Course guide
280656 - 280656 - Operation and Maintenance of Marine Engines and Systems

Unit in charge: Barcelona School of Nautical Studies
Teaching unit: 742 - CEN - Department of Nautical Sciences and Engineering.
Degree: BACHELOR'S DEGREE IN MARINE TECHNOLOGIES (Syllabus 2010). (Compulsory subject).
Academic year: 2022  ECTS Credits: 6.0  Languages: Catalan, Spanish

LECTURER
Coordinating lecturer: RAMON GRAU MUR
Others: Segon quadrimestre:
CLARA BOREN ALTES - GTDT1, GTDT2, GTDT3, GTDT4, GTDT5
RAMON GRAU MUR - GTDT1, GTDT2, GTDT3, GTDT4, GTDT5

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
GTM.CE24. 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.
GTM.CE32. Knowledge and capacity for implementation and management of energy audits.

Transversal:
STCW:

ME.1. A-III/1-1. Function: Marine engineering at the operational level
ME.2. A-III/1-1.1 Maintain a safe engineering watch
ME.3. A-III/1-KUP 1.1.1 Thorough knowledge of Principles to be observed in keeping an engineering watch, including: .1 duties associated with taking over and accepting a watch, .2 routine duties, undertaken during a watch, .3 maintenance of the machinery space logs and the significance of the readings taken, .4 duties associated with handing over a watch
ME.4. A-III/1-KUP 1.1.2 Safety and emergency procedures, change-over of remote/automatic to local control of all systems
ME.5. A-III/1-KUP 1.1.3 Safety precautions to be observed during a watch and immediate actions to be taken in the event of fire or accident, with particular reference to oil systems
ME.6. A-III/1-KUP 1.1.4 Engineer resource management: Knowledge of engine-room resource management principles, including: .1 allocation, assignment, and prioritization of resources, .2 effective communication, .3 assertiveness and Leadership, .4 obtaining and maintaining situational awareness, .5 consideration of team experience
ME.7. A-III/1-1.4 Operate main and auxiliary machinery and associated control systems
ME.8. A-III/1-KUP 1.4.1.6 Basic construction and operation principles of machinery systems, including: .6 other auxiliaries, including various pumps, air compressor, purifier, fresh water generator, heat exchanger, refrigeration, air conditioning and ventilation systems
ME.9. A-III/1-KUP 1.4.1.7 Basic construction and operation principles of machinery systems, including: .7 steering gear
ME.10. A-III/1-KUP 1.4.1.9 Basic construction and operation principles of machinery systems, including: .9 fluid flow and characteristics of lubricating oil, fuel oil and cooling systems
ME.11. A-III/1-KUP 1.4.1.10 Basic construction and operation principles of machinery systems, including: .10 deck machinery
ME.12. A-III/1-KUP 1.4.3.2 Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems: .2 steam boiler and associated auxiliaries and steam systems
ME.13. A-III/1-KUP 1.4.3.3 Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems: .4 other auxiliaries, including refrigeration, air conditioning and ventilation systems
ME.14. A-III/1-1.5 Operate fuel, lubrication, ballast and other pumping Systems and associated control systems
ME.15. A-III/1-KUP 1.5.1 Operational characteristics of pumps and piping systems, including control systems
ME.16. A-III/1-KUP 1.5.2 Operation of pumping systems: .1 routine pumping operations, .2 operation of bilge, ballast and cargo pumping systems
ME.17. A-III/1-KUP 1.5.3 Oilywater separators (or similar equipment) requirements and operation
ME.18. A-III/1-1.2. Function: Electrical, electronic and control engineering at the operational level
ME.19. A-III/1-1.2.2 Maintenance and repair of electrical and electronic equipment
ME.20. A-III/1-KUP 2.2.5.1 Function and performance tests of the following equipment and their configuration: .1 monitoring systems
ME.21. A-III/1-KUP 2.2.6 The interpretation of electrical and simple electronic diagrams
ME.22. A-III/1-3. Function: Maintenance and repair at the operational level
ME.23. A-III/1-3.2 Maintenance and repair of shipboard machinery and equipment
ME.24. A-III/1-KUP 3.2.5 Design characteristics and selection of materials in construction of equipment
ME.25. A-III/1-KUP 3.2.6 Interpretation of machinery drawings and handbooks
ME.26. A-III/1-KUP 3.2.7 The interpretation of piping, hydraulic and pneumatic diagrams
ETO.1. A-III/6-1. Function: Electrical, electronic and control engineering at the operational level
ETO.2. A-III/6-1.1 Monitor the operation of electrical, electronic and control systems
ETO.3. A-III/6-KUP 1.1.1.1 Basic understanding of the operation of mechanical engineering systems, including: .1 prime movers, including main propulsion plant
ETO.4. A-III/6-KUP 1.1.1.2 Basic understanding of the operation of mechanical engineering systems, including: .2 engine room auxiliary machinery
ETO.5. A-III/6-KUP 1.1.1.3 Basic understanding of the operation of mechanical engineering systems, including: .3 steering systems
ETO.6. A-III/6-KUP 1.1.1.4 Basic understanding of the operation of mechanical engineering systems, including: .4 cargo handling systems
ETO.7. A-III/6-KUP 1.1.1.5 Basic understanding of the operation of mechanical engineering systems, including: .5 deck machinery
ETO.8. A-III/6-KUP 1.1.1.6 Basic understanding of the operation of mechanical engineering systems, including: .6 hotel systems
ETO.9. A-III/6-KUP 1.1.2 Basic knowledge of heat transmission, mechanics and hydromechanics
ETO.10. A-III/6-KUP 1.1.7 Knowledge of: Instrumentation, alarm and monitoring systems
ETO.11. A-III/6-KUP 1.1.10 Knowledge of: Electrohydraulic and electro-pneumatic control systems
ETO.12. A-III/6-1.2 Monitor the operation of automatic control systems of propulsion and auxiliary machinery
ETO.13. A-III/6-KUP 1.2.1 Preparation of control systems of propulsion and auxiliary machinery for operation
ETO.14. A-III/6-1.3 Operate generators and distribution systems
ETO.15. A-III/6-KUP 1.3.1 Coupling, load sharing and changing over generators
ETO.16. A-III/6-KUP 1.3.2 Coupling and breaking connection between switchboards and distribution
TEACHING METHODOLOGY

