Curricular Unit Form (FUC)

Course:	**FIRST CYCLE IN MECHANICAL ENGINEERING**					
Curricular Unit (UC)	**Heat Transfer**				Mandatory	**X**
					Optional	
Scientific Area:	**Energy and Control Systems**					
Year: **3º**	Semester: **1º**	ECTS:**5,5**		Total Hours: **4,5**		
Contact Hours:	T:	TP:**67,5**	PL:	S:	OT:	TT:
Professor in charge		Academic Degree /Title		Position		
Nuno Ricardo Serra		**PhD**		**Adjunct professor**		

T- Theoretical ; TP – Theory and practice ; PL – Laboratory ; S – Seminar ; OT –Tutorial ; TT – Total of contact hours

Entry into Force	Semester: **Summer**	Academic Year: **2019/2020**

Objectives of the curricular unit and competences (max. 1000 characters)

The main objective of this course is to introduce the fundamental notions of heat transfer by addressing the different mechanisms associated with this phenomenon, conduction, convection and radiation, and their most common applications in the field of mechanical engineering.

Students should be able to evaluate and quantify the various forms of heat transfer present in the processes associated with mechanical engineering, as well as establish the fundamental equations and boundary conditions that characterize these processes, using practical examples of engineering.

Syllabus (max. 1000 characters)

Introduction

Heat transfer mechanisms: conduction, convection and radiation.

Conduction

One-dimensional steady conduction. Fourier's law. Transient heat conduction: Lumped Systems Analysis; large surface walls, infinite cylinders and spheres; approximate solution by the first term of the infinite series.

Convection

Coefficient of convection. Forced convection: Turbulent flow in flat plates and inside pipes. Natural convection: mechanism of natural convection; Grashof number; natural convection on surfaces; Natural convection inside shells; Heat loss through double glazed windows. Natural convection combined with forced convection.

Radiation

Radiation. Absorption, reflection and transmission. Stefan-Boltzman Law. Emissivity and absorptivity of a real surface. Gray bodies. Kirchoff Laws. Black body surrounded by black surfaces. Gray body surrounded by black surfaces. Shape factors and areas of exchange. Solar radiation; Terrestrial

atmosphere effect. Atmospheric emission.

Demonstration of the syllabus coherence with curricular unit's objectives (max. 1000 characters)

The syllabus of the course aims to provide students with knowledge regarding the various mechanisms of heat transfer; conduction, convection and radiation, in order to enable them to understand and solve the specific cases related to mechanical engineering in various areas such as: industrial production and maintenance; automobile production and maintenance; aeronautical maintenance; production, design, installation and maintenance of air conditioning systems.

Teaching methodologies (including evaluation) (max. 1000 characters)

Teaching Methodology

Starting with a theoretical approach, involving basic knowledge of general physics, thermodynamics and fluid mechanics, it evolves to a complementary theoretical-practical approach, including the description of case studies and the solving of exercises on them.

Assessment:

The knowledge assessment consists of a compulsory written component (exam) and a practical component (computational practical work). The computational component has no minimum grade or mandatory character. It is carried out in groups of 4 students and the report of the computational work must be delivered up to 1 week before the date of the normal exam of the curricular unit. The omission of report delivery by this date is equivalent to zero for this component.
In a special season, the only exam is a written exam.

Final Exam (80%) + Practical Work (20%).

Demonstration of the teaching methodologies coherence with the curricular unit's objectives
(max. 3000 characters)

The teaching methodologies adopted allow the theoretical knowledge on how heat transfer is processed, relating in each case this theory to the most common concrete phenomena in nature and mechanical systems, solving at each point of exposure of matter, concrete problems of heat transfer, thus allowing the understanding of the objectives of the curricular unit and the ability to solve practical cases.

Main Bibliography (max. 1000 characters)

- HOLMAN, J. P., "Transferência de Calor"
- ÇENGEL, Y. A.," Heat Transfer"
- INCROPERA, F., DEWITT, DAVID P., "Fundamentos da Transferência de Calor e Massa"
- KREITH, F.*." Princípios de Transmissão de Calor".*
- ÖZISIK, M.. *Transferência de Calor.*
- Macadams , "Heat Transmission", Editora MacGraw-Hill
- AAVV. *Problem Solvers Heat Transfer*. Research & Education Association.