UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH

Course guide
330051 - M1 - Mathematics I

Last modified: 25/04/2024

Unit in charge:	Manresa School of Engineering
Teaching unit:	749 - MAT - Department of Mathematics.

Degree:
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2016). (Compulsory subject).
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2016). (Compulsory subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2016). (Compulsory subject).
BACHELOR'S DEGREE IN MINERAL RESOURCE ENGINEERING AND MINERAL RECYCLING (Syllabus 2021). (Compulsory subject).

Academic year: 2024   **ECTS Credits:** 6.0   **Languages:** Catalan

LECTURER

Coordinating lecturer:	Rossell Garriga, Josep Maria

Others:
Alsina Aubach, Montserrat
Freixas Bosch, Josep
Domenech Blazquez, Margarita
Cors Iglesias, Josep M.
Sanchis Ferri, Francisco Miguel
Gilibets Palau, Inmaculada
Bastardas Ferrer, Gemma
Puente Del Campo, Maria Albina
Gimenez Pradales, Jose Miguel
Ventura Capell, Enric
Rubió Massegú, Josep
Delgado Rodríguez, Jorge
Tobias Rossell, Ester

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. CE1: Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge about: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial differential equations, numerical methods, numerical algorithms, statistics and optimization.

Transversal:
2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.
3. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.
4. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

TEACHING METHODOLOGY

Face-to-face sessions in a large group in which the professor explains the foundations of each topic, gives examples and sets the students exercises or tasks.

Independent study sessions in which students study the professor's explanations, look at them in depth with the help of the textbook and do the exercises or tasks proposed.

Face-to-face sessions in a small group in which the professor answers students' queries after their independent study and/or students carry out practicals.

LEARNING OBJECTIVES OF THE SUBJECT

On completion of the subject Mathematics I, students must be able to:

- Solve linear algebra and single variable calculus problems with the support of Maple software without difficulties.
- Think in increasingly abstract terms.
- Understand and apply deductive reasoning.
- Organise and apply theoretical knowledge to solve concrete problems.
- Interpret the results obtained with the help of computer tools.

STUDY LOAD

Type	Hours	Percentage
Hours small group	30,0	20.00
Self study	90,0	60.00
Hours large group	30,0	20.00

Total learning time: 150 h

CONTENTS

1. SINGLE VARIABLE DIFRERENTIAL CALCULUS

Description:
Basic functions in engineering
Differentiation and applications of the derivative
Linear approximation
Relative and absolute extrema
Zeros of functions: bisection and Newton-Raphson methods

Related activities:
Activities A1, A2 and P1

Full-or-part-time: 47h
Theory classes: 10h
Laboratory classes: 10h
Self study : 27h

2. SINGLE VARIABLE INTEGRAL CALCULUS

Description:
Area between curves. Definite integrals: Barrow's rule
Indefinite integrals
Integration techniques: direct integration, by substitution, by parts and rational functions.
Improper integrals
Numerical integration: trapezoidal rule and Simpson's rule

Related activities:
Activities A2 and P1

Full-or-part-time: 37h
Theory classes: 8h
Laboratory classes: 8h
Self study : 21h

3. LINEAR SYSTEMS, MATRICES AND DETERMINANTS

Description:
Calculation of matrices and determinants
Systems of linear equations
Gauss method: numerical solution
Least squares curve fitting

Related activities:
Activities A2 and P2

Full-or-part-time: 30h
Theory classes: 6h
Laboratory classes: 6h
Self study : 18h

4. LINEAR ALGEBRA

Description:
Rn spaces
Vector subspaces generated by a set of vectors
Basis, dimension
Change of basis
Eigenvalues and eigenvectors
Diagonalisation

Related activities:
Activities A2 and P2

Full-or-part-time: 30h
Theory classes: 6h
Laboratory classes: 6h
Self study : 18h

5. COMPLEX NUMBERS

Description:
Basic knowledge of complex numbers

Specific objectives:
This subject must be learned by the students independently, based on notes and questionnaires that are made available to them.

Related activities:
P1

Full-or-part-time: 6h
Self study : 6h

ACTIVITIES

A1: TOPIC 1

Description:
This activity must be carried out individually in the classroom.

Specific objectives:
On completion of the activity, students must be able to:
Calculate the derivative of explicitly and implicitly defined functions.
Find tangent and normal lines to a curve.
Approximate functions linearly.
Study increasing and decreasing functions.
Find the relative and absolute extrema of a function.
Formulate and solve optimisation problems.

Material:
Guidelines for practicals, lists of problems and a variety of materials available on ATENEA.

Delivery:
The assignment must be handed in to the professor.
It forms part of continuous assessment.
The realization of this test is necessary to pass the subject by course.

Full-or-part-time: 4h
Laboratory classes: 1h
Self study: 3h

A3: TOPICS 1,2,3 and 4

Description:
This activity must be carried out individually in the classroom.

Specific objectives:
On completion of the activity, students must be able to:
Make basic calculations related to the content of the subject with Maple.

Material:
Software that is available in the computer room.
Guidelines for practicals, lists of problems and a variety of materials available on ATENEA.

Delivery:
The assignment must be handed in to the professor.
It must be passed to pass the subject.
It forms part of continuous assessment.

Full-or-part-time: 4h
Laboratory classes: 1h
Self study: 3h

P1: TOPICS 1, 2 and 5

Description:
Individual test in the classroom related to the learning objectives for the subject.

Specific objectives:
To assess the general attainment of the objectives of topics 1, 2 and 5.
To assess the attainment of the individual learning competence.

Material:
Test papers (given out at the time of the test)
Lists of problems and a variety of materials available on ATENEA.

Delivery:
The assignment must be handed in to the professor.
It forms part of continuous assessment.

Full-or-part-time: 8h
Theory classes: 2h
Self study: 6h

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P2: TOPICS 3 and 4

Description:
Individual tests in the classroom related to the learning objectives for the subject.

Specific objectives:
To assess the general attainment of the objectives of topics 3, 4.

Material:
Test papers (given out at the time of the test)
Lists of problems and a variety of materials available on ATENEA.

Delivery:
The assignment must be handed in to the professor.
It forms part of continuous assessment.

Full-or-part-time: 8h
Theory classes: 2h
Self study: 6h

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GRADING SYSTEM

The mark NC is calculated from the marks corresponding to activities A1, A2, P1 i P2 in the following way: NC = 0,4*P1+0,4*P2+0,1*(A1+A2)
The learning objectives are considered to have been met if the final mark for continuous assessment NC is greater than or equal to 5.
Students with a mark for the subject (NC) of less than 5 may take a final examination (mark: NF).
The student's final mark will be ND=maximum (NC, NF).

EXAMINATION RULES.

All the activities are compulsory.
If students do not carry out one of the activities for the subject they will be given a mark of 0.

BIBLIOGRAPHY

Basic:
- Nakos, George; Joyner, David. Álgebra lineal con aplicaciones. México: Thomson, 1999. ISBN 9687529865.
- Lay, David C. Álgebra lineal y sus aplicaciones [on line]. 5ª ed. México: Pearson Educación, 2016 [Consultation: 07/06/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=6765. ISBN 9786073237451.
- Larson, Ron; Hostetler, Robert P.; Edwards, Bruce H. Cálculo y geometría analítica. Vol. 1. 6ª ed. Madrid: McGraw-Hill, 1999. ISBN 8448122291.
- Stewart, James. Cálculo de una variable: trascendentes tempranas. 6ª ed. México: International Thomson, 2008. ISBN 9789706866530.
- Yasskin, Philip B. CalcLabs with Maple for Stewart's single variable calculus. 5th ed. [Toronto, Ontario]: Thomson. Brooks/Cole, cop. 2003. ISBN 0534393705.
- Benavent, Roberto. Cuestiones sobre álgebra lineal. Madrid: Paraninfo, 2010. ISBN 9788428380973.
- Smith, Robert T.; Minton, Roland B.; Rafhi, Ziad A. T. Cálculo de una variable: trascendentes tempranas [on line]. McGraw Hill, 2019 [Consultation: 13/02/2023]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=8726. ISBN 9781456272340.