to present his/her work in front of the supervisor and submit his/her work to Blackboard.

ECO 398   TOPICS ON THE CYPRUS ECONOMY (6 ECTS)
(Prerequisite: ECO 211, ECO 221)
Instructor: Matsis Symeon
The aim of the course is to expose students to important economic issues and problems facing the Cyprus Economy. This course is designed to combine theory with practice by showing how economic principles can illuminate the workings of the Cyprus economy.   The course, therefore, builds on earlier economic theory and policy courses. Topics covered include: review of economic developments during 1960-2001; balance of payments issues exchange rate policy; monetary policy; implications of the single market and economic and monetary union; effECTS of financial reform and liberalisation; inflation and unemployment. The course also looks at some econometric models and empirical applications to the above topics.

ECO 415   GAME THEORY (6 ECTS)
(Prerequisite: ECO 301)
Instructor: Ziros Nicholas
The course develops and analyses the basic principles of Game Theory. Game Theory is the study of decision making between strategically interdependent agents. Static and dynamic games of complete information as well as incomplete information are examined. The various concepts and solution methods are illustrated by the use of economic applications such as bargaining, auctions, mechanism design, signalling and reputation.

ECO 473   APPLIED ECONOMETRICS (6 ECTS)
(Prerequisite: ECO 303)
Brief overview of the classical linear regression model. Econometric models for cross-section data and space-series data. Economic applications and the use of specialized econometric software are emphasized. Topics will be drawn from: (1) Theory of production functions (2) Models of multiple equations, (2) Models of limited dependent variables, (3) elements of spatial analysis and models for macroeconomic data.

ECO 497   RESEARCH METHODS IN APPLIED ECONOMICS II (8 ECTS)
(Prerequisite: ECO 397)
Instructors: All faculty members
The course is the continuation of ECO397 and provides a deeper analysis of the fundamental tools necessary for research in economics or for work as a professional economist. The course covers different aspECTS of the research toolbox of modern economists such as Mathematics and Statistics, Academic Skills for Economists and Empirical Econometric Skills. The aim is to introduce or review the tools students need in order to master the material presented in the programme on the one hand and to enable progress towards independent research and for work as a professional economist on the other hand.
Each student is required to present his/her work in front of the supervisor and submit his/her thesis to Blackboard. All theses that receive a prize will be posted on the website of the Department.

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MAS 101 Calculus I (8 ECTS)
Properties of real numbers. The supremum and infimum of a set and their basic properties. Sequences, limits of sequences, properties of convergent sequences, subsequences, basic theorems, nested intervals Property (briefly covered). Functions, limits of functions, sequential definition of limits. Continuous functions, intermediate value Theorem, extreme value Theorem, continuity of inverse functions, uniform continuity. Derivatives, basic theorems, derivatives of inverse functions, graphs of functions, Rolle's Theorem, Cauchy's mean value Theorem, l' Hopital's rule.

MAS 102 Calculus II (8 ECTS)
Partitions, upper and lower sums, Riemann integral on a closed interval. Basic existence theorems of integrals. Computation of volumes and areas. The Fundamental Theorems of Calculus, generalised integrals. Logarithmic and exponential functions. Basic methods of integration, integration by parts, substitution, induction formulas, integration of rational functions. Taylor's formula, computation of Taylor's formula for various basic functions. Approximation of smooth functions by polynomials, the irrationality of e. Series, comparison test, Cauchy's criterion, ratio test, nth root test, integral test, absolutely and conditionally convergent series, Leibniz's Theorem for alternating series, Abel's and Dirichlet's criteria, products of series.

MAS 121 Linear Algebra I (8 ECTS)

Numbers, equivalence relations. Groups, Examples (symmetric, cyclic, dihedral).Isomorphism. Rings and Fields. Examples. Vector spaces, basis, dimension. Linear maps. Matrices and linear maps. Rank, change of basis matrix. Determinant. Linear systems.

MAS 122 Linear Algebra II (8 ECTS)

Polynomial Ring. Eigen values, eigen vectors. Diagonalisation and applications. Theorem of Cayley – Hamilton, minimal polynomial. Generalised eigen spaces, nilpotent endomorphisms, Jordan canonical form. Inner product spaces (Gram – Schmidt).Orthogonal, self dual endomorphisms. Bilinear, quadratic forms.

