Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

Syllabus
Course description

Course title	Engineering Thermodynamics and Heat Transfer for Mechatronics
Course code	42186
Scientific sector	ING-IND/11
Degree	Ingegneria Industriale Meccanica
Semester	2
Year	2
Academic Year	2021-22
Credits	6
Modular	no

Total lecturing hours	36
Total lab hours	0
Total exercise hours	24
Attendance	Not mandatory
Prerequisites	
Course page	

Specific educational objectives	During the course, the issues related to heat transfer will be presented and analyzed and in particular: Analytical models of heat transmission in its forms like: ✓ first law of thermodynamics ✓ mechanisms of heat transfer ✓ conduction ✓ convection ✓ irradiance ✓ Initial and boundary conditions ✓ steady state heat transfer ✓ heat exchangers ✓ second law of thermodynamics ✓ acoustics: principles and applications

Lecturer	Dr. Marco Caniato
Scientific sector of the lecturer	ING-IND/11
Teaching language	English
Office hours	Appointment by email
Teaching assistant (if any)	
Office hours	18
List of topics covered	FUNDAMENTALS OF THERMODYNAMICS Units of measure and fundamentals of Thermometry. First Law of Thermodynamics Application Areas of Heat Transfer Modeling in Heat Transfer Specific Heats of Gases, Liquids, and Solids 7 Energy Transfer

	HEAT TRANSFER Heat transfer mechanisms. Thermal heat conduction in monodimensional systems in steady state. Thermal Conductivity Thermal Diffusivity Thermal heat convection and dimensional analysis. Boundary and Initial Conditions Thermal Contact Resistance Global heat transfer and heat exchangers. Thermal radiation. Numerical models for heat transfer Second law of thermodynamics Wave propagations in solids and fluids Psychoacoustics Sound pressure level and Sound Power level Sound Intensity Sound absorption and sound Insulation The measures in acoustics
Teaching format	Class lectures (Videos and slides) exercises using spreadsheets and numerical simulations Lecture material (slides and videos) will be available for download by the students.

Learning outcomes (ILOs)	The learning outcomes need to refer to the Dublin Descriptors: (1) Knowledge and understanding - energy balance terms - heat transfer mechanism influences and different efforts on dissipations - heat transfer behaviors - heat exchangers functions and design - Acoustics and sound wave propagation (2) Applying knowledge and understanding - the ability to solve the main heat transfer models applied to the different heat transfer behaviors - the ability to apply basic heat transfer mechanism to the design of simple heat exchangers - The ability to apply and solve simple problems in acoustics (3) Making judgements The student will be able to understand and compare and then choose the appropriate heat transfer behaviour in relation to a simple final application and sizing also using numerical simulations (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) Ability to learn - Lifelong learning capability through the acquisition of critical tools and critical evaluation of product and systems specifications - finding the analytical expression and the correct numerical solution, comparing different methodologies and sources

Assessment

Formative assessment

Form	Length /duration	ILOs assessed
Development of the assigned design work	During the course	(2), (3), (5)

Summative assessment

Form	%	Length /duration	ILOs assessed
In class (or office hours) exercises and discussion	100	20 hours (average for 30 minutes per exercise or oral discussion)	(1) (2), (3), (4), (5)

Assessment language	English
Evaluation criteria and criteria for awarding marks	To the admission to the second part, the first one has to be successfully passed. The first part (numerical exercise) consists of numerical questions. The answer is correct when the result provided falls within a given tolerance with respect to the reference value. The evaluation is based on the accuracy of the numerical result of each question. The minimum mark is 12 out of 30 suitable to pass to the second part. The score of this part contributes for 1/2 to the final mark. In the second part, each question concerns a different section of the program. They equally contributes to the final mark. The evaluation is based on the completeness of the answer in terms of 1) definition of the subject 2) analytical description 3) graphical and mathematical representations 4) proof (if required)

	The score of this second part contributes for 1/2 of the final mark.

Required readings	Teaching material, handouts, videos provided by the teacher
Supplementary readings	Yunus A. Cengel, Heat Transfer: A Practical Approach, McGraw-Hill Education, 2002 T.L. Bergman, A.S. Lavine, Fundamentals of heat and mass transfer, Whiley and Sons F. Alton Everest, K.C. Pohlmann – Master Handobook of acoustics, Sixth Edition, 2014, Mc. Graw - Hill