Degree competences to which the subject contributes

Specific:
1. The ability to solve mathematical problems that may arise in an engineering context. The ability to apply knowledge of linear algebra; geometry; differential geometry; differential and integral calculus; differential and partial differential equations; numerical methods; numerical algorithms; statistics and optimisation

General:
2. THE ABILITY TO ANALYSE AND SYNTHESISE: The ability to think abstractly about the fundamental concepts of a text or exposition and to intelligibly present the result of one's work.

Teaching methodology

- Presencial sessions of content exhibition.
- Presencial sessions of practical work (exercises).
- Autonomous work of study and realization of exercises.

Into the theoretical sessions will be introduced the concepts and fundamental results of each subject, as well as examples and cases. In the practical sessions, students will have to solve exercises and problems. They will help them to understand the concepts studied and to acquire the skill of expressing oneself correctly, using the notions and tools of the course.

On the other hand, students will have to solve a collection of exercises and problems. These exercises will be solved during the problem classes and also with non-presence work. Besides the partial and final examinations, during the course it will make a follow-up of the learning of the students. They will have a collection of solved problems which has to serve as reference book and guide for the resolution of the exercises. Moreover, each teacher has some fixed consulting hours where students can solve different doubts concerning theory classes and problems.

Learning objectives of the subject

To provide the students the basic tools of the differential and integral calculation of two and three variables. Introducing vectorial calculation and their more important applications: areas of surfaces, mass centres, flows, circulations.
# Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 32h</th>
<th>21.33%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group: 28h</td>
<td>18.67%</td>
</tr>
<tr>
<td></td>
<td>Self study: 90h</td>
<td>60.00%</td>
</tr>
</tbody>
</table>
## 1. Functions of several variables

<table>
<thead>
<tr>
<th>Description:</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Related activities:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Classes of theoretical explanation and resolution of problems of diverse difficulty (individual and in group). Study and individual work.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specific objectives:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Parametric representation of a curve and calculate the length. Curvatura, torsion and Frenet trihedral. Graphically represent sets of level.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning time:</th>
<th>27h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes:</td>
<td>5h</td>
</tr>
<tr>
<td>Practical classes:</td>
<td>3h</td>
</tr>
<tr>
<td>Self study:</td>
<td>19h</td>
</tr>
</tbody>
</table>

## 2. Differential calculus

<table>
<thead>
<tr>
<th>Description:</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Related activities:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Theoretical explanation and resolution of problems of different difficulty classes (individual and group). Study and individual work.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specific objectives:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowing derived functions of various variables. Calculation of higher order derivatives. Study and determination of relative and absolute ends.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning time:</th>
<th>41h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes:</td>
<td>9h</td>
</tr>
<tr>
<td>Practical classes:</td>
<td>8h</td>
</tr>
<tr>
<td>Self study:</td>
<td>24h</td>
</tr>
</tbody>
</table>
### 3. Integral calculation

**Learning time:** 38h  
- Theory classes: 8h  
- Practical classes: 7h  
- Self study: 23h

**Description:**  

**Related activities:**  
Theoretical explanation and resolution of problems of different difficulty classes (individual and group). Study and individual work.

**Specific objectives:**  
Calculate double and triple integrals. Apply changes of variables. Physical applications of the double and triple integrals.

### 4. Vectorial analysis

**Learning time:** 44h  
- Theory classes: 10h  
- Practical classes: 10h  
- Self study: 24h

**Description:**  

**Related activities:**  
Theoretical explanation and resolution of problems of different difficulty classes (individual and group). Study and individual work.

**Specific objectives:**  
Parameterization of surfaces. Calculation of the integral of a field scalar and a vector field on a surface. Application of the divergence of Stokes theorems.
### Planning of activities

**ACTIVITY 1: THEORY CLASSES**
- **Description:** Presentation of the contents of the subject by the teacher and student self-study.
- **Support materials:** Class notes. Basic bibliography.
- **Specific objectives:** Provide students the basic tools of the differential, integral and Vector calculus.

| Hours | Theory classes: 26h  
Self study: 30h |
|-------|---------------------|

**ACTIVITY 2: EXERCISE CLASSES**
- **Description:** Students and the teacher will solve problems in the class that have been formerly proposed.
- **Support materials:** Class notes. Basic bibliography. Collection of problems. Mathematical software.
- **Specific objectives:** Assimilate and practice the theoretical concepts discussed in class.

| Hours | Practical classes: 28h  
Self study: 38h |
|-------|---------------------|

**ACTIVITY 3: FIRST CONTROL**
- **Description:** Control after about three weeks from the beginning of course with the aim that both students and the teacher, make an initial assessment of the operation of the course and take corrective action, if necessary.
- **Support materials:** Class notes. Collection of exercises to solve individually. Basic bibliography.
- **Specific objectives:** Provide guidance to students how to prepare the subject.
### ACTIVITY 4: SECOND CONTROL

**Description:**

**Support materials:**
Class notes. Collection of exercises to solve individually. Basic bibliography.

**Descriptions of the assignments due and their relation to the assessment:**
Making an individual control.

**Specific objectives:**
Students should properly set the limits of integration in double and triple integrals and swap this order and calculate these integrals making a change appropriate variable, if necessary.

| Hours | Theory classes: 1h  
Self study: 6h |
|-------|------------------|

### ACTIVITY 5: PARTIAL EXAM

**Description:**
Making the partial examination of the subject.

**Descriptions of the assignments due and their relation to the assessment:**
The mark of this exam represents 30% of the final grade. If not overcome, it recovered with a score of 5 if the final exam is passed.

**Specific objectives:**
Develop the knowledge acquired in the theoretical and practical sessions. Write clearly and concisely the problems and issues raised manner.

| Hours | Theory classes: 2h  
Self study: 5h |
|-------|------------------|

### ACTIVITY 6: FINAL EXAM

**Description:**
Making a final exam with all the contents of the subject.

**Support materials:**
Tests determined from previous years available on Athena.

**Descriptions of the assignments due and their relation to the assessment:**
The mark of this exam represents 50% of the final grade.

**Specific objectives:**
Develop the knowledge acquired in theoretical and practical sessions. Write clearly and concisely the problems and issues raised manner.

| Hours | Theory classes: 2h  
Self study: 5h |
|-------|------------------|
Qualification system

The final qualification of the subject will be obtained from the four following marks with the indicated ponderation:

- Final exam qualification: 50%
- Partial exam qualification: 25%
- First control qualification: 10%
- Second control qualification: 15%

The partial and final examinations consist on one part with questions about concepts related with the learning objectives of the subject regarding the knowledge or the understanding and a set of application exercises.

Regulations for carrying out activities

In the examinations and controls are not allowed to use of any kind of calculator, computer, mobile or similar telephone. The teacher can request the student identification in any moment during the realization of evaluation act.

The irregular actions that can go to a significant variation of the qualification of one or more students (to copy or let copy) constitute a fraudulent realization of an evaluation act. This action will mean the qualification descriptive failed and numeric of 0 in evaluation act and subject.

Bibliography

Basic:


Complementary:


Others resources:

Hyperlink

http://atenea.upc.edu