COURSE OUTLINE

(1) GENERAL

SCHOOL	Engineering		
ACADEMIC UNIT	Industrial Design and Production Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**2004**	**SEMESTER**	**2**
COURSE TITLE	Differential and Integral Calculus I		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	3
Laboratory	1	2
	4	**5**

COURSE TYPE	General background
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.uniwa.gr/courses/IDPE232/

(2) LEARNING OUTCOMES

Learning outcomes

Upon successful completion of this course, the student will be able to acquire:

- the required theoretical background and ability to be able to use the differential calculus of a variable in Probability, Statistics and Engineering problems that they will be called upon to face in the later years of their studies
- the ability to deal with problems involving sets, supremum sets, infimum sets, real number series (convergence, monotony, recursive series), function limits, function continuity, function derivative, functions terms, Taylor theorem, convex and concave functions
- the ability to apply function calculus results of a real variable to engineering/scientific problems.

General Competences

- Production of free, creative and inductive thinking
- Working independently
- Team work
- Decision-making
- Search for, analysis and synthesis of data and information, with the use of modern scientific tools for solving problems in specialized applications
- Working in an interdisciplinary environment

The above General Competences correspond to Level 6 of the European Qualifications Framework.

(3) SYLLABUS

The set of real numbers.

Series of real numbers. Convergence. Cauchy Series. Upper and lower series limit.

Real functions of a real variable. Elementary functions (exponential, logarithmic, trigonometric, hyperbolic, inverse trigonometric, inverse hyperbolic). Basic concepts of differential calculus (limits, lateral limits, continuity, uniform continuity, derivative). Differential calculus theorems (Rolle theorem, mean value theorems, de l'Hospital rule, Taylor formula). Differential calculus applications (local extremes, inflection points, asymptotic curve, graph study, Newton method).

Indefinite Integrals. Integration by factors. Completion by replacement. Special integration methods (integration with reductive formulas, integration of explicit functions, analysis in simple fractions, binomial integrals, reduction to integrals of explicit functions by substitution).

Definite integrals. Riemann sums. Fundamental theorem of integral calculus. Variable change. Applications in Physics, Geometry and Engineering (calculation of flat area, curve arc length, solid volume by rotation, surface area by rotation, center of gravity/mass, moment of inertia, force work, etc.). Taylor and MacLaurin power series function development.

Applications using Matlab software. Introduction to the Matlab environment (workspace and command window, command history, documentation system). Numerical and alphanumeric data (character, string). Matlab data types and accuracy. Create, import and manage data. Mathematical and logical operators and expressions. Data visualization (graphs, diagrams and graphics). Creating scripts and functions (Matlab Editor, m-files). Implementation of programs with loops, conditional statements, nested loops and user-defined functions.

Basic arithmetic functions. Definition and handling of variables. Output format. Symbolic variables. Symbolic mathematical calculations in Matlab. Basic functions for engineers in Matlab (trigonometric, hyperbolic, etc.). Solving numerical equations. Roots of polynomials. Complex numbers. Complex functions. Symbolic calculations with complex numbers. Functions. Introduction to arithmetic derivation and arithmetic integration in Matlab.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face
USE OF INFORMATION ANDCOMMUNICATIONS TECHNOLOGY	Communication with students through the platform with emails & announcements on the course's website (e-class). Powerpoint display with projector and laptop. Demonstration of modern mathematical software (Matlab, Mathematica, Wolfram Alpha) on the taught subjects. Announcement of course notes in electronic form on the course's website (e-class). Referral to websites with related applications (Desmos, Maxima, Geogebra). Utilization of the computer laboratory of the Department. Possibility of examinations through the tool of Exercises in e-class.

TEACHING METHODS

Activity	*Semester workload*
Lectures	39
Laboratory	26
Computing exercises	30
Individual study	55
Course Total (30h/ECTS)	**150**

STUDENT PERFORMANCE EVALUATION	**Language of assessment:** Greek (English for ERASMUS students upon request). Students are assessed through a written examination, which includes short-answer questions and problem solving. There is a possibility for an intermediate examination in the middle of the semester. Delivery of assignments and written/oral examination in the Laboratory (40%). Students with learning difficulties are examined in accordance with article 37 of the Internal Regulations of the UNIWA. The evaluation criteria have been presented to the students before the final examination and the individual grade of the subjects is written in them. Students can see their writing and their individual grades in the topics, as well as receive clarifications about them after pointing out any mistakes.

(5) **ATTACHED BIBLIOGRAPHY**

***- Suggested bibliography**:*

1. Νικόλαος Χαλιδιάς, Εφαρμοσμένα Μαθηματικά για Οικονομολόγους και Μηχανικούς, Broken Hill Publishers, 2021.
2. Spivak Michael, Διαφορικός και Ολοκληρωτικός Λογισμός, ΙΔΡΥΜΑ ΤΕΧΝΟΛΟΓΙΑΣ & ΕΡΕΥΝΑΣ ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ, 2η Έκδοση, 2010.
3. Finney R.L., Weir M.D., Giordano F.R., Απειροστικός Λογισμός Τόμος Ι, ΙΔΡΥΜΑ ΤΕΧΝΟΛΟΓΙΑΣ & ΕΡΕΥΝΑΣ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ, 2009.
4. Παντελίδης Γεώργιος Ν., Ανάλυση, Τόμος Ι, Εκδόσεις Ζήτη, 3η έκδ. βελτ./2008.
5. Γεωργίου Δημήτρης, Ηλιάδης Σταύρος, Μεγαρίτης Αθανάσιος, Πραγματική Ανάλυση, ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ, 2η έκδοση, 2017.
6. Ντούγιας Σωτήρης, Απειροστικός Λογισμός, Τόμος Α, LIBERAL BOOKS, 2007.