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#### GENERAL

SCHOOL	School of Economic and Administrative Studies				
	School of Engineering				
ACADEMIC UNIT	Departmen	t of Economics			
	Departmen	t of Computer	Science and E	ngin	eering
LEVEL OF STUDIES	Postgraduat	te			-
COURSE CODE	ECSY01		SEMESTER	1	
COURSE TITLE	Introductio	n to Data Visu	alization		
INDEPENDENT TEACHING AC if credits are awarded for separate componen lectures, laboratory exercises, etc. If the credits whole of the course, give the weekly teaching hou		HING ACTIVITIES components of the course, e.g. the credits are awarded for the aching hours and the total creditsWEEKLY TEACHING HOURSCREDITS			CREDITS
Lectures 3 3.5 E		3.5 ECTS			
Add rows if necessary. The organisation of teaching and the teaching					
	). General bac	kground			
general background, special background, specialised general knowledge, skills development	General bac	.Kgi oʻunu			
PREREQUISITE COURSES:	-				
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek				
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No				
COURSE WEBSITE (URL)	-				

#### **LEARNING OUTCOMES**

#### Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
- Guidelines for writing Learning Outcomes

After successfully passing this course, the students will be able to:

- Know the state-of-the-art and the historical evolution of the area under study
- Understand in depth the fundamental concepts of data visualization (gestalt principles & clutter avoidance; pre-attentive attributes (size color, shape, etc))
- Understand and be able to manipulate fundamental types of data representation (tables, different types of charts, other);
- Be able to use choice mechanisms and fine tuning of visualizations

#### **General Competences**

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology Adapting to new situations Decision-making Working independently Team work Working in an international environment Working in an interdisciplinary environment Project planning and management Respect for difference and multiculturalism Respect for the natural environment Showing social, professional and ethical responsibility and sensitivity to gender issues Criticism and self-criticism Production of free, creative and inductive thinking

Productio	n of new research ideas Others
•	Production of free, creative and inductive thinking
٠	Search for, analysis and synthesis of data and information, with the use of the
	necessary technology
٠	Team work
٠	Algorithmic thinking
٠	Abstraction ability for problem modeling
٠	Apply research results in solving practical problems
٠	Literature studying and management

## **SYLLABUS**

- Situational context understanding, including the audience, communication mechanism, and desired tone.
- Common types of visuals and their appropriate usage; specific types of visuals (simple text, table, heatmap, line graph, vertical bar chart, vertical stacked bar chart, waterfall chart, horizontal bar chart, horizontal stacked bar chart, and square area graph); visuals to be avoided (pie, donut, 3D charts)
- Gestalt Principles of Visual Perception; their application to visualizations such as tables and graphs. Alignment, strategic use of white space, and contrast.
- Mechanisms of sight and memory; preattentive attributes (size, color, and position on page) and their usage; visual hierarchies of components; color as a strategic visualization tool
- Decisions regarding the type of graph and ordering of data; visual (de) emphasis via color, thickness of lines, and relative size; alignment and positioning of components; use of words to title, label, and annotate.
- Team-based project

<b>DELIVERY</b> Face-to-face, Distance learning, etc.	Face to face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	<ul> <li>Use of projector and lectures.</li> <li>Course website main and posting of teach and notes, program</li> <li>Announcement of a course web site.</li> <li>Use of email and so exchange and impro- students.</li> </ul>	d interactive board during ntenance. Announcements hing material (lecture slides is). issessment marks via the cial media for information oved communication with
<b>TEACHING METHODS</b> The manner and methods of teaching are	Activity	Semester workload
described in detail.	Lectures	18 Nrs
fieldwork, study and analysis of bibliography.	Non-directed Study	31 11/5
tutorials, placements, clinical practice, art	Projects	39 hrs

workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc. The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the ECTS	Course total	88 hrs
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	<ul> <li>Methods of evaluation</li> <li>At each lecture, the prepared on the maparticipate in the cr</li> <li>At each lecture, the answer to questions the learning outcom</li> <li>A programming assision</li> <li>Final exam</li> </ul>	e students are asked to be aterial of the lecture and to ritical discussions that arise. e students are asked to s and exercises related to nes of the previous lecture. ignment (project).

- Suggested bibliography:

- Nussbaumer Knaf. Storytelling with Data, A Data Visualization Guide for Business Professionals. Willey, 2015. Κωδικός Βιβλίου στον Εύδοξο: 80503822
- Chun-houh Chen, Wolfgang Härdle, Antony Unwin. Handbook of Data Visualization [electronic resource]. 2008. Springer Berlin Heidelberg. ISBN 9783540330370 Κωδικός Βιβλίου στον Εύδοξο: 73240257
- Glenn J. Myatt, Wayne P. Johnson. Making Sense of Data II : A Practical Guide to Data Visualization, Advanced Data Mining Methods, and Applications. 2009, Wiley UBCM ebooks. Κωδικός Βιβλίου στον Εύδοξο: 91720096

- Related academic journals:

- IEEE Transactions of Visualization and Computer Graphics
- Information Visualization
- Journal of Visual Languages and Computing
- Visual Informatics

#### GENERAL

SCHOOL	School of Economic and Administrative Studies				
	School of Engineering				
ACADEMIC UNIT	Departmen	t of Economics			
	Departmen	t of Computer	Science and E	ngin	eering
LEVEL OF STUDIES	Postgradua	te			
COURSE CODE	ECSY02 SEMESTER 1				
COURSE TITLE	Microecono	omics I			
<b>INDEPENDENT TEACHING ACTIVITIES</b> if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits		HING ACTIVITIES components of the course, e.g. the credits are awarded for the aching hours and the total creditsWEEKLY TEACHING HOURSCREDITS			CREDITS
Lectures		3		4 ECTS	
Add rows if necessary. The organisation of teaching and the teaching					
	). Special back	ground			
general background,		Ground			
special background, specialised general					
PREREOUISITE COURSES:	_				
LANGUAGE OF INSTRUCTION	Greek				
and EXAMINATIONS:					
IS THE COURSE OFFERED TO	No				
ERASMUS STUDENTS					
COURSE WEBSITE (URL)	-				

#### **LEARNING OUTCOMES**

#### Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
- Guidelines for writing Learning Outcomes

By the end of the course the student will be able to:

- To know the economic tools for understanding and analyzing the decision-making of consumers.
- Understand and analyze the decision-making of firms, the production process, production cost and technology.
- To recognize and analyze the optimal pricing strategies of firms e.g., price discrimination, mark-up.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology Adapting to new situations Decision-making Project planning and management Respect for difference and multiculturalism Respect for the natural environment Showing social, professional and ethical responsibility and Working independently Team work Working in an international environment Working in an interdisciplinary environment Production of new research ideas sensitivity to gender issues Criticism and self-criticism Production of free, creative and inductive thinking .....

Others...

- Working independently
- Decision-making
- Working in an interdisciplinary environment
- Criticism and self-criticism
- Production of free, creative and inductive thinking

#### **SYLLABUS**

- Consumer theory
- Producer theory
- Monopoly power and price discrimination
- Empirical applications with the use of r software and maxima

<b>DELIVERY</b> Face-to-face, Distance learning, etc.	Face-to-face		
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	e-mail is used for the communication with the students and an electronic platform is used for posting students' grades		
TEACHING METHODS	Activity	Semester workload	
The manner and methods of teaching are	Lectures	18 hrs	
described in detail. Lectures, seminars, laboratory practice.	Non-directed study	43 hrs	
fieldwork, study and analysis of bibliography, tutorials placements clinical practice art	Projects	39 hrs	
workshop, interactive teaching, educational			
etc.			
The student's study hours for each learning			
directed study according to the principles of			
the ECTS			
	Course total	100 hrs	
STUDENT PERFORMANCE	Written final exam		
<b>EVALUATION</b> Description of the evaluation procedure	Project		
Language of evaluation, methods of			
choice questionnaires, short-answer questions,			
open-ended questions, problem solving, written work, essay/report, oral examination,			
public presentation, laboratory work, clinical examination of patient, art interpretation,			
other			
Specifically-defined evaluation criteria are aiven, and if and where they are accessible to			
students.			

- Suggested bibliography: - Related academic journals:

- MasCollel, Whinston, Green "Microeconomic Theory", Oxford University Press (1995).
- Thomas Nechyba, Microeconomics: An Intuitive Approach with Calculus, Cengage Learning; 2nd edition.
- Hammock, M. R., Mixon, J. W. Microeconomic Theory and Computation. Springer-Verlag New York, (2016).

#### GENERAL

SCHOOL	School of Economic and Administrative Studies				
	School of Engineering				
ACADEMIC UNIT	Departmen	t of Economics			
	Departmen	t of Computer	Science and E	ngir	eering
LEVEL OF STUDIES	Postgraduat	te			-
COURSE CODE	ECSY03 SEMESTER 1				
COURSE TITLE	Computer F	Programming I			
<b>INDEPENDENT TEACHING ACTIVITIES</b> if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits		HING ACTIVITIES components of the course, e.g. the credits are awarded for the aching hours and the total credits WEEKLY TEACHING HOURS		CREDITS	
	Lectures		3		4 ECTS
Add rows if necessary. The organisation of teaching and the teaching					
	). Conoral had	skaround			
general background, special background, specialised general knowledge, skills development	General bac	.kground			
PREREQUISITE COURSES:	-				
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek				
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No				
COURSE WEBSITE (URL)	-				

#### **LEARNING OUTCOMES**

#### Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

 Description of the level of

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
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  Guidelines for writing Learning Outcomes
- After completing the course the students will be able to:
  - Understand a Python program
    - Write programs in Python
    - Use the data structures available in Python
    - Use the control structure of Python
    - Organize their programs using functions
    - Develop small applications, e.g. searching and sorting

General Competences			
Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma			
Supplement and appear below), at which of the following	does the course aim?		
Search for, analysis and synthesis of data and	Project planning and management		
information, with the use of the necessary technology	Respect for difference and multiculturalism		
Adapting to new situations	Respect for the natural environment		
Decision-making	Showing social, professional and ethical responsibility and		
Working independently	sensitivity to gender issues		
Team work	Criticism and self-criticism		

Working in an international environment Working in an interdisciplinary environment Production of new research ideas	Production of free, creative and inductive thinking  Others			
<ul> <li>Production of free, creative and ind</li> </ul>	luctive thinking			
• Search for, analysis and synthesis o	f data and information, with the use of the			
necessary technology				
Adapting to new situations				
Analysis of requirements for problem solving				
Algorithmic thinking				
Abstraction ability for problem modeling				
Working independently				

## SYLLABUS

•

- Introduction
- Interactive interpreter
- Data structures
  - o Lists and tuples
  - o Strings
  - Dictionaries
  - Control structures
    - Decision
    - Repetition
- Functions and recursive functions
- Searching and Sorting

<b>DELIVERY</b> Face-to-face, Distance learning, etc.	Face to face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	<ul> <li>Use of projector an lectures.</li> <li>Course website ma and posting of teac and notes, program</li> <li>Announcement of a course web site.</li> <li>Use of email and so exchange and improstudents.</li> </ul>	d interactive board during intenance. Announcements hing material (lecture slides ns). assessment marks via the ocial media for information oved communication with
TEACHING METHODS	Activity	Semester workload
The manner and methods of teaching are	Lectures	18 hrs
Lectures, seminars, laboratory practice,	Non-directed study	37 hrs
fieldwork, study and analysis of bibliography, tutorials placements clinical practice art	Projects	45 hrs
workshop, interactive teaching, educational		
visits, project, essay writing, artistic creativity, etc.		
The student's study hours for each low in		
activity are given as well as the hours of non-		

directed study according to the principles of the ECTS		400.1
	Course total	100 hrs
STUDENT PERFORMANCE		
EVALUATION	The evaluation is based on t	final exams and
Description of the evaluation procedure	programming projects	
Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other Specifically-defined evaluation criteria are		
given, and if and where they are accessible to students.		

