

Course of study in
"Economics, Management and International Markets" - [L-33].
 a.y. 2021/2022

SUBJECT

Introduction to Mathematics and Principles of Financial Mathematics

SDS: SECS-S/06 - ECT: 9
 I YEAR; I SEMESTER

Lecturer: **Prof. Sonia Lombardi**
 Disciplinary tutor: **Dr. Gianluigi Cisco**

<p>Qualification and scientific background of the lecturer</p>	<p>October 2019 - to date: University Tutor for the course in Anthropology (BIO / 08 - Anthropology - ECT 12) for IUL Online University Degree class L-22 "Sport Sciences" a.y. 2019/2020.</p> <p>1st September 2019: Teacher of Mathematics and Science with open-ended contract at Convitto Nazionale Cicognini, Prato.</p> <p>May 2019 - October 2019: University Tutor for the course in Anthropology (BIO / 08 - Anthropology - ECT 12) for IUL Online University, Degree class L-22 "Sport Sciences" a.y. 2018/2019".</p> <p>February 2019 - February 2020: Adjunct Lecturer for the course in Statistical Methods for Business (SECS S / 03 - Economic Statistics- ECT 12) for the IUL Online University in the Master course "Educational Methodologies, anthro-psycho-pedagogical and legal and economic aspects" 24 ECT.</p> <p>September 2018 - to date: <i>Vice Principal at Convitto Nazionale Cicognini in Prato, Italy.</i></p> <p>March 2018 - December 2019: Associate Researcher at ISC, Institute of Complex Systems - CNR, Sesto Fiorentino, Florence.</p> <p>March 2018: PhD in Ethology and Ecology, Biology, XXIX° cycle, entitled: "Ecology and behaviour of the Fallow deer (Dama dama L. 1758): an advanced structural equation models approach" at the University of Florence. Tutor: Dr. Giacomo Santini. Doctoral coordinator: Prof. Alberto Ugolini.</p> <p>12 December 2016-December 2019: she took part as <i>Biostatistician</i> in the research project entitled "<i>Population studies, migration and condition of stocks of red deer in Bulgaria</i>" in collaboration with Prof.</p>
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	<p><i>Peter Genov and Dr. Anna Ganeva at the Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences-(BAS), Sofia, Bulgaria, and Dr. Stefano Focardi from CNR- ISC (The Institute Complex Systems) Florence, Italy.</i></p> <p>30 March 2015 - 30 March 2018: PhD student at ISC, Institute of Complex Systems - CNR.</p> <p>15 July 2014: Habilitation in Mathematics and Science.</p> <p>October 2008: Degree in Statistics and Information Systems at the Department of Statistics, Faculty of Economics, University of Florence, supervisors: Prof. Giovanni Marchetti and Dr. Stefano Focardi.</p> <p>Title of the thesis "Statistical spatio-temporal analysis of animal migration movements using telemetry in the Mediterranean environment: a Bayesian approach".</p> <p>2004 - 2005: Collaboration as <i>CATI</i> (Computer Assisted Telephone Interviewer) operator at the Department of Statistics "G. Parenti" of the University of Florence.</p> <p>2004: Teacher at the Ecological Statistics Course held at ISPRA (National Institute for Environmental Protection and Research ex "A. Ghigi") on the use of the statistical software "R", and the statistical package "WISP". (I.N.F.S.) on the use of the statistical software "R", and the statistical package "WISP" in "Methods of density population estimate" (8 hrs. lesson).</p> <p>2002: Master's degree in Natural Sciences at the Faculty of Mathematics, Physics, Chemistry and Natural Sciences, University of Florence: supervisors Prof. Guido Chelazzi and Dr. Stefano Focardi.</p> <p>Title of the thesis "Causal factors of reproductive success of fallow deer (Dama dama, L.1758) in the lek".</p>
<p>Description of contents and subdivision of the programme into teaching modules</p>	<p>The course consists of 3 modules covering the following topics.</p> <p>Module 1 - Functions</p> <ul style="list-style-type: none"> ➤ The set \mathbb{R}: real numbers, operations, properties. ➤ The set \mathbb{R}^n : vectors, operations, properties. ➤ Functions. Compound function. ➤ Functions. Inverse function and intersections with axes. ➤ Real functions of a real variable: domain, maxima/minimum. ➤ Real functions of a real variable: convexity, other properties. ➤ Real functions of n real variables: domain, maxima/minimum. ➤ Real functions of n real variables: convexity, other properties. ➤ Functions that can be analysed graphically.

	<p>Module 2 - Successions, series, limits, differential calculus</p> <ul style="list-style-type: none"> ➤ Successions of real numbers. ➤ Number series. ➤ Limits and continuity for functions of a real variable. ➤ Limits and continuity for functions of two or n real variables. ➤ Differential calculus in one variable. ➤ Derivability and differentiability. ➤ Derivation rules. Taylor formula. ➤ Differential calculus in n variables. ➤ Partial derivatives and gradients. ➤ Free extremes, excellent conditions and convexity. ➤ Constrained extremes, Lagrange's method. <p>Module 3 - Principles of financial mathematics</p> <ul style="list-style-type: none"> ➤ Temporal structure of the exchange of amounts. ➤ capital and interest. ➤ Contracts, exchange, prices. Risks. ➤ The exponential law. ➤ Incomes, Capital Accumulation. ➤ Amortisation plans. ➤ Investment valuation (NPV). Internal rate of return of a financial transaction (IRR). <p><i>Please note: the mathematics topics in the course are useful for preparing for the Financial Adviser exam.</i></p>
<p>Abstract</p>	<p>Mathematics is the language in which most of modern Economics is written. The course aims to provide the basic mathematical tools to develop the analytical thinking skills that students need later on in their academic career. Upon completing the study program, students will have acquired knowledge related to: the mathematical methods for the quantitative analysis of business and economic phenomena, the tools for financial calculus and their practical.</p> <p>Content Summary</p> <ul style="list-style-type: none"> ➤ Linear algebra. ➤ Functions. ➤ Limits. ➤ Continuity. ➤ The differential calculus. ➤ Two-variable functions. ➤ Principles of financial mathematics. ➤ The capital.

