uc3m | Universidad Carlos III de Madrid

SUBJECT: Complements to Telecommunication Engineering		
MASTER DEGREE: Master in Space Engineering	ECTS: 6	

WEEKLY PLANNING

WEEK NUMBER	SESSION NUMBER	SESSION ID	DESCRIPTION	TEACHING (MAR LECTURES	Continuous Assessments	SPECIAL ROOM FOR SESSION (Computer room, audiovisual room)	WEEKLY PROGRAMMING FOR STUDENT DESCRIPTION	CLASS HOURS (1,66 h = 50 min + 50 min)	HOMEWORK HOURS (max. est. 3,25 h)
0	1		**Course Introduction** Contents, teachers, schedule, etc.	X				1,66	3,25
0	2		**Introduction to Telecommunication Engineering** Definition and types of telecommunication systems. Overview of fundamentals of communication systems.	X				1,66	3,25
0	3	S1	**Signals and systems. Time and Frequency domains.** Definition and taxonomy of signals. Examples of signals, and basic operations. Definition of a system. Examples, and properties of systems. Characterization of deterministic signals. Characterization and properties of linear time invariant systems.	x				1,66	3,25
0	4	S2	**Signals and systems. Time and Frequency domains.** Representation of signals by their harmonic components, with some examples. Fourier series to represent periodic signals: definition, properties and examples. Fourier transform to represent aperiodic signals: definition, properties and examples. Definition of the frequency response of a linear time invariant system, and methods to calculate this response.	X	Quiz			1,66	3,25
1	5	S3	**Signals and Systems. Filtering, sampling, and quantification of signals** Definition of filtering and types of filters: shaping filters and frequency selective filters. Sampling of continuous time signals: The Nyquist sampling theorem, and effect of sampling in the frequency domain. Definition and effects of the spectral overlapping. Relationships between frequency responses of the continuous time and the discrete time signals. Reconstruction of sampled signals: interpolation and low pass filtering. Quantification of sampled signals for analog to digital conversion: resolution and quantization error.	x	Quiz			1,66	3,25
1	6	S4	**Signals and Systems (LABORATORY)** Illustration of concepts presented in Sessions S1-S3.		Quiz	X	Preparation of the lab session, reading of the lab script	1,66	3,25
1	7	E1	**The Electromagnetic Model.** Maxwell's Equations. Vector fields and material/media parameters. Electrostatic, magnetostatic, electrodynamics. Power, energy and Poynting vector. Wave equation.	X	Quiz			1,66	3,25
1	8	S5	**Introduction to communication systems. Noisy channel modeling.** Classification of communication systems: analog vs digital communication systems. Analog communication systems: amplitud, phase and frequency modulations. Statistical model of noise in communication systems: additive white and Gaussian noise. Definition of the signal to noise ratio in communication systems.	X	Quiz			1,66	3,25
2	9	S6	**Digital communication systems. Baseband and bandpass modulations.** Baseband modulations: Pulse amplitude modulation: constellations, shaping filters, and bandwidth. Bandpass modulations: phase and frequency shift modulations. Overview of advanced modulation techniques.	x	Quiz			1,66	3,25
2	10	E2	**EM Waves. Free space propagation I.** Propagation fundamentals: Phase velocity, wavelength, TEM wave, Power flow, Perpendicularity of E and H. Polarization.	X	Quiz			1,66	3,25
2	11	E3	**EM Waves. Free space propagation II.** Reflection: reflection coefficient, standing wave. Refraction: Snell's Laws. Diffraction. Scattering.	x	Quiz			1,66	3,25
2	12	S7	**Digital communication systems.** Design of digital receivers in noisy channels, and computation of the probability of error.	x	Quiz			1,66	3,25
3	13	S8	**Digital communication systems I (LABORATORY)** Illustration of concepts presented in Sessions S5-S7	x	Quiz	x	Preparation of the lab session, reading of the lab script	1,66	3,25
3	14	E4	**EM Waves. Free space propagation (LABORATORY)** Illustration of Sessions E2 and E3.	x	Quiz	x	Preparation of the lab session, reading of the lab script	1,66	3,25

3	15	E5	**EM Waves. Waveguide propagation.** Differences with free space propagation. Transmission line theory. Metallic waveguides and transmission lines (coaxial and planar technologies).	x	Quiz			1,66	3,25
3	16	S9	**Digital communication systems II (LABORATORY)** Illustration of concepts presented in Sessions S5-S7		Quiz	x	Preparation of the lab session, reading of the lab script	1,66	3,25
4	17	E6	**Introduction to Radiation Phenomena.** Far field. Fundamental parameters of antennas. Brief description of types of antennas. FRIIS Equation.	x	Quiz			1,66	3,25
4	18	E7	**EM Waves. Waveguide propagation (LABORATORY)** Illustration of Sessions E5 and E6.		Quiz	x	Preparation of the lab session, reading of the lab script	1,66	3,25
4	19	E8	**Transmitters and receivers.** Block diagrams. Types. Brief introduction to its active and passive components: amplifiers, oscillator, directional couplers, resonators, filters. Power waves and scattering matrix.	x	Quiz			1,66	3,25
4			**FESTIVO**					1,66	3,25
5	20	E9	**EM Waves. Transmitters and receivers (LABORATORY)** Illustration of Session E8.		Quiz	x	Preparation of the lab session, reading of the lab script	1,66	3,25
5	21	T1	**Introduction to communications networks and the OSI reference model** Elements of a network. Types of networks. Switched networks. Circuit and packet switch. The need for layers and standards. The OSI reference model.	x	Quiz			1,66	3,25
5	22	T2	**Introduction to Ethernet** Local area networks. The IEEE 802.3 standards. Supported transmission media and speeds. Frame format and addressing.	x	Quiz			1,66	3,25
5	23	T3	**Introduction to TCP/IP** IETF standards. IP header format and addressing. Routing algorithms. TCP header format. Reliable transport mechanisms. Congestion control.	x	Quiz			1,66	3,25
6	24	T4	**Communication networks (LABORATORY)** Illustration of Sessions T1-T3		Quiz	x	Preparation of the lab session, reading of the lab script	1,66	3,25
							Subtotal 1	42	81
				Total 1 (Hours of class plus student homework)				123	
			Tutorials, handing in, etc.,					1,8	--
			Assessment				The exam will take place on th	4	4
							Subtotal 2	6	4
				Total 2 (Hours of class plus student homework)				10	
							Total *(around 160h)*	133	