COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF SCIENCES		
DEPARTMENT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	ISCED level 6 – Bachelor's or equivalent level		
COURSE CODE	YN104	**SEMESTER**	1st Semester
COURSE TITLE	Informatics I		

TEACHING ACTIVITIES *If the ECTS Credits are distributed in distinct parts of the course e.g. lectures, labs etc. If the ECTS Credits are awarded to the whole course, then please indicate the teaching hours per week and the corresponding ECTS Credits.*	**TEACHING HOURS PER WEEK**	**ECTS CREDITS**
	5	5
Please, add lines if necessary. Teaching methods and organization of the course are described in section 4.		

COURSE TYPE *Background, General Knowledge, Scientific Area, Skill Development*	General Background
PREREQUISITES:	
TEACHING & EXAMINATION LANGUAGE:	Greek
COURSE OFFERED TO ERASMUS STUDENTS:	NO
COURSE URL:	https://eclass2.emt.duth.gr/courses/CHEM-N1104/

(2) LEARNING OUTCOMES

Learning Outcomes
Please describe the learning outcomes of the course: Knowledge, skills and abilities acquired after the successful completion of the course.

The aim of the course is to introduce students to the fundamental principles of Statistical Programming, with an emphasis on the analysis of quantitative and qualitative data from the field of Chemistry, using the open-source programming language R.

Upon successful completion of this course, students will be able to:

- Understand both the theoretical and laboratory components of the course.
- Understand why Statistics and Data Science is applied across all scientific disciplines
- Explore various areas of application within Industry 4.0 (Chemistry 4.0).
- Perform data entry and preprocessing of experimental data within the Integrated Development Environment (IDE) of RStudio
- Apply quantitative data analysis methods (such as descriptive statistics, exploratory data analysis, and correlation analysis) as well as data visualization techniques using the R programming language.
- Learn how to extract useful information hidden within raw data, which can then be transformed into knowledge for various research problems.
- Acquire the necessary skills to develop routines and functions for solving problems in Chemistry and the Life and Health Sciences, particularly those related to the quantitative analysis of experimental data.

General Skills

Name the desirable general skills upon successful completion of the module

Search, analysis and synthesis of data and information,	*Project design and management*
ICT Use	*Equity and Inclusion*
Adaptation to new situations	*Respect for the natural environment*
Decision making	*Sustainability*
Autonomous work	*Demonstration of social, professional and moral responsibility and*
Teamwork	*sensitivity to gender issues*
Working in an international environment	*Critical thinking*
Working in an interdisciplinary environment	*Promoting free, creative and inductive reasoning*
Production of new research ideas	

(3) COURSE CONTENT

Week 1: Introduction to Programming and Data Science, Historical Overview, Industry 4.0, Programming Languages, R Programming Language, and Integrated Development Environments (IDEs).

Week 2: Data Structures and Objects, Vectors (Numeric, Logical, Character), Matrices, Lists, Multidimensional Arrays, Data Frames. Keywords, Identifiers, Assignment, Arithmetic Operators, Relational Operators, Logical Operators, Order of Operations, and Operations with Data Objects.

Week 3: File Management and Data Import, Referencing Elements of Objects (Vector, Matrix, List, Multidimensional Array, Data Frame), Basic Functions, and Libraries.

Week 4: Data Frames, Internal Structure of Data Frames, Handling Missing Values, Converting Vectors into Data Frames.

Week 5: Multidimensional Data Visualization, Visualization Processes using the lattice and ggplot2 libraries.

Week 6: Descriptive Statistics, Summarizing Variables and Observations within a Data Frame, Measures of Central Tendency, and Measures of Variability.

Week 7: Graphical Representation and Data Visualization, Bar Charts, Pie Charts, Frequency Distribution Histograms, Exploratory Data Analysis (Boxplots, Scatterplots).

Week 8: Control Flow, Selection Statements, Conditional Loops and Command Execution, Syntax of if, if…else.

Week 9: Repetition Statements (for, while, repeat loops).

Week 10: User-Defined Functions, Function Arguments, Function Assignment, and Code Debugging.

Week 11: Data Science Workflow, Data Cleaning and Transformation, Exploratory Analysis, and Visualization.

Week 12: Statistical Modeling, Linear Regression, Least Squares Model, Model Definition, and Model Fit Diagnostics.

Week 13: Applications in Chemistry, Life, and Health Sciences, Data Science Workflows, Data Cleaning and Transformation, Handling Missing Observations, and Domain-Specific Applications.

(4) LEARNING & TEACHING METHODS - EVALUATION

TEACHING METHOD *Face to face, Distance learning, etc.*	Face to face
USE OF INFORMATION & COMMUNICATIONS TECHNOLOGY (ICT) *Use of ICT in Teaching, in Laboratory Education, in Communication with students*	Use of ICT in Teaching Use of ICT in Communication with students
TEACHING ORGANIZATION *The ways and methods of teaching are described in detail.* *Lectures, Seminars, Laboratory Exercise, Field Exercise, Bibliographic research & analysis, Tutoring, Internship (Placement), Clinical Exercise, Art Workshop, Interactive learning, Study visits, Study / creation, project, creation, project. Etc.* *The supervised and unsupervised workload per activity is indicated here, so that total workload per semester complies to ECTS standards.*	**Activity** / **Workload/semester** Lectures: 26 Tutoring: 13 Bibliographic research & analysis: 60 Laboratory Exercise: 26 Total: 125
STUDENT EVALUATION *Description of the evaluation process* *Assessment Language, Assessment Methods, Formative or Concluding, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Essay / Report, Oral Exam, Presentation in audience, Laboratory Report, Clinical examination of a patient, Artistic interpretation, Other/Others* *Please indicate all relevant information about the course assessment and how students are informed*	**Student evaluation languages** Greek **Method (Formative or Concluding)** Summative **Student evaluation methods** Written Exam with multiple choice test Written Exam with Problem Solving **Rate** **40** **60**

(5) SUGGESTED BIBLIOGRAPHY

- Εισαγωγή στον Προγραμματισμό και στη Στατιστική Ανάλυση με R. Ι. Ντζούφρας. ΚΑΛΛΙΠΟΣ Ανοικτές Ακαδημαϊκές Εκδόσεις. ISBN: 9789606034497.
- Η Επιστήμη των Δεδομένων μέσα από τη Γλώσσα R. Β. Βερύκιος, Β. Καγκλής, Η. Σταυρόπουλος. ΚΑΛΛΙΠΟΣ Ανοικτές Ακαδημαϊκές Εκδόσεις. ISBN: 9789606033940.
- Εισαγωγή στη Στατιστική με την R. J. Verzani. ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ. ISBN: 9789604616725.

Eudoxus

- Εισαγωγή στον Προγραμματισμό και στη Στατιστική Ανάλυση με R. Ι. Ντζούφρας. ΚΑΛΛΙΠΟΣ Ανοικτές Ακαδημαϊκές Εκδόσεις. ISBN: 9789606034497.
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