Syllabus

Descrizione corso

Titolo insegnamento	Elements of modelling for Applied Physics and Engineering Systems
Codice insegnamento	46013
Titolo aggiuntivo	
Settore Scientifico-Disciplinare	IIND-07/B
Lingua	Inglese
Corso di Studio	Corso di Dottorato di ricerca in Sustainable Energy and Technologies (Energie e Tecnologie sostenibili)
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	3
Ore didattica frontale	20
Ore di laboratorio	0
Ore di studio individuale	75
Ore di ricevimento previste	
Sintesi contenuti	1. mastering the most important concepts about modelling physical systems 2. developing simulation models based on the mathematical description of physical systems 3. applying the concepts to case studies 4. understanding potential and limitations of simulation for

	applications
Argomenti dell'insegnamento	List of topics covered Modeling and simulating: Calculation vs. simulation. Model accuracy. Model validation. Model definition: Definition of model for physical systems. Analytical vs numerical solutions. Model refinement and extension. Finite difference approaches: Solution of partial derivatives differential equations with finite difference approaches. Consistency, stability and convergence. First order schemes (forward, backward). Second order schemes (central, Crank-Nicolson) Applications: Development of case studies. Examples from thermal and thermodynamic systems. Modelling of systems and solutions of control problems.
Parole chiave	
Prerequisiti	
Insegnamenti propedeutici	
Modalità di insegnamento	Lectures (blackboard and/or slides) and spreadsheet implementation.
Obbligo di frequenza	Not compulsory
Obiettivi formativi specifici e risultati di apprendimento attesi	(1) Knowledge and understanding: - Modelling and simulation vs calculations - Derivation of models for physical systems - Numerical solutions of differential equations (2) Applying Knowledge and understanding: - Defining models for case studies - Applying simulations to understand system behavior - Calculating multiple performance aspects (3) Making judgments: - Comparing different modelling approaches - Deciding the degree of accuracy required for the specific application - Optimizing the design or behavior of a system using modelling

	approaches (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
Obiettivi formativi specifici e risultati di apprendimento attesi (ulteriori info.)	
Modalità di esame	
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	- Carl-Eric Hagentoft, 2001, Introduction to Building Physics, Professional Pub Service
Altre informazioni	
Obiettivi di Sviluppo Sostenibile (SDGs)	Istruzione di qualità, Lotta contro il cambiamento climatico, Utilizzo responsabile delle risorse, Energia rinnovabile e accessibile