COURSE OUTLINE

CE0210–Multivariable Calculus

(1) GENERAL

SCHOOL	ENGINEERING SCHOOL		
ACADEMIC UNIT	CIVIL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**CE0210**	**ΕΞΑΜΗΝΟ ΣΠΟΥΔΩΝ**	2^0
COURSE TITLE	**Multivariable Calculus**		

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**
	3	4
210		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General Background Course
PREREQUISITE COURSES:	Students are advised to have the fundamental knowledge of Mathematical Analysis I and Linear Algebra.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	-
COURSE WEBSITE (URL)	https://eclass.uniwa.gr/courses/CIV198/

(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.

ConsultAppendix 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 context of the course aims to introduce the students to the fundamental concepts of multivariable calculus so that they will be able to handle efficiently the mathematical models arising in their specialty.

Upon successful completion of the course, students will have:

- In-depth knowledge in basic subjects of the differential and integral calculus of real functions in 2 and 3 variables.
- Thorough knowledge and skills to effectively use the differential and integral calculus of functions in many

variables, as well as the theory of vector analysis.
- Fundamental mathematical thinking and critical judgement.
- Basic mathematical knowledge to formulate safety regulation codes and design economically complex civil engineering projects.

Specifically, students will be able to:

- recognize and distinguish the appropriate methods for solving various problems through the infinite calculus of multivariable functions.
- apply the methods of differential calculus to optimization problems.
- solve complex civil engineering problems that arise as applications from the differential and integral calculus of functions in many variables, as well as vector analysis operations.
- understand the concepts of partial derivative, double, triple, convolution and surface integral.
- apply the above types of integrals to calculate known physical quantities such as the mass, the moment of inertia, the charge distribution, and the vector field flux.
- realize the flexibility given by choosing the suitable order of integration with respect to a variable and apply it to calculate volumes of solids and surface areas, an extremely difficult, if not impossible, task to do through the traditional Euclidean Geometry methods.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the DiplomaSupplement 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…*

Upon successful completion of the course, students will have acquired the following general skills:

- Search, analysis and synthesis of data and information, using the necessary technologies.
- DecisionMaking.
- Autonomouswork

(3) SYLLABUS

The Euclidean space $\mathbb{R}^n$. Functions between Euclidean spaces, limit and continuity of functions. Differentiation of vector-valued functions of a single variable, applications in mechanics and differential geometry, polar, cylindrical and spherical coordinates. Differentiable functions, partial and directional derivative, the concept of differential. Vector fields, gradient-divergence-curl. Fundamental theorems of differentiable functions (mean value theorem, Taylor). Inverse function theorem. Implicit function theorems. Functional dependence. Local and conditional extremes. Double and triple integrals: definitions, integrability criteria, properties. Change of variables, applications. Contour integrals: Contour integral of the first and second kind, contour integrals independent of path, Green's Theorem.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures. Blackboard presentations. Exercises, tests and homework.
USE OF INFORMATION AND	

<table>
<tr><td>COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>Communication and Electronic Submission.</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>39</td></tr><tr><td>Essay writing</td><td>26</td></tr><tr><td>PersonalStudy</td><td>55</td></tr><tr><td></td><td></td></tr><tr><td>Coursetotal</td><td>120</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>Language of evaluation: Greek

• Final written exam: 100%

or

• Mid-term exam: 20%
• Final written exam: 80%

The evaluation criteria are presented to the students prior to the exam, the grading system assigned to the examination is clearly determined and the final grade received by the students is accessible via the online platform of the Institution. In addition, the students can see their writings, their overall and individual scores for each examination question and they can be given clarifications. Finally, any mistakes are also reported and pointed out.</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

GreekBibliography:

1. GeorgoudisI.,MakrigiannisA., Prezerakos N., (2016), “Mathematics for Engineers/ Multivariable Functions/ Differential Equations”, ModernPublishingL.T.D.
2. Rassias T., (2016), “Mathematical Analysis II”, Tsotras Publishing.

ForeignBibliography:

1. Courant R., John F., (1999), “Introduction to Calculus and Analysis II”, Springer.
2. Apostol T.M., (1960), “Mathematical Analysis: A Modern Approach to Advanced Calculus”, Addison-Wesley.