- Introduction to Computation and Programming Using Python, John V. Guttag
- Introduction to Programming with Python, Schneider David
- Programming with Python, Stratos Kalafatoudis, Georgios Stamoulis
- Introduction to Programming with the aid of Python, Electronic book, George Manis
- Python Scripting for Computational Science [electronic resource], Hans Petter Langtangen
- Beginning Python [electronic resource], Magnus Lie Hetland

#### GENERAL

SCHOOL	School of Ec	conomic and A	dministrative	Stud	dies
	School of Engineering				
ACADEMIC UNIT	Departmen	t of Economics			
	Departmen	t of Computer	Science and E	ngir	neering
LEVEL OF STUDIES	Postgraduat	te			
COURSE CODE	ECSY04		SEMESTER	1	
COURSE TITLE	Statistics &	Probabilities			
<b>INDEPENDENT TEACHING ACTIVITIES</b> if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits		WEEKLY TEACHINO HOURS	3	CREDITS	
Lectures		3		3.5 ECTS	
Add rows if necessary. The organisation o	f teaching and t n	the teaching			
<b>COURSE TYPE</b> general background, special background, specialised general knowledge, skills development	General bac	ckground			
PREREQUISITE COURSES:	No				
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek				
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No				
COURSE WEBSITE (URL)	-				

#### **LEARNING OUTCOMES**

#### Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
- Guidelines for writing Learning Outcomes

After completing the course, students will be able to:

- Understand the basic concepts of statistics and probability.
- Comprehend the significance of statistics in the field of economic sciences and apply it to practical problems.
- Collect, organize, and analyze data.
- Utilize descriptive statistical measures, such as measures of central tendency and variability, for data interpretation.
- Understand and apply probability distributions, both discrete and continuous random variables, to practical problems.
- Familiarize themselves with estimation theory and make point estimates.

• Calculate confidence intervals for population parameters and perform significance tests.

With these general skills and knowledge, students will be capable of analyzing data and interpreting the results of these analyses, applying statistical methods to economic problems, and making decisions based on reliable statistical analyses.

<b>General Competences</b> Taking into consideration the general competences that the Supplement and appear below), at which of the following	he degree-holder must acquire (as these appear in the Diploma does the course aim?
Search for, analysis and synthesis of data and	Project planning and management
information, with the use of the necessary technology	Respect for difference and multiculturalism
Adapting to new situations	Respect for the natural environment
Decision-making	Showing social, professional and ethical responsibility and
Working independently	sensitivity to gender issues
Team work	Criticism and self-criticism
Working in an international environment	Production of free, creative and inductive thinking
Working in an interdisciplinary environment	
Production of new research ideas	Others

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Data analysis
- Decision-making
- Production of free, creative and inductive thinking

## **SYLLABUS**

- Introduction to Statistics and its significance in the field of economic sciences
- Basic statistical concepts (data, variables, statistical characteristics)
- Data collection, organization, and presentation
- Descriptive statistical measures measures of central tendency & variability
- Probability
- Probability distributions of discrete random variables
- Probability distributions of continuous random variables.
- Introduction to Estimation Theory
- Point estimation
- Confidence intervals for the mean and proportion of a population
- Confidence intervals for the difference of means between two populations
- Confidence intervals for the difference of proportions/risks between two populations

DELIVERY	Face-to-face
Face-to-face, Distance learning, etc.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	Email is used for communication with students, as well as the electronic platform of the secretary's office for posting students' grades.

TEACHING METHODS		
The manner and methods of teaching are	Activity	Semester workload
described in detail. Lectures, seminars, laboratory practice,	Lectures	18 hrs
fieldwork, study and analysis of bibliography,	Non-directed study	39 hrs
tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.	Projects	31 hrs
The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the ECTS		
	Course total	88 hrs
<b>STUDENT PERFORMANCE</b> <b>EVALUATION</b> Description of the evaluation procedure	Written final exams	
Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other		
Specifically-defined evaluation criteria are given, and if and where they are accessible to students.		

- "Statistics" from Robert S. Witte & John S. Witte
- "Statistics for Business and Economics" from Paul Newbold, William L. Carlson, & Betty Thorne
- "Statistics and Econometrics" from Orley Ashenfelter & Phillip B. Levine

#### GENERAL

SCHOOL	School of Ed	conomic and A	dministrative	Stud	dies
	School of Er	ngineering			
ACADEMIC UNIT	Departmen	t of Economics			
	Departmen	t of Computer	Science and E	ngir	neering
LEVEL OF STUDIES	Postgradua	te			
COURSE CODE	ECSY05		SEMESTER	1	
COURSE TITLE	Macroecon	omics			
<b>INDEPENDENT TEACHING ACTIVITIES</b> if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits		WEEKLY TEACHINO HOURS	3	CREDITS	
Lectures		3		3.5 ECTS	
Add rows if necessary. The organisation o	f teaching and t N	the teaching			
COURSE TYPE general background, special background, specialised general knowledge, skills development	General bac	ckground			
PREREQUISITE COURSES:	-				
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek				
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No				
COURSE WEBSITE (URL)	-				

#### **LEARNING OUTCOMES**

#### Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A
Description of the level of

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  Guidelines for writing Learning Outcomes
  - Understanding of the neoclassical growth model and growth models with human capital.
  - Learning how to use key methodological tools in modern dynamic macroeconomics.
  - Establishment of a strong foundation for further study of modern macroeconomics.
  - Familiarity with the process of conducting research, including research ideas formation, literature review, conduct of analysis and presentation of results.

#### **General Competences**

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology Adapting to new situations Decision-making Working independently Project planning and management Respect for difference and multiculturalism Respect for the natural environment Showing social, professional and ethical responsibility and sensitivity to gender issues Team work Working in an international environment Working in an interdisciplinary environment Production of new research ideas Criticism and self-criticism Production of free, creative and inductive thinking ..... Others...

- Working independently
- Working in an international environment
- Criticism and self-criticism
- Production of free, creative and inductive thinking

## **SYLLABUS**

- Facts of economic growth
- Solow growth model
- Fundamentals of Neoclassical Growth
- Neoclassical growth model
- Human capital and economic growth

<b>DELIVERY</b> Face-to-face, Distance learning, etc.	Face-to-face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	<ul> <li>Course materia the e-course pla</li> <li>Grades are subition</li> <li>Students are re- engines for science</li> </ul>	I is available online through atform mitted through ClassWeb. equired to work with search entific journals
TEACHING METHODS	Activity	Semester workload
The manner and methods of teaching are	Lectures	18 hrs
Lectures, seminars, laboratory practice,	Non-directed study	39 hrs
fieldwork, study and analysis of bibliography,	Projects	31 hrs
workshop, interactive teaching, educational		
visits, project, essay writing, artistic creativity, etc.		
The student's study hours for each learning		
activity are given as well as the hours of non-		
directed study according to the principles of the ECTS		221
	Course total	88 hrs
STUDENT PERFORMANCE EVALUATION	• Writton problem	m cot
Description of the evaluation procedure	Written final ov	in set
Language of evaluation methods of	• written indiex	dili
evaluation, summative or conclusive, multiple		
choice questionnaires, short-answer questions, open-ended questions, problem solving,		
written work, essay/report, oral examination,		
examination of patient, art interpretation, other		
Specifically-defined evaluation criteria are given, and if and where they are accessible to students.		

- Suggested bibliography:

- Acemoglu, Daron (2009) Introduction to Modern Economic Growth, Princeton Univ Press
- Barro R.J, Sala-i-Martin, X. (2003) Economic Growth, MIT Press.
- Romer, D. (2018) Advanced Macroeconomics, McGraw-Hill.

- Related academic journals: Indicative:

- American Economic Review
- Journal of Economic Perspectives
- Quarterly Journal of Economics
- Review of Economics and Statistics
- Economic Journal

## GENERAL

SCHOOL	School of Ed	conomic and A	dministrative	Stud	lies
	School of Engineering				
ACADEMIC UNIT	Departmen	t of Economics			
	Departmen	t of Computer	Science and E	ngin	eering
LEVEL OF STUDIES	Postgradua	te			
COURSE CODE	ECSY06		SEMESTER	1	
COURSE TITLE	Machine Le	arning I			
<b>INDEPENDENT TEACHING ACTIVITIES</b> if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits		WEEKLY TEACHING HOURS	à	CREDITS	
Lectures		3		4 ECTS	
Add rows if necessary. The organisation o	f teaching and t	the teaching			
	). Conoral hav	karound			
aeneral backaround.	General bac	rground			
special background, specialised general					
knowledge, skills development					
PREREQUISITE COURSES:	-				
LANGUAGE OF INSTRUCTION	Greek				
and EXAMINATIONS:					
IS THE COURSE OFFERED TO	No				
ERASMUS STUDENTS					
<b>COURSE WEBSITE (URL)</b>	-				

## **LEARNING OUTCOMES**

#### Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
- Guidelines for writing Learning Outcomes
  - After successfully passing this course, the students will be able to:
  - Analyze complex data with modern mathematical models
  - Model complex machine learning problems
  - Apply parametric and non-parametric machine learning mechanisms
  - Design decision support machines
  - Apply basic mathematical tools and methods to practical issues appearing during machine learning problem solving

# General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and<br/>information, with the use of the necessary technology<br/>Adapting to new situationsProject planning and management<br/>Respect for difference and multiculturalism<br/>Respect for the natural environment<br/>Showing social, professional and ethical responsibility and<br/>sensitivity to gender issues<br/>Criticism and self-criticism

Working in an international environment	Production of free, creative and inductive thinking
Working in an interdisciplinary environment	
Production of new research ideas	Others
<ul> <li>Production of free, creative, and</li> </ul>	d inductive thinking
Search for, analysis and synthes	sis of data and information, with the use of the
necessary technology	
<ul> <li>Adapting to new situations</li> </ul>	
Requirement analysis	
Algorithmic thinking	
Abstraction ability for problem	modeling
Autonomous work	

