Course guides

3200011 - M1 - Mathematical Methods I

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual 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 TEXTILE TECHNOLOGY AND DESIGN ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR’S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2010). (Compulsory subject).

Academic year: 2020   ECTS Credits: 6.0   Languages: Catalan, Spanish

LECTURER

Coordinating lecturer: Gisela Pujol Vázquez
Others: José Domínguez
José Gibergans Båguena
Massimo Milesi
Rodrigo Ramírez

PRIOR SKILLS

Is highly desirable to have completed mathematics courses provided in the curriculum of the different types of secondary education giving access to degree studies.

Evaluations consist of acts of classroom evaluation and / or other evaluation activities as part of continuous assessment. If you do not perform any of the acts or activities shall be considered qualified to zero.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
3. (ENG) Capacitat per a la resolució dels problemes matemàtics que puguin platenjar-se a l'enginyeria. Aptitud per aplicar els coneixements sobre: àlgebra lineal; geometria, geometria diferencial; càlcul diferencial i integral; equacions diferencials i amb derivades parciais; mètodes numèrics; algorítmica numèrica; estadística i optimització.

Transversal:
2. 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

- Lectures presenting content.
- Face-to-face sessions of practical work.
- Independent work study and conducting exercises.
- Preparation and implementation of individual and / or group activities.

In the sessions of explanatory content teacher introduce the theoretical foundations of the subject, concepts, methods and illustrated with suitable examples to facilitate understanding results. The students will independently study to assimilate the concepts, solve exercises either manually or with the help of computer.

Students will become familiar in the use of a mathematical software package in order to use it as a tool for numerical, symbolic and graphic calculation.

LEARNING OBJECTIVES OF THE SUBJECT

Students will have to consolidate the fundamental concepts of differential and integral calculus. They will also have to know and understand the concepts and results of linear algebra and geometry.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Hours medium group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

TOPIC 1: COMPLEX NUMBERS

Description:
1.1. The concept of complex numbers.
1.2. Graphical representation.
1.3. Binomial, polar and trigonometric forms.
1.4. Operations with complex numbers.
1.5. Euler’s formula.
1.7. N-th root of a complex number.

Specific objectives:
- Understand the concept and representations of complex numbers and basic operations with complex numbers.

Full-or-part-time: 20h
Theory classes: 4h
Practical classes: 4h
Self study : 12h
TOPIC 2: SINGLE-VARIABLE DIFFERENTIAL CALCULUS

Description:
2.2. Extrema. Optimization.
2.3. Taylor polynomial. Linear approximation.

Specific objectives:
- Understand the concept of continuous and derivable functions.
- Correctly interpret the meaning of a derivative.
- Correctly apply the concepts of linear approximation and Taylor polynomial approximation.
- Correctly carry out basic operations and use the technique of optimisation.

Full-or-part-time: 45h
Theory classes: 9h
Practical classes: 9h
Self study : 27h

TOPIC 3: INTEGRAL CALCULUS

Description:
3.1. Definite integration.
3.2. Indefinite integration. Methods: change of variable and integration by parts.
3.3. Applications of definite integral.
3.4. Improper integrals.

Specific objectives:
For students to:
- Understand the concept of a Riemann definite integral, the fundamental theorem of calculus, and Barrow's rule.
- Carry out indefinite integration, quasi-indefinite integration and integration by parts.
- Apply the definite integral to find areas, moments of inertia, volumes, etc..
- Understand the concept of improper integral and the techniques for calculating them.

Full-or-part-time: 45h
Theory classes: 9h
Practical classes: 9h
Self study : 27h

TOPIC 4: LINEAR ALGEBRA: VECTOR SPACES AND DIAGONALISATION

Description:
4.1. Vector spaces. Subspaces of Rn:
- Vector subspaces. Generated subspaces.
- Linear independence. Bases.
- Diagonalisation. Eigenvectors and eigenvalues.

Specific objectives:
- Understand the specific concepts and techniques applicable to vector spaces, in particular Rn spaces:
  vector subspaces, the generating set of a subspace, linear dependence and independence, bases.
- Calculate the eigenvalues and eigenvectors of a matrix and understand the diagonalisation technique.

Full-or-part-time: 40h
Theory classes: 8h
Practical classes: 8h
Self study : 24h
ACTIVITIES

ACTIVITY 1: COMPUTER-ASSISTED WORK

Description:
Learn mathematical software able to solve complex problems

Material:
Documentation

Full-or-part-time: 10h
Self study: 10h

ACTIVITY 2: Quiz

Description:
At the end of each subject, a student will answer a quiz.

Full-or-part-time: 10h
Self study: 10h

ACTIVITAT 3: EXAMS

Description:
Exams and tasks

Full-or-part-time: 8h
Theory classes: 8h

GRADING SYSTEM

The evaluation of the course will be partial evaluations by the following weights:
- Midterm exams: 70% (First exam: 30%, Second exam: 40%)
- Tasks: 30%

If a non-satisfactory grade is obtained in the first part, the exam may be re-evaluated.

EXAMINATION RULES.

The evaluations consist of the partial exams and other evaluable activities that are part of the continuous evaluation. If any of the exams or activities are not carried out, it will be considered qualified with zero.

The irregular actions (for example to copy, to let copy) it will mean the qualification of fail with 0 in the act of evaluation.
BIBLIOGRAPHY

Basic:

RESOURCES

Other resources:
- Exercises
- Theoretical notes
- Basic Maple tutorials