



## Teaching Guide

Identifying Data					2020/21
Subject (*)	Heat transfer	Code	730G05022		
Study programme	Grao en Enxeñaría Naval e Oceánica				
Descriptors					
Cycle	Period	Year	Type	Credits	
Graduate	1st four-month period	Third	Obligatory	4.5	
Language	Spanish				
Teaching method	Hybrid				
Prerequisites					
Department	Ciencias da Navegación e Enxeñaría MariñaEnxeñaría Naval e Industrial				
Coordinador	Lamas Galdo, Isabel	E-mail	isabel.lamas.galdo@udc.es		
Lecturers	Lamas Galdo, Isabel	E-mail	isabel.lamas.galdo@udc.es		
Web					
General description	Heat transfer modes: conduction, convection and radiation. Practical applications.				
Contingency plan	<p>1. Modifications to the contents No modifications.</p> <p>2. Methodologies *Teaching methodologies that are maintained No modifications.  *Teaching methodologies that are modified No modifications.</p> <p>3. Mechanisms for personalized attention to students E-mail, moodle and teams. These will be consulted every day.</p> <p>4. Modifications in the evaluation No modifications.  *Evaluation observations: The exams will take place online.</p> <p>5. Modifications to the bibliography or webgraphy No modifications.</p>				

## Study programme competences / results

Code	Study programme competences / results
A14	Knowledge of the applied thermodynamics and of the transmission of the heat.
B2	That the students know how to apply its knowledge to its work or vocation in a professional way and possess the competences that tend to prove itself by the elaboration and defense of arguments and the resolution of problems in its area of study
B3	That the students have the ability to bring together and to interpret relevant data (normally in its area of study) to emit judgments that include a reflection on relevant subjects of social, scientific or ethical kind
B4	That the students can transmit information, ideas, problems and solutions to a public as much specialized as not specialized
B5	That the students developed those skills of learning necessary to start subsequent studies with a high degree of autonomy
B6	Be able to carrying out a critical analysis, evaluation and synthesis of new and complex ideas.



C1	Using the basic tools of the technologies of the information and the communications (TIC) necessary for the exercise of its profession and for the learning throughout its life.
C4	Recognizing critically the knowledge, the technology and the available information to solve the problems that they must face.

Learning outcomes			
Learning outcomes		Study programme competences / results	
Know the basic concepts of heat transfer. Know the basics of the processes of conduction and convection of heat as a transport mechanism. Know the basic concepts of heat transfer of external and internal flow of fluids for its application on fluid mechanics processes. Know the operation of heat exchange equipment for industrial use to develop projects of some simple equipment.	A14	B2	C1
		B3	C4
		B4	
		B5	
		B6	

Contents	
Topic	Sub-topic
The following topics develop the contents indicated in the Verification Memory (Memoria de Verificación), which are:	Conduction Convection Heat exchangers
1. Introduction	Introduction Heat transfer modes Conservation of energy
2. One-dimensional steady heat conduction	Introduction General heat conduction equation Cartesian coordinates Thermal contact resistance Cylindrical coordinates Spherical coordinates Fins
3. Numerical methods	Introduction Solution of the governing equations
4. Transient heat conduction	Lumped system analysis Semi-infinite solids Other cases
5. External forced convection	Introduction Flow across flat plates Flow across cylinders Flow across spheres Flow across tube banks Other cases
6. Internal forced convection	The entrance region Laminar flow Turbulent flow Non-circular tubes Distribution of temperature



7. Free convection	Introduction Vertical plates Inclined and horizontal plates Cylinders Spheres
8. Boiling and condensation	Boiling Condensation
9. Heat exchangers	Introduction DTML method Epsilon-NUT method
10. Radiation heat transfer	Fundamentals Radiation heat transfer

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student's personal work hours	Total hours
Guest lecture / keynote speech	A14 B2 B3 B4 B5 B6 C1 C4	30	30	60
Mixed objective/subjective test	A14 B2 B3 B4 B5 B6 C4 C1	9.5	0	9.5
Problem solving	A14 B2 B3 B4 B5 B6 C1 C4	21	21	42
Personalized attention		1	0	1

(\*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	
Methodologies	Description
Guest lecture / keynote speech	Classes
Mixed objective/subjective test	Exam/s
Problem solving	Students must deliver exercises

Personalized attention	
Methodologies	Description
Guest lecture / keynote speech	Attention will be provided by personalized attention, e-mail and Teams.
Problem solving	Academic dispense is allowed. Students who request it must contact teacher to realize additional homework.
Mixed objective/subjective test	

Assessment			
Methodologies	Competencies / Results	Description	Qualification
Problem solving	A14 B2 B3 B4 B5 B6 C1 C4	Students must deliver exercises	30



Mixed objective/subjective test	A14 B2 B3 B4 B5 B6 C4 C1	Exam/s	70
Others			

### Assessment comments

#### Students

who request academic dispense must realize other activities proposed by the teacher. The qualification is the same as problem solving.

The

evaluation criteria of the 2nd opportunity are the same as those of the 1st opportunity except that, in case of partial exams, the mark obtained in these will not be taken into account in the 2nd opportunity.

In order to pass it will be necessary to obtain at least 4 in the final exam and 5 in the global score.

### Sources of information

#### Basic

- Incropera, F. P.; DeWitt, D. P., (). Fundamentos de Transferencia de Calor y Materia. Pearson Educación
  - Cengel, Y.A. (). Heat Transfer. A Practical Approach. McGraw-Hill
  - Sáiz Jabardo, J.M., Arce Ceinos, A., Lamas Galdo, M.I. (). Transferencia de Calor. Universidade da Coruña
  - Mills, A.F. (). Transferencia de Calor, 1ª Ed. Irwin
  - Holman, H.P. (). Transferencia de Calor. McGraw-Hill
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#### Complementary

### Recommendations

#### Subjects that it is recommended to have taken before

Thermodynamics /730G03014

#### Subjects that are recommended to be taken simultaneously

Fluid Mechanisc /730G03018

#### Subjects that continue the syllabus

Graduation Project/730G03068

#### Other comments



To help achieve a sustained immediate environment and meet the objective of action number 5:

"Healthy and sustainable environmental and social teaching and research" of the "Green Campus Ferrol Action Plan":

The delivery of the documentary works that are made in this matter:

Will be requested in virtual format and / or computer support

It will be done through Moodle, in digital format without the need to print them

If it is necessary to make them on paper:

Plastics will not be used

Double-sided prints will be made.

Recycled paper will be used.

Printing of drafts will be avoided.

A sustainable use of resources and the prevention of negative impacts on the natural environment must be made

The importance of ethical principles related to the values of sustainability in personal and professional behaviors must be taken into account

Gender perspective is incorporated into the teaching of this subject (non-sexist language will be used, bibliography of authors of both sexes will be used, intervention in class of students will be encouraged ...)

Work will be done to identify and modify prejudices and sexist attitudes, and the environment will be influenced to modify them and promote values of respect and equality.

Discrimination situations must be detected and actions and measures will be proposed to correct them.

(\*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.