#### **SYLLABUS**

- Introduction, fundamental npotions and problems of machine learning
- Supervised learning
- Linear regression
- Classification with the k-nearest neighbours
- The Perceptron algorithm
- Neural networks-nonlinear regression
- Multilayer neural networks
- Support vector machines
- Convolutional neural networks
- Combinations of learning algorithms (Bagging, Boosting, Adaboost)
- Stochastic methods
- Maximum likelihood
- Maximum a posteriori

DELIVERY Face-to-face, Distance learning, etc. USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	<ul> <li>Face to face</li> <li>Use of slide pro</li> <li>Use of compute demonstration</li> <li>Course website</li> <li>Announcement material (lectur programs) and University of lo</li> <li>Use of email an information exo communication</li> </ul>	jector ers for programming maintenance s and posting of teaching e slides and notes, marks through the annina ecourse platform d social media for change and improved with students
TEACHING METHODS	Activity	Semester workload
The manner and methods of teaching are described in detail.	Lectures	18 hrs
Lectures, seminars, laboratory practice,	Non-directed study	37 hrs
fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational	Projects	45 hrs

visits, project, essay writing, artistic creativity, etc. The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the FCTS			
	Course total	100 hrs	
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	Final exam and programmir	ng assignments	

-Προτεινόμενη Βιβλιογραφία :

- Μηχανική Μάθηση, Δ. Μπότσης, Κ. Διαμαντάρας, Εκδόσεις Κλειδάριθμος, 2019.
- Αναγνώριση Προτύπων και Μηχανική Μάθηση, C. Bishop, Εκδόσεις Φουντάς, 2019
- Machine Learning: A Bayesian and Optimization Perspective, S. Theodoridis, Academic Press, 2020.
- Understanding Deep Learning, S. Prince, MIT Press 2023.

-Συναφή επιστημονικά περιοδικά:

- IEEE Transactions on Pattern Analysis and Machine Intelligence
- IEEE Transactions on Neural Networks and Learning Systems

#### GENERAL

SCHOOL	School of Ec	School of Economic and Administrative Studies			
	School of Er	ngineering			
ACADEMIC UNIT	Departmen	t of Economics			
	Departmen	t of Computer	Science and E	ngir	eering
LEVEL OF STUDIES	Postgraduat	te			
COURSE CODE	ECSY07		SEMESTER	1	
COURSE TITLE	Econometri	CS			
INDEPENDENT TEACHI if credits are awarded for separate co lectures, laboratory exercises, etc. If the whole of the course, give the weekly teach	IING ACTIVITIES components of the course, e.g. the credits are awarded for the aching hours and the total creditsWEEKLY TEACHING HOURSCREDITS		CREDITS		
		Lectures	3		4 ECTS
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d)					
	). Special back	round			
general background, special background, specialised general knowledge, skills development	Special back	ground			
PREREQUISITE COURSES:	No				
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek				
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No				
COURSE WEBSITE (URL)	-				

#### **LEARNING OUTCOMES**

#### Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

 Description of the level of

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
  Guidelines for writing Learning Outcomes

By the end of the course the student will be able to:

- understand and apply least squares and maximum likelihood estimation methods to the multiple regression model
- prove and appreciate the small and large sample properties of the estimators under various conditions
- prove and understand the fundamental theorems in econometrics: Gauss-Markov and Cramer-Rao
- perform statistical testing hypothesis and find confidence intervals for the regression parameters based on well defined statistics under various conditions
- perform predictions based on the regression model and find confidence intervals for future variables.

# • utilize and estimate time series models like AR and ARIMA models. Understand use and define concepts like spectral density function and frequency domain estimation.

#### General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and	Project planning and management
information, with the use of the necessary technology	Respect for difference and multiculturalism
Adapting to new situations	Respect for the natural environment
Decision-making	Showing social, professional and ethical responsibility and
Working independently	sensitivity to gender issues
Team work	Criticism and self-criticism
Working in an international environment	Production of free, creative and inductive thinking
Working in an interdisciplinary environment	
Production of new research ideas	Others
Data Analysis	
Beneficial and a second state of the second structure	La tra casa da

- Develop econometric modelling abilities
- Understand more deeply econometric tools useful for forecasting and economic policy analysis

#### **SYLLABUS**

•	The multiple regression model
•	Least squares theory
•	Maximum likelihood estimation
•	Statistics for testing hypothesis, confidence intervals and predictions for the
	regression model.
•	The general regression model with autocorrelated residuals and/or
	heteroscedasticity

• Predictions on the basis of the regression model

<b>DELIVERY</b> Face-to-face, Distance learning, etc.	Face-to-face		
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	e-mail is used for the communication with the students and an electronic platform is used for posting students' grades		
TEACHING METHODS	Activity	Semester workload	
The manner and methods of teaching are	Lectures	18 hrs	
Lectures, seminars, laboratory practice,	Non-directed study	43 hrs	
fieldwork, study and analysis of bibliography,	Projects	39 hrs	
workshop, interactive teaching, educational	teaching, educational		
visits, project, essay writing, artistic creativity,			
etc.			
The student's study hours for each learning			
activity are given as well as the hours of non- directed study according to the principles of			
the ECTS			
	Course total	100 hrs	
STUDENT PERFORMANCE			
<b>EVALUATION</b> Description of the evaluation procedure	written final exam		

Language of evaluation, methods of	
evaluation, summative or conclusive, multiple	
choice questionnaires, short-answer questions,	
open-ended questions, problem solving,	
written work. essav/report. oral examination.	
nublic presentation laboratory work clinical	
evamination of nations and interpretation	
examination of patient, art interpretation,	
other	
Specifically-defined evaluation criteria are	
given and if and where they are accessible to	
studente	
students.	

- Amemiya, Takeshi (1985). Advanced Econometrics, Harvard University Press
- Greene, William (2017). Econometric Analysis, Pearson.

#### GENERAL

SCHOOL	School of Ec	School of Economic and Administrative Studies			
	School of Er	School of Engineering			
ACADEMIC UNIT	Departmen	t of Economics			
	Departmen	t of Computer	Science and E	ngir	eering
LEVEL OF STUDIES	Postgraduat	te			-
COURSE CODE	ECSY08		SEMESTER	1	
COURSE TITLE	Computer F	Programming I	I		
INDEPENDENT TEACHI if credits are awarded for separate co lectures, laboratory exercises, etc. If the whole of the course, give the weekly teacl	ING ACTIVITIES omponents of the course, e.g. the credits are awarded for the ching hours and the total credits bing hours and the total credits		CREDITS		
Lectures 3 3.5 EC		3.5 ECTS			
Add rows if necessary. The organisation of teaching and the teaching					
COURSE TYPE general background, special background, specialised general knowledge skills development	Special background				
PREREQUISITE COURSES:	Computer Programming with Python				
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek				
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No				
COURSE WEBSITE (URL)	-				

#### **LEARNING OUTCOMES**

#### Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

Description of the level of

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
   Guidelines for writing Learning Outcomes
- After completing the course the students will be able to:

## • Manage data in the disks

- o files
- o databases
- Use Python packets
  - o numpy
  - o matplotlib
- work with spreadsheets in Python
- Use Pandas for applications on economics
- Write object oriented programs with Python
- Write simple machine learning applications with Python

## **General Competences**

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and	Project planning and management
information, with the use of the necessary technology	Respect for difference and multiculturalism
Adapting to new situations	Respect for the natural environment

Decision-making Working independently Team work Working in an international environment Working in an interdisciplinary environment Production of new research ideas Showing social, professional and ethical responsibility and sensitivity to gender issues Criticism and self-criticism Production of free, creative and inductive thinking ..... Others...

- Production of free, creative and inductive thinking
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Adapting to new situations
- Analysis of requirements for problem solving
- Algorithmic thinking
- Abstraction ability for problem modeling
- Working independently

## **SYLLABUS**

- Management of data structures on the disk
  - files
  - o databases
- The numpy package
- Data management with Pandas
- Python and spreadsheets
- The matplotlib library
- Python and machine learning
- Object oriented programming with Python

USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students       Use of projector and interactive board during lectures.         Use of ICT in teaching, laboratory education, communication with students       Course website maintenance. Announcemer and posting of teaching material (lecture slid and notes, programs).         Announcement of assessment marks via the course web site.       Use of email and social media for informatio exchange and improved communication with students.         The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.       Activity       Semester workload Lectures         The student's study hours for each learning       Mon-directed study       31 hrs	<b>DELIVERY</b> Face-to-face, Distance learning, etc.	Face to face		
TEACHING METHODSActivitySemester workloadThe manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.ActivitySemester workloadThe student's study hours for each learningImage: clinical practice art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.Image: clinical practice art workshop, interactive teaching, educational workshop, educati	USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	<ul> <li>Use of projector an lectures.</li> <li>Course website ma and posting of teac and notes, program</li> <li>Announcement of a course web site.</li> <li>Use of email and so exchange and impr students.</li> </ul>	d interactive board during intenance. Announcements hing material (lecture slides is). assessment marks via the ocial media for information oved communication with	
activity are given as well as the hours of non- directed study according to the principles of the ECTS	<b>TEACHING METHODS</b> The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc. The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the ECTS	Activity Lectures Non-directed study Projects	Semester workload 18 hrs 31 hrs 39 hrs	

STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure	The evaluation is based on final exams and programming projects
Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other	
Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	

- Introduction to Computation and Programming Using Python, John V. Guttag
- Introduction to Programming with Python, Schneider David
- Programming with Python, Stratos Kalafatoudis, Georgios Stamoulis
- Introduction to Programming with the aid of Python, Electronic book, George Manis
- Python Scripting for Computational Science [electronic resource], Hans Petter Langtangen
- Beginning Python [electronic resource], Magnus Lie Hetland

#### GENERAL

SCHOOL	School of Ed	conomic and A	dministrative	Stud	dies
	School of Ei	School of Engineering			
ACADEMIC UNIT	Departmen	t of Economics			
	Departmen	t of Computer	Science and E	ngir	neering
LEVEL OF STUDIES	Postgradua	te			
COURSE CODE	ECSE01		SEMESTER	2	
COURSE TITLE	Scientific P	rogramming La	inguages		
INDEPENDENT TEACHI if credits are awarded for separate co lectures, laboratory exercises, etc. If the whole of the course, give the weekly teach	<b>NG ACTIVITI</b> mponents of the e credits are aw hing hours and	<b>ES</b> e course, e.g. varded for the the total credits	WEEKLY TEACHING HOURS	ì	CREDITS
		Lectures	3		4 ECTS
Add rows if necessary. The organisation of methods used are described in detail at (a	f teaching and t ]).	the teaching			
COURSE TYPE general background, special background, specialised general knowledge, skills development	Special bacl	kground			
PREREQUISITE COURSES:	-				
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek				
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No				
COURSE WEBSITE (URL)	-				

#### **LEARNING OUTCOMES**

#### Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
   Guidelines for writing Learning Outcomes

After successful completion of the course students will be able to:

- understand programs written in Matlab and R
- write Matlab and R programs
- use the data structures and programming capabilities of Matlab and R
- organize their programs with functions
- develop small applications

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and	Project planning and management
information, with the use of the necessary technology	Respect for difference and multiculturalism
Adapting to new situations	Respect for the natural environment
Decision-making	Showing social, professional and ethical responsibility and
Working independently	sensitivity to gender issues
Team work	Criticism and self-criticism
Working in an international environment	Production of free, creative and inductive thinking
Working in an interdisciplinary environment	
Production of new research ideas	Others

- Production of free, creative and inductive thinking
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Adapting to new situations
- Analysis of requirements for problem solving
- Algorithmic thinking
- Abstraction ability for problem modelling
- Working independently

## **SYLLABUS**

The course is structured as follows:

- Matlab:
  - o The MATLAB environment
  - Variables-vectors-arrays
  - o Data types
  - Operators
  - o Control structures
  - o Functions
  - o Data import and export
  - o Graphs
  - o Algebra
  - o Calculus
  - Factorization and integration
  - Polynomials
- R:
- o The environment
- Data types
- o Operators
- Control structures
- $\circ$  Functions
- o Graphs
- Data input and output
- o Statistics
- o Machine learning with R

<b>DELIVERY</b> Face-to-face, Distance learning, etc.	Face to face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	<ul> <li>Use of projector and interactive board during lectures.</li> <li>Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, programs).</li> <li>Announcement of assessment marks via the course web site.</li> <li>Use of email and social media for information exchange and improved communication with students.</li> </ul>

TEACHING METHODS	Activity	Semester workload
The manner and methods of teaching are	Lectures	18 hrs
Lectures, seminars, laboratory practice,	Non-directed study	37 hrs
fieldwork, study and analysis of bibliography,	Projects	45 hrs
workshop, interactive teaching, educational		
visits, project, essay writing, artistic creativity, etc.		
The student's study hours for each learning		
activity are given as well as the hours of non-		
directed study according to the principles of the ECTS		
	Course total	100 hrs
STUDENT PERFORMANCE	The evaluation is based on f	inal exams and
<b>EVALUATION</b> Description of the evaluation procedure	programming projects	
Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other		
Specifically-defined evaluation criteria are given, and if and where they are accessible to students.		

- Programming in MATLAB, Marc E. Hernite, Cengage Learning, 2009
- Essential MATLAB for Engineers and Scientists, Brian H. Hahn and Daniel T. Valentine, Academic Press, 2017
- The Book of R, A First Course in Programming and Statistics, Tilman M. Davies, No Starch Press, 2016
- R for Data Science, Hadley Wickham, Mine Çetinkaya-Rundel, Garrett Grolemund, O'Reilly Media, Inc., 2023

# GENERAL

SCHOOL	School of Ed	conomic and A	dministrative	Stud	dies
	School of Engineering				
ACADEMIC UNIT	Department of Economics				
	Departmen	t of Computer	Science and E	ngir	eering
LEVEL OF STUDIES	Postgradua	te			
COURSE CODE	ECSE02		SEMESTER	2	
COURSE TITLE	Special Top	ics in Linear A	lgebra		
INDEPENDENT TEACHI if credits are awarded for separate co lectures, laboratory exercises, etc. If the whole of the course, give the weekly teacl	<b>ING ACTIVITIES</b> components of the course, e.g. he credits are awarded for the ching hours and the total credits		WEEKLY TEACHING HOURS		CREDITS
	Lectures		3		3.5 ECTS
Add rows if necessary. The organisation o	of teaching and the teaching				
methods used are described in detail at (a	l).				
COURSE I YPE aeneral hackaround	Special back	kground			
special background, specialised general					
knowledge, skills development					
PREREQUISITE COURSES:	-				
LANGUAGE OF INSTRUCTION	Greek				
and EXAMINATIONS:	0.001				
IS THE COURSE OFFERED TO	No				
ERASMUS STUDENTS					
COURSE WEBSITE (URL)	-				

#### **LEARNING OUTCOMES**

#### Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
   Guidelines for writing Learning Outcomes

After successful attendance of the course the students are expected to:

- Understand the importance of the relevant concepts in general and especially in Economics.
- Know the basic methods and tools as well as their fields of application.
- Can apply the relevant methods to solve problems with the help of a computer.

General Competences					
Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma					
Supplement and appear below), at which of the following	does the course aim?				
Search for, analysis and synthesis of data and	Project planning and management				
information, with the use of the necessary technology	Respect for difference and multiculturalism				
Adapting to new situations	Respect for the natural environment				
Decision-making	Showing social, professional and ethical responsibility and				
Working independently	sensitivity to gender issues				
Team work	Criticism and self-criticism				
Working in an international environment	Production of free, creative and inductive thinking				
Working in an interdisciplinary environment					
Production of new research ideas	Others				
Production of free, creative and inductive thinking					

• Decision-making.

- Team work.
- Abstraction ability for problem modeling.
- Search for, analysis and synthesis of data and information, with the use of the necessary technology.

# **SYLLABUS**

- Introduction and general concept.
- Linear transformations.
- Eigenvectors and Eigenvalues.
- Characteristic polynomial.
- Linear systems of equations.
- Linear programming and applications.

<b>DELIVERY</b> Face-to-face, Distance learning, etc.	Face to face			
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	<ul> <li>Use of projector and computer during lectures</li> <li>Course website maintenance. Announcement and posting of teaching material (lecture slide and notes).</li> <li>Announcement of assessment marks via the course website</li> </ul>			
TEACHING METHODS	A ativity	Com actor workload		
The manner and methods of teaching are		18 hrs		
described in detail.	Non-directed study	31 hrs		
fieldwork, study and analysis of bibliography,	Projects	39 hrs		
tutorials, placements, clinical practice, art workshop, interactive teaching, educational				
visits, project, essay writing, artistic creativity,				
The student's study hours for each learning activity are aiven as well as the hours of non-				
directed study according to the principles of	Course total	88 hrs		
STUDENT PERFORMANCE	The evaluation is based on fina	al exams and		
EVALUATION	programming assignments			
Description of the evaluation procedure				
Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other				
Specifically-defined evaluation criteria are given, and if and where they are accessible to students.				

Suggested bibliography:

- Searle, S. R. (1982), Matrix Algebra Useful for Statistics, Wiley.
- Gilbert Strang (1999), Γραμμική Άλγεβρα και Εφαρμογές, Πανεπιστημιακές Εκδόσεις Κρήτης.

#### GENERAL

SCHOOL	School of E	conomic and A	dministrative	Stu	dies
	School of Engineering				
ACADEMIC UNIT	Department of Economics				
	Departmen	t of Computer	Colonno and F	nair	ooring
	Departmen	t of Computer	Science and E	ngir	leering
LEVEL OF STUDIES	Postgraduate				
COURSE CODE	ECSE03		SEMESTER	2	
COURSE TITLE	Machine Le	arning II			
INDEPENDENT TEACHI if credits are awarded for separate co lectures, laboratory exercises, etc. If the whole of the course, give the weekly teach	<b>IING ACTIVITIES</b> components of the course, e.g. the credits are awarded for the uching hours and the total credits		WEEKLY TEACHING HOURS		CREDITS
	Lectures		3		4 ECTS
Add rows if necessary. The organisation of methods used are described in detail at (a	f teaching and t ]).	the teaching			
COURSE TYPE general background, special background, specialised general knowledge, skills development	General bad	ckground			
PREREQUISITE COURSES:	-				
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek				
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No				
COURSE WEBSITE (URL)	-				

#### **LEARNING OUTCOMES**

#### Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
- Guidelines for writing Learning Outcomes

After successfully passing this course, the students will be able to:

- Analyze complex data with modern mathematical models
- Model complex machine learning problems
- Apply parametric and non-parametric machine learning mechanisms
- Design decision support machines
- Apply basic mathematical tools and methods to practical issues appearing during machine learning problem solving

**General Competences** Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology Adapting to new situations Decision-making Project planning and management Respect for difference and multiculturalism Respect for the natural environment Showing social, professional and ethical responsibility and 

 Working independently
 sensitivity to gender issues

 Team work
 Criticism and self-criticism

 Working in an international environment
 Production of free, creative and inductive thinking

 Working in an interdisciplinary environment
 ......

 Production of new research ideas
 Others...

 •
 Production of free, creative, and inductive thinking

 •
 Search for, analysis and synthesis of data and information, with the use of the

- necessary technology
- Adapting to new situations
- Requirement analysis
- Algorithmic thinking
- Abstraction ability for problem modeling
- Autonomous work

# SYLLABUS

## Unsupervised learning

- Probability density estimation
- Data clustering
  - The K-means algorithm
  - Spectral clustering
  - Mixture models

Dimensionality reduction, and latent variable modeling

- Singular value decomposition
- Principal component analysis
- Canonical correlation analysis
- Linear discriminant analysis.
- Nonlinear methods
- Independent component analysis

<b>DELIVERY</b> Face-to-face, Distance learning, etc.	Face to face		
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	<ul> <li>Use of slide projector</li> <li>Use of computer for programming demonstration</li> <li>Course website maintenance</li> <li>Announcements and posting of teaching material (lecture slides and notes, programs) and marks through the University of Ioannina ecourse platform</li> <li>Use of email and social media for information exchange and improved communication with students</li> </ul>		
<b>TEACHING METHODS</b> The manner and methods of teaching are	Activity	Semester workload	
described in detail. Lectures seminars laboratory practice	Non-directed study	10 1115 37 hrs	
fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.	Projects	45 hrs	
The student's study hours for each learning activity are given as well as the hours of non-			

directed study according to the principles of the ECTS	Course total	100 hrs
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other	Final exam and programmir	ng assignments
Specifically-defined evaluation criteria are given, and if and where they are accessible to students.		

-Προτεινόμενη Βιβλιογραφία :

- Μηχανική Μάθηση, Δ. Μπότσης, Κ. Διαμαντάρας, Εκδόσεις Κλειδάριθμος, 2019.
- Αναγνώριση Προτύπων και Μηχανική Μάθηση, C. Bishop, Εκδόσεις Φουντάς, 2019
- Machine Learning: A Bayesian and Optimization Perspective, S. Theodoridis, Academic Press, 2020.
- Understanding Deep Learning, S. Prince, MIT Press 2023.

