Course guide

280722 - 280722 - Propulsion Systems and Electrical Plant

**Unit in charge:** Barcelona School of Nautical Studies

**Teaching unit:** 709 - DEE - Department of Electrical Engineering.

**Degree:** MASTER’S DEGREE IN THE MANAGEMENT AND OPERATION OF MARINE ENERGY FACILITIES (Syllabus 2016). (Compulsory subject).

**Academic year:** 2023  **ECTS Credits:** 5.0  **Languages:** Catalan, Spanish

**LECTURER**

**Coordinating lecturer:** PAU CASALS TORRENS

**Others:** Segon quadrimestre: PAU CASALS TORRENS - MGOIEM RICARD BOSCH TOUS - MGOIEM

**PRIOR SKILLS**

Knowing circuit theory and have the ability to do calculations in DC and AC circuits (single and three phase). Ability to compute and solve problems of electrical machines.

**DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES**

**Specific:**
CE6-MGOIEM. Capacitat per conèixer, entendre i utilitzar els principis dels sistemes de generació, transport i distribució d'energia
CE13MGOIEM. Coneixement i capacitat per projectar operacions de manteniment de sistemes de màquines i motors tèrmics i hidràulics i màquines elèctriques marines

**Generical:**
CG1-MGOIEM. Conocimientos suficientes en materias básicas y tecnológicas, que le capaciten para el desarrollo de nuevos métodos y procedimientos
CG2-MGOIEM. (ENG) Capacidad para resolver problemas complejos y tomar decisiones con responsabilidad sobre bases científicas y tecnológicas en el ámbito de su especialidad
CG4-MGOIEM. (ENG) Capacidad para gestionar, optimizar y controlar los procesos de operación, reparación, rediseño, conversión, mantenimiento e inspección de las instalaciones anteriores
CG6-MGOIEM. (ENG) Capacidad para desarrollar los conocimientos para el análisis e interpretación de mediciones, cálculos, valoraciones, tasaciones, peritaciones, estudios, informes y documentos técnicos en el ámbito de su especialidad

**Transversal:**
CT2. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

**Basic:**
CB6. Possess knowledge and understanding that provide a basis or opportunity be original in the development and / or application of ideas, often in a research context.

CB8. Students should be able to integrate knowledge and handle the complexity of making judgments based on information that, being incomplete or limited, includes reflections on the responsibilities social and ethical linked to the application of their knowledge and judgments.
TEACHING METHODOLOGY

Analysis of real applications.
Development of attitudes and skills sistemes electrical operation of the vessel.
Case studies and articles on the subject.
Perform work individually.

LEARNING OBJECTIVES OF THE SUBJECT

Understanding the drawing and connections of different types of machines and electrical applications.
Know the regulatory systems of V, f, P, Q in synchronous generators.
Know the regulatory systems and control of start and variation of speed of electric motors.
Having the ability to perform calculations and solve problems of machines and electrical systems, using the corresponding equivalent circuits.
On the other hand, one of the objectives of this course is to provide knowledge, understanding and skills of the STCW of electrical systems at the management level:
- Management and operation of electrical control equipment, including systems of more than 1,000 V (STCW A-III / 2).
- Knowledge to test electrical equipment to detect faults and keep them in working order or repair. (STCW A-III / 2).
- Knowledge of the use and safe operation of electrical equipment. (STCW A-III / 5).

"This course will evaluate the following STCW competences:"

Taula A-III/2

5. Manage operation of electrical and electronic control equipment
5.1. Marine electrotechnology, electronics, power electronics, automatic control engineering and safety devices
5.2. "Design features and system configurations of automatic control equipment and safety devices for the following:
   .1 main engine
   .2 generator and distribution system
   .3 steam boiler"
5.3. Design features and system configurations of operational control equipment for electrical motors
5.4. Design features of highvoltage installations

6. Manage troubleshooting, restoration of electrical and electronic control equipment to operating condition
Practical knowledge
6.1. Troubleshooting of electrical and electronic control equipment
6.2. Function test of electrical, electronic control equipment and safety devices
6.3. Troubleshooting of monitoring systems

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tr>
<td>Hours large group</td>
<td>45,0</td>
<td>100.00</td>
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Total learning time: 45 h
### Topic 1 Introduction to marine electrical technology.

**Description:**
Introduction to the subject. Protections (current and differential), Neutral regimes, Overvoltage Grounding and short-circuit characteristics.

Competences in accordance with STCW Code Section A-III/2: Manage operation of electrical and electronic control equipment. KUP: Marine electrotechnology, electronics, power electronics, automatic control engineering and safety devices.
KUP: Design features and system configurations of automatic control equipment and safety devices for the following:
- .1 main engine
- .2 generator and distribution system
- .3 steam boiler
Design features and system configurations of operational control equipment for electrical motors

**Full-or-part-time:** 16h 45m
- Theory classes: 2h
- Laboratory classes: 1h
- Self study: 13h 45m

### Topic 2 Propulsion systems and power plant.

**Description:**

Competences in accordance with STCW Code Section A-III/2: Manage operation of electrical and electronic control equipment. KUP: Marine electrotechnology, electronics, power electronics, automatic control engineering and safety devices.
KUP: Design features and system configurations of automatic control equipment and safety devices for the following:
- .1 main engine
- .2 generator and distribution system
- .3 steam boiler
Design features and system configurations of operational control equipment for electrical motors

**Full-or-part-time:** 14h 45m
- Laboratory classes: 1h
- Self study: 13h 45m
**Topic 3 Converters system for the regulation of electric motors.**

**Description:**

Competences in accordance with STCW Code Section A-III/2: Manage operation of electrical and electronic control equipment. KUP: Marine electrotechnology, electronics, power electronics, automatic control engineering and safety devices. KUP: Design features and system configurations of automatic control equipment and safety devices for the following: 1 main engine, 2 generator and distribution system, 3 steam boiler. Design features and system configurations of operational control equipment for electrical motors.

