Course guide
340026 - CAAV-F2O43 - Advanced Calculus

Unit in charge: Vilanova i la Geltrú School of Engineering
Teaching unit: 749 - MAT - Department of Mathematics.

Degree:
- BACHELOR’S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
- BACHELOR’S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2009). (Optional 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).

Academic year: 2023
ECTS Credits: 6.0
Languages: Catalan

LECTURER

Coordinating lecturer: Prat Farran, Joana d’Arc
Others: Sanchez Campoy, Miguel
        Simó Mezquita, Este
        Prat Farran, Joana d’Arc
        Trullols Farreny, Enric

PRIOR SKILLS

- Mastering the basic tools of differential and integral calculus of real functions in one real variable.
- Knowledge how to operate with complex numbers.
- Understanding of the factorization of polynomials with real or complex coefficients.
- Knowledge of the basic tools of linear algebra.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.

TEACHING METHODOLOGY

The theoretical foundations of the subject will be taught to the large groups, if necessary with the help of media, such as transparencies, video or computer-assisted simulations.
At the beginning of each content will be given a list of representative problems, the numerical solution if necessary, to serve as motivation for students to realize them.
Also will be proposed problems that require the use of a computer medium.

LEARNING OBJECTIVES OF THE SUBJECT

The general objectives to get from the students at the end of the course are:
o Understand and apply, if necessary using specific software, the basic techniques of differential calculus of several variables and integral calculus of several variables.
o Understand and apply, if necessary using specific software, integration of scalar and vector fields on curved surfaces, as well as the integral theorems of Gauss and Stokes.
**STUDY LOAD**

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Hours large group</td>
<td>52.5</td>
<td>35.00</td>
</tr>
<tr>
<td>Self study</td>
<td>90.0</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>7.5</td>
<td>5.00</td>
</tr>
</tbody>
</table>

**Total learning time:** 150 h

**CONTENTS**

(ENG) 1- Differential multivariable calculus

**Description:**
1.1 Conics and quadrics
1.2 Scalar functions of two variables
1.3 Partial derivatives and directional derivatives. Tangent plane and normal vector

**Full-or-part-time:** 36h
Theory classes: 9h
Practical classes: 6h
Self study: 21h

(ENG) 2- Applications of multivariable calculus

**Description:**
2.1 Double Integral. Change to polar coordinate
2.2 Triple Integral. Changes in cylindrical and spherical coordinates

**Full-or-part-time:** 36h
Theory classes: 9h
Practical classes: 6h
Self study: 21h

(ENG) 3- Integral multivariable calculus

**Description:**
3.1 Vector functions of several variables. Differential operators
3.2 Curves and Surfaces. Parameterization
3.3 Line integral
3.4 Surface integral

**Full-or-part-time:** 42h
Theory classes: 11h
Practical classes: 6h
Self study: 25h
(ENG) 4- Applications of integral multivariable calculus

Description:
4.1 Stokes Theorem
4.2 Conservative Fields
4.3 Divergence Theorem

Full-or-part-time: 30h
Theory classes: 7h
Practical classes: 6h
Self study: 17h

ACTIVITIES

(ENG) 1- PROBLEMS AND EXERCISES BY SPECIFIC SOFTWARE
Full-or-part-time: 16h
Laboratory classes: 4h
Self study: 12h

(ENG) 2- EXAM OF CONTENTS 1 AND 2
Full-or-part-time: 2h
Guided activities: 2h

(ENG) 3- EXAM OF CONTENTS 3 AND 4
Full-or-part-time: 2h
Guided activities: 2h

(ENG) 4- EXAM OF CONTENTS 1, 2, 3 AND 4
Full-or-part-time: 3h
Guided activities: 3h

GRADING SYSTEM

The course evaluation will be with the activities 1, 2 and 3. Each activity has the following weights in the final:
- Activity 1. Problems and exercises using specific software: 30%
- Activity 2. Exam of Content until week of partial exams: 20%
- Activity 3. Exam of all Content: 50%

Activity 3 is the only re-gradable activity.
EXAMINATION RULES.

In no case can it be copied or allowed to be copied; Failure to comply with this rule in any of the activities will result in a 0 in the grade for the corresponding activity or in the final grade.
The particular regulations of the activities will be announced in each case with enough time.
All activities are individual.
Activity 2 will be carried out in the week reserved for the first testing period of the course, which appears in the EPSEVG Academic Calendar.
Activity 3 will be carried out in the final evaluation period that appears in the EPSEVG Academic Calendar.

BIBLIOGRAPHY

Basic:

RESOURCES

Hyperlink:
- "3D CALC PLOTTER" de Paul Seeburger de Brighton Campus
  Aplicació interactiva que permet visualitzar:
  - funcions escalar de dues variables, les seves derivades parcials i direccional i les corresponents rectes tangents, les corbes de nivell i el vector gradient,
  - corbes i superfícies parametrizades.
- "CALCULUS APPLETS AT SLU" del Dept. of Mathematics and Computer Science of Saint Louis University
  Col.lecció d’aplicacions interactives per al Càlcul de diverses variables, de les quals destaquem:
  - visualització de funcions escalars de dues variables, corbes de nivell i seccions,
  - visualització de corbes i superfícies,
  - visualització i càlcul d’integrals de línia,
  - visualització i càlcul d’integrals de superfície.