2022/2023 – M1 IMDEA Course Plan
Semester 1

Teachning Unit	Lecture	Contents	Hours	ECTS
Acoustics & mechanics	Acoustics I	Plane wave in rectangular and cylindrical waveguide Reflection, transmission in a waveguide Scattering of plane wave with an interface	60	6
	Room acoustics 1	Physical phenomena involved in the sound propagation in a room. Control of room acoustics by passive (materials). Measurements of room characteristics, simulate the room acoustics	34	3
	Vibrations I	One Degree of Freedom (DOF) System : free and forced vibrations. Two Degree of Freedom (DOF) System : free and forced vibrations with and without damping. N Degree of Freedom System. From discrete to continuous systems, elementary model for the longitudinal vibrations of a bar Transverse vibrations of strings, transverse vibrations of membranes	20	2
Communication	English	The aim of this course if to know and practice technical english for acoustics, mechanics, electronics and electroacoustics.	18	2
Electroacoustics	Loudspeaker system	Model and measure usual loudspeaker systems (sealed enclosure, vented enclosure, electrical filters)	27	3
	Microphone basics	Be able to choose a microphone according to the datasheet. Be able to model (sensitivity) an electrodynamic omnidirectional microphone.	12	1
	Transducers basics	Model an electroacoustic system with an analytical approach and equivalent circuits. Usual characteristics of an electroacoustic chain. Analyze a mechanical system and represent the equivalent electrical diagram. Calculate analytically the response of a mechanical system. Analyze an acoustic system and represent the equivalent electrical diagram. Calculate analytically the response of an acoustic system. Represent the equivalent network to the usual couplings (electromechanical, electroacoustic). Represent the equivalent network to an electrodynamic transducer. Calculate analytically the response (efficiency, sensitivity) of an electrodynamic transducer	32	3
Electronics, Signal processing	Electronics basics	Electronic circuit theory, diodes, impulse response, resonant circuits, active filters, transistor… Practical work on electronic systems	24	2
	Signal 1	4 to 6 projects in Python dedicated to : - Discrete time signals, Fourier transform - Basics on digital filtering, basics on time frequency transform, basics on beamforming	20	2
Methodology	Instrumentation basics	Instrumentation and metrology for acoustics and vibrations Sound pressure measurement Loudspeaker impedance measurement Metrology in acoustics	10	1
	Maths for acoustics I	Projection techniques on orthogonal bases. Advanced matrix operations (Projections, LU, QR, Householder, Decomposition in Singular Values). Practical applications of the Hilbertian theory. Approximation by least mean square polynomial or with exponential. Solving a given physical problem through adapted development (orthogonal polynomials).	30	3
	Python for Audio	This course aims at discovering and practicing Python langage. Some examples about Audio applications are included.	24	2
Total			**311**	**30**