Syllabus

Course title
Building HVAC Systems

Course code
45528

Scientific sector
ING-IND/11
Building Physics and Building Energy Systems

Degree
Master Energy Engineering

Semester
2nd

Year
1

Academic year
2023/24

Credits
9

Modular
no

Total lecturing hours
70+20

Total lab hours

Total exercise hours

Attendance
Strongly recommended

Prerequisites
Students attending this course should have already passed the exam of "Applied Energetics" (1st semester).
It is extremely important that the attendance to this course takes place in parallel with the course "Advanced Applications of Building Physics"

Course page
https://www.unibz.it/en/faculties/engineering/master-energy-engineering/course-offering/

Specific educational objectives
This course consists of 70 hr of frontal lectures and 20 hr of practical design applications. The first part of the course will deal with the determination of heating and loads and occupants’ comfort to properly size the HVAC systems of a building. Then the preparation of the energy balance of a building according to the technical standards will be dealt with. Finally, the various type of HVAC systems (all water, mixed air-water and all air) will be presented and in the final part the fundamentals of HVAC design will be outlined. In parallel with the course lectures, the student will be required to prepare design work about a simple HVAC system (e.g. heating system for a residential building).

Lecturer
Prof. Alessandro Prada

Scientific sector of the lecturer
ING-IND/11

Teaching language
English

Office hours
Tuesday 16:30 – 18:00 - Check online updates

Teaching assistant (if any)

Office hours
### List of topics covered

The course will cover the following topics:

**Heating design load calculation**
- Heating load calculations, natural and mechanical ventilation, user profiles and operation schedules, occupant comfort and health.

**Energy Balance of a Building**
- Preparation of the energy balance of a building, heat losses due to transmission and ventilation, effects of solar radiation, heat gains, HVAC systems efficiency, basics of energy performance evaluation and certification.

**HVAC Systems**
- Design of heating, cooling, ventilating and air conditioning systems: hydronics, all air and mixed air/water systems. Distribution network (piping and air ducts) terminal units. Heat recovery equipment

### Teaching format

Class lectures (blackboard and/or slides) and design exercises using spreadsheets. Some of the lecture material (slides) will be available for download by the students.

### Learning outcomes

**Knowledge and understanding:**
By the end of the course, students should be able to:
1. master the most important concepts about heating and cooling loads of a building and its energy performance.
2. have a clear understanding of the operation of HVAC systems.

**Applying Knowledge and understanding:**
Apply the above concepts to the design of HVAC systems.

**Making judgments:**
Evaluate the heating and cooling load of a building, evaluate the performance of an HVAC system and the energy use of a building.

**Communication skills:**
Being able to express engineering concepts also with the aid of technical drawings and technical reports.
<table>
<thead>
<tr>
<th>Learning skills</th>
<th>Being able to self-train and stay up to date with the evolution of the technical standards and with the market innovations.</th>
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</thead>
<tbody>
<tr>
<td>Assessment</td>
<td>Project of a simple HVAC System followed by oral discussion</td>
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<td>Assessment language</td>
<td>English</td>
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<tr>
<td>Evaluation criteria and criteria for awarding marks</td>
<td>Coursework will be weighted as follows: final oral examination (50%), student project work about a HVAC system. (50%). In order to take the oral examination, the project work must be completed.</td>
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**Required readings**
- EN ISO 12831 and other relevant EN ISO standards (especially the EN ISO 52000 family)
- notes taken during the lessons

**Supplementary readings**