

Syllabus

Descrizione corso

Titolo insegnamento	Advanced Applications of Building Physics
Codice insegnamento	45506
Titolo aggiuntivo	
Settore Scientifico-	ING-IND/11
Disciplinare	
Lingua	Inglese
Corso di Studio	Corso di laurea magistrale in Ingegneria energetica
Altri Corsi di Studio (mutuati)	
Docenti	prof. Andrea Gasparella, andrea.gasparella@unibz.it https://www.unibz.it/en/faculties/engineering/academic- staff/person/30619
Assistente	
Semestre	Secondo semestre
Anno/i di corso	1
CFU	9
Ore didattica frontale	56
Ore di laboratorio	30
Ore di studio individuale	139
Ore di ricevimento previste	
Sintesi contenuti	Learning objective of the course:
	 mastering the most important concepts about heat and mass transfer through the building envelope and the corresponding equations mastering the most important concepts about environmental comfort and indoor air quality and their quantitative expressions applying these concepts to the calculation and simulation of components and buildings applying numerical and analytical approaches to the design of



	building envelope structures
	4. understanding and using building simulation
Argomenti	Psychrometrics:
dell'insegnamento	Fundamentals of thermodynamics of moist air. Relevant quantities and processes. Psychrometric diagrams.
	Modeling:
	Introduction to modelling. Finite difference approaches and characterization.
	Building Energy Balance:
	Steady state and dynamic calculations of the heating and cooling peak load and energy need profiles of a building.
	Air node heat balance. Surface balance and terms: conduction,
	convection, radiation (long and short wave), gains, infiltration and ventilation. Unsteady state conduction. Numerical solution. Dynamic transfer properties. Long wave radiation. Radiosity
	network. Radiant gains. Solar radiation. Radiosity network. Solar gains.
	Moisture migration:
	Heat and mass transfer through building structures, interstitial and surface condensation. Moisture verifications and appropriate desig practices.
	Environmental quality:
	Energy balance of human body, sensible and latent heat
	exchanges with the environment, thermal comfort, relevant factors
	affecting comfort in winter and summer, evaluation indices,
	effective temperature. Indoor air quality and evaluation indexes. Measurement and instruments.
	Measurement and instruments.
	European and international standards:
	Contents and application of the European and international standards about the calculation of energy use for space heating
Parole chiave	and cooling and the energy performance of buildings. Building Physics; Building Energy Balance; Indoor Environmental
r arvie critave	Quality; Thermal Comfort; Indoor Air Quality
Prerequisiti	

Insegnamenti propedeutici	
Modalità di insegnamento	Lectures (blackboard and/or slides) and spreadsheet
Modalità di l'isegnamento	implementation.
Obbligo di frequenza	Not mandatory.
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•	(1) Knowledge and understanding:
risultati di apprendimento	- Building energy balance terms
attesi	- Building envelope behavior (heat and mass transfer)
	- Occupants' thermal comfort
	- Indoor air quality
	(2) Applying Knowledge and understanding:
	- Solving the main energy balance calculation aspects and using
	simulation
	- Calculating heat and mass transfer in building components
	- Assessing thermal comfort
	- Sizing ventilation systems
	(3) Making judgments:
	- Comparing different building envelope configuration and
	contrasting their performance
	- Optimizing the envelope design as for heat and mass transfer
	- Assessing thermal comfort and making decisions about
	improvement strategies
	- Assessing and improving indoor air quality
	(4) Communication skills:
	- Using the appropriate technical vocabulary related to the topic
	- Preparing a report representing and summarizing complex
	results and providing appropriate interpretation
	(5) Learning skills
	- Decomposing a complex problem into sub-problems, finding
	the analytical expression and the numerical solution
	- Comparing different methods and sources
	- Consulting technical standards and keeping up to date with
	regulation.
Obiettivi formativi specifici e	
risultati di apprendimento	
attesi (ulteriori info.)	



Modalità di esame	Case study project (report discussion) and oral exam on the different topics of the course. - Formative assessment: Development of the case-study project during the course; ILOs assessed: (2), (3), (5); - Summative assessment: 50% project work presentation: 20 min x 3 times; ILOs assessed: (2), (3), (4); 50% oral examination including discussion of the report: about 1 hour; ILOs assessed: all except (5).
Criteri di valutazione	Marks are attributed according to the following assessment aspects: - Synthesis ability to explain the fundamental aspects of the problem (0= nothing, 1= insufficient; 2=sufficient; 3 = full) - Analysis ability to describe details and specific formulas/models (0= nothing, 1= insufficient; 2=sufficient; 3 = full) - Application ability to implement the principles and formulas and to solve practical cases (0= nothing, 1= insufficient; 2=sufficient; 3 = full) - Reporting ability to represent and summarize the main results and to provide an appropriate interpretation.
Bibliografia obbligatoria	Teaching material, handouts, booklets from the reserve collection
Bibliografia facoltativa	 H. Hens, 2012, Building Physics: Heat, Air and Moisture, Fundamentals and Engineering Methods with Examples and Exercises, Second Edition Carl-Eric Hagentoft, 2001, Introduction to Building Physics, Professional Pub Service ASHRAE, HANDBOOKS - Vol. 1-4 ed. ASHRAE 2009-2012. (UNI) EN ISO 52016-1, 13791 and other relevant UNI EN ISO standards.
Altre informazioni	Connections with other courses. The course "Advanced Applications of Building Physics" introduces several building physics topics necessary for a more comprehensive and effective understanding of other courses related to building energy efficiency (i.e., "Building HVAC Systems" and "Special Issues of Building Physics").

	Professional applications of the covered topics:
	The topics presented in this course can be applied in all those
	professional activities involving the design and the re-design of the
	building system, such as those performed in building engineering
	offices and companies, as well as for the assessment of energy
	performance and indoor environmental quality of the built
	environment.
Obiettivi di Sviluppo	Buona salute, Lotta contro il cambiamento climatico, Città e
Sostenibile (SDGs)	comunità sostenibili, Energia rinnovabile e accessibile