**Specific objectives:**
Give knowledge, understanding and aptitude of the competence: Management and operation of electrical control equipment (STCW A-III/2). Design features and system configurations of operational control equipment for electrical motors.

**Full-or-part-time:** 15h
Laboratory classes: 1h
Self study: 14h

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**Topic 4 Control and regulation of electrical generation parameters.**

**Description:**
Control frequency / active power (P) and voltage / reactive power (Q). Influence of the transitory regime: Start, reverse, cycle of waves in bad weather.

Competences in accordance with STCW Code Section A-III/2: Manage operation of electrical and electronic control equipment. KUP: Marine electrotechnology, electronics, power electronics, automatic control engineering and safety devices. KUP: Design features and system configurations of automatic control equipment and safety devices for the following: 1 main engine, 2 generator and distribution system, 3 steam boiler. Design features and system configurations of operational control equipment for electrical motors.

**Specific objectives:**
Give knowledge, understanding and aptitude of the competence: Management and operation of electrical control equipment (STCW A-III/2).

**Full-or-part-time:** 15h
Laboratory classes: 1h
Self study: 14h
**Topic 5** Limits of operation of a generator. Curves P-Q. Selection of generators.

**Description:**
Types of regulators, their feeder. Types of response and feedback $V$, $I$, $P$, $Q$.

Competences in accordance with STCW Code Section A-III/2: Manage operation of electrical and electronic control equipment.
KUP: Marine electrotechnology, electronics, power electronics, automatic control engineering and safety devices.
KUP: Design features and system configurations of automatic control equipment and safety devices for the following:
.1 main engine
.2 generator and distribution system
.3 steam boiler
Design features and system configurations of operational control equipment for electrical motors

**Full-or-part-time:** 15h
Laboratory classes: 1h
Self study: 14h

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**Topic 6** Operation of high voltage installations.

**Description:**

Competences in accordance with STCW Code Section A-III/2: Manage operation of electrical and electronic control equipment.
KUP: Marine electrotechnology, electronics, power electronics, automatic control engineering and safety devices.
KUP: Design features and system configurations of automatic control equipment and safety devices for the following:
.1 main engine
.2 generator and distribution system
.3 steam boiler
Design features and system configurations of operational control equipment for electrical motors
Design features of high voltage installations

**Specific objectives:**
Give knowledge, understanding and aptitude of the competence: Management and operation of electrical control equipment, including those with a voltage higher than 1000 V (STCW A-III / 2).
Knowledge on the use and safe operation of electrical equipment (STCW A-III / 5).

**Full-or-part-time:** 15h
Theory classes: 14h
Laboratory classes: 1h
**Topic 7 Performance tests of electrical control and safety equipment.**

**Description:**

Competences in accordance with STCW Code Section A-III/2: Manage operation of electrical and electronic control equipment.

KUP: Marine electrotechnology, electronics, power electronics, automatic control engineering and safety devices.

KUP: Design features and system configurations of automatic control equipment and safety devices for the following:
.1 main engine
.2 generator and distribution system
.3 steam boiler

Design features and system configurations of operational control equipment for electrical motors

**Specific objectives:**
Give the knowledge, understanding and aptitude of the competence: Knowledge on the use and safe operation of electrical equipment. (STCW A-III / 5).

**Full-or-part-time:** 15h
Laboratory classes: 1h
Self study : 14h

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**Topic 8 Diagnosis of failures. Troubleshooting.**

**Description:**
Detection, location and correction of faults in electrical equipment and control systems.

Competences in accordance with STCW Code Section A-III/2: Manage trouble-shooting, restoration of electrical and electronic control equipment to operating condition.

KUP: Troubleshooting of electrical and electronic control equipment. Function test of electrical, electronic control equipment and safety devices. Troubleshooting of monitoring systems

**Specific objectives:**
Give knowledge, understanding and aptitude of the competence: Knowledge to test electrical equipment, detect faults and keep them in working condition or repair them (STCW A-III / 2).

**Full-or-part-time:** 14h 45m
Laboratory classes: 1h
Self study : 13h 45m

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**GRADING SYSTEM**

During the course there will be continuous evaluations, according to the following percentages:
Continuous assessment 40% (Tests, Works)
Laboratory practices 20%
Final Exam 40%

**EXAMINATION RULES.**

Attendance and realization of the hands-on labs, is a compulsory requirement. 10 hours during the face-to-face weeks.
BIBLIOGRAPHY

Basic:

Complementary:

RESOURCES

Other resources:
Tips and technical articles provided by teachers in ATENEA.
Marine Rules of Classifications Societies.
Watching videos (internet) on aspects of interest and related to the subject