Receive, understand and synthesize knowledge.
Document practical cases.
Develop reasoning and critical thinking and defend it orally or in writing.
Perform an individual work.
Application of knowledge through the engine room simulator.

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the course the student will be able to:

- Know the elements, operation and maintenance of marine systems.
- Know how to carry out the guard shift according to the accepted principles and procedures.
- Know the frequency and scope of monitoring of equipment and machine systems according to the manufacturer's recommendations and accepted procedures.
- Keep an adequate record of the evolution and activities related to the ship's engine systems.
- Distribute and allocate resources.
- Communicate clearly and unambiguously.
- Make decisions and plan operations in accordance with the manufacturer's manual and safety and anti-pollution requirements.
- Interpret drawings and machinery manuals.
- Interpret diagrams of piping, hydraulic and pneumatic systems.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Hours medium group</td>
<td>4,0</td>
<td>2.67</td>
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<tr>
<td>Hours large group</td>
<td>50,0</td>
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</tr>
<tr>
<td>Hours small group</td>
<td>3,0</td>
<td>2.00</td>
</tr>
<tr>
<td>Guided activities</td>
<td>3,0</td>
<td>2.00</td>
</tr>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h
## 1. Generalities of the systems

**Description:**
General and introduction to systems.
Description of the facilities on board, identification and distribution of spaces and systems in a vessel
Procedures, security, resource management

**Related competencies:**
- A31-1.1.2. A-III/1-KUP 1.1.2 Safety and emergency procedures, change-over of remote/automatic to local control of all systems
- A31-1.1.4. A-III/1-KUP 1.1.4 Engineeroom Resource management: Knowledge of engine-room resource management principles, including: .1 allocation, assignment, and prioritization of resources, .2 effective communication, .3 assertiveness and Leadership, .4 obtaining and maintaining situational awareness, .5 consideration of team experience
- A31-1.1.3. A-III/1-KUP 1.1.3 Safety precautions to be observed during a watch and immediate actions to be taken in the event of fire or accident, with particular reference to oil systems
- A31-1.1.1. A-III/1-KUP 1.1.1 Thorough knowledge of Principles to be observed in keeping an engineering watch, including: .1 duties associated with taking over and accepting a watch, .2 routine duties, undertaken during a watch, .3 maintenance of the machinery space logs and the significance of the readings taken, .4 duties associated with handing over a watch

**Full-or-part-time:** 4h
Theory classes: 2h
Guided activities: 1h
Self study: 1h

## 2. Operation and maintenance of pumps

**Description:**
Description of the operation of the different types of pumps and of the maintenance activities carried out on them.

**Related competencies:**
- A31-1.4.1i. A-III/1-KUP 1.4.1.9 Basic construction and operation principles of machinery systems, including: .9 fluid flow and characteristics of lubricating oil, fuel oil and cooling systems
- A31-1.4.1f. A-III/1-KUP 1.4.1.6 Basic construction and operation principles of machinery systems, including: .6 other auxiliaries, including various pumps, air compressor, purifier, fresh water generator, heat exchanger, refrigeration, airconditioning and ventilation systems

**Full-or-part-time:** 4h
Theory classes: 2h
Guided activities: 1h
Self study: 1h

## 3. Operation and maintenance of valves

**Description:**
Description of the operation of the different types of valves and of the maintenance activities carried out.

**Related competencies:**
- A31-1.4.1i. A-III/1-KUP 1.4.1.9 Basic construction and operation principles of machinery systems, including: .9 fluid flow and characteristics of lubricating oil, fuel oil and cooling systems
- A31-1.4.1f. A-III/1-KUP 1.4.1.6 Basic construction and operation principles of machinery systems, including: .6 other auxiliaries, including various pumps, air compressor, purifier, fresh water generator, heat exchanger, refrigeration, airconditioning and ventilation systems

**Full-or-part-time:** 4h
Theory classes: 2h
Guided activities: 1h
Self study: 1h
4. Operation and maintenance of heat exchangers

Description:
Description of the operation of the different types of heat exchangers and of the maintenance activities carried out in them.

Related competencies:
A36-1.1.2. A-III/6-KUP 1.1.2 Basic knowledge of heat transmission, mechanics and hydromechanics
A31-1.4.1i. A-III/1-KUP 1.4.1.9 Basic construction and operation principles of machinery systems, including: .9 fluid flow and characteristics of lubricating oil, fuel oil and cooling systems
A31-1.4.1f. A-III/1-KUP 1.4.1.6 Basic construction and operation principles of machinery systems, including: .6 other auxiliaries, including various pumps, air compressor, purifier, fresh water generator, heat exchanger, refrigeration, airconditioning and ventilation systems

Full-or-part-time: 4h
Theory classes: 2h
Guided activities: 1h
Self study: 1h

5. Operation and maintenance of filters and sewage treatment plants

Description:
Description of the operation of the filters and treatment plants and of the maintenance activities carried out in these

Related competencies:
A31-1.4.1f. A-III/1-KUP 1.4.1.6 Basic construction and operation principles of machinery systems, including: .6 other auxiliaries, including various pumps, air compressor, purifier, fresh water generator, heat exchanger, refrigeration, airconditioning and ventilation systems

Full-or-part-time: 4h
Theory classes: 2h
Guided activities: 1h
Self study: 1h

6. Operation and maintenance of oleohydraulic systems and lubrication

Description:
Oleohydraulic components, their operation and operation of oleohydraulic installations on board

