300323 - CIASA-OA - Air Conditioning and Installations in Aircraft and Airport Systems

Coordinating unit: 300 - EETAC - Castelldefels School of Telecommunications and Aerospace Engineering
Teaching unit: 717 - EGE - Department of Engineering Presentation
Academic year: 2017
Degree: BACHELOR'S DEGREE IN AIR NAVIGATION ENGINEERING (Syllabus 2010). (Teaching unit Optional)
              BACHELOR'S DEGREE IN AIRPORT ENGINEERING (Syllabus 2010). (Teaching unit Optional)
              BACHELOR'S DEGREE IN AEROSPACE SYSTEMS ENGINEERING (Syllabus 2015). (Teaching unit Optional)
ECTS credits: 6  Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: Definit a la infoweb de l'assignatura
Others: Definit a la infoweb de l'assignatura

Opening hours
Timetable: Tuesday from 12 a.m. to 2:00 p.m.
           Wednesday from 11 a.m. to 2 p.m.

Prior skills
Sufficient knowledge of Physics and Thermodynamics.

Degree competences to which the subject contributes

Basic:

CB2. (ENG) CB2 - Que los estudiantes sepan aplicar sus conocimientos a su trabajo o vocación de una forma profesional y posean las competencias que suelen demostrarse por medio de la elaboración y defensa de argumentos y la resolución de problemas dentro de su área de estudio

CG1. (ENG) CG1 - Capacidad para el diseño, desarrollo y gestión en el ámbito de la ingeniería aeronáutica que tengan por objeto, de acuerdo con los conocimientos adquiridos, los vehículos aeroespaciales, los sistemas de propulsión aeroespacial, los materiales aeroespaciales, las infraestructuras aeroportuarias, las infraestructuras de aeronavegación y cualquier sistema de gestión del espacio, del tráfico y del transporte aéreo.

CG2. (ENG) CG2 - Planificación, redacción, dirección y gestión de proyectos, cálculo y fabricación en el ámbito de la ingeniería aeronáutica que tengan por objeto, de acuerdo con los conocimientos adquiridos, los vehículos aeroespaciales, los sistemas de propulsión aeroespacial, los materiales aeroespaciales, las infraestructuras aeroportuarias, las infraestructuras de aeronavegación y cualquier sistema de gestión del espacio, del tráfico y del transporte aéreo.

CG8. (ENG) CG8 - Conocimiento, comprensión y capacidad para aplicar la legislación necesaria en el ejercicio de la profesión de Ingeniero Técnico Aeronáutico.

CG5. (ENG) CG5 - Capacidad para llevar a cabo actividades de proyección, de dirección técnica, de peritación, de redacción de informes, de dictámenes, y de asesoramiento técnico en tareas relativas a la Ingeniería Técnica Aeronáutica, de ejercicio de las funciones y de cargos técnicos genuinamente aeroespaciales.
At the end of the course of air conditioning and facilities in aircraft and airport systems, the student has to be capable of:

- Identify elements of the facilities of refrigeration and air conditioning systems airport.
- Identify the elements of refrigeration and air conditioning of aircraft in general in flight.
- Identify the elements of refrigeration and air conditioning of aircraft in general on Earth.
- Design and calculation facilities of refrigeration and air conditioning of the airport systems.
- Designing and calculating facilities for spaces in airports to store goods that cannot break the cold chain.
- Explain the principle of utilization of air from the engines of the aircraft and the techniques that exist for winterizing the cabin air (heating, cooling, humidification, dehumidification, ventilation and pressurization of the cabin of flight and passenger air).
- Design and in general calculate the components of refrigeration and air conditioning of the aircraft in flight.

