

Course guide

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

Last modified: 27/05/2024

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: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

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

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.CE26. Knowledge of methods of regulation and control of machines and marine systems and their applications on board.
GTM.CE32. Knowledge and capacity for implementation and management of energy audits.

Transversal:

EIN N3. ENTREPRENEURSHIP AND INNOVATION - Level 3. Using knowledge and strategic skills to set up and manage projects. Applying systemic solutions to complex problems. Devising and managing innovation in organizations.

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 Engine room 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, airconditioning 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 1.4.3.4 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
- 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/1-2. Function: Electrical, electronic and control engineering at the operational level
- ME.19. A-III/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

Type	Hours	Percentage
Self study	90,0	60.00
Hours small group	15,0	10.00
Hours large group	45,0	30.00

Total learning time: 150 h

CONTENTS

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 :

A31-1.1.1. 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
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
A31-1.1.4. A-III/1-KUP 1.1.4 Engine room 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
A31-1.1.2. A-III/1-KUP 1.1.2 Safety and emergency procedures, change-over of remote/automatic to local control of all systems

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 :

A31-1.4.1f. 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

A31-1.4.1i. 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: 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 :

A31-1.4.1f. 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

A31-1.4.1i. 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: 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 :

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

A31-1.4.1i. 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

A36-1.1.2. A-III/6-KUP 1.1.2 Basic knowledge of heat transmission, mechanics and hydromechanics

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 :

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

A36-1.1.10. A-III/6-KUP 1.1.10 Knowledge of: Electrohydraulic and electro-pneumatic control 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 :

A36-1.2.1. A-III/6-KUP 1.2.1 Preparation of control systems of propulsion and auxiliary machinery for operation

A36-1.1.7. A-III/6-KUP 1.1.7 Knowledge of: Instrumentation, alarm and monitoring 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

A36-1.1.10. A-III/6-KUP 1.1.10 Knowledge of: Electrohydraulic and electro-pneumatic control systems

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: .9 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 :

A31-1.4.3.. 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
A36-1.3.2. A-III/6-KUP 1.3.2 Coupling and breaking connection between switchboards and distribution
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
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
A31-1.5.1. A-III/1-KUP 1.5.1 Operational characteristics of pumps and piping systems, including control systems
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
A36-1.2.1. A-III/6-KUP 1.2.1 Preparation of control systems of propulsion and auxiliary machinery for operation
A31-1.4.1g. A-III/1-KUP 1.4.1.7 Basic construction and operation principles of machinery systems, including: .7 steering gear
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
A31-2.2.6. A-III/1-KUP 2.2.6 The interpretation of electrical and simple electronic diagrams
A36-1.1.7. A-III/6-KUP 1.1.7 Knowledge of: Instrumentation, alarm and monitoring systems
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
A31-1.5.3. A-III/1-KUP 1.5.3 Oilywater separators (or similar equipment) requirements and operation
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
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
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
A31-2.2.5a. A-III/1-KUP 2.2.5.1 Function and performance tests of the following equipment and their configuration: .1 monitoring systems
A31-1.1.4. 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
A31-1.4.3.. 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
A36-1.3.1. A-III/6-KUP 1.3.1 Coupling, load sharing and changing over generators
A31-1.4.1j. A-III/1-KUP 1.4.1.10 Basic construction and operation principles of machinery systems, including: .10 deck machinery
A36-1.1.1a. 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
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
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
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

Full-or-part-time: 30h

Laboratory classes: 30h

GRADING SYSTEM

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

$$N_{\text{final}} = 0.5 N_t + 0.5 N_s$$

N_{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 assesment activities will receive the qualification of absent

BIBLIOGRAPHY

Basic:

- Engine-room simulator : IMO Model Course, 2.07. London: International Maritime Organization, 2017. ISBN 9789280116762.
- Sols, Alberto. Fiabilidad, mantenibilidad, efectividad : un enfoque sistémico. Madrid: Universidad Pontificia de Comillas, 2000. ISBN 8489708932.
- Gómez de León, Félix Cesáreo. Tecnología del mantenimiento industrial. Murcia: Universidad de Murcia. Servicio de Publicaciones, 1998. ISBN 8483710080.
- Mobley, R. Keith. An Introduction to predictive maintenance. 2nd ed. Amsterdam: Butterworth Heinemman, 2002. ISBN 0750675314.
- International Maritime Organization. Electro-technical officer. IMO model course 7.08. London: IMO, 2014. ISBN 9789280115802.

Complementary:

- Grau Castelló, Vicente. Máquinas marinas. Madrid: ETSIN, 1995.
- Hernández Molina, Ricardo. Maquinaria auxiliar : disposición y servicios. Cádiz: Universidad de Cádiz, 1991.
- Maquinaria marítima auxiliar. México DF: UTHEA, 1965.
- Smith, Ricky; Mobley, R. Keith. Industrial machinery repair : best maintenance practices pocket guide [on line]. Amsterdam: Butterworth Heinemman, 2003 [Consultation: 01/09/2022]. Available on: <https://www.sciencedirect-com.recursos.biblioteca.upc.edu/book/9780750676212/industrial-machinery-repair>. ISBN 0750676213.
- Macián Martínez, Vicente et al. Mantenimiento de motores diesel. Valencia: Editorial Universidad Politécnica de Valencia, 2002. ISBN 8497051319.
- Manzano Orrego, Juan José. Mantenimiento de máquinas eléctricas. 4a ed. Madrid: Paraninfo, 2002. ISBN 8497321103.
- Blanco Barragán, Luis; Sánchez Ovies, Ángel. Mantenimiento de equipos electrónicos. Madrid: Thomson Paraninfo, 2002. ISBN 8497320948.

RESOURCES

Other resources:

Engine Room Simulator TRANSAS ERS 5000