Related competencies:
A36-1.1.10. A-III/6-KUP 1.1.10 Knowledge of: Electrohydraulic and electro-pneumatic control systems
A31-1.4.1i. A-III/1-KUP 1.4.1.9 Basic construction and operation principles of machinery systems, including: .9 fluid flow and characteristics of lubricating oil, fuel oil and cooling systems

Full-or-part-time: 8h
Theory classes: 6h
Guided activities: 1h
Self study: 1h
7. Operation and maintenance of pneumatic systems, start-up and ventilation

Description:
Pneumatic components, their operation, operation and maintenance of the on-board facilities and the start-up and ventilation system

Related competencies:
A36-1.1.10. A-III/6-KUP 1.1.10 Knowledge of: Electrohydraulic and electro-pneumatic control systems
A31-1.4.3.. A-III/1-KUP 1.4.3.4 Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems: .4 other auxiliaries, including refrigeration, airconditioning and ventilation systems
A36-1.1.7. A-III/6-KUP 1.1.7 Knowledge of: Instrumentation, alarm and monitoring systems
A36-1.2.1. A-III/6-KUP 1.2.1 Preparation of control systems of propulsion and auxiliary machinery for operation

Full-or-part-time: 8h
Theory classes: 6h
Guided activities: 1h
Self study: 1h

8. Bilge and bilge service

Description:
Concept, functions, components and operative.

Related competencies:
A31-1.5.2. A-III/1-KUP 1.5.2 Operation of pumping systems: .1 routine pumping operations, .2 operation of bilge, ballast and cargo pumping systems

Full-or-part-time: 4h
Theory classes: 2h
Guided activities: 1h
Self study: 1h

9. Saltwater and freshwater services

Description:
Concept, functions, components and operative of the services of fire, wash, ballast, refrigeration and potable.

Specific objectives:

Related competencies:
A31-1.5.2. A-III/1-KUP 1.5.2 Operation of pumping systems: .1 routine pumping operations, .2 operation of bilge, ballast and cargo pumping systems

Full-or-part-time: 6h
Theory classes: 4h
Guided activities: 1h
Self study: 1h
10. Fuel service

**Description:**
Concept, functions, components and operation of the fuel service.

**Specific objectives:**

**Related competencies:**
A31-1.4.1i. A-III/1-KUP 1.4.1.9 Basic construction and operation principles of machinery systems, including: fluid flow and characteristics of lubricating oil, fuel oil and cooling systems

**Full-or-part-time:** 4h
Theory classes: 2h
Guided activities: 1h
Self study: 1h
10. Operation of systems and equipment using a machine simulator

