### 230637 - CTC - Critical Thinking and Creativity

**Coordinating unit:** 230 - ETSETB - Barcelona School of Telecommunications Engineering  
**Teaching unit:** 739 - TSC - Department of Signal Theory and Communications  
**Academic year:** 2019  
**Degree:** MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Teaching unit Optional)  
MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Teaching unit Optional)  
MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Teaching unit Optional)  
**ECTS credits:** 5  
**Teaching languages:** English

#### Teaching staff

**Coordinator:** Elias Fusté, Antoni  
**Others:** Ferran Canal; Angel Cardama; Marcel Coderch

#### Prior skills

English: upper intermediate, advanced, or proficiency (equivalent to B2, C1, C2 of the Council of Europe's Common European Framework of Reference for Languages)

#### Requirements

Prerequisite studies: degree (Bachelor's) in science or engineering.  
Enrollment in this course will be limited to 25 students. Priority will be given to students enrolled in the Signal Theory and Communications Dept. postgraduate program (MERIT).

#### Teaching methodology

Lecture assisted by "power point" slides. 40% of class time is devoted to performing exercises.  
The slides will be distributed to all attendees.  
Also, readings and statements of appropriate exercises will be distributed.  
Analysis and discussion of current issues, with application of methods and tools for an organized approach to problem solving.  
Viewing and discussion of videos from many disciplines and a wide range of sources.

#### Learning objectives of the subject

The aim of this course is to help students understand and practice the techniques and tools that enable them to enhance and develop their creativity as well as the appreciation of creativity in other people. In this course, students will learn the techniques of problem solving in engineering and the knowledge and use of creative techniques for obtaining new or alternative solutions, teamwork, to motivation, for improving performance of alternative solutions, as well as the concept of innovation in all areas of their future professional work. Following a methodology based on logic, scientific method, and statistical decision theory, the student will focus problems, to appreciate the importance of the environment and interaction with the systems, and the influence of their knowledge and perception in search for information. When students have successfully completed this course will be able to troubleshoot, optimize and design products and services, dissect arguments, distinguish between good and bad reasoning, fallacies discover and find and target the key elements of a discussion. There will also be encouraged critical thinking, enabling them to articulate and defend their own views and recognize and identify possible defects in their beliefs and reasoning.
### Study load

<table>
<thead>
<tr>
<th></th>
<th>Total learning time: 125h</th>
<th>Hours large group:</th>
<th>39h</th>
<th>31.20%</th>
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<tbody>
<tr>
<td>Hours medium group:</td>
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<td>0h</td>
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<tr>
<td>Hours small group:</td>
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<td>0h</td>
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<td>Guided activities:</td>
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<td>0h</td>
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<tr>
<td>Self study:</td>
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<td>86h</td>
<td>86h</td>
<td>68.80%</td>
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# 1. Introduction. Some key concepts. Taxonomies

**Description:**
- Ideas
- Creativity
- Engineering problem solving
- Effectiveness vs. Efficiency
- Identity Environment-System
- Innovation
- Types of Innovations
- The killer applications
- Keys for a innovative entrepreneurship
- Innovation cases
- Reflexions about Innovation
- Inventions
- Examples and Creativity cases
- Creativity performance
- Features of geniuses

**Learning time:** 9h
**Theory classes:** 9h

# 3. Critical Thinking

**Description:**
- Data, information and knowledge
- Critical Thinking
- Famous engineers performances
- Development of knowledge
- Research and obtain information
- Perception
- Thinking and reasoning
- Conscious and subconscious Mind.
- Role of the Mind in Learning
- The Heuristics
- Reasoning
- Brain and Mind, role of the cerebral hemispheres

**Learning time:** 15h
**Theory classes:** 15h
## 3. Problem Solving and Engineering Design

<table>
<thead>
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<th>Description:</th>
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<tbody>
<tr>
<td>- Finding creative solutions</td>
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<td>- Strategy to promote creativity.</td>
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<td>- Convergent and Divergent Problems</td>
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<td>- Procedures for obtaining solutions.</td>
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<td>- Team Leadership</td>
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<td>- Leadership and Executive Intelligence.</td>
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**Learning time:** 6h  
Theory classes: 6h

## 4. Creative Techniques

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<th>Description:</th>
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<tbody>
<tr>
<td>- Pure Creative techniques.</td>
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<td>- Lateral Thinking</td>
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<td>- Reversal Techniques</td>
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<td>- Analogies Method</td>
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<td>- Forced Relationship Techniques</td>
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<td>- Strata</td>
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<td>- Da Vinci Technique</td>
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<tr>
<td>- Automated Writing Technique</td>
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<td>- Pseudo Dream Technique</td>
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<tr>
<td>- Creative Systematized Techniques</td>
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<td>- Logical Thinking</td>
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<tr>
<td>- Tree of Ideas or Mind Maps</td>
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<tr>
<td>- SWOT (Strengths, Weaknesses, Opportunities, and Threats)</td>
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<td>- &quot;Six Hats&quot; Method</td>
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<td>- Discretization, partition or division Techniques.</td>
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<td>- Morphological Matrix Method.</td>
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<td>- Key Questions Technique</td>
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<td>- Brainstorming</td>
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<tr>
<td>- CPS (creative problem solving)</td>
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<tr>
<td>- TRIZ (Theory of Inventive Problem Solving) method</td>
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<td>- Delphi Method</td>
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**Learning time:** 12h  
Theory classes: 12h
5. Summary and Conclusions

Description:
- Summary of all main subject concepts.
- Critical review of the subject and teacher.
- Proposed improvements.

Learning time: 3h
- Theory classes: 3h

Qualification system

Ongoing evaluation of weekly assignments exercises and class contributions to the discussions proposed: 100%

Examinations consist to solve a creative problem by a students team

Bibliography

Basic:

Complementary: