Course guide
330527 - GQ - Quality Management

Unit in charge: Manresa School of Engineering
Teaching unit: 750 - EMIT - Department of Mining, Industrial and ICT Engineering. 749 - MAT - Department of Mathematics.
Degree: BACHELOR'S DEGREE IN AUTOMOTIVE ENGINEERING (Syllabus 2017). (Compulsory subject).
Academic year: 2022  ECTS Credits: 4.5  Languages: Catalan

LECTURER
Coordinating lecturer: JOSEP FREIXAS BOSCH & JORDI ALBIOL RODRÍGUEZ
Others: RESTA DE PROFESSORAT EPSEM DELS DEPARTAMENTS MAT I EMIT

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
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 equations and partial derivatives; numerical methods; numerical algorithms; statistics and optimization.
CE17. Quality control knowledge.

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.
3. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.
4. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

TEACHING METHODOLOGY

In the content presentation sessions the teacher will introduce the theoretical bases of the subject, concepts, methods and results and illustrate them with convenient examples to facilitate understanding. Students, independently will have to study in order to assimilate the concepts, solve the proposed exercises either with the help of the computer or not. Face-to-face sessions where the teacher will resolve the doubts that the students have after their autonomous study, and / or will do practices. Assessment activities 1 and 2 (A1 and A2 respectively) are part of the face-to-face sessions and may consist of partial assessment tests and / or work to be done and delivered individually.

LEARNING OBJECTIVES OF THE SUBJECT

Upon completion of the subject of Quality Management, the student must be able to:

- Solve problems related to probability and statistics fluently.
- Use with good judgment probabilistic and statistical tools for modeling and solving problems of reliability and quality control.
- Manipulate data, apply the appropriate theoretical methods and draw conclusions from the results obtained.
- Know and be able to apply the quality management tools taught during the course.
## STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>22.5</td>
<td>20.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>22.5</td>
<td>20.00</td>
</tr>
<tr>
<td>Self study</td>
<td>67.5</td>
<td>60.00</td>
</tr>
</tbody>
</table>

**Total learning time:** 112.5 h

## CONTENTS

### 1. PROBABILITY

**Description:**
Notion of probability, conditional probability, total probabilities and Bayes formula: applications.
Independence of events.
Applications to reliability.
Circuits in series, parallel, combinations of series and parallel and bridge structures.
Active and passive redundancy.

**Related activities:**
Activity 1: as a part of Evaluation 1 (A1)

**Full-or-part-time:** 11h 15m
Theory classes: 2h 15m
Laboratory classes: 2h 15m
Self study : 6h 45m

### 2. DISCRETE DISTRIBUTIONS

**Description:**
Discrete random variables.
Probability and accumulated probability functions.
Moments of a discrete random variable.
Discrete notable distributions: uniform, geometric, binomial and Poisson.
Applications to the reliability of k-de-n systems.

**Related activities:**
Activity 2: as a part of Evaluation 1 (A1)

**Full-or-part-time:** 15h
Theory classes: 3h
Laboratory classes: 3h
Self study : 9h
3. CONTINUOUS DISTRIBUTIONS

Description:
Continuous random variables.
Density and distribution functions.
Moments of a continuous random variable. Continuous notable distributions: uniform, normal and exponential.
Normal approximation of binomial and Poisson distributions.
Reliability functions of these remarkable distributions.
Failure rate and its relationship to reliability.
Measurement of the importance of components in repairable and non-repairable systems.

Related activities:
Activity 3: as a part of Evaluation 1 (A1)

Full-or-part-time: 18h 45m
Theory classes: 3h 45m
Laboratory classes: 3h 45m
Self study: 11h 15m

4. NOTIONS OF STATISTICAL INFERENCE

Description:
Random sampling and sample distributions.
Estimation problem.
Notion of point estimators and confidence intervals.
Statistical decision: hypothesis test.
Tests for mean and population variance.
Other tests of hypothesis, randomness, independence and normality.

Related activities:
Activity 4: as a part of Evaluation 1 (A1)

Full-or-part-time: 7h 30m
Theory classes: 1h 30m
Laboratory classes: 1h 30m
Self study: 4h 30m

5. ASSURANCE OF QUALITY: RELIABILITY

Description:
Reliability and failure.
Life tests of fixed duration.
Life tests of fixed faults.
Non-constant failure rate. Weibull model.
Accelerated Life Tests.

Related activities:
Activity 5: as a part of Evaluation 2 (A2)

Full-or-part-time: 15h
Theory classes: 3h
Laboratory classes: 3h
Self study: 9h
6. QUALITY ASSURANCE: REGRESSIONS

Description:
Simple linear regression. Linear statistical models.
Least squares method.
Linear model using matrices.
Coefficients R and r. Residual analysis.
Inference and contrast of hypotheses.
Multiple linear regression.

Related activities:
Activity 6: as a part of Evaluation 2 (A2)

Full-or-part-time: 22h 30m
Theory classes: 4h 30m
Laboratory classes: 4h 30m
Self study: 13h 30m

7. QUALITY MANAGEMENT AND CONTROL

Description:
Statistical quality control.
Exploratory data analysis.
Continuous improve.
6 sigma and DMAIC improvement methodologies.
ISO and IATF16949 quality regulations.

Related activities:
Activity 7: as a part of Evaluation 2 (A2)

Full-or-part-time: 15h
Theory classes: 9h
Laboratory classes: 3h
Self study: 3h
ACTIVITIES

COURSE ACTIVITIES

Description:
For the first four topics of the course: a test to be performed in the classroom and activities to be performed outside the classroom. All of them must be delivered and made individually.
For the topics, fifth, sixth and seventh: a test to be performed in the classroom and activities to be performed outside the classroom. All of them must be delivered and made individually.

Specific objectives:
At the end of these activities the student must be able to:

1. Know and be able to apply different probabilistic tools aimed at quality management and system reliability.
2. Have initiative and criteria to apply probabilistic methods and procedures that contribute to the improvement of quality.
3. Know and be able to apply different tools to improve quality management.
4. Organize, graphically represent a collection of data to treat them statistically in the most convenient way for quality management.
5. Know how to apply quality management tools and know contents of the main regulations in the automotive industry.
6. Apply quality improvement systems to an organization.

Material:
Lists of problems and diverse material available at ATENEA. Software available.

Delivery:
All activities are mandatory.

Full-or-part-time: 1h 30m
Theory classes: 1h 30m

GRADING SYSTEM

The final grade (NF) is obtained from the partial grade (QP) and the final grade (QF).
The objectives of the subject will be considered achieved if QP is greater than or equal to 5 where QP = 0.5 * (A1 + A2) and A1 and A2 comprise respectively all the evaluation activities of each of the two halves of the course.
The student whose QP mark is less than 5 must do a final exam and obtain a 5 or a greater mark to pass the subject.

Students with a QP grade of less than 5 must take a global exam and obtain a grade greater than or equal to 5 in order to pass the subject.
The final grade is obtained from: NF = maximum (QP, QF).

Regarding the assessment of CT1 competence. ENTREPRENEURSHIP AND INNOVATION, at the end of the course the student must show initiative, weighing risks and opportunities and assuming the consequences. Acquire basic knowledge about organizations and management techniques as well as detect or generate opportunities and solutions to known problems and become familiar with the tools and techniques of generating ideas.

EXAMINATION RULES.

All activities are mandatory.
If one of the activities of the subject is not carried out, it will be considered qualified with zero.
BIBLIOGRAPHY

Basic:

Complementary:
- Lipschutz, Seymour; Schiller, John J; Cortiñas Vázquez, Pedro; Santos Peña, Julián; Guzmán Justicia, Luis. Introducción a la probabilid... [etc.]: McGraw-Hill/Interamericana de España, DL 2001. ISBN 8448125045.

RESOURCES

Other resources:
Specific material indicated in the platform "Atena"