Universidad Zaragoza

Year : 2019/20

25867 - Mathematics I

Syllabus Information

Academic Year: 2019/20
Subject: 25867 - Mathematics I
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 558 - Bachelor's Degree in Industrial Design and Product Development Engineering
ECTS: 6.0
Year: 1
Semester: First semester
Subject Type: Basic Education
Module: ---

1.General information

1.1.Aims of the course

1.2.Context and importance of this course in the degree

1.3.Recommendations to take this course

2.Learning goals

2.1.Competences

BC01. Students have demonstrated knowledge and understanding in a field of study that is part of the general secondary education curricular, and is typically at a level which, although it is supported by advanced textbooks, includes some aspects that involve knowledge of the forefront of their field of study.

BC02. Students can apply their knowledge to their work or vocation in a professional manner and have competences typically demonstrated through devising and defending arguments and solving problems within their field of study.

BC03. Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include an important reflection on social, scientific or ethical issues.

BC04. Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences.

BC05. Students have developed those skills needed to undertake further studies with a high degree of autonomy.

GC04. Ability to organize time effectively and coordinate activities to acquire new knowledge quickly and perform under pressure.

GC05. Capacity to collect, manage, analyze and synthesize information from various sources for the development of design projects and product development. Capacity to use this documentation to obtain conclusions aimed at solving problems and making decisions with initiative, creativity and critical thinking, in order to generate new product concepts, new ideas and solutions.

GC06. Ability to generate the necessary documentation for the proper transmission of ideas through graphics, reports and technical documents, models and prototypes, oral presentations in Spanish and other languages.

GC07. Ability to use and master techniques, skills, tools and techniques and communication and others specific of design engineering needed for design practice.

GC08. Ability to learn continuously, to develop autonomous learning strategies and to work in multidisciplinary groups with motivation and determination to achieve goals.

SC01. Ability to solve mathematical problems that may arise in Engineering in Industrial Design and Product Development. Ability to apply knowledge of linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and partial differential equations; numerical methods; numerical algorithmic; statistical and optimization.

BC:BASIC COMPETENCES. GC: GENERAL COMPETENCES. SC: SPECIFIC COMPETENCES.

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. It favors the acquisition of knowledge related to single and multivariable differential and integral calculus. A wide range of teaching and learning tasks are implemented, such as theory sessions, computer lab sessions, group work, autonomous work, and tutorials.

Students are expected to participate actively in the class throughout the semester.

Classroom materials will be available via Moodle. These include a repository of the lecture notes used in class, the course syllabus, as well as other course-specific learning materials.

Further information regarding the course will be provided on the first day of class.

4.2.Learning tasks

The course includes the following learning tasks:

- **Lectures** (1.68 ECTS: 42 hours). Theory sessions will take place three hours a week, until complete 42 hours. Topics will be presented using the blackboard and computer presentations. Theoretical content, illustrative examples and problem solving will be combined during the theory sessions. Lecture notes and a set of problems (and their corresponding solutions) will be available for the students.
- **Computer lab sessions** (0.48 ECTS: 12 hours). There will be 6 computer lab sessions. Each session is scheduled for 2 hours and takes place every 2 weeks approximately. The mathematical software *Maxima* will be used in this course. The emphasis is on the graphic, symbolic and numerical aspects of the subject. The problems are designed to force the student to engage in critical, analytic, and interpretive thinking beyond rote manipulation of calculus formulas. Students are provided in advance with task guidelines for each session.
- **Group work** (0.8 ECTS: 20 hours). Group work will be guided by regular meetings and seminars, where the teacher will provide help and feedback. Group sizes are between 3-4 students. Different types of work may be proposed with some or all of the subjects of the first semester.
- **Autonomous work** (2.92 ECTS: 73 hours).
- **Exams** (0.12 ECTS: 3 hours). Written exams.

4.3.Syllabus

The course will address the following topics:

1. Single variable differential and integral calculus.

1. Real numbers.
2. Real-valued functions. Limits and continuity.
3. Derivatives. Applications of the derivatives.
4. Numerical methods for solving nonlinear equations.
5. Polynomial approximation: Taylor polynomial. Interpolation.
6. Integration. Techniques of integration. Numerical integration. Applications of the definite integral.
7. Plane curves. Parametric equations and polar coordinates.

2. Multivariable differential and integral calculus.

1. The geometry of plane and space.
2. Functions of several variables. Domains. Graphs. Limits and continuity.
3. Partial derivatives and the gradient vector. Differentiability and the tangent plane.
4. Higher derivatives. Maximum and minimum values.
5. Multiple integral.

4.4.Course planning and calendar

Activity /	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Week															
Lectures	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Computer lab sessions		X	X	X	X	X	X	X	X	X	X	X	X	X	
Group work					X	X	X	X	X	X	X	X	X	X	
Exams									X						X
Autonomous work	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

For further details concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the ?Escuela de Ingeniería y Arquitectura de la Universidad de Zaragoza?, website, https://eina.unizar.es/.

4.5.Bibliography and recommended resources