2024/2025 – M1 IMDEA Course Plan
Semester 2

Teachning Unit	Lecture	Contents	Hours	ECTS
Acoustics fundamentals	Green's functions	Be able to use Green's functions and Integral formalism to solve simple realistic problems (using Python).	30	3
Acoustic Engineering	CAD modeling	Basic principles and SolidWorks user interface, introduction to sketching, modeling simple parts (prismatic and revolution), use of advanced solid features (rehearsal, shells and ribs, scans, ...), use of drawings, upward assembly.	20	2
	Sound Perception	Auditory system, pitch perception, frequency perception (masking, auditory filters), intensity perception, applications to industrial problems. Sound space perception, Analysis of auditory scenes. Design of listening tests, statistical analysis of experimental results, examples on perceptive evaluation of loudspeakers.	20	2,5
	Vibrations experiments	Free and forced oscillations of a system having a single or two degrees of freedom. Determination of mode parameters of a beam / Chladni's vibrating plates. Forced vibrations of a beam, Free oscillations of a string. Revving of an engine / order analysis, Dynamic balancing.	20	2
Electroacoustics	Electrodynamic motors	Basics of magnetism (Magnetic field, Electromagnetism, Magnetic materials, Ferromagnetic materials). Application of magnetism to loudspeaker motor design (magnetostatics, voice coil design). 2D FEM modelling of motors (with free software FEMM).	24	2,5
	Transmission lines	General concepts on transmission lines. Equations of acoustic transmission lines without and with viscothermal effects. Transfer Matrix and impedance calculation. Effect of higher order modes. Measurement techniques of acoustic wave guides.	20	2
Signal & Instrumentation	Digital electronics	Introduction to digital electronics, digital signal processing, devices, IDE (integrated development environment).	10	1
	Digital filtering	General concepts of digital filters, Z transform, poles ans zeros, stability, frequency response, design of IIR and FIR filters.Virtual instrumentation, Digital filtering, Use of a development starter kit, Real time applications, Implementation on chip (DSP).	26	3
	LP analog electronics	Courses and practical activities (to build and test a circuit, as a low-power audio amplifier, using simulation tool and laboratory instruments).	31	3
	Signal II	Non-stationary data analysis, digital filtering, acoustic imaging.	24	2
Project	Project	During the 1st year of the programme, students must conduct a project dealing with electroacoustics. The aim is to carry out a feasibility study involving modelling using lumped elements, CAD modelling and measurement aspects. The project is supported by « tools for project » : - Introduction to DSP and Akabak - Principles of audio product development - Introduction to Green development - Introduction to scientific expression (writing and presentation / rehearsal) - Introduction to scientific expression (writing with LateX) The project is presented using a report and a final defense during the IMDEA show.	60	7
TOTAL			**285**	**30**