280653 - Refrigeration and Air Conditioning Facilities

Coordinating unit: 280 - FNB - Barcelona School of Nautical Studies
Teaching unit: 742 - CEN - Department of Nautical Sciences and Engineering
Academic year: 2017
Degree: BACHELOR'S DEGREE IN MARINE TECHNOLOGIES/BACHELOR'S DEGREE IN NAVAL SYSTEMS AND TECHNOLOGY ENGINEERING (Syllabus 2016). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN MARINE TECHNOLOGIES (Syllabus 2010). (Teaching unit Compulsory)
ECTS credits: 4,5
Teaching languages: Spanish

Teaching staff
Coordinator: IGNACIO ECHEVARRIETA SAZATORNIL
Others: IGNACIO ECHEVARRIETA SAZATORNIL - 1

Prior skills
It is advisable that the students have passed Thermodynamics.

Degree competences to which the subject contributes

Specific:
1. Ability to design and manage energy optimization systems applied to marine installations.
2. Knowledge of the fundamentals of Fluid Mechanics machines and systems, internal combustion engines, steam turbines and gas, steam generators, cooling and air conditioning.

Teaching methodology
Teaching method is class work with the possibility of individual or grupal work and its presentation, practical exercises and individual work with the material in ATENEA.

Learning objectives of the subject

Knowledge of cycles and theoretical basics of refrigeration.
Thorough knowledge of the elements of marine refrigeration devices and refrigerants used.
Marine HVAC systems.
Recovery and recycling of refrigerants.
Knowledge of refrigeration and HVAC devices and ability to apply it for the calculation of these installations.
Knowledge of the life cycle of a product related with refrigeration and application to the development of products and services in the marine engineering.
Planning and use of the required information for a project or academical work.
STCW competences:
Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board.
Project characteristics and selection of materials for the building of equipment.
Interpretation of instructions books and drawings.
Operational functions of systems and equipments.
Main and auxiliary machinery operation and their control systems.
Maintenance of marine machinery systems including control devices.
Other competences:
Obtain, understand and synthesise knowledge.
Lay out and resolve technical problems.
Prepare technical reports.
Find solutions for practical problems.
Prepare the report of laboratory practices or works.
Analyse results.
Relate knowledges of different subjects.
Develop the evaluating and reasoning capacity.

### Study load

<table>
<thead>
<tr>
<th><strong>Total learning time:</strong> 112h 30m</th>
<th>Hours large group:</th>
<th>40h</th>
<th>35.56%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours medium group:</td>
<td>5h</td>
<td></td>
<td>4.44%</td>
</tr>
<tr>
<td>Hours small group:</td>
<td>0h</td>
<td></td>
<td>0.00%</td>
</tr>
<tr>
<td>Guided activities:</td>
<td>0h</td>
<td></td>
<td>0.00%</td>
</tr>
<tr>
<td>Self study:</td>
<td>67h 30m</td>
<td></td>
<td>60.00%</td>
</tr>
</tbody>
</table>
280653 - Refrigeration and Air Conditioning Facilities

<table>
<thead>
<tr>
<th>Content</th>
<th>Learning time: 5h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fundamental principles.</strong></td>
<td>Theory classes: 5h</td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Description of the objective and study of the different systems used historically.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Refrigeration cycles.</th>
<th>Learning time: 5h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 5h</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thermodynamical cycles used in refrigeration, their representation in diagrams and main characteristics and elements.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Refrigerant fluids.</th>
<th>Learning time: 5h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 5h</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Environmental impact. Safety.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mechanical compression.</th>
<th>Learning time: 13h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 13h</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Refrigerants used. Classifications. Toxicity, flammability and environmental pollution.</td>
</tr>
<tr>
<td></td>
<td>Primary and secondary refrigerants.</td>
</tr>
<tr>
<td></td>
<td>Elements of the single and compound mechanical compression installations. Flooded and dry evaporators. Direct and secondary fluid installations.</td>
</tr>
<tr>
<td></td>
<td>Compound cycles.</td>
</tr>
<tr>
<td></td>
<td>Types of compressor and capacity control devices.</td>
</tr>
<tr>
<td></td>
<td>Evaporators. Defrosting systems.</td>
</tr>
<tr>
<td></td>
<td>Control and automation devices.</td>
</tr>
<tr>
<td></td>
<td>Auxiliary devices. Piping.</td>
</tr>
</tbody>
</table>
### Refrigerant recovery and recycling.

**Description:**
Systems for the recovery of all the refrigerant and oil from an installation prior to wrecking.

**Learning time:**
- Theory classes: 1h
- Self study: 1h

### Marine refrigeration installations.

**Description:**
- Modern ammonia installations.
- Refrigeration installations with brine.
- Refrigeration chambers in the ships.
- Reefer.
- Refrigerated containers.

**Learning time:**
- Theory classes: 5h

### HVAC

**Description:**
- Diagrams. Processes.
- HVAC in ships.
- Operation and maintenance.

**Learning time:**
- Theory classes: 5h

### Absorption systems.

**Description:**
- Absorption systems.

**Learning time:**
- Theory classes: 2h 30m
Final exam with a value of 70% of the qualification, partial exams or another works with a total value of 30% of the qualification. Reevaluation is made with an exam.

Qualification system

If a student does not make any exam, his qualification will be not presented.

Bibliography

Basic:


Complementary: