**COURSE OUTLINE**

1. **GENERAL**

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| **SCHOOL** | FINANCE AND STATISTICS | | | | |
| **ACADEMIC UNIT** | STATISTICS AND INSURANCE SCIENCE | | | | |
| **LEVEL OF STUDIES** | UNDERGRADUATE | | | | |
| **COURSE CODE** | SAMATH22 | **SEMESTER** | | 3rd | |
| **COURSE TITLE** | PROBABILITY II | | | | |
| **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 HOURS** | | **CREDITS** |
| Lectures | | | 5 | | 6 |
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| *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* | compulsory - General Background | | | | |
| **PREREQUISITE COURSES:** | none  However the 2nd semester course “Probability I” helps heavily the understanding of this course | | | | |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | Greek | | | | |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | NO | | | | |
| **COURSE WEBSITE (URL)** | https://eclass.unipi.gr/courses/SAE117/ | | | | |

1. **LEARNING OUTCOMES**

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| **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* | |
| This course is a continuation of PROBABILITY I / SAMATH21. Together they give a comprehensive introduction to probability theory that deals with the quantitative treatment of uncertainty and the use of mathematical tools in handling this uncertainty**.** The course introduces the students to the concept of multivariate random variables, including marginal and conditional distributions, conditional expected values and variances, independent random variables, correlation, special multivariate distributions and limit theorems.  On completion of this course the student should be able to:   * Understand the concept of multivariate distributions * Derive marginal and conditional distributions * Calculate conditional expected values and variances * Apply the concepts of independence and conditional probability to practical problems * Find the joint distribution of functions of random variables * Find the distribution of the sum of random variables using generating functions * Understand the behavior of a sequence of random variables by the aid of laws of large numbers * Apply the Central Limit Theorem to practical 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*  *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…*  *…….* |
| *Decision-making*  *Working independently*  *Production of free, creative and inductive thinking* | |

1. **SYLLABUS**

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| **Bivariate distributions:** Joint distribution of two random variables, Marginal distributions, Expectation of a function of two random variables, Conditional distributions, Conditional expectations, Geometric probability, Covariance and correlation coefficient  **Multivariate distributions and independence:** Joint distribution of *n* > 2 random variables, Independent random variables, Random sample, Order statistics.  **Distributions of functions of random variables:** Joint distribution of functions of random variables, Distribution of sum, difference, product and ratio of two random variables, Chi-square distribution, Student’s *t* distribution, *F* distribution.  **Special multivariate distributions:** Multinomial distribution, Multivariate hypergeometric distribution, Bivariate Normal distribution.  **Generating functions:** Moment generating function, Probability generating function, Characteristic function, Generating functions of sums of independent random variables, Generating functions of multivariate distributions.  **Limit Theorems:** Convergence of a sequence of random variables, Weak law of large numbers, Strong law of large numbers, Central limit theorem. |

1. **TEACHING and LEARNING METHODS - EVALUATION**

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| **DELIVERY** *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* | Electronic communication with students.  Power point presentations  Use of the e-class platform. |
| **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*** | ***Semester workload*** | | Lectures | 60 | | Independent study | 90 | |  |  | |  |  | |  |  | |  |  | |  |  | |  |  | |  |  | | Course total | ***150*** | |
| **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 exams (multiple choice questions and problem solving)  Oral exams for students with disabilities. |

1. **ATTACHED BIBLIOGRAPHY**

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| *- Suggested bibliography:*  Koutras, M. (2016). Introduction to Probability Theory and its Applications. Tsotras Publications, Athens (in Greek).  Antzoulakos D.L and Koutras M,V. (2016). Probability Exercises, Part II, UNIBOOKS Publications, Athens (in Greek)  Hoel, P.G., Port, S.C., Stone, C.J. (2015) Introduction to Probability Theory. Crete University Publications (in Greek).  Ross S. (2011). A First Course in Probability, Klidarithmos Publications, Athens (in Greek).  Charalambides, C. (2011). Probability Theory and Applications. Symmetria Publications, Athens (in Greek).  *- Related academic journals:* |