MAS 131 Basic Mathematics (8 ECTS)

Methods and applications of differentiation. Methods of integration and applications. Improper Integrals. Power series. Fourierseries. Elements of analytic geometry on the place and in space. Functions and surfaces. Polar coordinates. Partial derivatives and Lagrange multipliers. Multiple integration and Jacobien.

MAS 132 - Basic Mathematics II (7 ECTS)

Analytic Geometry in R2: Vectors, inner product, length, distance between points. Equation for a line, tangent, vertical line to a curve. Circles, ellipses, parabolas, hyperbolas. Analytic Geometry in R3: Vectors, algebraic, geometric properties. Inner product, length, distance between points. Equation for a line (parametric-vector, cartesian format), distance of a point to a line. Regions in Euclidean space. Functions: Curves in the plane, regions between curves, curve intersections. Graphs of functions in R3, analytically and implicitly defined. Solids bounded by surfaces and intersections of surfaces. Transformations: Linear transforms, linear independence and geometric interpretation of determinant. Geometric transforms (translation, rotation, reflection, orthogonal transforms). Polar, cylindrical and spherical coordinates and regions defined in these coordinates. Curves: Curve parametrization in R2 and R3. Velocity, acceleration and tangent line. Arc length. Differentiation: Partial derivatives of multivariable functions. Tangent plane and linear approximation. Gradient and directional derivative. Integration: Double integrals over rectangles and general regions of R2.

MAS 133 - Sets and Algebraic Structures (7 ECTS)

Set Theory: Sets, subsets. Set operations, complement, De Morgan's laws, power set. Cartesian product. Relations, equivalence relations (equivalence classes modulo m, projective space, rational numbers). Venn diagrams. Elements of propositional logic (quantifiers, negation, truth diagrams). Functions: Image of a set, inverse image. Inverse function. Composition of functions, graphs. Sets of functions. Countable sets, uncountable sets. Diagonal procedure. Reductio ad absurdum and Mathematical Induction. Well Ordering Principle and Principle of Mathematical Induction. Examples
 16
from Number Theory and other areas of mathematics for understanding the procedure for proving a statement using these methods. Number Theory: Divisibility. Greatest common factor and least common multiple. Euclidean algorithm. Fundamental Theorem of Arithmetic. Applications to polynomials. Introduction to Algebraic Structures: Binary operations. Closure of operations. Properties of closed operations.

Examples (composition of functions, matrix multiplication, inverse, congruence classes). Subgroups, groups (examples from cyclic groups (complex unit roots), symmetric group). The group (Z_n , +) as a quotient. Rings, fields and solving first order equations $ax = b$.

MAS 191 - Mathematics with computers (8 ECTS)
MATLAB's environment. MATLAB functions. For, while and if loops. Graphics in two and three dimensions. Programming. Polynomials. Reading from and writing in files. Computer arithmetic and error propagation. Symbolic computing. Special topics and applications (solution of nonlinear algebraic equations and linear systems, eigenvalue problems, numerical integration, ordinary differential equations).

MAS 202 Multivariate Integral Calculus (8 ECTS)
Integrals of continuous functions with compact support (on $Q = I_1 \times I_2 \times I_3 \times ... \times I_n$), step functions. Theorem of transformation of variables (for linear and C^1-invertible transformations). Integrable functions and sets, properties. Computation of volumes, Fubini's Theorem, Cavalieri's Principle (i.e. sphere, cylinder, cone). Convergence theorems (interchangeability of limit and integral). Transformations theorems (without proof), applications. Parametrised surfaces, partition of unity. Surface and curve integrals (computation of area of surfaces). Differential forms, Stokes' Theorem (Green, Gauss, Stokes), applications.

MAS 203 Ordinary Differential Equations (8 ECTS)
Basic notions. Solution techniques for first-order equations and physical applications. Theorems of Existence and Uniqueness. Linear systems and exponential of matrices. Higher order linear equations. Method of power series: Smooth and singular solutions. Smooth dependence of solutions on parameters.

MAS 261 Introduction to Probability (8 ECTS)
Probability, random variables, distribution functions ,independence, expected value, moment generating functions, random rectors, conditional distribution, conditional expected value, laws of large numbers, central limit theorem.

