Universidad Carlos III de Madrid
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COURSE: TECNOLOGÍAS DE ALTA FRECUENCIA (HIGH FRECUENCY TECHNOLOGY)		
DEGREE: INGENIERÍA DE SISTEMAS DE COMUNICACIONES	**YEAR: 3º**	**TERM: 2º**

WEEKLY PLANNING

WEEK	SESSIÓN	DESCRIPTION	GROUPS (mark X)		SPECIAL ROOM FOR SESSION (Computer classroom, audio-visual classroom)	Indicate YES/NO if the session needs 2 teachers	WEEKLY PROGRAMMING FOR STUDENT		
			LECTURES	SEMINARS			DESCRIPTION	CLASS HOURS	HOMEWORK HOURS (Max. 7h week)
1	1	**Introduction** **Unit 1. Overview Waveguides and Lines** 1.1 Guided Waves. TE, TM and TEM modes. 1.2 Description of the solutions. 1.3 TEM Modes. The transmission line. 1.4 The telegrapher's equations.	X		NO	NO	Review of guided waves topics previously studied in 'Electromagnetic Fields'	1,66	5
1	2	**Unit 1. Overview Waveguides and Lines** 1.5 The terminated transmission line. Standing waves. 1.6 Standing waves: cases.		X	NO	NO	Review of the discussed concepts	1,66	
2	3	**Unit 1. Overview Waveguides and Lines. Technologies.** 1.7 Excitation of a transmission line. 1.8 Technologies. 1.9 Transmission line calculators.	X		NO	NO	Review of the discussed concepts. Examples using on line transmission line calculators.	1,66	6

2	4	**Unit 2. Smith Chart and Impedance Matching** 2.1 The impedance Smith chart. 2.2 The admittance Smith chart. 2.3 The slotted measurement line.		X	NO	NO	Review of the discussed concepts	1,66	
3	5	**Unit 2. Problems about Smith Chart** 2.4 The standing wave measurement. 2.5 Problems about standing waves and measurement lines.	X		NO	NO	Home solving of proposed problems	1,66	6
3	6	**Unit 2. Smith Chart and Impedance Matching** 2.6 Impedance matching definition. 2.7 Selection of a matching circuit. 2.8 lambda/4 matching network. 2.9 Simple stub matching network.		X	NO	NO	Review of the discussed concepts	1,66	
4	7	**Unit 2. Problems about Smith Chart** 2.10 Lumped elements matching network (problem). 2.11 Double stub matching network (problem).	X		NO	NO	Home solving of proposed problems	1,66	7
4	8	**Unit 3. Scattering (S) Parameters** 3.1 Transmission line equivalent to a guided mode. 3.2 Circuital and wave description of a dipole.		X		NO	Review of the discussed concepts	1,66	
5	9	**Unit 3. S Parameters (Multi-port Networks)** 3.3 Waveguides joints (multi-port networks). Circuital and wave description of a multi-port network. Z and Y params. Reciprocal and lossless networks. 3.4 S params. Matrix definition. 3.5 Relationships between among S, Z and Y. 3.6 S matrix properties.	X		NO	NO	Review of the discussed concepts	1,66	7
5	10	**Lab 1:** Measurement of the wavelength and impedance in a microwave bench in X band; matching of a passive dipole.		X	TSC Dep. Labs.	NO	Measurement of the wavelength and impedance; matching of a passive dipole.	1,66	
6	11	**Unit 3. S Params (Multi-port Networks)** 3.7 Change of the reference planes of an S matrix. 3.8 S matrix of a terminated N-port network. 3.9 S matrix of a series resistor, a shunt resistor, a transmission line section and an ideal transistor.	X		NO	NO	Home solving of proposed problems	1,66	6
6	12	**Unit 3. S Params. Problems** Calculation of the S parameters matrix of different networks.		X		NO	Home solving of proposed problems	1,66	
7	13	**Unit 4. S Params.** 4.1 Properties and S matrix of the cascade combination of 2-port	X		NO	NO	Review of the discussed concepts	1,66	6