-Συναφή επιστημονικά περιοδικά:

- IEEE Transactions on Pattern Analysis and Machine Intelligence
- IEEE Transactions on Neural Networks and Learning Systems

#### GENERAL

SCHOOL	School of Ec	School of Economic and Administrative Studies			
	School of Engineering				
ACADEMIC UNIT	Department of Economics				
	Departmen	t of Computer	Science and E	ngin	eering
LEVEL OF STUDIES	Postgraduat	te			-
COURSE CODE	ECSE04		SEMESTER	2	
COURSE TITLE	Microecono	omics II			
INDEPENDENT TEACHI if credits are awarded for separate co lectures, laboratory exercises, etc. If the whole of the course, give the weekly teach	<b>HING ACTIVITIES</b> components of the course, e.g. the credits are awarded for the aching hours and the total credits		WEEKLY TEACHING HOURS		CREDITS
	Lectures		3		4 ECTS
Add rows if necessary. The organisation of	f teaching and t	the teaching			
	). Special back	around			
general background,	Special back	ground			
special backgrouna, specialisea general knowledge, skills development					
PREREQUISITE COURSES:	-				
LANGUAGE OF INSTRUCTION	Greek				
and EXAMINATIONS:					
IS THE COURSE OFFERED TO	No				
ERASMUS STUDENTS					
COURSE WEBSITE (URL)	-				

#### **LEARNING OUTCOMES**

#### Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
  Guidelines for writing Learning Outcomes
- By the end of the course the student will be able to:
  - To know the economic tools for understanding and analyzing (i) the structure of the market for products or services, (ii) the decision-making of companies regarding product pricing, product quality, their entry into a new product market.
  - Understand the strategic interactions between businesses.
  - To develop strategic thinking with Game Theory.
  - To recognize and analyze business strategies that limit competition.

#### **General Competences**

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology Adapting to new situations Decision-making Working independently Project planning and management Respect for difference and multiculturalism Respect for the natural environment Showing social, professional and ethical responsibility and sensitivity to gender issues Team work Working in an international environment Working in an interdisciplinary environment Production of new research ideas Criticism and self-criticism Production of free, creative and inductive thinking ..... Others...

- Working independently
- Working in an interdisciplinary environment
- Decision-making
- Criticism and self-criticism
- Production of free, creative and inductive thinking

## **SYLLABUS**

- Game theory
- Oligopoly and strategic interaction
- Anticompetitive behavior and antimonopolistic policy
- Empirical applications with the use of r software and maxima

<b>DELIVERY</b> Face-to-face, Distance learning, etc.	Face-to-face			
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	e-mail is used for the communication with the student and an electronic platform is used for posting students grades			
TEACHING METHODS The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc. The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the ECTS	Activity       Lectures       Non-directed study       Projects	Semester workload 18 hrs 43 hrs 39 hrs		
	Course total	100 hrs		
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	<ul> <li>written final ex</li> <li>written work</li> </ul>	kam		

- Suggested bibliography:

- Related academic journals:

- MasCollel, Whinston, Green "Microeconomic Theory", Oxford University Press (1995).
- Thomas Nechyba, Microeconomics: An Intuitive Approach with Calculus, Cengage Learning; 2nd edition.
- Lynne Pepall, Dan Richards, George Norman, "Industrial Organization", 2016, Blackwell Publishing.
- Game Theory for Applied Economists, Gibbons Robert, Princeton University Press.
- Hammock, M. R., Mixon, J. W. Microeconomic Theory and Computation, Springer-Verlag New York, (2016).

# COURSE OUTLINE "Advanced Statistical Modelling"

#### **GENERAL**

SCHOOL	School of Economic and Administrative Studies				
	School of Engineering				
ACADEMIC UNIT	Department of Economics				
	Departmen	t of Computer :	Science and E	ngir	eering
LEVEL OF STUDIES	Postgraduat	te			
COURSE CODE	ECSE05 SEMESTER 2				
COURSE TITLE	Advanced S	tatistical Mod	elling		
INDEPENDENT TEACHI if credits are awarded for separate co lectures, laboratory exercises, etc. If the whole of the course, give the weekly teach	<b>HING ACTIVITIES</b> components of the course, e.g. the credits are awarded for the aching hours and the total credits		WEEKLY TEACHING HOURS	, I	CREDITS
		Lectures	3		4 ECTS
Add rows if necessary. The organisation of methods used are described in detail at (a	f teaching and t [].	the teaching			
COURSE TYPE general background, special background, specialised general knowledge, skills development	special back	ground			
PREREQUISITE COURSES:	No				
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek				
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No				
COURSE WEBSITE (URL)	-				

## **LEARNING OUTCOMES**

#### Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
  Guidelines for writing Learning Outcomes

Upon completion of the course, students will be able to:

- Analyze large volumes of data, which is crucial for understanding and interpreting economic phenomena.
- Understand basic regression models.
- Create statistical models that can be used for analyzing economic relationships and making predictions.
- Utilize statistical methodology to solve complex economic problems, such as understanding the determinants of consumer behavior or forecasting future economic trends.
- Communicate the results of their analyses to others, including economists, policymakers, and the general public.
- Use statistical software such as STATA/R for data analysis and model creation.
- Evaluate the validity and accuracy of statistical methods and results.

<b>General Competences</b> Taking into consideration the general competences that Supplement and appear below), at which of the following	the degree-holder must acquire (as these appear in the Diploma 9 does the course aim?				
Search for, analysis and synthesis of data and information, with the use of the necessary technology Adapting to new situations Decision-making Working independently Team work Working in an international environment Working in an interdisciplinary environment Production of new research ideas	Project planning and management Respect for difference and multiculturalism Respect for the natural environment Showing social, professional and ethical responsibility and sensitivity to gender issues Criticism and self-criticism Production of free, creative and inductive thinking  Others				
• Search for, analysis and synthesis of data and information, with the use of the					

- necessary technology
- Data analysis
- Decision-making
- Production of free, creative and inductive thinking

## **SYLLABUS**

- Statistical Hypothesis Testing for Quantitative Variables
- Statistical Hypothesis Testing for Categorical Variables
- Analysis of Variance (ANOVA)
- Correlation
- Simple Linear Regression
- Multiple Linear Regression
- Conclusions and Interpretation of Regression
- Assumptions of Ordinary Least Squares (OLS) Method
- Regression with Variable Transformations and/or Indicator Variables
- Heteroscedasticity
- Panel Data
- Instrumental Variables
- Simultaneous Equation Models
- Construction of Polynomial Models
- Logistic Regression Models
- Time Series

DELIVERY	Face-to-face			
USE OF INFORMATION AND	Email is used for communic	ation with students, as well		
COMMUNICATIONS TECHNOLOGY	as the electronic platform of the secretary's office for			
Use of ICT in teaching, laboratory education, communication with students	posting students' grades.			
TEACHING METHODS	Activity	Semester workload		
The manner and methods of teaching are	Lectures18 hrsNon-directed study43 hrs			

Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc. The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the ECTS	Projects	39 hrs
	Course total	100 hrs
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	Written final exam	

- "Statistics" from Robert S. Witte & John S. Witte
- "Statistics for Business and Economics" from Paul Newbold, William L. Carlson, & Betty Thorne
- "Statistics and Data Analysis for Financial Engineering" from David Ruppert

#### GENERAL

SCHOOL	School of Ed	conomic and A	dministrative	Stud	dies
	School of Engineering				
ACADEMIC UNIT	Department of Economics				
	Departmen	t of Computer	Science and E	ngir	neering
LEVEL OF STUDIES	Postgradua	te		0	0
COURSE CODE	ECSE06		SEMESTER	2	
COURSE TITLE	Advanced F	inancial Econo	ometrics		
INDEPENDENT TEACHI if credits are awarded for separate co lectures, laboratory exercises, etc. If the whole of the course, give the weekly teacl	HING ACTIVITIES components of the course, e.g. the credits are awarded for the uching hours and the total creditsWEEKLY TEACHING HOURSCREDITS			CREDITS	
	Lectures 3 3.5 ECTS			3.5 ECTS	
Add rows if necessary. The organisation of methods used are described in detail at (a	f teaching and t !).	the teaching			
COURSE TYPE general background, special background, specialised general knowledge, skills development	General background				
PREREQUISITE COURSES:	Econometrics, Statistics and Probabilities				
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek				
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No				
COURSE WEBSITE (URL)	-				

#### **LEARNING OUTCOMES**

#### Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
- Guidelines for writing Learning Outcomes

After completing the course, students will be able to:

- Analyze financial data of various frequencies to separate empirical properties and stylized facts of financial data.
- Understand advanced financial risk analysis models.
- Manage financial-economic models for the prediction, management and volatility of financial risk.
- Use statistical/econometric packages to analyze financial data by evaluating the validity and accuracy of results in real world problems.

#### **General Competences**

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology Adapting to new situations Decision-making Working independently Project planning and management Respect for difference and multiculturalism Respect for the natural environment Showing social, professional and ethical responsibility and sensitivity to gender issues

Team work	Criticism and self-criticism
Working in an international environment	Production of free, creative and inductive thinking
Working in an interdisciplinary environment	
Production of new research ideas	Others
<ul> <li>Search, analysis and synthesis of data</li> </ul>	ita and information, using the necessary
technologies	
technologies	
Data analysis	
<ul> <li>Decision making</li> </ul>	
Autonomous work	
Teamwork	
Evercise criticism and self-criticism	
<ul> <li>Promotion of free, creative and ind</li> </ul>	uctive thinking

## SYLLABUS

- Asset returns
  - Empirical properties and stylized facts
    - Marke efficiency and predictability
- Volatility modeling
  - Univariate and multivariate autoregressive conditional heteroskedasticity
  - (ARCH) family of models
    - Stochastic volatility models
    - Applications to risk management and derivatives pricing
- Extreme value theory and copulas
  - Univariate models
  - Multivariate models
- Ultra high frequency time series
  - Market microstructure models
  - Realized variance, covariance and bi-power variation
  - Applications to volatility modeling and market microstructure models
- Continuous time models
  - Common models for equity and interest rates
  - Applications to derivatives pricing
  - Relationship to realized variance

<b>DELIVERY</b> Face-to-face, Distance learning, etc.	Distance learning			
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	Email is used for communication with students, as well as the electronic platform of the secretary's office for posting students' grades.			
TEACHING METHODS	Activity	Semester workload		
The manner and methods of teaching are	Lectures	18 hrs		
Lectures, seminars, laboratory practice,	Non-directed study	39 hrs		
fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art	Projects	31 hrs		
workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.				
The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of				
the ECTS	Course total	88 hrs		

STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other	<ul><li>essay/report</li><li>public presentation</li></ul>
Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	

- Suggested bibliography: - Related academic journals:

- Taylor, S. (2005). Asset Price Dynamics, Volatility, and Prediction. Princeton University Press.
- Jondeau, E., Poon, S.-H., and Rockinger, M. (2006). Financial Modeling Under Non-Gaussian Distributions, Springer-Verlag ebook. Available online from UW libraries.
- Zivot, E. and Wang, J. (2006). Modeling Financial Time Series with S-PLUS, Second Edition. Springer-Verlag.
- Tsay, R. (2006). Analysis of Financial Time Series, Second Edition. Wiley.

