Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

Syllabus
Course description

Course title	HVAC Systems
Course code	45528
Scientific sector	ING-IND/11 (09/C2)
Degree	Master Energy Engineering
Semester	2nd
Year	1
Academic year	2020/21
Credits	9
Modular	no

Total lecturing hours	90
Total lab hours	
Total exercise hours	
Attendance	Strongyl reccomended
Prerequisites	Students attending this course should have already passed the exam of "Engineering Thermodynamics, Heat and Mass Transfer" (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/sciencetechnology/master-energy-engineering/

Specific educational objectives	This course consists of 55 hr of frontal lectures and 25 hr of practical design applications. The first part of the course will deal with the determination of heating and loads and occupants comfort in order 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. Paolo Baggio Dr. Prada Alessandro
Scientific sector of the lecturer	ING-IND/11 (09/C2)
Teaching language	English
Office hours	Tuesday 18:30 – 20:00 - 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 • Equipment for heating and cooling: boilers, unitary air conditioners, water chillers storage tanks, circulation pumps. Renewable energy equipment: thermal solar panels and heat pumps. Equipment operating curves and partial load operation. Safety devices and introduction to safety standards.
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 wnwegy 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 nergy use of a building. **Communication skills:** Being able to express engineering concepts also with the aid of technical drawings and technical reports.

	Learning skills Being able to self-train and stay up to date with the evolution of the technical standards and with the market innovations
Assessment	Project of a simple Hvac System followed by oral discussion
Assessment language	English
Evaluation criteria and criteria for awarding marks	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.

Required readings	• (UNI) EN ISO 12831 and other relevant (UNI) EN ISO standards (in particular of the (UNI) EN ISO 52000 family) • notes taken during the lessons
Supplementary readings	• W. T. Grondzik, Air-Conditioning System design Manual, ASHRAE/Butterworth, 2007 • ASHRAE, HANDBOOK - Vol. 1-4 ed. ASHRAE 2015-2018 (or later). • T. E. Mull, HVAC Principles and Application Manual, McGraw-Hill, 1997