COURSE OUTLINE

(1) GENERAL

SCHOOLS	NATURAL SCIENCES		
ACADEMIC UNIT/UNITS	MATHEMATICS		
TITLE OF MASTER'S DEGREE	COMPUTATIONAL AND STATISTICAL DATA ANALYTICS (MCDA)		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	MCDA101	**SEMESTER**	A
COURSE TITLE	METHODS FOR STATISTICAL DATA ANALYSIS		

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	3	7.5
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*	General background
PREREQUISITE COURSES:	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/MATH1145/ https://thalis.math.upatras.gr/~vpiperig/MCDA-YDA/index.html

(2) LEARNING OUTCOMES

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*

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.

On successful completion of the course a student will be able:

- 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.

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	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*

- 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.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Lectures (face to face)</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>• Use of ICT in teaching
✓ Electronic slide presentations,
✓ Use of language R.
• Course support with web site space and Computer Laboratory facilities provided by the Department of Mathematics.</td></tr>
<tr><td>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</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<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></td><td></td></tr>
<tr><td>Written work examination</td><td>4.5</td></tr>
<tr><td>Written examination</td><td>3</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Total number of hours for the Course (25 hours of work-load per ECTS credit)</td><td>187.5</td></tr>
</table>
</td></tr>
<tr><td>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.</td><td>Assessment Language: Greek
Assessment Language for Erasmus students: English

Assessment methods:
For the succeed completion of this course, three written works must be delivered. Written examination is compulsory.

Minimum passing grade: 5
Maximum passing grade: 10</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

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