**Description:**
Operation by simulator

**Related competencies:**
A31-1.1.2. A-III/1-KUP 1.1.2 Safety and emergency procedures, change-over of remote/automatic to local control of all systems
A31-1.5.2. A-III/1-KUP 1.5.2 Operation of pumping systems: .1 routine pumping operations, .2 operation of bilge, ballast and cargo pumping systems
A36-1.1.1b. A-III/6-KUP 1.1.1.2 Basic understanding of the operation of mechanical engineering systems, including: .2 engine?room auxiliary machinery
A36-1.1.5a. A-III/6-KUP 1.1.1.1 Basic understanding of the operation of mechanical engineering systems, including: .1 prime movers, including main propulsion plant
A31-1.4.1j. A-III/1-KUP 1.4.1.10 Basic construction and operation principles of machinery systems, including: .10 deck machinery
A36-1.3.1. A-III/6-KUP 1.3.1 Coupling, load sharing and changing over generators
A31-1.4.3. A-III/1-KUP 1.4.3.4 Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems: .4 other auxiliaries, including refrigeration, airconditioning and ventilation systems
A31-1.1.4. A-III/1-KUP 1.1.4 Engineroom Resource management: Knowledge of engine-room resource management principles, including: .1 allocation, assignment, and prioritization of resources, .2 effective communication, .3 assertiveness and Leadership, .4 obtaining and maintaining situational awareness, .5 consideration of team experience
A31-2.2.5a. A-III/1-KUP 2.2.5.1 Function and performance tests of the following equipment and their configuration: .1 monitoring systems
A31-1.4.1i. A-III/1-KUP 1.4.1.9 Basic construction and operation principles of machinery systems, including: .9 fluid flow and characteristics of lubricating oil, fuel oil and cooling systems
A36-1.1.1e. A-III/6-KUP 1.1.1.5 Basic understanding of the operation of mechanical engineering systems, including: .5 deck machinery
A36-1.1.1c. A-III/6-KUP 1.1.1.3 Basic understanding of the operation of mechanical engineering systems, including: .3 steering systems
A31-1.5.2. A-III/1-KUP 1.5.3 Oilywater separators (or similar equipment) requirements and operation
A36-1.1.1f. A-III/6-KUP 1.1.1.6 Basic understanding of the operation of mechanical engineering systems, including: .6 hotel systems
A36-1.1.7. A-III/6-KUP 1.1.7 Knowledge of: Instrumentation, alarm and monitoring systems
A31-2.2.6. A-III/1-KUP 2.2.6 The interpretation of electrical and simple electronic diagrams
A31-1.1.3. A-III/1-KUP 1.1.3 Safety precautions to be observed during a watch and immediate actions to be taken in the event of fire or accident, with particular reference to oil systems
A31-1.4.1g. A-III/1-KUP 1.4.1.7 Basic construction and operation principles of machinery systems, including: .7 steering gear
A36-1.2.1. A-III/6-KUP 1.2.1 Preparation of control systems of propulsion and auxiliary machinery for operation
A36-1.1.1d. A-III/6-KUP 1.1.1.4 Basic understanding of the operation of mechanical engineering systems, including: .4 cargo handling systems
A31-1.5.1. A-III/1-KUP 1.5.1 Operational characteristics of pumps and piping systems, including control systems
A31-1.4.1f. A-III/1-KUP 1.4.1.6 Basic construction and operation principles of machinery systems, including: .6 other auxiliaries, including various pumps, air compressor, purifier, fresh water generator, heat exchanger, refrigeration, airconditioning and ventilation systems
A31-1.1.1. A-III/1-KUP 1.1.1.1 Thorough knowledge of Principles to be observed in keeping an engineering watch, including: .1 duties associated with taking over and accepting a watch, .2 routine duties, undertaken during a watch, .3 maintenance of the machinery space logs and the significance of the readings taken, .4 duties associated with handing over a watch
A36-1.3.2. A-III/6-KUP 1.3.2 Coupling and breaking connection between switchboards and distribution
A31-1.4.3. A-III/1-KUP 1.4.3.2 Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems: .2 steam boiler and associated auxiliaries and steam systems

**Full-or-part-time:** 30h
Laboratory classes: 30h
GRADING SYSTEM

The final grade is the sum of the following partial grades:

\[ N_{\text{final}} = 0.5 \times N_t + 0.5 \times N_s \]

- \( N_{\text{final}} \): Final qualification
- \( N_t \): Qualification of the theory part
- \( N_s \): Evaluation rating simulator

It is necessary to attend a minimum of 80% of the simulator sessions for this part of the course to be graded. In the case of not reaching the score of 3.0 in any of the two parts of the subject, it will mean that the maximum attainable mark is 4.0 in the evaluation.

A final re-evaluation test will be carried out for students who meet the requirements established by the center's regulations, which will consist of a single test in which the entire subject of the course will be evaluated.

Methods of demonstrating competence: approved training and approved training with simulators

Competency assessment criteria: column 4 of table A-III / 1 of the associated competence

EXAMINATION RULES.

If any of the evaluation activities is not carried out, it will be considered as not punctuated.

A student who doesn't complete any of the assessment activities will receive the qualification of absent

BIBLIOGRAPHY

Basic:

Complementary:

RESOURCES

Other resources:
Engine Room Simulator TRANSAS ERS 5000