820076 - AEAE - Advanced Statistics and Applications in Engineering

**Coordinating unit:** 295 - EEBE - Barcelona East School of Engineering  
**Teaching unit:** 749 - MAT - Department of Mathematics  
**Academic year:** 2017  
**Degree:** BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)  
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)  
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)  
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Optional)  
BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Teaching unit Optional)  
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)  
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)  
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Optional)  
BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)  
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)  
BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Teaching unit Optional)  
**ECTS credits:** 6  
**Teaching languages:** Catalan, Spanish

**Teaching staff**

**Coordinator:** PABLO BUENESTADO CABALLERO  
email: Pablo.Buenestado@upc.edu  
**Others:** PABLO BUENESTADO CABALLERO

**Opening hours**

**Timetable:** Session 2017-2018:  
Tuesday 10-12 h (Small group)  
Thursday 11-14 h (Big group)

**Requirements**

Statistics

**Degree competences to which the subject contributes**

**Specific:**
1. Solve mathematical problems that may arise in engineering. Apply knowledge of linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and partial differential equations; numerical methods; numerical algorithms; statistics and optimisation.

**Transversal:**
2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.
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Teaching methodology
The sessions are made in the computer rooms.
Learning is based on applied engineering problems.
In each session the subject of learning is presented.
Practices are working individually or in pairs, depending on the activity.

Learning objectives of the subject
Students gain confidence to tackle problems related to the statistics and their applications in engineering.
The statistic that students learn in this course is very advanced and useful for the future of an engineer.
In recent years a large increase in jobs for engineers in the field of applied statistics is appreciated.
With this course we want to help the student to train in this area.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>45h</th>
<th>30.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Hours small group:</td>
<td>15h</td>
<td>10.00%</td>
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<tr>
<td></td>
<td>Guided activities:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Self study:</td>
<td>90h</td>
<td>60.00%</td>
</tr>
</tbody>
</table>
## Content

<table>
<thead>
<tr>
<th>Inference Based on One Sample</th>
<th>Learning Time: 40h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Theory classes: 8h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 8h</td>
</tr>
<tr>
<td></td>
<td>Self study: 24h</td>
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**Description:**
Initially working the usual statistical models for engineering. Analysis of different types of sampling and sampling the main elements. We review the basics of inference: Confidence intervals Hypothesis contrast

**Related activities:**
Practical statistical modeling. Recognizes the model from a sample. Practice simulation to estimate. Experience the mean estimate. Practice simulation for contrast. Decision making on average.

**Specific objectives:**
Reviewing the most useful engineering statistical models.
Deepen the main concepts related to the inference based on a single sample.
Learn to make decisions by estimating and contrast.

<table>
<thead>
<tr>
<th>Inference Based on Two Samples</th>
<th>Learning Time: 30h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 6h</td>
</tr>
<tr>
<td></td>
<td>Self study: 18h</td>
</tr>
</tbody>
</table>

**Description:**
Inference two population means. Analysis of data pairs. Inference proportions. Inference two variances.

**Related activities:**
Practice of Inference for two averages
Practice of inference data pairs
Practice of Inference for two proportions
Practice of Inference for two variances

**Specific objectives:**
Enable the student to make decisions for cases with 2 samples.
### Adjust Models. Multiple Linear Regression

**Description:**
Using linear regression of two variables for modeling engineering data based on hypothesis testing. Linear model to predict values.
Learn the possibilities of the linear model for nonlinear relationships.
Extend the linear regression model to several variables.

**Related activities:**
Practice of Linear modeling for two variables
Practice of multiple linear modeling

**Specific objectives:**
Modeling linear relationship between two variables.
Learn the technique of linear modeling of several variables.

### Analysis of Variance

**Description:**
Learn to perform analysis of variance pruebas of hypotheses.
ANOVA of a single factor.
ANOVA formulation.
ANOVA with two or three factors.

**Related activities:**
Practice of analysis of variance of a factor
Practice of analysis of variance of two factors
Practice of ANOVA of three factors

**Specific objectives:**
Using the ANOVA technique for making decisions with a factor.
Using ANOVA applied to engineering problems with 2 or 3 factors.
The evaluation focuses on the delivery of individual or couple work. The course can be done without attending the classroom.

**Qualification system**

The reports must be submitted within the deadline and with good presentation.

** Regulations for carrying out activities**

**Bibliography**

**Basic:**

**Complementary:**