**SYLLABUS**

1. **GENERAL**

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| **SCHOOL** | Applied Economic and Social Sciences |
| **SECTION** | Regional and Economic Development |
| **LEVEL OF STUDIES**  | Undergraduate |
| **COURSE CODE** | 6703 | **SEMESTER OF STUDY** | 7 ο |
| **COURSE TITLE** | Spatial Econometrics |
| **TEACHER** | AGGELIKI MENEGAKI |
| **INDEPENDENT TEACHING ACTIVITIES** *where credit is awarded for discrete parts of the course e.g. lectures, laboratory exercises, etc. If credit is* *awarded for the whole course, indicate the weekly teaching hours and the total number of credits* | **WEEKLY TEACHING HOURS** | **TEACHING/CREDIT UNITS** |
| Lectures | 4 | 5 |
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| *Add rows if necessary. The teaching organisation and the teaching methods used are described in detail in 4.* |  |  |
| **TYPE OF COURSE***Background , General Knowledge, Scientific Area, Skills Development* | Scientific Area |
| **PREREQUISITE COURSES:** |  |
| **LANGUAGE OF TEACHING AND EXAMINATION:** | Greek |
| **THE COURSE IS OFFERED TO ERASMUS STUDENTS** |  |
| **ELECTRONIC COURSE PAGE (URL)** | The course will be presented together with notes and other supporting material in the https://oeclass.aua.gr/eclass/ |

1. **LEARNING OUTCOMES**

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| **Learning Outcomes** |
| *The learning outcomes of the course are described as the specific knowledge, skills and competences of an appropriate level that students will acquire after successful completion of the course.**Consult Annex A* * *Description of the Level of Learning Outcomes for each cycle of study according to the Qualifications Framework of the European Higher Education Area*
* *Descriptive Indicators for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning*

*and Annex B** *Learning Outcomes Writing Comprehensive Guide*
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| Knowledge:* To understand the fundamental concepts of spatial economics, spatial econometrics and spatial analysis.
* To know the basic economic forces that interact in space, to understand the causes of spatial dynamics and spatial relationships, to understand how space affects the national economy, regional economies and economic concentrations.
* To understand the extension of the use of the concepts and tools of economic analysis and econometrics to spatial issues; to know indicators and quantitative methods of measuring spatial economics, spatial inequalities and interactions, spatial concentrations and to measure spatial dynamics with quantitative indicators.

Competencies:* They will have developed the ability to distinguish the different relationships that can be established between spatial units
* They will have developed the ability to distinguish the process by which the development of one spatial unit or entity contributes to the development of others.
* They will have developed the critical ability to interpret and evaluate spatial development issues using econometric methods.

Skills:* Students will be able to have opinions, analyse and measure real economic phenomena related to space and spatial systems.
* They will be able to refer to reliable sources of statistical data
* They will be able to quantitatively study spatial relationships, inequalities, economic and social convergence/divergence of spatial units using different criteria.
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| **General skills** |
| *Taking into account the general competences that the graduate should have acquired (as listed in the Diploma Supplement and listed below), which one(s) does the course aim at?* |
| ***Search, analysis and synthesis of data and information, using the necessary technologies*** *Adapting to new situations* ***Decision-making*** *Autonomous work* *Teamwork* *Working in an international environment* *Working in an interdisciplinary environment* ***Generating new research ideas***  | *Project planning and management* *Respect for diversity and multiculturalism* ***Respect for the natural environment*** *Demonstrate social, professional and ethical responsibility and sensitivity to gender issues* *Exercise of criticism and self-criticism* ***Promoting free, creative and inductive thinking*** |
| Search, analysis and synthesis of data and information, using the necessary technologies Project planning and management Decision-making Generating new research ideasPromoting free, creative and deductive thinking |

1. **COURSE CONTENT**

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| 1. INTRODUCTORY CONCEPTS: The complexity of the concept of space (geographical, social and functional space, space of activities, space of ideas), space as a mathematical concept, measurement in space (distance and metric functions), the concept of scale, effects on economic phenomena due to scale (microeconomics, macroeconomics), effects of space on economic phenomena (differential economic development of geographical areas, spatial inequalities), introduction of space in the study of economic phenomena, from econometrics to spatial econometrics, the framework of spatial econometrics, the concepts of spatial dependence and heterogeneity.
2. CONNECTIVITY IN SPACE: Definition of connectivity in space, the concept of neighborhood, spatial interaction matrices (spatial adjacency matrices, spatial weighted adjacency matrices, spatial distance matrices, spatial weighting matrices), spatial lag operators, circularity and redundancy of spatial lag operators, properties of spatial weight matrices.
3. Spatial statistics: forms of spatial data, types of spatial units (point, linear, surface), basic spatial operations, continuous and discrete connectivity analysis (zones, networks), geostatistical measures of position (spatial mean, weighted spatial mean, centre point), geostatistical measures of dispersion (standard distance, lack of standard distance), graphical presentation of spatial data, thematic cartography, Gaster and Newman cartograms.
4. SPATIAL DISTRIBUTIONS: The concept of variable and distribution, types of distributions with respect to the variable (distribution of values, order-magnitude, frequencies, probability), standard or theoretical probability distributions (discrete, binomial, uniform, random, hypergeometric, normal, exponential, beta and gamma), spatial variables and types of spatial variables, distributions in space, detection of spatial typologies by reduction to reference standards.
5. ECONOMETIC AND REGIONAL INDICES IN THE STUDY OF SPATIAL FACTS: Theil index, Lorenz curve, Gini coefficient, Florence coefficient, Gini - Hirschman coefficient.
6. LINEAR MODELS OF SPATIAL ECONOMICS: spatial specification of a linear model, spatial linear regression model for cross-sectional and space-time data, the spatial lag model (with direct and indirect effects), the spatial error model.
7. NON-GRAMMIC MODELS OF SPATIAL LOSS AND BALANCE: gravity models in space, spatial models based on transport costs, hierarchical spatial systems, spatial dipoles, polycentric systems.
8. Spatial stochastic processes: definitions, random field, stationarity and isotropy, local symmetry, mixed sequences, spatio-temporal series analysis, spatial white noise process, spatial autoregressive process, spatial moving average process, asymptotic approaches, spatial sampling.
9. EVALUATION OF PARAMETERS OF SPATIAL SAMPLES: Least squares method, uses and limitations of the least squares method, maximum likelihood estimators, properties of estimators, hypothesis testing and diagnostic tests using maximum likelihood, applications.
10. SPATIAL HETEROGENEITY AND SPATIAL DEPENDENCE INDICES: general concepts, heterogeneity tests in the presence of spatial dependence, spatial expansion of parameters, other forms of spatial heterogeneity, the concept of spatial dependence, methods of spatial dependence, analysis of spatial patterns, types of spatial patterns (random, normal, clustered).
11. SPATIAL HETEROGENEITY and spatial dependence indices: spatial autocorrelation, general indices (Morans I, Getis and Ord General G), local indices (Local Morans I - cluster and outlier analysis, Getis and Ord G\* - Hot spot analysis).
12. OTHER NON-GRAPHIC METHODS - SPATIAL NETWORKS: Modeling spatial systems on graphs, the concepts of topology and network geometry, measures of space and topology, measures of 13) OTHER NON-LINEAR METHODS - Spatial Networks: finding the minimum path in spatial networks, Dijkstra's algorithm, the concept of modularity, network partitioning into communities with the modularity optimization algorithm.centrality, the degree distribution, other distributions of topological quantities.
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1. **TEACHING and LEARNING METHODS - EVALUATION**

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| **METHOD OF DELIVERY***Face-to-face, Distance learning, etc.* | Lectures and meetings with students  |
| **USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES***Use of ICT in Teaching, Laboratory Training, Communication with students* | Computer and interactive whiteboard will be used in the teaching. Communication with students will be done on a personal level, also using e-mail and telecommunication (e.g. Skype) |
| **ORGANISATION OF TEACHING***The way and methods of teaching are described in detail.**Lectures, Seminars, Laboratory Exercise, Field Exercise, Study & Analysis of Literature, Tutoring, Practical (Placement), Clinical Exercise, Artistic Workshop, Interactive teaching, Educational visits, Study visits, Project work, Writing work / assignments, Artistic creation, etc.**The student's study hours for each learning activity as well as the hours of unguided study are indicated so that the total workload at semester level corresponds to the ECTS standards.* |

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| ***Activity*** | ***Semester workload*** |
| Lectures | 52 hours |
| Study of course material (material taught) | 52 hours |
| Exercises and practice of in economic applications | 21 hours |
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| Course Total | 125 hours |

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| **STUDENT ASSESSMENT** *Description of the evaluation process**Language of Evaluation, Evaluation Methods, Formative or Inferential, Multiple Choice Test, Multiple Choice Test, Short Answer Questions, Test Development Questions, Problem Solving, Written Work, Report, Oral Examination, Oral Examination, Public Presentation, Laboratory Work, Clinical Examination of a Patient, Artistic Interpretation, Other**Explicitly identified assessment criteria are stated and if and where they are accessible to students.* | Written exam at the end of the course and Semester Assignment during the semester. |

1. **RECOMMENDED-BIBLIOGRAPHY**

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| **Basic textbooks:**1. Argyris, Th. (1985). Economics of space. Volume II, Urban economics, Publishing house of Afon Kyriakidis, Thessaloniki.

**Foreign Language Bibliography**1. Anselin, L. (2013). Spatial econometrics: methods and models (Vol. 4). Springer Science & Business Media.
2. Arbia, G. (2006). Spatial econometrics: statistical foundations and applications to regional convergence. Springer Science & Business Media.
3. Elhorst, P. (2014), Spatial Econometrics: From Cross-sectional Data to Spatial Panels. Springer, London
4. Le Sage J, Pace K (2009), Introduction to Spatial Econometrics. Boca Raton: Taylor and Francis
5. Kelejian, H., & Piras, G. (2017). Spatial econometrics. Academic Press.

**Indicative Articles*** Anselin L. (2003), Spatial Externalities, Spatial Multipliers and Spatial Econometrics. International Regional Science Review, 26, 153-166
* Anselin, L. (1995). Local Indicators of Spatial Association- LISA. Geographical analysis, 27(2), 93-115.
* Anselin, L. (2010). Thirty years of spatial econometrics. Papers in regional science, 89(1), 3-25.
* Celebioglu, F., & Dall'Erba, S. (2010). Spatial Disparities across the Regions of Turkey: An Exploratory Spatial Data Analysis. The Annals of Regional Science,45(2), 379-400.
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