MAS 262 Introduction to Statistics (8 ECTS)
Statistics. Sufficiency and completeness. Exponential families of distributions. Unbiasedness, unbiased estimators. Cramer – Raoinequality. Method of moments, maximum likelihood estimators, confidence intervals, hypothesis testing.

MAS 301 Real Analysis (8 ECTS)
The real number system R, the least upper bound property and its consequences. Countable and uncountable sets. The Cantorternary set. Introductory theory of metric spaces. The metric spaces R and Rn. Compact sets. Heine – Borel Theorem, Bolzano –Weierstrass Theorem. Sequences of real numbers, limit superior and inferior of a sequence. Cauchy sequences, series of real numbers. Complete metric spaces, Cantor intersection Theorem, the fixed point Theorem and applications. Continuous functions. Topological characterisation of continuity. Continuity and compactness. Uniform continuity, Lipschitz functions. Sequences and series of functions. Pointwise

convergence, uniform convergence. Uniform convergence and continuity, uniform convergence and integration, uniform convergence and differentiation. The space C ([a,b]), the topology of uniform convergence.

MAS 302 Complex Analysis I (8 ECTS)
Complex numbers, Basic complex functions, Cauchy- Riemann equations, holomorphic functions, harmonic functions.(Exponential, trigonometric and logarithmic functions).Contontintegration, Cauchy's theorem, Cauchy's integral formula. Morera's theorem, Liouville's theorem, the fundamental theorem of algebra. The Maximum modulus theorem. Taylor series, Laurent series, calculus of residues. Conformal mapping, linear fractional transformation.

MAS 303 Partial Differential Equations (7 ECTS)
Separation of variables – Fourier series. First order Partial Differential Equations. Nonlinear first order Partial Differential Equations. Linear second order Partial Differential Equations. Elliptic, Parabolic and Hyperbolic Partial Differential Equations.

MAS 304 Functional Analysis (7 ECTS)
Metric spaces: Examples and elements of the theory of metric spaces. Banach spaces: Norm, dimension and compactness, bounded operators, linear functionals, dual space, the spaces lp,$1 \leq p \leq \infty$, Hilbert spaces: Inner products, orthogonal sums, orthonormal bases, the Riesz representation theorem, the adjoint operator, self – adjoint, unitary and normal operators. Fundamental theorems for Banach spaces: the Hahn–Banach theorem, reflexive spaces, the uniform boundedness theorem, weak and strong convergence, the open mapping and closed graph theorems. Applications: The fixed point theorem and its applications to the theory of linear, integral and differential equations, applications to the theory of approximation.

MAS 321 Introduction to Algebra (7 ECTS)
Basic properties of groups. Cayley's theorem. Subgroup and Lagrange's theorem. Normal subgroups and factor groups. First isomorphism theorem. Group actions. Basic properties of rings. Ideals. R – modules over principal ideal domain and the fundamental theorem of finitely generated abelian groups.

MAS 331 Classical Differential Geometry (8 ECTS)
Curves in R^n (parametrisation, orientation, length).Curves in R^2 (normal field, curvature, Frenet frame). Isoperimetric inequality. Curves in R^3 (curvature, torsion,

Frenet frame). Surfaces in R^3: parametrisation, tangent plane, first and second fundamental form, curvature (Gaussian, mean), geometric interpretation of curvature, examples. Intrinsic geometry of surfaces (local isometry, Christoffel symbols, Theorema Egrerium of Gauss,, vector fields, parallel transport, geodesics). Gauss-Bonnet Theorem.
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MAS 350 Stochastic Processes (7 ECTS)
Basic concepts, continuous and discrete time Markov processes, birth and death processes, Poisson processes, introduction tomartingales, Brownian motion.
6thSemester

MAS 361 Probability Theory (8 ECTS)
Measure spaces and σ-algebras, stochastic independence, measurable functions and random variable, distribution functions, Lebesque integral and mean value, convergence of sequences of random variables, laws of large numbers, characteristic function, central limit theorem, conditional probability, conditional mean value

MAS 362 Statistical Theory (7 ECTS)
Stochastic convergence, asymptotic properties of moments timators and maximum likelihood estimators, asymptotic normality and efficiency, hypothesis testing, asymptotic properties and efficiency of tests.

