Course guide
300050 - TIQ - Quantum Information Technology

Unit in charge: Castelldefels School of Telecommunications and Aerospace Engineering
Teaching unit: 748 - FIS - Department of Physics.

Degree: BACHELOR’S DEGREE IN NETWORK ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR’S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR’S DEGREE IN AEROSPACE SYSTEMS ENGINEERING (Syllabus 2015). (Optional subject).

Academic year: 2022 ECTS Credits: 6.0 Languages: Catalan, Spanish, English

LECTURER

Coordinating lecturer: Definit a la pàgina web del curs al lloc web de l'EETAC.

Others: Definit a la pàgina web del curs al lloc web de l'EETAC.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Transversal:
1. EFFICIENT ORAL AND WRITTEN COMMUNICATION. Communicating verbally and in writing about learning outcomes, thought-building and decision-making. Taking part in debates about issues related to the own field of specialization.
2. 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.
3. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.
4. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

TEACHING METHODOLOGY

LEARNING OBJECTIVES OF THE SUBJECT

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self study</td>
<td>84,0</td>
<td>56.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>42,0</td>
<td>28.00</td>
</tr>
<tr>
<td>Guided activities</td>
<td>24,0</td>
<td>16.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h
## INTRODUCCIÓ A LA FISICA QUANTICA

**Description:**
- Solid state applications of the quantum mechanics: semiconductors, superconductors and lasers.

**Full-or-part-time:** 22h  
Theory classes: 7h  
Guided activities: 3h  
Self study : 12h

## QUANTUM COMPUTING

**Description:**
- Definition of qubits. Bloch sphere.
- Basic applications with quantum circuits: non-cloning theorem, quantum parallelism, Bell state generators-measuremeters, superdense coding, teleportation.

**Full-or-part-time:** 45h  
Theory classes: 14h  
Guided activities: 6h  
Self study : 25h

## QUANTUM PROCESSORS

**Description:**
- Quantum Supremacy or Advantage. Current quantum processors.

**Full-or-part-time:** 38h  
Theory classes: 11h  
Guided activities: 5h  
Self study : 22h
QUANTUM COMMUNICATION

Description:
- Cryptography Classical vs. Quantum.
- Quantum Key Distribution Session. Basic protocols: BB84, B89, and E91.
- Quantum Information. Definition of quantum entropy. Holevo Theorem.
- Quantum data compression and quantum error correction.

Full-or-part-time: 45h
Theory classes: 10h
Guided activities: 10h
Self study: 25h

ACTIVITIES

(ENG) (AV1): CONTROL DE PROBLEMES DELS TEMES 1 I 2

Full-or-part-time: 6h 30m
Theory classes: 1h 30m
Self study: 5h

(ENG) (AV2): CONTROL DE PROBLEMES DELS TEMES 3 I 4

Full-or-part-time: 6h 30m
Theory classes: 1h 30m
Self study: 5h

(ENG) (AV3): ACTIVITATS DIRIGIDES D'APLICACIONS PRÀCTIQUES

Full-or-part-time: 81h
Guided activities: 21h
Self study: 60h

(ENG) (AV4): PROJECTE APLICACIÓ DE LES TECNOLOGIES DE LA INFORMACIÓ QUÀNTICA

Full-or-part-time: 25h
Theory classes: 2h
Guided activities: 3h
Self study: 20h

(ENG) (AV5): EXAMEN DE MIG QUADRIMESTRE

Full-or-part-time: 1h 30m
Guided activities: 1h 30m
(ENG) (AV6): EXAMEN DE FINAL DE QUADRIMESTRE

Full-or-part-time: 1h 30m
Guided activities: 1h 30m

GRADING SYSTEM

BIBLIOGRAPHY

Basic:

Complementary: