# Course guide
# 280718 - 280718 - Thermal Engines

**Last modified:** 27/05/2024

**Unit in charge:** Barcelona School of Nautical Studies
**Teaching unit:** 742 - CEN - Department of Nautical Sciences and 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:** Spanish

## LECTURER

**Coordinating lecturer:** ERIC JOSE PASCUAL SOLDEVILLA

**Others:** Segon quadrimestre:
ERIC JOSE PASCUAL SOLDEVILLA - MGOIE

## DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

**Specific:**
CE1-MGOIEM. Coneixements adequats per iniciar l'activitat investigadora. Metodologia de la investigació aplicada a l'àmbit de l'especialitat
CE3-MGOIEM. Capacitat per conèixer, entendre i utilitzar els principis de la cogeneració en instal·lacions marines
CE6-MGOIEM. Capacitat per conèixer, entendre i utilitzar els principis dels sistemes de generació, transport i distribució d'energia
CE12MGOIEM. Coneixement i capacitat per optimitzar la gestió de màquines i motors tèrmics i hidràulics
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
CG5-MGOIEM. (ENG) Capacidad de integración de sistemas marítimos complejos y de traducción en soluciones viables
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
CG11MGOIEM. Capacitat per realitzar tasques d'investigació, desenvolupament i innovació en l'àmbit de la seva especialitat

**Transversal:**
CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

CT1. ENTREPRENEURSHIP AND INNOVATION: Knowing and understanding the organization of a company and the sciences that govern the activity; be able to understand the business rules and relationships between planning, industrial and commercial strategies, quality and profit.

**Basic:**
CB10. Students must possess the learning skills that enable them continue studying in a way that will be largely self-directed or autonomous.

## TEACHING METHODOLOGY

Acquire, understand and synthesize knowledge.
And solve problems.
Prepare technical reports.
Adopt solutions in practical cases.
Making memory works.

## LEARNING OBJECTIVES OF THE SUBJECT

Explain the construction and functional characteristics of marine engines. Analyze the internal behavior of the motors. Provide the knowledge necessary for analysis and diagnosis. Study of performance and power.
This course will evaluate the following STCW A-III/2 competences:
Manage the operation of propulsion plant machinery
Plan and schedule operations
Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery
Manage fuel, lubrication and ballast operations

This knowledge is necessary in accordance with STCW A-III/2 and it's developed according to CHIEF ENGINEER OFFICER AND SECOND ENGINEER OFFICER (Model course 7.02) (2014 Edition)

## STUDY LOAD

| Type | Hours | Percentage |
|---|---|---|
| Self study | 80,0 | 64.00 |
| Hours large group | 45,0 | 36.00 |

**Total learning time:** 125 h

## CONTENTS

### Analysis of power and performance

**Description:**
Description of the design features and working mechanisms of the main engines and auxiliary machinery.

**Full-or-part-time:** 2h
Theory classes: 2h

### Energy load

**Description:**
Description of the systems and the propulsion characteristics of diesel engines, including the speed, power and fuel consumption. Analysis of the operating limits of the propulsion installation.

**Specific objectives:**
Manage the operation of propulsion plant machinery
Design features, and operative mechanism of marine diesel engines and associated auxiliaries.

**Full-or-part-time:** 1h
Theory classes: 1h

### Optimization and control

**Description:**
Functions and mechanisms of automatic control of the main motor. Operation and operation of main propulsion and auxiliary machinery, including associated systems.

**Specific objectives:**
Plan and schedule operations
Thermodynamics and heat transfer Mechanics and hydromechanics
Propulsive characteristics of diesel engines, including speed, power and fuel consumption
Thermal cycle, thermal efficiency and thermal balance of marine diesel engine
Physical and chemical properties of fuels and lubricants

**Full-or-part-time:** 2h
Theory classes: 2h

### Electronic injection

**Description:**
Functions and requirements of the injection devices. Functions and mechanisms of automatic control of the main motor.

**Full-or-part-time:** 1h
Theory classes: 1h

### Supercharger

**Description:**
Utility and boost modes. Supercharger of large two-stroke engines. Two-stage supercharging engines and low compression ratio.

**Full-or-part-time:** 1h
Theory classes: 1h

### Rotary engines

**Description:**
Rotary engines, types and alternative fuels. Operating Principles: Wankel, Radmax, Quasiturbine, Round Engine, etc.

**Full-or-part-time:** 1h
Theory classes: 1h

### Diagram Interpretation

**Description:**
Obtaining, interpreting and analyzing diagrams. Analysis of the heat cycle, thermal efficiency and thermal balance of the motor.

**Full-or-part-time:** 1h
Theory classes: 1h

**Polluting emissions**

**Description:**
Emission sources. Gaseous pollutants. Factors affecting emissions. Reducing emissions.

**Full-or-part-time:** 1h
Theory classes: 1h

**Operatión, faults and repairs**

**Description:**
Inspection, diagnosis and failure analysis of diesel engines.

**Specific objectives:**
Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery
Start up and shut down main propulsion and auxiliary machinery, including associated systems
Operating limits of propulsion plant
The efficient operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery
Manage fuel, lubrication and ballast operations
Operation and maintenance of machinery, including pumps and piping systems

**Full-or-part-time:** 2h 30m
Theory classes: 2h 30m

## GRADING SYSTEM

The final score is the sum of the following partial grades:
Nfinal = 0.6*Npf + 0.4*Nec

Nfinal: Final Rating
Npf: Rated final test
Nec: Course exercises and workshop practices

The final test consists of a part with issues related to the learning objectives of the course in terms of knowledge or understanding concepts, and a set of application exercises. Continuous assessment consists of various tests and formative activities, both individual and group, made during the course.

## EXAMINATION RULES.

If you have not done laboratory activities, work or evaluation, is considered as punctuated.
It is considered not submitted when not perform any of the tests.

## BIBLIOGRAPHY

**Basic:**
- Carreras Planells, Ramón ... [et al.]. Motores de combustión interna : fundamentos. 2a ed. Barcelona: Edicions UPC, 1994. ISBN 8476534019.
- Heywood, John B. Internal combustion engine fundamentals. New York: McGraw-Hill, 1988. ISBN 007028637X.
- Kates, Edgar J. Motores diesel y de gas de alta compresión. 2a ed. Barcelona: Reverté, 1982. ISBN 842914837X.
- Lichty, Lester C. Procesos de los motores de combustión. Madrid: Ediciones del Castillo, 1970.
- Pérez del íio, José. Tratado general de máquinas marinas. 8 vol [on line]. Barcelona: Planeta, 1959-1970 [Consultation: 14/07/2021]. Available on: http://hdl.handle.net/2117/130277.
- Woodyard, Doug. Pounder's marine diesel engines and gas turbines [on line]. 9th ed. Oxford [etc.]: Elsevier Butterworth Heinemann, 2009 [Consultation: 01/09/2022]. Available on: https://www-sciencedirect-com.recursos.biblioteca.upc.edu/book/9780750689847/pounders-marine-diesel-engines-and-gas-turbines. ISBN 9780750689847.
- Muñoz Domínguez, Marta; Rovira De Antonio, Antonio José. Máquinas térmicas [on line]. Madrid: UNED Universidad Nacional de Educación a Distancia, [2014] [Consultation: 01/09/2022]. Available on: https://lectura-unebook-es.recursos.biblioteca.upc.edu/viewer/9788436268867. ISBN 9788436268867.
- Álvarez Flórez, Jesús A.; Callejón i Agramunt, Ismael; Forns Farrús, Sergi. Motores de combustión interna [on line]. Madrid: UNED - Universidad Nacional de Educación a Distancia, [2005] [Consultation: 01/09/2022]. Available on: https://lectura-unebook-es.recursos.biblioteca.upc.edu/viewer/9788436270860. ISBN 9788436270860.
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**Complementary:**
- Cabronero Mesas, Daniel. Motores de combustión interna. 3a ed. corregida. Barcelona: l'autor, 2003. ISBN 8460449114.
- Obert, Edward F. Motores de combustión interna : análisis y aplicaciones. México: CECSA, 1966.
- Taylor, Charles Fayette. The Internal combustion engine in theory and practice. 2nd ed. rev. Massachusetts: MIT Press, 1985. ISBN 0262200511.
- Giacosa, Dante. Motores endotérmicos : motores de encendido por chispa : a carburación y a inyección, motores de encendido por compresión Diesel, lentos y rápidos, motores rotativos - turbinas de gas: teoría, construcción, pruebas. Barcelona: Omega, 1988. ISBN 8428208484.
- Payri González, Francisco; Desantes Fernández, José María. Motores de combustión interna alternativos. Valencia: Editorial UPV, 2011. ISBN 9788483637050.