280683 - Operation and Maintenance of High Voltage Systems

Coordinating unit: 280 - FNB - Barcelona School of Nautical Studies
Teaching unit: 709 - DEE - Department of Electrical Engineering
Academic year: 2020
Degree: BACHELOR'S DEGREE IN MARINE TECHNOLOGIES (Syllabus 2010). (Teaching unit Optional) BACHELOR'S DEGREE IN MARINE TECHNOLOGIES/BACHELOR'S DEGREE IN NAVAL SYSTEMS AND TECHNOLOGY ENGINEERING (Syllabus 2016). (Teaching unit Optional)
ECTS credits: 6
Teaching languages: Catalan, Spanish

Requirements

To register this subject, it must be approved:
280641 Electricity and Electrotechnical
280660 Electric propulsion and power electronics, or, 280665 Vessel Power Plant.

Degree competences to which the subject contributes

Specific:
1. Knowledge of the organization and project management of repair, installation, modification, redesign and maintenance of machines and systems of ships, within the scope of its special ad, ie, operation and exploitation.

General:
3. IDENTIFY I resoldre Capacitat PER L'Ambit problemes IN MARINA DE L'ENGINYERIA. Capacitat per the plantejament i resolució de problemes de l'i'àmbit enginyeria assumint marina iniciatives, prenent decisions i aplicant solucions creatives in the marc d’a systematic methodology.

Transversal:
2. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.

Teaching methodology

- Receive, understand and synthesize knowledge.
- Analysis of real applications.
- Define and solve problems.
- Application of theoretical knowledge to the operation of HV systems.
- Laboratory practices of HV.
- Study of cases and articles on topics of the subject.
- Perform work individually.

Learning objectives of the subject

- Know the high voltage technology (installations> 1000 V)
- Know the insulating materials used
- Know and apply the regulations and regulations of Classification Societies
- Establish and apply security procedures
- Have the ability to perform premature fault detection
- Understand the effects of surges in AT systems
- Identify system typology
- Use equipment and materials for the detection, location and repair of faults

"This course will evaluate the following STCW competences Section A-III/6: " E1. Monitor the operation of electrical, electronic and control systems, KUPs E.1.1 to E.1.4 and E4. Operate and maintain power systems in excess of 1,000 volts,"
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KUPs E.4.1 to E.4.4.

<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours large group</th>
<th>%</th>
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<tbody>
<tr>
<td><strong>Total learning time:</strong> 150h</td>
<td>30h</td>
<td>20.00%</td>
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<tr>
<td>Hours medium group:</td>
<td>15h</td>
<td>10.00%</td>
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<tr>
<td>Hours small group:</td>
<td>10h</td>
<td>6.67%</td>
</tr>
<tr>
<td>Guided activities:</td>
<td>5h</td>
<td>3.33%</td>
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<tr>
<td>Self study:</td>
<td>90h</td>
<td>60.00%</td>
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## Content

<table>
<thead>
<tr>
<th>Topic 1. High Voltage Systems</th>
<th>Learning time: 5h</th>
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<tr>
<td></td>
<td>Theory classes: 5h</td>
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**Description:**
Introduction, high voltage power systems, electric discharge, electric arc, grounded. Insulating materials. How to read electrical diagrams, representation of circuits and electrical appliances.

"This course will follow the STCW competences Section A-III / 6: " E1. Monitor the operation of electrical, electronic and control systems, KUPs E.1.1 to E.1.4 and E4. Operate and maintain power systems in excess of 1,000 volts, KUPs E.4.1 to E.4.4.

<table>
<thead>
<tr>
<th>Topic 2. High voltage safety regulations</th>
<th>Learning time: 5h</th>
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<tr>
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<td>Theory classes: 5h</td>
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**Description:**
Risks and electrical precautions, security operations. Standards and regulations. Security isolation procedures, the safe use of test equipment, Energized electrical work permit. Procedures that must be followed before, during and after performing any high voltage work.

"This course will follow the STCW competences Section A-III / 6: " E1. Monitor the operation of electrical, electronic and control systems, KUPs E.1.1 to E.1.4 and E4. Operate and maintain power systems in excess of 1,000 volts, KUPs E.4.1 to E.4.4.

<table>
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<tr>
<th>Topic 3. Distribution tables and protections</th>
<th>Learning time: 7h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 7h</td>
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**Description:**

"This course will evaluate the following STCW competences Section A-III/6: " E1. Monitor the operation of electrical, electronic and control systems, KUPs E.1.1 to E.1.4 and E4. Operate and maintain power systems in excess of 1,000 volts, KUPs E.4.1 to E.4.4.
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## Topic 4. Maintenance

<table>
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<th>Learning time: 6h</th>
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<tr>
<td>Theory classes: 6h</td>
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### Description:
Periodic reviews: ground connection, protection verification. Inspections by thermographies. Electrical equipment for hazardous areas: types of protection and equipment. Interlocked systems. Recognition of failure levels. Marine applications of electrical protection. Selection of suitable equipment for the isolation and testing of HV equipment. 5 kV insulation resistance tests and polarization index tests on HV equipment.

*This course will evaluate the following STCW competences Section A-III/6: " E1. Monitor the operation of electrical, electronic and control systems, KUPs E.1.1 to E.1.4 and E4. Operate and maintain power systems in excess of 1,000 volts, KUPs E.4.1 to E.4.4.*

## Topic 5. Operation of AT systems

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<th>Learning time: 7h</th>
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<td>Theory classes: 7h</td>
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### Description:
The synchronization and control of the generators. Introduction to energy management systems. The operation of the energy systems during planned situations and failure, including abrupt stop of electric propulsion engines. Measures to be taken during the loss of high voltage control installations. Carry out a switching and isolation procedure in an AT system.

*This course will evaluate the following STCW competences Section A-III/6: " E1. Monitor the operation of electrical, electronic and control systems, KUPs E.1.1 to E.1.4 and E4. Operate and maintain power systems in excess of 1,000 volts, KUPs E.4.1 to E.4.4.*

## Qualification system

The final grade is the sum of the following partial grades:
\[
N_{final} = 0.2 \times N_f + 0.2 \times N_p + 0.6 \times N_c
\]

- \(N_{final}\): final grade.
- \(N_f\): final evaluation note.
- \(N_p\): partial evaluation note.
- \(N_c\): note continuous evaluation and directed activities.

The continuous evaluation consists of different cumulative activities, both individual and group, of a formative nature, made during the course (in the classroom and outside of it), work, presentations, practical laboratory activities, etc.

## Regulations for carrying out activities

- Assistance and completion of laboratory practices is mandatory.
- If any of the laboratory or continuous assessment activities are not carried out, it will be considered as not scoring.
- Will be considered Not Submitted: Who has not attended or have a global grade lower than 0.5 points.
- In no case you can have forms in the learning controls or exams.
- In exams only calculator and pens are allowed.
- The use of mobile phones is prohibited.
Bibliography

Basic:


Complementary:


Others resources:

Notes and technical articles provided by the teacher.
Regulations of the Classification Societies.
Dossiers of electrical equipment manufacturers: Electra Molins, ABB, Siemens, Rolls Royce, Schneider Electric, etc.