Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

Syllabus
Course description

Course title	Fundamentals of thermo-fluid-dynamics
Course code	47508
Scientific sector	ING-IND/10
Degree	**Master in Industrial Mechanical Engineering**
Semester	I
Year	II
Academic year	2018/19
Credits	5
Modular	No

Total lecturing hours	28
Total lab hours	
Total exercise hours	18
Attendance	
Prerequisites	
Course page	

Specific educational objectives	*The course specifically deals with the fundamental concepts of thermal-fluid systems, integrates and complements topics of thermodynamics, heat transfer and fluid mechanics introduced in previous elective courses and supplies some tools useful for the numerical simulation of thermal-fluid systems.* *The course consists of one module of 28 hours of frontal lectures and 18 hours of exercises.* *The lectures introduce the fundamentals of thermal-fluid-dynamic, by presenting and discussing the governing equations of fluid flow motion and heat transfer. Proper terms and definitions will be introduced, as well as the appropriate conservation principles needed to analyze a complete fluid-flow system.* *Particular emphasis will be given to the study of practical applications in industrial engineering, such as heat exchangers and cooling fins. Combustion principles and flame dynamics will be also discussed.* *During the course, both a bottom-up approach (starting from fundamental equations) and a top-down approach (starting from the system level) will be used.* *The concepts of computational fluid dynamic (CFD) will be presented by means of the application of numerical techniques to the solution of some practical fluid flow and heat transfer problems. A commercial CFD software will be presented and applied to illustrative fluid flow and heat*

	transfer problems. *Exercises proposed during the course consist in solving practical design problems with the aim of giving the students a deeper comprehension and understanding of the topics.*

Lecturer	Dr. Francesco Patuzzi francesco.patuzzi@unibz.it
Scientific sector of the lecturer	ING-IND/10
Teaching language	English
Office hours	By appointment
Teaching assistant *(if any)*	-
Office hours	-
List of topics covered	The course will cover the following topics: • Fundamental equations of fluid mechanics in differential and integral form and common approximations • Review on turbulence models • Review on modes of heat transfer • Computational fluid dynamics and application to practical examples. • Heat exchangers: types, design principles, performance evaluation, numerical simulation • Cooling fins: fins performance parameters, parametric design, numerical simulation, effects of flow conditions • Combustion principles and introduction to flame dynamics
Teaching format	*The course consists of lectures in which the topics are presented by the professor. There are also classes (exercises) that will give practical examples of the application of the theoretical topics and the utilization of commercial software for computational fluid dynamic. Course topics will be presented at the blackboard and using electronic slides. Teaching material and additional materials will be provided by the Professor during the semester.*

Learning outcomes	Through the study and the application of the topics presented during the lessons, students should acquire: 1) the knowledge and understanding of the fundamentals of thermo-fluid-dynamic 2) the ability of applying knowledge and understanding of the theoretical principles to the analysis of thermal-fluid systems

	3) the ability to make autonomous judgements in the assessment of numerical solution of thermal-fluid systems 4) communication skills to correctly and properly present the concepts acquired in the course and to solve simple application problems regarding thermal-fluid systems 5) lifelong learning skills through the possession of the tools for the acquisition of technical information on the thermal-fluid systems and to update knowledge.
Assessment	**Formative assessment** *In class and laboratory exercises and activities (2,3,4,5)* **Summative assessment** *Examination of the course is carried out by means of an oral exam. The oral examination includes questions to assess the knowledge and understanding of the course topics and questions designed to assess the ability to transfer these skills to case studies and practical applications (1,2,3,4)* *Questions on practical applications also assess the ability of the student to apply the knowledge and understanding of the course topics, the ability to make judgments and finally, the student communication skills (1-5).*
Assessment language	English
Evaluation criteria and criteria for awarding marks	It is relevant for the assessment of the oral exam to: master the specific language (also with respect to teaching language); prove the understanding of the topics and learning skills; evaluate and establish relationships between topics; grow specific skills in critical thinking. Regarding the practical applications, it is relevant to clearly describe suitable technical solutions and be able to make critical judgments and apply the theoretical concepts.

Required readings	*Didactic materials will be provided by the professor during the course.* *There is no single textbook that covers the entire course. The course material is collected from various sources that will be announced during the course.* *Some relevant sources are:* - *M. Moran, H. Shapiro, B. Munson, D. DeWitt, Introduction to Thermal Systems Engineering: Thermodynamics, Fluid Mechanics, and Heat Transfer, Wiley* - *F. Incropera, D. DeWitt, Fundamentals of Heat*

	and Mass Transfer, Wiley - *G.F.C. Rogers, Yon Mayhew. Engineering Thermodynamics: Work and Heat Transfer, Pearson Education* *A selection of the material presented in class and useful material will be available in the course reserve collection database*
Supplementary readings	-