#### GENERAL

SCHOOL	School of Ec	School of Economic and Administrative Studies			
	School of Er	School of Engineering			
ACADEMIC UNIT	Departmen	Department of Economics			
	Departmen	t of Computer	Science and E	ngir	eering
LEVEL OF STUDIES	Postgraduat	te			
COURSE CODE	ECSE07		SEMESTER	2	
COURSE TITLE	Time Series	Analysis			
INDEPENDENT TEACHI if credits are awarded for separate co lectures, laboratory exercises, etc. If the whole of the course, give the weekly teach	HING ACTIVITIES components of the course, e.g. the credits are awarded for the aching hours and the total credits			CREDITS	
		3		3.5 ECTS	
Add rows if necessary. The organisation o	f teaching and t N	the teaching			
<b>COURSE TYPE</b> general background, special background, specialised general knowledge, skills development	Special back	kground			
PREREQUISITE COURSES:	-				
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek				
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No				
COURSE WEBSITE (URL)	-				

#### **LEARNING OUTCOMES**

#### Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
  Guidelines for writing Learning Outcomes

## After completing the course the students will be able to:

- Understand the concept of a discrete-time signal
- Analyse linear time-invariant systems
- Use the discrete-time Fourier transform and the discrete Fourier transform
- Understand the concept of a stochastic process
- Understand the concepts of autocorrelation function and power spectral density
- Practically obtain the power spectral density of a stochastic signal

## **General Competences**

··· · · · <b>F</b> ···· ···					
Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma					
Supplement and appear below), at which of the following	J does the course alm?				
Search for, analysis and synthesis of data and	Project planning and management				
information, with the use of the necessary technology	Respect for difference and multiculturalism				
Adapting to new situations	Respect for the natural environment				
Decision-making	Showing social, professional and ethical responsibility and				
Working independently	sensitivity to gender issues				
Team work	Criticism and self-criticism				
Working in an international environment	Production of free, creative and inductive thinking				
Working in an interdisciplinary environment					
Production of new research ideas	Others				

- Production of free, creative and inductive thinking
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Adapting to new situations
- Analysis of requirements for problem solving
- Algorithmic thinking
- Abstraction ability for problem modeling
- Working independently

## **SYLLABUS**

- Time series and discrete-time signals
- Linear time-invariant systems
- Discrete-time Fourier Transform and Discrete Fourier Transform
- Discrete-time stochastic processes
- Correlation function and power spectral density
- Spectral estimation

<b>DELIVERY</b> Face-to-face. Distance learnina. etc.	Face to face			
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	<ul> <li>Use of slide projector</li> <li>Use of computers for programming demonstration</li> <li>Course website maintenance</li> <li>Announcements and posting of teaching material (lecture slides and notes, programs) and marks through the University of Ioannina ecourse platform</li> <li>Use of email and social media for information exchange and improved communication with students</li> </ul>			
TEACHING METHODS	Activity	Semester workload		
described in detail.	Lectures	18 hrs		
Lectures, seminars, laboratory practice, fieldwork study and analysis of hibliography	Non-directed study	31 hrs		
tutorials, placements, clinical practice, art	Projects	39 hrs		
workshop, interactive teaching, educational visits, project, essay writing, artistic creativity.				
etc.				
The student's study hours for each learning				
activity are given as well as the hours of non-				
the ECTS				
	Course total 88 hrs			
STUDENT PERFORMANCE				
<b>EVALUATION</b> Description of the evaluation procedure	The evaluation is based on final exams and			
Language of evolution methods of	programming projects			
Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical				

examination of patient, art interpretation, other	
Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	

- Probability, Random Variables and Stochastic Processes, 4<sup>th</sup> Edition, A. Papoulis, S.U. Pillai
- Discrete Time Signal Processing, A. Oppenheim, R. W. Schafer

GENERAL				
SCHOOL	School of Economic and Administrative Studies			
	School of E	School of Engineering		
ACADEMIC UNIT	Departmen	t of Economics		
	Departmen	t of Computer	Science and Eng	ineering
LEVEL OF STUDIES	Postgradua	te		
COURSE CODE	ECSE08		SEMESTER 2	
COURSE TITLE	Dynamic M	acroeconomic	s	
INDEPENDENT TEACHI if credits are awarded for separate co lectures, laboratory exercises, etc. If the whole of the course, give the weekly teacl	<b>NG ACTIVITI</b> mponents of the e credits are aw hing hours and	<b>ES</b> e course, e.g. varded for the the total credits	WEEKLY TEACHING HOURS	CREDITS
		Lectures	3	3.5 ECTS
Add rows if necessary. The organisation of	f teaching and a	the teaching		
	ij. Gonoral bai	ckground		
general background,	General ba	ckground		
special background, specialised general				
	_			
LANGUAGE OF INSTRUCTION	Greek			
and EXAMINATIONS:				
IS THE COURSE OFFERED TO	No			
ERASMUS STUDENTS				
COURSE WEBSITE (URL)	-			

## **LEARNING OUTCOMES**

#### Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

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- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
- Guidelines for writing Learning Outcomes
  - Learning the tools for solving, simulating, and interpreting modern dynamic macroeconomic models.
  - Learning to use programming languages like Matlab to illustrate how dynamic models can be applied to simulate economic scenarios.
  - Acquiring skills in analyzing time-series data to comprehend economic trends, fluctuations, and cycles using statistical and econometric methods.
  - Familiarity with executing research, conducting review of existing literature, performing rigorous analyses, and effectively communicating findings through result presentations.

#### **General Competences**

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology Adapting to new situations Decision-making Project planning and management Respect for difference and multiculturalism Respect for the natural environment Working independently Team work Working in an international environment Working in an interdisciplinary environment Production of new research ideas Showing social, professional and ethical responsibility and sensitivity to gender issues Criticism and self-criticism Production of free, creative and inductive thinking .....

Others...

- Working independently
- Working in an international environment
- Criticism and self-criticism
- Production of free, creative and inductive thinking

#### **SYLLABUS**

- Tools for Dynamic Optimization in discrete time
- Aggregate fluctuations, stylized business cycle facts
- Real Business Cycle (RBC) models
- Using MATLAB to solve and simulate dynamic general equilibrium models

<b>DELIVERY</b> Face-to-face, Distance learning, etc.	Distance learning			
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	<ul> <li>Course material is available online through the e- course platform</li> <li>Grades are submitted through ClassWeb.</li> <li>Students are required to work with search engines for scientific journals</li> </ul>			
TEACHING METHODS	Activity	Semester workload		
The manner and methods of teaching are	Lectures	18 hrs		
Lectures, seminars, laboratory practice,	Non-directed study	39 hrs		
fieldwork, study and analysis of bibliography, tutorials placements clinical practice art	Projects	31 hrs		
workshop, interactive teaching, educational				
visits, project, essay writing, artistic creativity, etc.				
The student's study hours for each learning activity are given as well as the hours of non-				
directed study according to the principles of the				
ECTS	Course total	88 hrs		
STUDENT PERFORMANCE				
EVALUATION	Assignment			
Description of the evaluation procedure	Written final exam			
Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open- ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other				
Specifically-defined evaluation criteria are given, and if and where they are accessible to students.				

- Suggested bibliography:

- Wickens, Michael. Macroeconomic Theory: A Dynamic General Equilibrium Approach.
- Thomas Cooley, ed., Frontiers of Business Cycle Research.
- George McCandless, The ABCs of RBCs: An Introduction to Dynamic Macroeconomic Models.
- Carl Walsh, Monetary Theory and Policy.
- David Romer, Advanced Macroeconomics.
- Lars Ljungqvist and Thomas Sargent, Recursive Macroeconomic Theory.
- Olivier Blanchard and Stanley Fischer, Lectures on Macroeconomics.
- Jerome Adda and Russell Cooper, Dynamic Economics-Quantitative Methods and Applications.

- Related academic journals:

- American Economic Review
- Journal of Monetary Economics
- European Journal of Political Economy
- Review of Economic Dynamics

#### GENERAL

SCHOOL	School of Ec	School of Economic and Administrative Studies			
	School of Er	School of Engineering			
ACADEMIC UNIT	Departmen	Department of Economics			
	Departmen	t of Computer	Science and E	ngir	eering
LEVEL OF STUDIES	Postgraduat	te			
COURSE CODE	ECSE09		SEMESTER	2	
COURSE TITLE	Special Top	ics in Microeco	onomics		
INDEPENDENT TEACHI if credits are awarded for separate co lectures, laboratory exercises, etc. If the whole of the course, give the weekly teacl	HING ACTIVITIES components of the course, e.g. the credits are awarded for the control to the total credits the total credits the credits are awarded for the the credits are awarded for the the credits are awarded for the the credits are awarded for the the credits are awarded for the credits ar			CREDITS	
	Lectures				4 ECTS
Add rows if necessary. The organisation of methods used are described in detail at (a	f teaching and t  ).	he teaching			
COURSE TYPE general background, special background, specialised general knowledge, skills development	Special back	ground			
PREREQUISITE COURSES:	Microeconomics I and II				
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek				
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No				
COURSE WEBSITE (URL)	-				

#### **LEARNING OUTCOMES**

#### Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

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  Guidelines for writing Learning Outcomes

The course focuses on firms' choices and imperfectly competitive markets. Particularly on the role of networks and the behaviour of platforms.

In the last part of the course, we will cover techniques for computing optimal actions in asymmetric-information games focusing on bidding in auctions.

Students will be able to understand:

- Firms' decisions related to the design and diffusion of technology.
- The role of economics of information.

**General Competences** 

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology Adapting to new situations Decision-making Project planning and management Respect for difference and multiculturalism Respect for the natural environment Showing social, professional and ethical responsibility and sensitivity to gender issues Criticism and self-criticism Production of free, creative and inductive thinking .....

Others...

- Working Independently
- Decision Making
- Criticism and Self-criticism
- Production of free and inductive thinking

#### **SYLLABUS**

- Markets with network goods: Network effects; Empirical evidence on network effects; Markets for a single network good: Modelling the demand for a network good; Provision of a network good
- Topics on Platforms and Two-sided Markets: Monopoly platform pricing; Platforms competition; Media markets
- Asymmetric-information games and Bayesian-Nash equilibrium; Auctions

<b>DELIVERY</b> Face-to-face, Distance learning, etc.	Face to face		
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	<ul> <li>The material for the lesson will be available electronically through the e-course platform</li> <li>Grades will be submitted using class-web</li> <li>Students will be obliged to use search machines or the internet for scientific journals</li> </ul>		
TEACHING METHODS	Activity	Semester workload	
The manner and methods of teaching are described in detail	Lectures	18 hrs	
Lectures, seminars, laboratory practice,	Non-directed study	43 hrs	
fieldwork, study and analysis of bibliography, tutorials placements clinical practice art	Projects	39 hrs	
workshop, interactive teaching, educational			
visits, project, essay writing, artistic creativity, etc.			
The student's study hours for each learning			
activity are given as well as the hours of non-			
directed study according to the principles of the ECTS			
	Course total	100 hrs	
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination,	Final written exam		
public presentation, laboratory work, clinical examination of patient, art interpretation, other Specifically-defined evaluation criteria are			
given, and if and where they are accessible to students.			

