UNIVERSITÀ DI PAVIA

Anno Accademico 2020/2021

TECHNICAL PHYSICS

Enrollment year	2019/2020
Academic year	2020/2021
Regulations	DM270
Academic discipline	ING-IND/10 (TECHNICAL PHYSICS)
Department	DEPARTMENT OF ELECTRICAL,COMPUTER AND BIOMEDICAL ENGINEERING
Course	INDUSTRIAL ENGINEERING
Curriculum	PERCORSO COMUNE
Year of study	2°
Period	2nd semester (08/03/2021 - 14/06/2021)
ECTS	9
Lesson hours	90 lesson hours
Language	Italian
Activity type	WRITTEN AND ORAL TEST
Teacher	MAGRINI ANNA (titolare) - 3 ECTS MAGRINI ANNA (titolare) - 6 ECTS
Prerequisites	Mathematics and physics
Learning outcomes	The course aims to introduce the cultural basis necessary to understand the fundamental principles of thermodynamics and the energy analysis of systems and the basics of heat transfer by conduction, convection and radiation to apply them through exercises in plant components and energy systems. In particular, it is investigated the application of the fundamental equations mass conservation and energy balance in the field of thermodynamics with reference also to examples and applications relating to HVAC systems. At the end of the course the student will be able to set up the analysis of heat transfer, thermal systems and will acquire a set of concepts that allow application to practical problems of heat transfer and heat loss of real systems.

Course contents

Thermodynamics
Principles of thermodynamics: general definitions. Reversibility and irreversibility. Work and heat. The principle for closed and open systems, internal energy and enthalpy. II Principle: definitions, entropy. Performance of thermal machines. Carnot cycle. COP of inverse cycle. Thermodynamic diagrams. Ideal gases and their major transformations. Cycles with ideal gas: cycles Otto, Joule and Diesel. Efficiency. Direct and inverse cycles (fluids with liquid-vapor phase transition), heat pump systems.

Heat transfer
Mechanisms of heat transfer. Heat conduction in solids: fundamental law of conduction and its application to flat and cylindrical surfaces in stady-state conditions, thermal insulation and critical thickness of insulation, electrical analogy. Heat transfer in natural and forced convection, finned surfaces. Heat transfer by radiation: definitions, basic laws, black body, gray bodies, electrical analogy. Overall heat transfer coefficient. Heat exchangers and their sizing. Heat transfer in dynamic conditions: calculation methods

Thermodynamics of moist air
Definition of significant parameters: relative and absolute humidity, enthalpy. Mollier diagram for moist air. Transformations on the diagram. Applications and calculations relating to HVAC systems: fundamental thermodynamic processes, mass and energy balances, sensible and latent heat loads, the main systems' configurations. Measuring instruments. The behavior of materials against moisture. Surface and interstitial condensation. Application examples.

Teaching methods

Lectures (hours/year in lecture theatre): 68
Practical class (hours/year in lecture theatre): 0
Practicals / Workshops (hours/year in lecture theatre): 0

Reccomended or required readings

Moran M., Shapiro H.N., Munson B.R., DeWitt D.P., Elementi di Fisica tecnica per l’ingegneria, McGraw Hill Editore . A.Magrini, L.Magnani. Fisica Tecnica, Volume I - Esempi di calcolo di termodinamica e trasmissione del calore. Città Studi Edizioni. ---------- A.Magrini, L.Magnani. Fisica Tecnica, Volume II - Esempi di calcolo di psicrometria, acustica e illuminotecnica. . Città Studi Edizioni, 2009.---------- Y.A. Cengel. Termodinamica e Trasmissione del Calore. McGraw Hill 3a Ed. 2009.---------- F. Kreith. Principi di trasmissione del calore. Liguori Ed..----------

Assessment methods

The final verification is represented by a written test (usually in computer room) and an oral exam (the day after the written test) in the dates fixed in the calendar. Documents, videolessons and exames with solution are available on Kiro web page. The access to the news is indicated in the teacher's web page.

Further information

The course provides the basic skills for understanding and solving problems to reach the targets indicated by the 2030 Agenda on Sustainable Development.
In particular, theoretical contents and practical applications address topics related to Goal 7 (Clean and accessible energy), Goal 11 (sustainable cities and communities), Goal 12 (responsible consumption and production), Goal 13 (fight against climate change)

	$lbl_legenda_sviluppo_sostenibile