		networks: transmission matrix T. 4.2 Linear and reciprocal networks. 4.3 Ideal reciprocal N=3 port networks.							
7	14	**Unit 4. S Params (Multi-port Networks)** 4.4 Lossy reciprocal 3-port networks. Resistive dividers. 4.5 Wilkinson divider. Even and odd modes analysis.		X	NO	NO	Review of the discussed concepts	1,66	
8	15	**First Mid-Term Exam (Units 1, 2 y 3)**	X		NO	NO	Study for the mid-term exam	1,66	7
8	16	**Lab. 2:** Introduction to the microwave CAD. Modelling of a microwave circuit. Analysis and interpretation of results.		X	TSC Dep. Labs.	NO	Simulation and interpretation of a high frequency circuit	1,66	
9	17	**Unit 4. S Params (Multi-port Networks)** 4.6 Linear and reciprocal 4-port networks. 4.7 Directional couplers and hybrids.	X		NO	NO	Review of the discussed concepts	1,66	6
9	18	**Unit 4. S Params (Multi-port Networks)** 4.8 Coupled transmission lines and couplers based on coupled lines. 4.9 Non reciprocal networks: isolators, circulators. 4.10 Problems.		X	NO	NO	Review of the discussed concepts. Home solving of proposed problems	1,66	
10	19	**Unit 4. Problems about Multi-port Networks** 4.11 Solving of different cases applying all the learned techniques.	X		NO	NO	Home solving of proposed problems	1,66	6
10	20	**Unit 5. Microwave Resonators** 5.1 Series resonant circuit. 5.2 Parallel resonant circuit. 5.3 Resonators parameters: the quality factor Q. 5.4 Microwave resonators based on transmission line stubs.		X	NO	NO	Review of the discussed concepts	1,66	
11	21	**Unit 5. Microwave Resonators** 5.5 Cavities. 5.6 Resonators coupling. **Unit 6. Microwave Filters** 6.1 Introduction to the microwave filters. 6.2 Problems about resonators and filters.	X		NO	NO	Review of the discussed concepts. Home solving of proposed problems	1,66	5
11	22	**Unit 7. Microwave Measurements: Network and Spectrum analyzers.** 7.1 The network analyzer. 7.2 The spectrum analyzer.		X	NO	NO	Review of the discussed concepts	1,66	

12	23	**Unit 8. Introduction to Microwave Amplifiers** 8.1 Devices. 8.2 Gain of a linear amplifier. 8.3 Single stage amplifier: stability.	X		NO	NO	Review of the discussed concepts	1,66	
12	24	**Unit 8. Introduction Microwave Amplifiers** 8.4 Design of a single stage amplifier: 8.4.1 Maximum gain case. Synthesis of the source and load terminations. 8.4.2. Specified gain case. 8.4.3 Specified noise case (unilateral). 8.5 Bias and DC de-coupling networks.		X		NO	Review of the discussed concepts	1,66	7
13	25	**Unit 8. Problems about Amplifiers** 8.6 Analysis and design of some specified amplifiers.	X		NO	NO	Home solving of proposed problems	1,66	
13	26	**Lab. 4**: Design of a microwave amplifier. Measurement of different active and passive high frequency circuits by means of network and spectrum analyzers.		X	TSC Dep. Labs.	NO	Application of the studied concepts to the design of a microwave linear amplifier using MATLAB and microwave design CAD	1,66	7
14	27	**Second Midterm Exam (Units 1 to 8)**	X		NO	NO	Study for the mid-term exam	1,66	
14	28	**Review:** Solution of problems from previous exams.		X	NO	NO	Study for the final exam	1,66	7
10	29	**Lab. 3:** Design of a passive multi-port circuit using commercial microwave CAD.			TSC Dep. Labs.	NO	Design of a passive microwave circuit from a set of specifications.	1,66	1
							Subtotal 1	**48,33**	**89**
		Total 1 *(Hours of class plus student homework hours between weeks 1-14)*						137,33	
15		Tutorials, handing in, etc.						7	
16		Assessment						3	7
17									
18									
							Subtotal 2	**3**	**14**
		Total 2 *(Hours of class plus student homework hours between weeks 15-18)*						17	
TOTAL *(Total 1 + Total 2. Maximum 180 hours)*								**154,33**	