- P. Belleflamme, M. Peitz | industrial organization: markets and strategies
- Gibbons R. | game theory for applied economists
- Martin J. Osborne and Ariel Rubinstein | a course in game theory
- David Easley and Jon Kleinberg, Networks, Crowds, and Markets: reasoning about a highly connected world, Cambridge University Press.
- Armstrong M. | "Competition in Two-sided Markets", (2006), Rand Journal of Economics 37: 668-691

#### GENERAL

SCHOOL	School of Economic and Administrative Studies				
	School of Engineering				
ACADEMIC UNIT	Department of Economics				
	Departmen	Department of Computer Science and Engineering			
LEVEL OF STUDIES	Postgraduate				
COURSE CODE	ECSE10 SEMESTER 2				
COURSE TITLE	Introduction to Business Intelligence				
INDEPENDENT TEACHI if credits are awarded for separate co	NG ACTIVITI	ES 2 course. e.a.	WEEKLY	WEEKLY	
lectures, laboratory exercises, etc. If the whole of the course, give the weekly teach	the credits are awarded for the china hours and the total credits		HOURS	x	CREDITS
	Lectures 3 4 ECTS			4 ECTS	
Add rows if necessary. The organisation of methods used are described in detail at (a	of teaching and the teaching (d).				
COURSE TYPE	Special back	kground			
general background,					
knowledge, skills development					
PREREQUISITE COURSES:	-				
LANCHACE OF INSTRUCTION	Creak				
and EXAMINATIONS:	ыстеек				
IS THE COURSE OFFERED TO	No				
ERASMUS STUDENTS					
COURSE WEBSITE (URL)	-				

#### **LEARNING OUTCOMES**

#### Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
- Guidelines for writing Learning Outcomes

After successfully passing this course the students will be able to:

- Know the state-of-the-art and the historical evolution of the area under study
- Understand in depth the fundamental concepts of business intelligence
- Understand in depth the critical elements of a data warehouse architecture
- Design and organize the structure of a data warehouse using appropriate data representations both at the logical and conceptual levels, such that the data can be easily and efficiently retrieved
- Query data warehouses with SQL and OLAP operators

#### **General Competences**

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and	Project planning and management
information, with the use of the necessary technology	Respect for difference and multiculturalism
Adapting to new situations	Respect for the natural environment
Decision-making	Showing social, professional and ethical responsibility and
Working independently	sensitivity to gender issues
Team work	Criticism and self-criticism
Working in an international environment	Production of free, creative and inductive thinking

Working in an interdisciplinary environment Production of new research ideas	 Others
• Production of free, creative and in	nductive thinking
<ul> <li>Search for, analysis and synthes necessary technology</li> </ul>	sis of data and information, with the use of the
<ul> <li>Team work</li> <li>Algorithmic thinking</li> <li>Abstraction ability for problem me</li> <li>Apply research results in solving p</li> <li>Literature studying and managem</li> </ul>	odeling practical problems nent

## **SYLLABUS**

- Overview of the area of data warehousing and OLAP.
- Review of fundamental database concepts and SQL.
- Multidimensional models, hierarchies, data warehouse architectures.
- Data warehouse design.
- OLAP & data analytics.
- Project development.

<b>DELIVERY</b> Face-to-face, Distance learning, etc.	Weekly Lectures		
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	<ul> <li>Use of projector and interactive board during lectures.</li> <li>Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, programs).</li> <li>Announcement of assessment marks via the course web site.</li> <li>Use of email and social media for information exchange and improved communication with students.</li> </ul>		
<b>TEACHING METHODS</b> The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc. The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the ECTS	Activity Lectures Non-directed study Projects	Semester workload 18 hrs 37 hrs 45 hrs	
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure Language of evaluation, methods of evaluation summative or conclusive multiple	<ul> <li>At each lecture, the stu prepared on the materi participate in the critical</li> </ul>	dents are asked to be ial of the lecture and to al discussions that arise.	

choice questionnaires, short-answer questions, open-ended auestions, problem solving,	• At each lecture, the students are asked to answer	
written work, essay/report, oral examination,	to questions and exercises related to the learning	
public presentation, laboratory work, clinical	outcomes of the previous lecture.	
other	<ul> <li>A programming assignment (project).</li> </ul>	
	Final exam	
Specifically-defined evaluation criteria are aiven, and if and where they are accessible to	The evaluation procedure is accessible to students via	
students.	the course website.	

- Suggested bibliography:

- Available via Springerlink: Data Warehouse Systems: Design and Implementation, A. Vaisman & E. Zimanyi, Springer, 2nd edition 2022, https://doi.org/10.1007/978-3-662-65167-4
- Book [22683637]: Θεμελιώδεις αρχές συστημάτων βάσεων δεδομένων, Συγγραφείς: Elmasri Ramez, Navathe Shamkant B., Έκδοση: 6η Έκδοση Αναθεωρημένη/2012, ISBN: 978-960-531-281-7, Διαθέτης (Εκδότης): ΔΙΑΥΛΟΣ Α.Ε. ΕΚΔΟΣΕΙΣ ΒΙΒΛΙΩΝ
- Book [18548901]: Συστήματα διαχείρισης βάσεων δεδομένων, Συγγραφείς: Ramakrishnan Raghu, Gehrke Johannes, Έκδοση: 3η Έκδοση/2011, ISBN: 978-418-960-371-5, Διαθέτης (Εκδότης): ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε.
- Book [12535833]: Συστήματα Βάσεων Δεδομένων, Συγγραφείς: Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Έκδοση: 6η έκδ./2011, ISBN: 978-960-512-623-0, Διαθέτης (Εκδότης): Χ. ΓΚΙΟΥΡΔΑ & ΣΙΑ ΕΕ

- Related academic journals:

- ACM Transactions on Database Systems
- IEEE Transactions on Knowledge and Data Engineering
- The VLDB Journal, Springer
- Information Systems, Elsevier

# **COURSE OUTLINE "Comparative Effectiveness Research"**

## GENERAL

SCHOOL	School of Economic and Administrative Studies				
	School of Engineering				
ACADEMIC UNIT	Departmen	Department of Economics			
	Departmen	t of Computer	Science and E	ngin	eering
LEVEL OF STUDIES	Postgraduat	Postgraduate			
COURSE CODE	ECSE11 SEMESTER 2				
COURSE TITLE	Comparativ	e Effectivenes	s Research		
INDEPENDENT TEACHI if credits are awarded for separate co lectures, laboratory exercises, etc. If the whole of the course, give the weekly teach	<b>IING ACTIVITIES</b> components of the course, e.g. he credits are awarded for the ching hours and the total credits		WEEKLY TEACHINO HOURS	Ĵ	CREDITS
	Lectures 3 4 EC		4 ECTS		
Add rows if necessary. The organisation of methods used are described in detail at (a	f teaching and t 1).	the teaching			
COURSE TYPE general background, special background, specialised general knowledge, skills development	Special back	kground			
PREREQUISITE COURSES:	-				
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek				
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No				
COURSE WEBSITE (URL)	-				

## **LEARNING OUTCOMES**

#### Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

Description of the level

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
  Guidelines for writing Learning Outcomes

Upon completion of the course, students will be able to:

- Understand the basic principles of survival analysis and its application to time-toevent data.
- Apply survival models and conduct risk analysis on real-world data.
- Grasp the fundamental principles of post-analysis and be able to summarize results from various studies.
- Evaluate the quality of post-analyses and assess the risk of bias.
- Comprehend the design and statistical analysis of clinical trials and apply the relevant methods to real data.
- Apply their analytical skills to practical problems in economic evaluation of treatments and interventions.
- Utilize statistical software such as STATA/R for data analysis and the implementation of the aforementioned methodologies.

## **General Competences**

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim? Search for, analysis and synthesis of data and Project planning and management

information, with the use of the necessary technology Adapting to new situations Decision-making Working independently Team work Working in an international environment Working in an interdisciplinary environment

Respect for difference and multiculturalism Respect for the natural environment Showing social, professional and ethical responsibility and sensitivity to gender issues Criticism and self-criticism Production of free, creative and inductive thinking

Others ... Production of new research ideas Search for, analysis and synthesis of data and information, with the use of the

necessary technology

- Data analysis
- **Decision-making** •
- Production of free, creative and inductive thinking

## **SYLLABUS**

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Introduction to Survival Analysis

- Survival Time Distribution
- Estimation and Verification of Survival Functions
- **Risk Analysis** •
- **Multivariable Models** •
- **Applications in Economics**

#### Introduction to Meta-Analysis

- **Applications in Intervention Outcome Studies** •
- Methodology for Combining Study Results
- Summary Meta Analyses •
- Meta -Analyses with Multiple Outcomes
- **Applications in Economics** •

#### Introduction to Clinical Trials

- **Basic Concepts of Clinical Trial Design** •
- **Randomized Clinical Trial Design**
- Statistical Methods for Clinical Trial Analysis
- Applications in Clinical Trials and Economic Evaluation •

DELIVERY	Face-to-face		
Face-to-face, Distance learning, etc.			
USE OF INFORMATION AND	Email is used for communication with students, as well		
COMMUNICATIONS TECHNOLOGY	as the electronic platform of the secretary's office for		
Use of ICT in teaching, laboratory education,	posting students' grades.		
communication with statents	1 0 0		
TEACHING METHODS	Activity	Semester workload	
TEACHING METHODS The manner and methods of teaching are described in datail	Activity Lectures	Semester workload 18 hrs	
TEACHING METHODS The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice,	Activity Lectures Non-directed study	Semester workload 18 hrs 43 hrs	
TEACHING METHODS The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorika, placements, clinical, practice, art	Activity Lectures Non-directed study Projects	Semester workload 18 hrs 43 hrs 39 hrs	

workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc. The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the ECTS	Course total	100 hrs
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	Written final exam	

- "Applied Survival Analysis: Regression Modelling of Time-to-Event Data" from David W. Hosmer Jr., Stanley Lemeshow & Susanne May.
- "Statistical Methods for Meta-Analysis" from Larry V. Hedges & Ingram Olkin.
- "Design and Analysis of Clinical Trials: Concepts and Methodologies" from Shein-Chung Chow, Jen-Pei Liu, &Yi-Lin Wu.

