

## 2.4 CE0240 – Probability & Statistics

### (1) GENERAL

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|---|---|-----------------|---|
| <b>SCHOOL</b>   | ENGINEERING SCHOOL  |                 |   |
| <b>ACADEMIC UNIT</b>  | CIVIL ENGINEERING DEPARTMENT  |                 |   |
| <b>LEVEL OF STUDIES</b>   | UNDERGRADUATE   |                 |   |
| <b>COURSE CODE</b>  | CE0240  | <b>SEMESTER</b> | 2 |
| <b>COURSE TITLE</b>   | Probability & Statistics  |                 |   |
| <b>INDEPENDENT TEACHING ACTIVITIES</b><br><i>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</i> | <b>WEEKLY TEACHING HOURS</b>  | <b>CREDITS</b>  |   |
|   | 3   | 4               |   |
|   |   |                 |   |
|   |   |                 |   |
| <i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i>  |   |                 |   |
| <b>COURSE TYPE</b><br><i>general background, special background, specialised general knowledge, skills development</i>  | Special Background Course   |                 |   |
| <b>PREREQUISITE COURSES:</b>  |   |                 |   |
| <b>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</b>  | Greek   |                 |   |
| <b>IS THE COURSE OFFERED TO ERASMUS STUDENTS</b>  |   |                 |   |
| <b>COURSE WEBSITE (URL)</b>   | <a href="https://eclass.uniwa.gr/modules/auth/opencourses.php?fc=69">https://eclass.uniwa.gr/modules/auth/opencourses.php?fc=69</a> |                 |   |

### (2) LEARNING OUTCOMES

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| <p><b>Learning outcomes</b></p> <p><i>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.</i></p> <p><i>Consult Appendix A</i></p> <ul style="list-style-type: none"> <li>• <i>Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area</i></li> <li>• <i>Descriptors for Levels 6, 7 &amp; 8 of the European Qualifications Framework for Lifelong Learning and Appendix B</i></li> <li>• <i>Guidelines for writing Learning Outcomes</i></li> </ul>   |
| <p>The purpose of this course is to provide students with the knowledge and skills for the application of statistical methods required for data analysis and the extraction of valuable conclusions relevant to their fields of study. The course aims to familiarise students with the fundamental concepts of applied statistics, particularly the concepts of descriptive statistics, probability theory, and inferential statistics, that students should be able to analyse and process experimental data or research results field studies. Students will also become familiar with the use of widely known statistical analysis software data analysis tools such as SPSS, MS Excel.</p> <p>Upon successful completion of the course the student will be able to:</p> <ul style="list-style-type: none"> <li>• Describe the concepts of a random experiment, a sample space and an event.</li> <li>• Describe the classical and the axiomatic foundations of Probability Theory and use the main properties of probability measure.</li> <li>• Apply the basic enumeration principles and use the formulas for the number of permutations and</li> </ul> |

- combinations of a set of objects.
- Describe the concept of conditional probability and of the stochastic independence of events.
  - Solve probability problems using the total probability theorem, Bayes' formula and the multiplication rule.
  - Describe the concept of random variable, of distribution function, of probability mass function and of probability density function.
  - Compute the moments of distributions, in particular the expectations and the variances.
  - Recognize the most important special discrete and continuous distributions.
  - Describe the concepts of multidimensional and in particular 2-dimensional random variables, its joint distribution function, joint probability mass function and joint probability density function.
  - Describe the concept of independent random variables.
  - Explain the notions of covariance and correlation coefficient and compute them for given pairs of random variables.
  - Identify the concepts of probability generating functions and moment generating functions and compute them for given random variables.
  - Explain the Central Limit Theorem and use it for approximate computations of probabilities.
  - Estimate the unknown parameter of a distribution using the method of maximum likelihood estimates.
  - Construct confidence intervals for the unknown parameters in the case of normal populations.
  - Deduce conclusions regarding testing statistical hypotheses in case of normal populations or large sample sizes.

### 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...*

Specifically, students will be able to perform:

- Search, analysis and synthesis of data and information using the necessary technologies.
- Production of free, creative and inductive thinking
- Decision-making
- Teamwork
- Autonomous work
- Working in an interdisciplinary environment

### (3) SYLLABUS

The main topics of this course are:

1. Basic research methods, selection of data collection methods and measurement methods, techniques of data collection and sampling techniques, types of variables, measurement scales
2. Numerical Descriptive Statistics
3. Basic concepts of probability
4. Discrete probability distributions
5. Normal and Other Continuous Distributions. Central Limit Theorem and its Applications
6. Sampling Distributions
7. Confidence Interval Estimation
8. Statistical Case Tests
9. Analysis of Variance, Criterion Testing  $\chi^2$
10. Simple Linear Regression Analysis
11. Introduction to Multiple Regression Analysis

#### (4) TEACHING and LEARNING METHODS - EVALUATION

| <p style="text-align: center;"><b>DELIVERY</b><br/><i>Face-to-face, Distance learning, etc.</i></p>  | Face-to-face   |          |                   |          |    |                                    |    |  |  |  |  |              |            |
|--|--|----------|-------------------|----------|----|------------------------------------|----|--|--|--|--|--------------|------------|
| <p style="text-align: center;"><b>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</b><br/><i>Use of ICT in teaching, laboratory education, communication with students</i></p>  | Teaching using ICT, Communication and Electronic Submission.   |          |                   |          |    |                                    |    |  |  |  |  |              |            |
| <p style="text-align: center;"><b>TEACHING METHODS</b><br/><i>The manner and methods of teaching are described in detail.</i><br/><i>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.</i></p> <p><i>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</i></p>                            | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="background-color: #e0e0e0;">Activity</th> <th style="background-color: #e0e0e0;">Semester workload</th> </tr> </thead> <tbody> <tr> <td>Lectures</td> <td style="text-align: center;">39</td> </tr> <tr> <td>Study and analysis of bibliography</td> <td style="text-align: center;">69</td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td>Course total</td> <td style="text-align: center;"><b>108</b></td> </tr> </tbody> </table> | Activity | Semester workload | Lectures | 39 | Study and analysis of bibliography | 69 |  |  |  |  | Course total | <b>108</b> |
| Activity   | Semester workload  |          |                   |          |    |                                    |    |  |  |  |  |              |            |
| Lectures   | 39   |          |                   |          |    |                                    |    |  |  |  |  |              |            |
| Study and analysis of bibliography   | 69   |          |                   |          |    |                                    |    |  |  |  |  |              |            |
|  |  |          |                   |          |    |                                    |    |  |  |  |  |              |            |
|  |  |          |                   |          |    |                                    |    |  |  |  |  |              |            |
| Course total   | <b>108</b>   |          |                   |          |    |                                    |    |  |  |  |  |              |            |
| <p style="text-align: center;"><b>STUDENT PERFORMANCE EVALUATION</b><br/><i>Description of the evaluation procedure</i></p> <p><i>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</i></p> <p><i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></p> | <p>Language of evaluation: Greek</p> <p>Final written examination: 70%</p> <p>Written works: 30%</p>   |          |                   |          |    |                                    |    |  |  |  |  |              |            |

#### (5) ATTACHED BIBLIOGRAPHY

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| <p><u>Greek Bibliography:</u></p> <ol style="list-style-type: none"> <li>1. Alexandropoulos, A., Katopodis, E., Paliatsos, A., Prezerakos, N. Statistics, Synchroni Ekdotiki, Book code in Eudoxos: 6826 (in Greek)</li> <li>2. Papageorgiou, E., Halikias, M. Probability and Statistics for Engineers using SPSS and MATLAB. Book Code at Eudoxos: 94643849 (in Greek)</li> <li>3. Zafeiropoulos, K. Introduction to Statistics and Probability, Kritiki Publications, Book Code in Eudoxos: 59368069 (in Greek)</li> <li>4. Walpole-R., R., Myers-S., Myers-K. Ye, Statistics and Probability, Ed. Tziola, Book Code in Eudoxos: 68374152 (in Greek)</li> <li>5. Ioannidis, D., Statistical Methodology, Ziti Publishers, Book code in Eudoxos: 12550473 (in Greek)</li> </ol> |
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