MAS 371 Numerical Analysis II (7 ECTS)
Preliminaries: Basic definitions and theorems of Linear Algebra –Lagrange and Hermite interpolation – Newton-Cotes quadrature rules. Vector and matrix norms: Basic definitions and properties –Induced matrix norms – Perturbed linear systems

(perturbation analysis) – Condition of linear systems – Iterative refinement. Methods for eigenproblems: The Gershgorin theorems – The Rayleigh quotient – The power and inverse iteration methods –Similarity transformation methods (Givens and Householder for symmetric matrices – Basic forms of the LR and the QR algorithms) – Sturm sequence property for the eigen values of symmetric tri-diagonal matrices. Iterative methods for linear systems: General iterative methods – The methods of Jacobi, Gauss-Seidel and SOR – Convergence theorems – Asymptotic rate of convergence – Introduction to the theory for the optimum SOR relaxation parameter. Orthogonal polynomials and Gauss quadrature rules: Zeros of orthogonal polynomials – Three-termrecurrence relation – Legendre, Chebyshev, Laguerre, Hermite and Jacobi polynomials – Gauss quadrature rules (Legendre, Chebyshev, Laguerre, Hermite and Jacobi.)

MAS 401 Measure Theory and Integration (7 ECTS)
General revision: Sets, orderings, cardinality, metric spaces. Measures: Algebras and σ- algebras, additive and σ- additive measures, outer measures, Borel measures on the real line. Integration: measurable functions, integration of positive functions, integration of complex valued functions, modes of convergence, product measures, the n – dimensional Lebesgue integral, integration in polar coordinates, signed measures, the Radon – Nikodym theorem, complex measures, differentiation on Euclidean space, functions of bounded variation. LP Spaces: The basic theory, the dual of LP , the useful inequalities, the distribution function, weak – LP spaces, interpolation.

MAS 402 Complex Analysis II (7 ECTS)
Compactness and convergence in the space of analytic functions. The space of meromorphic functions. Riemann mapping theorem. Weierstrass factorization theorem. Analytic continuation (Schwarz reflection principle, Monodromy theorem).Entire functions. Elements of Geometric theory.

MAS 418 Introduction to Fourier Analysis (7 ECTS)
Inner product spaces, Hilbert spaces, orthogonal systems, completeness, periodic functions, trigonometric polynomials and series, Fourier series, point wise convergence of Fourier series. Dirichlet's Theorem, Gibbs phenomenon, Parseval's Theorem. Cesàro and Abel summability, Fejér's Theorem, Poisson's Theorem, the Riemann-

Lebesgue Lemma. Convergence of special trigonometric series. Riemann's local Theorem. Differentiation and integration of Fourier series. Fourier transform, inversion Theorem, Plancherel's formula, convolution. Applications to PDEs.

MAS 425 Theory of Groups (7 ECTS)
Generators and relations. Homomorphism theorems. Direct and semi direct products. Group actions. Sylow theorems and p –groups. Simple groups. Composition series and the Jordan –Hölder theorem. Soluble and 124 nilpotent groups.

MAS 431 Introduction to Differentiable Manifolds (7 ECTS)
Manifolds, Tangent space. Partition of unity. Theorem of Sard. Vector fields, flows. Frobenius Theorem. Differenital forms. Theorem of Stokes. DeRham Theorem.

MAS 451 Linear Models I (7 ECTS)
The Simple Linear Regression Model: Estimation, Confidence Intervals, Hypothesis Testing. The Multiple Linear Regression Model: Estimation, Confidence Intervals, Hypothesis Testing. Model Adequacy and Model Selection. Polynomial Regression.

MAS 452 Linear Models II (7 ECTS)
Analysis of variance with one or more fixed-effECTS, Analysis of variance with one or more random-effECTS, Analysis of covariance, Generalised linear models: estimation in (for example) logistic or logarithmic regression, asymptotic properties.

MAS 456 Time Series (7 ECTS)
Stationary processes, second order moments. ARMA and ARIMA processes. Maximum likelihood estimation, least squares estimators, Yule-Walker estimators. Prediction of station ary processes. Introduction to model selection.

CS031 Introduction to Programming
Introduction of the basic principles of programming with emphasis on structured programming, abstraction, and the design, implementation, checking and debugging of modular programs. Application of these principles using the FORTRAN 90/95 programming language.