Course guide
280722 - 280722 - Propulsion Systems and Electrical Plant

Last modified: 18/10/2024

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: 2024 **ECTS Credits:** 5.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: JORDI ROGER RIBA RUIZ

Others: Segon quadrimestre:
JORDI ROGER RIBA RUIZ - MGOIE
RICARDO BOSCH TOUS- MGOIE

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
CG10MGOIEM. Capacitat per re-disseny i modificació d'equips i instal·lacions energètiques i de seguretat marines, dins l'àmbit de la seva especialitat, és a dir, operació, manteniment i explotació

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

Type	Hours	Percentage
Hours large group	45,0	100.00

Total learning time: 45 h

CONTENTS

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:
Permanent magnet generators. Electric diesel. Inboard engines. POD propellers. Time groups in three-phase transformers.

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:
Three-phase and polyphase rectification. Filtering of currents and voltages. Inverters. Choppers. Cycloconverters.

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

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

Topic 6 Operation of high voltage installations.

Description:
Introduction, high voltage power systems, voltages, insulating materials. Hierarchy of loads, influences of cyclic loads in the generation. Problems in the Dock Connection. Risks and electrical precautions, safe operations of active parts. Safety rules.

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:
Quality of service. Electromagnetic disturbances. Network analyzers Metrology: Measurement transformers (of V and I). Rogowski probes. Checking protections. Safety rules.

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

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 troubleâ□□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

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:
- Fraile Mora, Jesús. Máquinas eléctricas. 8a ed. Madrid: Ibergarceta, 2016. ISBN 9788416228669.
- Wildi, Theodore. Electrical machines, drives, and power systems. 6th ed. Essex: Pearson Education, 2014. ISBN 9781292024585.

Complementary:
- Boix, Oriol [et al.]. Tecnología eléctrica. Barcelona: Ceysa, 2002. ISBN 9788486108236.

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