Learning objectives of the subject

At the end of the course of air conditioning and facilities in aircraft and airport systems, the student has to be capable of:

- Identify elements of the facilities of refrigeration and air conditioning systems airport.
- Identify the elements of refrigeration and air conditioning of aircraft in general in flight.
- Identify the elements of refrigeration and air conditioning of aircraft in general on Earth.
- Design and calculation facilities of refrigeration and air conditioning of the airport systems.
- Designing and calculating facilities for spaces in airports to store goods that they cannot break the cold chain.
- Explain the principle of utilization of air from the engines of the aircraft and the techniques that exist for winterizing the cabin air (heating, cooling, humidification, dehumidification, ventilation and pressurization of the cabin of flight and passenger air).
- Design and in general calculate the components of refrigeration and air conditioning of the aircraft in flight.
300323 - CIASA-OA - Air Conditioning and Installations in Aircraft and Airport Systems

- To design and calculate the components of refrigeration and air conditioning of aircraft in general on Earth.
- Use an advanced CAD program to draw, develop or redesign elements calculated analytically.
- Project, design and calculate an installation air conditioning (cooling or heating) in general, and in particular of the aircraft, taking into account other facilities necessary to its operation (a project multidisciplinary)

**Study load**

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 36h 24.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours small group: 24h 16.00%</td>
</tr>
<tr>
<td></td>
<td>Guided activities: 6h 4.00%</td>
</tr>
<tr>
<td></td>
<td>Self study: 84h 56.00%</td>
</tr>
</tbody>
</table>
### 300323 - CIASA-OA - Air Conditioning and Installations in Aircraft and Airport Systems

<table>
<thead>
<tr>
<th><strong>Content</strong></th>
<th><strong>Learning time:</strong> 7h 30m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air conditioning and refrigeration. Introduction.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td></td>
</tr>
<tr>
<td>- Presentation, field of application of the subject and explanation of the objectives to be achieved.</td>
<td></td>
</tr>
<tr>
<td>- Concept of cold and air conditioning. Refrigeration.</td>
<td></td>
</tr>
<tr>
<td>- Types of installations. Fixed systems. Mobile systems.</td>
<td></td>
</tr>
<tr>
<td>- Presentation of projects proposed by the teacher. Assignment of the projects to be carried out by the student (individual project) or groups (multidisciplinary project)</td>
<td></td>
</tr>
<tr>
<td><strong>Related activities:</strong></td>
<td></td>
</tr>
<tr>
<td>- Proposals of the project to be carried out.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Air conditioning in airplanes and airports</strong></th>
<th><strong>Learning time:</strong> 18h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td></td>
</tr>
<tr>
<td>- Classification of refrigeration systems and heating systems.</td>
<td></td>
</tr>
<tr>
<td>- Air and steam cycle cooling systems in airplanes</td>
<td></td>
</tr>
<tr>
<td>- Distribution of air conditioning in airplanes.</td>
<td></td>
</tr>
<tr>
<td>- Pressurizing.</td>
<td></td>
</tr>
<tr>
<td><strong>Related activities:</strong></td>
<td></td>
</tr>
<tr>
<td>- Selection and assignment of the project to be carried out. Individual assistance of the teacher to the students.</td>
<td></td>
</tr>
</tbody>
</table>
### Refrigeration fluids

**Description:**
- Refrigerating fluids. Types and classification. Nomenclature. ASHRAE.
- Refrigerating fluids and refrigerating fluids.
- Mixtures of refrigerants: zeotropic and azeotropic.
- Refrigerants. Thermodynamic properties. Freezing point, specific heat, specific volume, density, temperature.
- Refrigerating fluids for primary and secondary circuits.
- Use of refrigerant fluids in air-conditioning applications in aircraft and airport systems. Refrigeration of the mechanical parts of an aircraft.

**Learning time:** 6h  
Theory classes: 3h  
Self study: 3h

### Diagram of Mollier and psicrometry.

**Description:**
- Types of Diagrams for resolution of air conditioning and refrigeration systems.

**Related activities:**
- Problems.
- Application to the project being carried out.

**Learning time:** 19h  
Theory classes: 6h  
Laboratory classes: 2h  
Guided activities: 1h  
Self study: 10h

### Compressors

**Description:**
- Compression.
- Field of application in airplanes.
- Engines and compressors. Classification and types according to the applications.
- Calculation of compressor.

**Related activities:**
- Problems.
- Application to the project being carried out.

**Learning time:** 17h  
Theory classes: 3h  
Laboratory classes: 4h  
Self study: 10h
**Lubricants**

<table>
<thead>
<tr>
<th>Description:</th>
<th>Learning time:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Definition and Types.</td>
<td>5h</td>
</tr>
<tr>
<td>- Characteristics.</td>
<td>Laboratory classes: 2h</td>
</tr>
<tr>
<td>- Lubricants and refrigerants. Compatibilities.</td>
<td>Self study: 3h</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Related activities:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Problems.</td>
<td></td>
</tr>
<tr>
<td>- Application to the project being carried out.</td>
<td></td>
</tr>
</tbody>
</table>

**Heat exchanger for refrigeration and air-conditioning installations.**

<table>
<thead>
<tr>
<th>Description:</th>
<th>Learning time: 17h</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Types of heat exchanger and refrigeration.</td>
<td>Theory classes: 3h</td>
</tr>
<tr>
<td>- The condenser. Concept. Types and classification.</td>
<td>Laboratory classes: 4h</td>
</tr>
<tr>
<td>- Design and calculation of heat exchangers to condense.</td>
<td>Self study: 10h</td>
</tr>
<tr>
<td>- Manufacture of capacitors.</td>
<td></td>
</tr>
<tr>
<td>- The evaporator. Concept. Types and classification.</td>
<td></td>
</tr>
<tr>
<td>- Defrosting. Types.</td>
<td></td>
</tr>
<tr>
<td>- Design and calculation of heat exchangers to evaporate.</td>
<td></td>
</tr>
<tr>
<td>- Manufacture of evaporators.</td>
<td></td>
</tr>
<tr>
<td>- Applications at airports.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Related activities:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Application to the project being carried out.</td>
<td></td>
</tr>
</tbody>
</table>
### Accessories, containers, regulation, control and safety

**Description:**
- Pressure vessels. Types. Design and calculation. Type record. Manufacturing.
- Valves, Distributors, Filters, Pressure switches, Thermostats, Safety valves.
- Isolation.
- Automations.
- Electric panels.

**Related activities:**
- Application to the project being carried out.
- Problems

**Learning time:** 15h
- Theory classes: 3h
- Laboratory classes: 2h
- Self study: 10h

### Welding in air conditioning and refrigeration

**Description:**
- Types of welding for air conditioning and refrigeration.
- Approval of welders.
- Approval of the procedure. Automation for series production.
- Authorized inspection bodies. Inspections.

**Related activities:**
- Application to the project being carried out.
- Problems

**Learning time:** 5h
- Theory classes: 3h
- Self study: 2h

### CAD FloXpress SW Design

**Description:**
- Knowledge and use of the SolidWorks CAD software FloXpress module

**Related activities:**
- Application to the project being carried out.

**Learning time:** 10h
- Laboratory classes: 2h
- Self study: 8h
300323 - CIASA-OA - Air Conditioning and Installations in Aircraft and Airport Systems

**Engineering projects in air conditioning and refrigeration**

**Learning time:** 30h 30m  
- Theory classes: 6h  
- Laboratory classes: 6h  
- Guided activities: 1h 30m  
- Self study: 17h

**Description:**
- Architecture of air conditioning and refrigeration systems in airports and airplanes.  
- Design, layout and interpretation of diagrams and schemes of air conditioning and refrigeration. Symbology.  
- Legislation and regulations.

**Qualification system**

Defined in the infoweb of the subject

**Regulations for carrying out activities**

All proposed activities are mandatory.

**Bibliography**

**Basic:**

**Others resources:**
- Room computers  
- SolidWorks Program