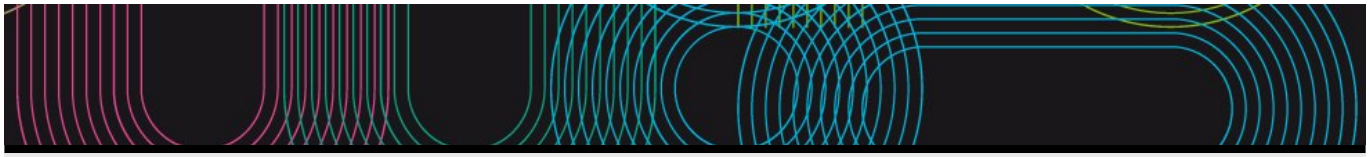

IDENTIFYING DATA				
Professional Software in Acoustics				
Subject	Professional Software in Acoustics			
Code	V05M135V01215			
Study programme	Máster Universitario en Matemática Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	Sobreira Seoane, Manuel Ángel			
Lecturers	García Lomba, Guillermo Recondo Estévez, Sara Sobreira Seoane, Manuel Ángel			
E-mail	msobre@gts.uvigo.es			
Web	http://www.m2i.es/docs/modulos/MESimNumerica/SoftProfenSimulacionNumerica/2.Sofware%20profesional%20en%20acustica.pdf			
General description	(*)Pretendese que o estudante se familiarice cos distintos paquetes de software para a simulación e resolución numérica de problemas acústicos, intentando que se manteña un paralelismo entre este curso e el de modelización acústica.			

Training and Learning Results	
Code	
C4	(*)Ser capaz de seleccionar un conjunto de técnicas numéricas, lenguajes y herramientas informáticas, adecuadas para resolver un modelo matemático.
C5	(*)Ser capaz de validar e interpretar los resultados obtenidos, comparando con visualizaciones, medidas experimentales y/o requisitos funcionales del correspondiente sistema físico/de ingeniería.
C8	(*)Conocer, saber seleccionar y saber manejar las herramientas de software profesional (tanto comercial como libre) más adecuadas para la simulación de procesos en el sector industrial y empresarial.
C9	(*)Saber adaptar, modificar e implementar herramientas de software de simulación numérica.

Expected results from this subject	Training and Learning Results
Basic: CG2: Be able to apply the acquired knowledge and abilities to solve problems in new or unfamiliar environments within broader contexts, including the ability to integrate multidisciplinary R & D in the business environment; CG4: To have the ability to communicate the findings to specialist and non-specialist audiences in a clear and unambiguous way. CG5: To have the appropriate learning skills to enable them to continue studying in a way that will be largely self-directed or autonomous, and also to be able to successfully undertake doctoral studies. Specific: CE4: Being able to select a set of numerical techniques, languages and tools, appropriate to solve a mathematical model. Numerical Simulation specialization: CS2: To adapt, modify and implement software tools for numerical simulation.	C4 C5 C8 C9

Contents
Topic

Subject 1: : numerical Methods in acoustics applied to one-dimensional problems	1.1. Introduction Numpy and Scipy libraries in Python 1.2. Approximation of Helmholtz equation: finite differences, finite elements and spectral methods 1.3. Behavior of the error in problems of propagation of waves: phase shift, error of dispersion and numerical pollution 1.4. Propagation of plane waves in multilayer media: transfer matrix method
Subject 2: Method of finite elements (*FEM) in acoustics	2.1. Introduction to the FEniCS library in Python 2.2. Vibrations in structures: coupling between a comprenssible fluid and a elastic solid. 2.3. Dissipation of noise: coupled problem - comprenssible fluid and porous layer 2.4. Transmission of vibrations: compressible fluids in presence of wall impedance, porous veils and thin plates 2.5. Approximation by means of finite elements of unbounded problems: absorbent conditions and perfectly matched layers (PML)
Subject 3: Applications FEM/BEM to the resolution of acoustic problems.	3.1 Modelling with OpenBEM of cavities and rooms in 2D and 3D. 3.2 Modelling problems of radiation. 3.3 Design of acoustic barriers by means of BEM. 3.4 Modelling acoustic problems with COMSOL Multiphysics.

Planning

	Class hours	Hours outside the classroom	Total hours
Mentored work	24	24	48
Mentored work	0	57	57
Lecturing	15	30	45

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

Methodologies

	Description
Mentored work	Development of basic practical cases, guided by the teacher to learn the fundamentals of the software.
Mentored work	Practical works on the application of the software and numerical methods in acoustic problems.
Lecturing	Brief masterclasses at the beggining of each session, covering the fundamental aspects of the methods and the software to apply in each case.

Personalized assistance

Methodologies	Description
Mentored work	Development of projects under the individual supervision of the teacher.

Assessment

	Description	Qualification	Training and Learning Results
Mentored work	Assesment will be carried out through the resolution of practical works. Up to six practical mentored works will be carried out. Problems related to sound diffraction, radiation (loudspeakers design), resonances in cavities, among others, will be solved using B.E.M and F.E.M. Different software platforms will be used, as COMSOL, OpenBEM, Python and FEniCS.	100	C4 C5 C8 C9

Other comments on the Evaluation

Sources of information

Basic Bibliography

Complementary Bibliography

D.T. Blackstock, **Fundamentals of Physical Acoustics**, John Wiley and Sons, 2000

G.C. Cohen, **Higher-order numerical methods for transient wave equations.**, Springer, 2002

COMSOL Acoustics module. User□s Guide and Model Library.,

F. Ihlenburg, **Finite Element Analysis of Acoustic Scattering.**, Springer, 2013

Peter M. Juhl, **The Boundaty Element Method for Sound Field Calculations**,

Anders Logg, Kent-Andre Mardal, Garth Wells, **Automated Solution of Differential Equations by the Finite Element Method. The FEniCS Book.**, Springer, 2012

Recommendations

Subjects that it is recommended to have taken before

Acoustics/V05M135V01204