#### GENERAL

SCHOOL	School of Economic and Administrative Studies				
	School of Engineering				
ACADEMIC UNIT	Department of Economics				
	Departmen	t of Computer	Science and E	ngir	eering
LEVEL OF STUDIES	Postgraduate				
COURSE CODE	ECSE12 SEMESTER 2				
COURSE TITLE	Microecono	ometrics			
INDEPENDENT TEACHI if credits are awarded for separate co lectures, laboratory exercises, etc. If the whole of the course, give the weekly teach	<b>ING ACTIVITIES</b> components of the course, e.g. he credits are awarded for the ching hours and the total credits		WEEKLY TEACHING HOURS		CREDITS
	Lectures		3		4 ECTS
Add rows if necessary. The organisation of methods used are described in detail at (a	f teaching and t !).	the teaching			
COURSE TYPE general background, special background, specialised general knowledge, skills development	Special back	kground			
PREREQUISITE COURSES:	Microeconomics, Statistics				
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek				
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No				
COURSE WEBSITE (URL)	-				

#### **LEARNING OUTCOMES**

#### Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
  Guidelines for writing Learning Outcomes
- By the end of the course the student will be able to:
  - Have a general and comprehensive understanding of econometric models used in with time-series and panel data.
  - Critically approach reading and interpretation of their own applied microeconomic analysis.
  - Analyse economic relationships using real-life data, estimate state of art models on these data and generate predictions about the relationships in question.

General Competences				
Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma				
Supplement and appear below), at which of the following	does the course aim?			
Search for, analysis and synthesis of data and	Project planning and management			
information, with the use of the necessary technology	Respect for difference and multiculturalism			
Adapting to new situations	Respect for the natural environment			
Decision-making	Showing social, professional and ethical responsibility and			
Working independently	sensitivity to gender issues			
Team work	Criticism and self-criticism			

Working in an international environment Working in an interdisciplinary environment Production of new research ideas Production of free, creative and inductive thinking

Others...

- Working independently
- Working in an international environment
- Working in an interdisciplinary environment
- Respect for difference and multiculturalism
- Criticism and self-criticism
- Production of free, creative and inductive thinking

## **SYLLABUS**

- Microeconomic data structure
- Simple regression
- Multiple regression
- Time series
- Panel data

DELIVERY	Face-to-face			
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	e-mail is used for the communication with the students and an electronic platform is used for posting students' grades			
TEACHING METHODS	Activity Semester workload			
The manner and methods of teaching are	Lectures	18 hrs		
Lectures, seminars, laboratory practice,	Non-directed study	43 hrs		
fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational	Projects	39 hrs		
visits, project, essay writing, artistic creativity, etc.				
The student's study hours for each learning activity are given as well as the hours of non-				
directed study according to the principles of the ECTS				
	Course total	100 hrs		
STUDENT PERFORMANCE				
<b>EVALUATION</b> Description of the evaluation procedure	written final exam			
Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other				
Specifically-defined evaluation criteria are given, and if and where they are accessible to students.				

- Suggested bibliography: - Related academic journals:

- Wooldridge, Jeffrey M. 2009. Introductory Econometrics: A Modern Approach. 4th edition.
- Wooldridge, Jeffrey M. 2010. Econometric Analysis of Cross Section and Panel Data. MIT Press.

## GENERAL

SCHOOL	School of Economic and Administrative Studies				
	School of Engineering				
ACADEMIC UNIT	Department of Economics				
	Department of Computer Science and Engineering				
LEVEL OF STUDIES	Postgraduate				
COURSE CODE	ECSE13		SEMESTER	2	
COURSE TITLE	Dynamic Systems Modelling				
<b>INDEPENDENT TEACHING ACTIVITIES</b> if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits		WEEKLY TEACHING HOURS		CREDITS	
Lectures		3		4 ECTS	
Add rows if necessary. The organisation of teaching and the teaching					
methods used are described in detail at (d).					
general background, special background, specialised general knowledge, skills development	General bac	rground			
PREREQUISITE COURSES:	-				
LANGUAGE OF INSTRUCTION	GREEK				
and EXAMINATIONS:					
IS THE COURSE OFFERED TO	NO				
COURSE WERSITE (URI )					
COURSE WEDSITE (URL)	_				

## **LEARNING OUTCOMES**

#### Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
   Guidelines for writing Learning Outcomes

After successful attendance of the course the students are expected to:

- Understand the importance of differential equations in system modeling
- Understand the basic facts for initial value problems and can solve differential equations and systems of differential equations.
- Know the basic numerical methods for initial value problems.
- Are in a position to implement these numerical methods in a computer.

General Competences				
Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma				
Supplement and appear below), at which of the following does the course aim?				
Search for, analysis and synthesis of data and	Project planning and management			
information, with the use of the necessary technology	Respect for difference and multiculturalism			
Adapting to new situations	Respect for the natural environment			
Decision-making	Showing social, professional and ethical responsibility and			
Working independently	sensitivity to gender issues			
Team work	Criticism and self-criticism			
Working in an international environment	Production of free, creative and inductive thinking			
Working in an interdisciplinary environment				
Production of new research ideas	Others			
<ul> <li>Production of free, creative and inductive thinking</li> </ul>				

• Decision-making.

- Team work.
- Abstraction ability for problem modeling.
- Search for, analysis and synthesis of data and information, with the use of the necessary technology.

# **SYLLABUS**

- Dynamic systems modeling methods.
- Examples of system modeling using differential equations.
- The initial value problem for ordinary differential equations.
- Systems of differential equations.
- Numerical methods.

<b>DELIVERY</b> Face-to-face. Distance learning. etc.	Weekly Lectures		
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	<ul> <li>Use of projector and c</li> <li>Course website mainter and posting of teachin and notes).</li> <li>Announcement of asse course website.</li> </ul>	omputer during lectures. enance. Announcements g material (lecture slides essment marks via the	
TEACHING METHODS	Activity	Semester workload	
The manner and methods of teaching are described in detail.	Lectures	18 hrs	
Lectures, seminars, laboratory practice,	Non-directed study	37 hrs	
tutorials, placements, clinical practice, art	Projects	45 hrs	
workshop, interactive teaching, educational visits, project, essay writing, artistic creativity.			
etc.			
The student's study hours for each learning			
activity are given as well as the hours of non- directed study according to the principles of	Course total	100 brc	
the ECTS		100 1115	
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure	The evaluation is based on fina programming assignments	al exams and	
Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other			
Specifically-defined evaluation criteria are given, and if and where they are accessible to students.			

Suggested bibliography:

- Αριθμητικές Μέθοδοι για Συνήθεις Διαφορικές Εξισώσεις. Γ. Δ. Ακρίβης, Β. Α.
   Δουγαλής. Πανεπιστημιακές Εκδόσεις Κρήτης, Ηράκλειο. Δεύτερη έκδοση, 2013, πρώτη ανατύπωση, 2015.
- Αριθμητική Ανάλυση: Συνήθεις Διαφορικές Εξισώσεις. Μ. Ν. Βραχάτης. Εκδόσεις Κλειδάριθμος, Αθήνα, 2012.
- Elementary Differential Equations and Boundary Value Problems. William E. Boyce, Richard C. DiPrima, John Wiley & Sons, Inc.

## GENERAL

SCHOOL	School of Economic and Administrative Studies				
	School of Engineering				
ACADEMIC UNIT	Department of Economics				
	Department of Computer Science and Engineering				
LEVEL OF STUDIES	Postgraduate				
COURSE CODE	ECSD01	SEMESTER 3			
COURSE TITLE	Diploma Thesis				
INDEPENDENT TEACHING ACTIVITIES if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits		WEEKLY TEACHING CRED HOURS		CREDITS	
					30 ECTS
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).					
COURSE TYPE general background, special background, specialised general knowledge, skills development	Skills Development - specialised				
PREREQUISITE COURSES:	-				
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek/English				
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No				
COURSE WEBSITE (URL)	_				

## **LEARNING OUTCOMES**

#### Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
  Guidelines for writing Learning Outcomes

The Diploma Thesis is a specialized project aimed at the synthesis of knowledge, problem solving, the use of tools and methods in line with the latest developments in research and technology, the learning of techniques, the conduct of research, the study and analysis of bibliography and the analysis and evaluation of results. The Thesis's topic is unique and gives the student the opportunity to get deeper in a specific area of specialization, which is of course part of the broader area of the current Postgraduate Course.

At the end of the Diploma Thesis, the student will be able to:

- Collect and integrate the available information on state-of-the-art techniques in the study area.
- Develop a plan and apply the known theory and methodologies to reach the solution to the given problem.
- Adapt the above techniques and methods to the specificities of the given problem with originality.
- Evaluate alternatives to the given problem and consciously pick one based on the prioritization of the dimensions of the problem.
- Organize and communicate results via a technical report (in the form of a dissertation), which, in addition to being submitted in writing, is also orally defended in a public defense

- Develop initiatives to facilitate the a	above tasks and take responsibility for their		
achievement.			
General Competences			
Taking into consideration the general competences that the	e degree-holder must acquire (as these appear in the Diploma		
Supplement and appear below), at which of the following a	oes the course aim?		
information with the use of the necessary technology	Project pluming and management Respect for difference and multiculturalism		
Adapting to new situations	Respect for the natural environment		
Decision-making	Showing social, professional and ethical responsibility and		
Working independently	sensitivity to gender issues		
Team work	Criticism and self-criticism		
Working in an international environment	Production of free, creative and inductive thinking		
Working in an interdisciplinary environment Droduction of new research ideas	Others		
Froduction of new research fueus	data and information with the use of the		
- Search for, analysis and synthesis of	data and mormation, with the use of the		
necessary technology			
<ul> <li>Adapting to new situations</li> </ul>			
- Decision-making			
<ul> <li>Working independently</li> </ul>			
- Working in an interdisciplinary environment			
<ul> <li>Project planning and management</li> </ul>			
<ul> <li>Production of free, creative and inductive thinking</li> </ul>			
<ul> <li>Project planning and management f</li> </ul>	<ul> <li>Project planning and management for Computer Science projects</li> </ul>		

# **SYLLABUS**

Thesis is an important part of the educational. During the preparation of the thesis report students are asked to synthesize their knowledge, apply their skills, apply what they learned during their studies, solve problems and using cutting-edge tools and methods in line with the latest developments in research and technology.

<b>DELIVERY</b> Face-to-face, Distance learning, etc.	Face to face supervision from a faculty member		
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	<ul> <li>Bibliographic search and result integration via the exploitation of online libraries</li> <li>Use of cutting-edge techniques and tools in the area</li> </ul>		
TEACHING METHODS	Activity	Semester workload	
The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice,	Bibliographic search and integration	150 hrs	
fieldwork, study and analysis of bibliography, tutorials placements clinical practice art	Solution design	150 hrs	
workshop, interactive teaching, educational	Solution implementation	300 hrs	
visits, project, essay writing, artistic creativity, etc.	Compilation of the final 150 hrs report		
The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of			
the ECTS			
	Course total	750 hrs	
STUDENT PERFORMANCE	ASSESSMENT METHOD:		
EVALUATION	<ul> <li>Diploma thesis submission</li> </ul>		
Description of the evaluation procedure	- Public presentation		
Language of evaluation, methods of	- Students who undertake a diploma thesis must		
choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination,	complete and submit	the text of the final	

public presentation, laboratory work, clinical examination of patient, art interpretation, other		report and present the results of their work in a public lecture.
Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	-	The diploma thesis is examined and graded by a three-member committee of instructors.

Suggested bibliography: