

## 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:	2017		
Degree:	MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Teaching unit Optional) MASTER'S DEGREE IN TELECOMMUNICATIONS 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, to 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.



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### Study load

Total learning time: 125h	Hours large group:	39h	31.20%
	Hours medium group:	0h	0.00%
	Hours small group:	0h	0.00%
	Guided activities:	0h	0.00%
	Self study:	86h	68.80%

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### Content

<p>1. Introduction. Some key concepts. Taxonomies.</p>	<p>Learning time: 9h Theory classes: 9h</p>
<p>Description:</p> <ul style="list-style-type: none"> <li>- Ideas</li> <li>- Creativity</li> <li>- Engineering problem solving</li> <li>- Effectiveness vs. Efficiency</li> <li>- Identity Environment-System</li> <li>- Innovation</li> <li>- Types of Innovations</li> <li>- The killer applications</li> <li>- Keys for a innovative entrepreneurship</li> <li>- Innovation cases</li> <li>- Reflexions about Innovation</li> <li>- Inventions</li> <li>- Examples and Creativity cases</li> <li>- Creativity performance</li> <li>- Features of geniuses</li> </ul>	
<p>3. Critical Thinking</p>	<p>Learning time: 15h Theory classes: 15h</p>
<p>Description:</p> <ul style="list-style-type: none"> <li>- Data, information and knowledge</li> <li>- Critical Thinking</li> <li>- Famous engineers performances</li> <li>- Development of knowledge</li> <li>- Research and obtain information</li> <li>- Perception</li> <li>- Thinking and reasoning</li> <li>- Conscious and subconscious Mind.</li> <li>- Role of the Mind in Learning</li> <li>- The Heuristics</li> <li>- Reasoning</li> <li>- Brain and Mind, role of the cerebral hemispheres</li> </ul>	

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<h3>3. Problem Solving and Engineering Design</h3>	<p>Learning time: 6h Theory classes: 6h</p>
<p>Description:</p> <ul style="list-style-type: none"> <li>- Finding creative solutions</li> <li>- Strategy to promote creativity.</li> <li>- Convergent and Divergent Problems</li> <li>- Procedures for obtaining solutions.</li> <li>- Team Leadership</li> <li>- Leadership and Executive Intelligence.</li> </ul>	
<h3>4. Creative Techniques</h3>	<p>Learning time: 12h Theory classes: 12h</p>
<p>Description:</p> <ul style="list-style-type: none"> <li>- Pure Creative techniques.</li> <li>- Lateral Thinking</li> <li>- Reversal Techniques</li> <li>- Analogies Method</li> <li>- Forced Relationship Techniques</li> <li>- Strata</li> <li>- Da Vinci Technique</li> <li>- Automated Writing Technique</li> <li>- Pseudo Dream Technique</li>   <li>- Creative Systematized Techniques</li> <li>- Logical Thinking</li> <li>- Tree of Ideas or Mind Maps</li> <li>- SWOT (Strengths, Weaknesses, Opportunities, and Threats)</li> <li>- "Six Hats" Method</li> <li>- Discretization, partition or division Techniques.</li> <li>- Morphological Matrix Method.</li> <li>- Key Questions Technique</li> <li>- Brainstorming</li> <li>- CPS (creative problem solving)</li> <li>- TRIZ (Theory of Inventive Problem Solving) method</li> <li>- Delphi Method</li> </ul>	

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5. Summary and Conclusions	Learning time: 3h Theory classes: 3h
<p>Description:</p> <ul style="list-style-type: none"> <li>- Summary of all main subject concepts.</li> <li>- Critical review of the subject and teacher.</li> <li>- Proposed improvements.</li> </ul>	

### Qualification system

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

### Regulations for carrying out activities

Examinations consist to solve a creative problem by a students team

### Bibliography

#### Basic:

- Chaffee, J. Thinking critically. 10th ed., int. ed. Boston: Wadsworth Cengage Learning, 2012. ISBN 9780495914037.
- Marina, J.A. Teoría de la inteligencia creadora. Barcelona: Anagrama, 2000. ISBN 9788433966520.
- Paul, R.W.; Elder, L. Critical thinking: tools for taking charge of your professional and personal life. New Jersey: Financial Times Prentice Hall, 2002. ISBN 0130647608.
- De Bono, E. El pensamiento lateral: manual de creatividad. Barcelona: Paidós, 2013. ISBN 9788449329456.
- Ruggiero, V.R. The art of thinking: a guide to critical and creative thought. 10th ed. New York: Pearson Education, 2012. ISBN 9780205108930.

#### Complementary:

- Bell, T.E.; Dooling, D. Engineering tomorrow: today's technology experts envision the next century. New York: IEEE Press, 2000. ISBN 0780353625.
- De Bono, E. Seis sombreros para pensar. Barcelona: Granica, 1996. ISBN 8475774415.
- Michalko, M. Thinkertoys: cómo desarrollar la creatividad en la empresa. 2a. ed. Barcelona: Gestión 2000, 2001. ISBN 8480885998.
- Brand, S. El laboratorio de Medios: inventando el futuro en el M.I.T. Madrid: Fundesco, 1994. ISBN 9788486094546.
- Henry Petroski. To engineer is human: the rol of failure in successful design. new York: Ed. Random House, 1992. ISBN 0679734163.