280660 - Electric Propulsion and Power Electronics

Coordinating unit: 280 - FNB - Barcelona School of Nautical Studies
Teaching unit: 709 - EE - Department of Electrical Engineering
Academic year: 2019
Degree: BACHELOR’S DEGREE IN MARINE TECHNOLOGIES (Syllabus 2010). (Teaching unit Compulsory)
ECTS credits: 4,5  Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: PABLO CASALS TORRENS
Others: Primer quadrimestre:
        PABLO CASALS TORRENS - 1, 2, 3

Requirements
Subjet 280641

Degree competences to which the subject contributes

Specific:
1. Knowledge of the fundamentals of power electronics and its application to board.
2. Knowledge of electric propulsion systems and their operation and maintenance.
3. Ability to design and manage energy optimization systems applied to marine installations.

Transversal:
1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.

Teaching methodology
Real applications analysis.
Application of theoretical knowledge to the laboratory practices.
Attitude and skills development for power plants operation.
Case studies and articles on the subject.
Perform work individually.

Learning objectives of the subject

- Understanding the basics of electrical machines.
- Understand the schemes and connections of different types of machines and applications.
- Understand the regulation systems of V, f, P, Q in synchronous generators in island and parallel.
- Understand the regulation and control systems of electrical motors.
- Having the ability to do calculations and solve problems of electrical machines, using the corresponding equivalent circuits.

Moreover, one objective of this course is to provide knowledge, understanding and proficiency of skills STCW A-III/1:
280660 - Electric Propulsion and Power Electronics

1. Having knowledge about the operation of electrical distribution systems, generation plant, generators and their synchronization, and motors starting associated control circuits.
2. Understand the use of measuring equipment and electrical testing for locating common faults and maintenance and repair.
3. Having the basic knowledge for the maintenance of electrical machines and their control systems. Use and safe operation of electrical equipment.

Competencies required and defined in Section A-III/1 (Minimum requirements for certification of officers in charge of the watch in unattended machinery or service engineers designated camera unattended machinery (propulsion power of 750 kW or more) of the International Convention on Standards of Training, Certification and Watchkeeping for seafarers.

"This course will evaluate the following STCW competences: 
E1. Monitor the operation of electrical, electronic and control systems and E3. Operate generators and distribution systems

This competence are assessed according to the section "evaluation" of this record.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 112h 30m</th>
<th>Hours large group: 30h</th>
<th>26.67%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours medium group: 0h</td>
<td>0.00%</td>
<td></td>
</tr>
<tr>
<td>Hours small group: 10h</td>
<td>8.89%</td>
<td></td>
</tr>
<tr>
<td>Guided activities: 5h</td>
<td>4.44%</td>
<td></td>
</tr>
<tr>
<td>Self study: 67h 30m</td>
<td>60.00%</td>
<td></td>
</tr>
</tbody>
</table>
280660 - Electric Propulsion and Power Electronics

Content

<table>
<thead>
<tr>
<th>Machine Type</th>
<th>Learning time: 3h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 1h</td>
</tr>
</tbody>
</table>

**DC machine**

**Description:**
Having knowledge about the operation of electrical distribution systems, generation plant, generators, motors and starter. Construction and operational systems and DC electrical equipment on board properties. Having the basic knowledge for the maintenance of electrical machines and their control systems. Competences in accordance with STCW Code Section A-III/1: 6. Operate electrical, electronic and control systems. KUP 6.1 Electrical equipment and 7. Maintenance and repair of electrical and electronic equipment. KUPs 7.1 to 7.4

<table>
<thead>
<tr>
<th>Machine Type</th>
<th>Learning time: 9h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 3h</td>
</tr>
</tbody>
</table>

**Synchronous machine**

**Description:**
Having knowledge about the operation of electrical distribution systems, generation plant, generators and their synchronization, associated control circuits. Operational and construction in the AC electrical systems and equipment onboard features. Having the basic knowledge for the maintenance of electrical machines and their control systems. Competences in accordance with STCW Code Section A-III/1: 6. Operate electrical, electronic and control systems. KUP 6.1 Electrical equipment and 7. Maintenance and repair of electrical and electronic equipment. KUPs 7.1 to 7.4

<table>
<thead>
<tr>
<th>Machine Type</th>
<th>Learning time: 6h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 4h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 2h</td>
</tr>
</tbody>
</table>

**Asynchronous machine**

**Description:**
Having knowledge about the operation of electrical distribution systems, motors and starters, associated control circuits. Operational and construction in the AC electrical systems and equipment onboard features. Having the basic knowledge for the maintenance of electrical machines and their control systems. Competences in accordance with STCW Code Section A-III/1: 6. Operate electrical, electronic and control systems. KUP 6.1 Electrical equipment and 7. Maintenance and repair of electrical and electronic equipment. KUPs 7.1 to 7.4
## 280660 - Electric Propulsion and Power Electronics

### - Start systems

<table>
<thead>
<tr>
<th>Description:</th>
<th>Learning time: 3h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Having knowledge about the operation of electrical distribution systems, motors and starters, associated control circuits. Operational and construction in the AC electrical systems and equipment onboard features. Having the basic knowledge for the maintenance of electrical machines and their control systems. Competences in accordance with STCW Code Section A-III/1: 6. Operate electrical, electronic and control systems. KUP 6.1 Electrical equipment and 7. Maintenance and repair of electrical and electronic equipment. KUPs 7.1 to 7.4</td>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td>Laboratory classes: 1h</td>
<td></td>
</tr>
</tbody>
</table>

### - Electrical Equipment

<table>
<thead>
<tr>
<th>Description:</th>
<th>Learning time: 3h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory classes: 1h</td>
<td></td>
</tr>
</tbody>
</table>

### - Energy balance

<table>
<thead>
<tr>
<th>Description:</th>
<th>Learning time: 2h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Having knowledge about the operation of electrical distribution systems, power plant. Competences in accordance with STCW Code Section A-III/1: 6. Operate electrical, electronic and control systems. KUP 6.1 Electrical equipment</td>
<td>Theory classes: 2h</td>
</tr>
</tbody>
</table>

### - Harmonic and transient

<table>
<thead>
<tr>
<th>Description:</th>
<th>Learning time: 2h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Having knowledge about the operation of electrical distribution systems, generation plant, generators and their synchronization, and start motors. Competences in accordance with STCW Code Section A-III/1: 6. Operate electrical, electronic and control systems. KUP 6.1 Electrical equipment</td>
<td>Theory classes: 2h</td>
</tr>
</tbody>
</table>
Planning of activities

Laboratory Practices

<table>
<thead>
<tr>
<th>Hours: 10h</th>
<th>Laboratory classes: 10h</th>
</tr>
</thead>
</table>

Description:

Practice 5. Reviews and equipment for locating faults in electrical machines.

Qualification system

During the course there will be continuous evaluations, according to the following percentages:

Continuous evaluations 30% (Lab. practices, Lab. exams, Works, Expositions)
Partial Exam 40%
Final Exam 30%

Reevaluation: Test that includes the concepts and objectives set for the final test.

Regulations for carrying out activities

Attendance and completion of the hands-on labs, is a compulsory requirement.
280660 - Electric Propulsion and Power Electronics

Bibliography

Basic:


Complementary:


Others resources:

Notes and technical articles contributed by teachers in ATENEA