

COURSE OUTLINE

(1) GENERAL

SCHOOLS	ENGINEERING, NATURAL SCIENCES		
ACADEMIC UNIT/UNITS	COMPUTER ENGINEERING AND INFORMATICS DEPARTMENT, DEPARTMENT OF MATHEMATICS		
TITLE OF MASTER'S DEGREE	<i>MSC in Data Driven Computing and Decision Making</i>		
LEVEL OF STUDIES	Post graduate		
COURSE CODE	MCDA101	SEMESTER	A
COURSE TITLE	Statistical Methods in Data Science		
INDEPENDENT TEACHING ACTIVITIES <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>	WEEKLY TEACHING HOURS	CREDITS	
Lectures and Computer Lab	3	7,5	
<i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i>	Total	7,5	
COURSE TYPE <i>general background, special background, specialised general knowledge, skills development</i>	General background		
PREREQUISITE COURSES:	No		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes		
COURSE WEBSITE (URL)	http://thalis.math.upatras.gr/~vpiperig/MCDA-YDA/index.html		

(2) LEARNING OUTCOMES

<p>Learning outcomes</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"> • <i>Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area</i> • <i>Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B</i> • <i>Guidelines for writing Learning Outcomes</i>
<p>The use of parametric methods in hypotheses testing problems is a well-established and standard procedure in statistical data analysis. When the conditions for the use of these methods are not satisfied and the sample size is quite large, asymptotic methods are utilized. At the same time, nonparametric methods have been developed and used in practice. In this course, the classical statistical theory of data analysis (both parametric and nonparametric) is introduced in such a way that the student receives specialized education in order to respond to the role of Statistician in the new era, where the field of data science is getting more appreciation.</p> <p>On successful completion of the course a student will be able:</p> <ul style="list-style-type: none"> • to combine the strict statistical theory, choosing the right methodology, with the practical implementation of statistical models in data analysis problems. • to use properly the statistical software R and communicate the results of statistical analysis accurately. • to read and learn new statistical methodologies independently.
<p>General Competences</p> <p><i>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?</i></p>

<p>Search for, analysis and synthesis of data and information, with the use of the necessary technology</p> <p>Adapting to new situations</p> <p>Decision-making</p> <p>Working independently</p> <p>Team work</p> <p>Working in an international environment</p> <p>Working in an interdisciplinary environment</p> <p>Production of new research ideas</p>	<p>Project planning and management</p> <p>Respect for difference and multiculturalism</p> <p>Respect for the natural environment</p> <p>Showing social, professional and ethical responsibility and sensitivity to gender issues</p> <p>Criticism and self-criticism</p> <p>Production of free, creative and inductive thinking</p> <p>.....</p> <p>Others...</p> <p>.....</p>
<ul style="list-style-type: none"> • 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 interdisciplinary environment • Production of free, creative and inductive thinking 	

(3) SYLLABUS

Measures of location and variability. Visual techniques for presenting discrete and continuous data. Sampling distributions and the central limit theorem. Confidence Intervals (CI) for the parameters of one or two independent populations. Asymptotic CI for the mean, proportion (one sample) and the difference in means, proportions (two samples). Testing statistical hypotheses for parameters using CI. Special topics in CI and relative tests. Basic elements in testing statistical hypotheses. Likelihood Ratio Test (LRT). Asymptotic LRT, chi-square goodness of fit test (test of independence) and Kolmogorov-Smirnov (KS) test. Tests for normality. Order statistics and CI for the median and quantiles. Sign test for the median. Methods for comparing the distributions of two samples. One-way Analysis of Variance (ANOVA) for independent and dependent samples and relative tests. Basic principles of experimental design. Simple linear regression. Correlation coefficients and tests. Modelling two-dimensional variables: the bivariate normal distribution and the theory of copulas. Applications are presented using the language R.

TEACHING and LEARNING METHODS - EVALUATION

<p>DELIVERY</p> <p><i>Face-to-face, Distance learning, etc.</i></p>	Face-to-face														
<p>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</p> <p><i>Use of ICT in teaching, laboratory education, communication with students</i></p>	<ul style="list-style-type: none"> • Use of ICT in teaching <ul style="list-style-type: none"> ✓ Electronic slide presentations ✓ Use of language R • Course support with web site space and Computer Laboratory facilities provided by the Department of Mathematics 														
<p>TEACHING METHODS</p> <p><i>The manner and methods of teaching are described in detail.</i></p> <p><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"> <thead> <tr> <th><i>Activity</i></th> <th><i>Semester workload</i></th> </tr> </thead> <tbody> <tr> <td>Lectures</td> <td>26</td> </tr> <tr> <td>Laboratory practise</td> <td>13</td> </tr> <tr> <td>Study (no driven)</td> <td>96</td> </tr> <tr> <td>Written work</td> <td>45</td> </tr> <tr> <td>Written work examination</td> <td>4,5</td> </tr> <tr> <td>Written examination</td> <td>3</td> </tr> </tbody> </table>	<i>Activity</i>	<i>Semester workload</i>	Lectures	26	Laboratory practise	13	Study (no driven)	96	Written work	45	Written work examination	4,5	Written examination	3
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Lectures	26														
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Written examination	3														
<p>STUDENT PERFORMANCE EVALUATION</p> <p><i>Description of the evaluation procedure</i></p> <p><i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice</i></p>	For the succeed completion of this course, three written works must be delivered. Written examination is compulsory.														

<p>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</p> <p>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</p>	<p>Smallest passing grade: 5 Largest passing grade: 10</p>

(4) ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*
PRINCIPLES AND APPLICATIONS OF ELECTRICAL ENGINEERING, G. Rizzoni and J. Kearns **SIXTH EDITION**, McGraw-Hill Education
MICROELECTRONIC CIRCUITS, A.S. Sedra and K.C. Smith, **SEVENTH EDITION**, Oxford University Press

- *Related academic journals:*

- Conover, W.J. *Practical Nonparametric Statistics*. 3rd edition Wiley, 1999.
- Hogg, R.V., McKean, J.W. and Craig, A.T. *Introduction to Mathematical Statistics*. 7th Edition. Pearson, 2012.
- Hollander, M. and Wolfe, D.A. *Nonparametric Statistical Methods*. 2nd edition. Wiley, 1999.
- Lehmann, E.L. and Romano, J. P. *Testing Statistical Hypotheses*. 3rd edition. Springer, 2005.
- Shao, J. *Mathematical Statistics*. 2nd Edition. Springer, 2003.
- Ugarte, M.D., Militino, A.F. and Arnholt, A.T. *Probability and Statistics with R*. Chapman & Hall, 2007.