	<ul style="list-style-type: none"> ➤ The economic rent. ➤ The interest. ➤ The amortisation plan. <p>The students will have acquired knowledge to work out both the quantitative and the qualitative perspectives. Solve dynamic optimisation problems which are key in financial mathematics.</p> <p>Teaching materials Video lessons. Lecture notes. Slides. Podcasts.</p>
<p>Learning objectives</p>	<p>The course aims to provide the mathematical tools necessary for the construction and study of simple economic models using functions of one or more variables.</p> <p>Specifically, it provides:</p> <ul style="list-style-type: none"> ➤ knowledge of the basic elements of the scientific method; ➤ knowledge and ability to understand basic mathematical tools, calculation techniques, optimisation problem-solving techniques; ➤ knowledge and ability to understand the main entities of financial mathematics.
<p>Expected learning outcomes</p>	<p>A. Knowledge and understanding: Basic mathematical tools; calculation techniques; techniques for solving optimisation problems; main entities of financial mathematics.</p> <p>B. Applied knowledge and understanding: To select and apply mathematical tools for the technical and quantitative analysis of economic and business cases.</p> <p>C. Autonomy of judgement: applying theoretical models independently for evaluation purposes; autonomously searching for and finding data, information, sources, doctrine for economic, business and financial evaluations; ability to take reasoned and sustainable positions with reference to the choice and application of mathematical and statistical analysis techniques.</p> <p>D. Communication skills: use of technically correct and effective vocabulary in a professional context; argumentation on mathematical, statistical and quantitative topics in general, using</p>

	<p>correct technical language and appropriate scientific references; proper use of office automation tools and efficient use of the IT tools learnt.</p> <p>E. Learning ability: to develop study methods appropriate to the different fields, functional to the autonomous development of knowledge/competences (the acquisition of a study method that is not mechanical or mnemonic, but reasoned and declined with attention to concepts); ability to carry out bibliographical, data and scientific research.</p>
<p>Skills to be acquired</p>	<p>EXPECTED RESULTS</p> <p>A. Use of advanced textbooks, knowledge of some cutting-edge topics within the subject studied.</p> <p>B. A professional approach to work and possession of appropriate skills to devise arguments, support them and solve problems within the subject studied. Ability to collect and interpret data useful for making independent judgements.</p> <p>C. Ability to communicate information, ideas, problems and solutions to specialists and non-specialists.</p> <p>D. Ability to undertake further studies with a high degree of autonomy.</p>
<p>Didactics organisation</p>	<p>DIDACTIC PROVISION</p> <ul style="list-style-type: none"> ➤ 9 hours of video lessons. ➤ 6 synchronous meetings on the platform. ➤ Podcasts of all the above-mentioned video lessons. <p>INTERACTIVE DIDACTICS</p> <ul style="list-style-type: none"> ➤ 1 course orientation forum. ➤ 3 in-depth thematic forums (1 per module). ➤ Possibility to carry out work in groups. ➤ 3 structured <i>e-activities</i> (as described in the section “<i>in itinere assessment methods</i>”). <p>SELF-LEARNING</p> <p>Teaching materials are provided for each module: in-depth thematic studies, articles and slides by the lecturer, open access readings, online resources, reference bibliography.</p>

<p>Recommended examination texts</p>	<ul style="list-style-type: none"> ➤ Castagnoli, E., Marinacci, M., Vigna, E. <i>Principi di Matematica per l'Economia</i>, 2017, Milan, EGEA, second edition, p. 723 - (ISBN 978-88-238-2246-7). ➤ Castellani, G., De Felice, M., Moriconi, F., <i>Manuale di finanza. Tassi d'interesse. Mutui e obbligazioni</i>, Il Mulino, 2005. <p>For the prerequisites the recommended text is:</p> <ul style="list-style-type: none"> ➤ Roberto D'Ercole - <i>Precorso di Matematica per Economia e Scienze</i>, 2011, Pearson Education, p.264 - (ISBN 9788871926308)
<p>In itinere assessment methods</p>	<p>Access to the final examination is subject to the following 3 e-activities:</p> <ul style="list-style-type: none"> ➤ 1 paper of approximately 1,000 words - module 1; ➤ 1 paper of approximately 1,000 words - module 2; ➤ 1 paper of approximately 1,000 words - module 3. <p>In particular, they will consist of multiple-choice or open-ended questions and exercises.</p>
<p>Procedure for the final examination</p>	<p>The assessment of learning will take the form of an oral interview on the course contents and any final report submitted. The grade (min 18, max 30 with possible honours) is determined by the level of performance for each of the following dimensions of the oral interview: mastery of contents, appropriateness of definitions and theoretical references, clarity of argument, command of specialist language.</p>
<p>Language of instruction</p>	<p>Italian</p>