SUBJECT TEACHING GUIDE

1082 - Passive Microwave devices

Master's Degree in Telecommunication Engineering

Academic year 2025-2026

1. IDENTIFYING DATA					
Degree	Master's Degree in Telecommunication Engineering			Type and Year	Compulsory. Year 1
Faculty	School of Industrial Engineering and Telecommunications				
Discipline					
Course unit title and code	1082 - Passive Microwave devices				
Number of ECTS credits allocated	5	Term		Semester based (2)	
Web					
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. INGENIERIA DE COMUNICACIONES
Name of lecturer	JUAN LUIS CANO DE DIEGO
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Other lecturers	

3.1 LEARNING OUTCOMES

- - To learn the basics of the generation and propagation of electromagnetic signals in transmission lines and waveguides with specific profiles. To analyze passive devices based on the most common transmission lines.
- To understand and project antenna feed architectures for telemetry, radar, satellite and radio-astronomy applications.

4. OBJECTIVES

- Ability to understand and manipulate the specific mechanisms of propagation and transmission of electromagnetic waves in planar structures and waveguide.
- Ability to identify and design components and subsystems in planar technology and waveguide associated with large ground and satellite communication systems.
- Ability to identify and design antenna feed architectures in applications of telemetry, radar, satellite and radio astronomy.
- Carrying out simulation exercises and visits to facilities.
- Development of a written work and oral presentation using new information technologies.
- Literature search.
- Team work. Internet search.

6. SUBJECT PROGRAM

CONTENTS	
1	Unit 1: Introduction: technologies, tools and techniques 1.1 – Introduction. 1.2 – Technologies. 1.2.1 – Microwave substrates. 1.2.2 – Planar transmission structures. 1.2.3 – Waveguides 1.2.4 – Substrate integrated waveguides (SIW) 1.3 – Simulation tools. 1.4 – Passive circuits manufacturing techniques. 1.4.1 – Wet etching 1.4.2 – Drilling 1.4.3 – Laser etching) 1.4.4 – Milling with numerically controlled machines (CNC) Unit 2: Scattering parameters 2.1 – Review of scattering parameters [S] 2.2 – Measurement techniques of scattering parameters 2.2.1 – Basic concepts of network analysis 2.2.2 – Introduction to the vector network analyzer (VNA) 2.2.3 – Practical tips Annex I: Introduction to Microwave Office Annex II: Introduction to ANSYS - HFSS

2	Unit 3: Microwave resonant circuits 3.1 – Introduction 3.1.1 – RLC series resonant circuit 3.1.2 – RLC parallel resonant circuit 3.2 – Short circuit ended L/2 line 3.3 – Short circuit ended L/4 line 3.4 – Open ended L/2 line 3.5 – Resonant ring 3.6 – Coupled lines feed technique 3.7 – Resonant cavity in a rectangular waveguide Unit 4: Microwave filters 4.1 – Introduction 4.2 – Filters design: insertion los method 4.2.1 – Practical filters responses 4.2.2 – Low pass prototype: binomial response 4.2.3 – Low pass prototype: equal ripple response 4.2.4 – Low pass prototype: linear phase response 4.3 – Impedance and frequency scaling 4.3.1 – Band-pass and band-reject transformations 4.4 – Filters implementation 4.4.1 – Richards transformations 4.4.2 – Kuroda identities 4.4.3 – Impedance and admitance inverters 4.4.4 – Step impedance low-pass filter 4.4.5 – Coupled lines band-pass filter 4.4.6 – Band-pass filter and band-reject filter with L/4 resonant lines 4.4.7 – Band-pass filter with capacitively coupled resonant series lines Unit 5: N-port networks – Power dividers and directional couplers 5.1 – Introduction 5.2 – Basic properties of dividers and couplers 5.3 – The T junction as power divider 5.4 – The Wilkinson divider 5.5 – Quadrature hybrid (90º) 5.6 – Directional couplers with coupled lines 5.7 – The Lange coupler 5.8 –180º Hybrid

3	Unit 6: Waveguide circuits and systems 6.1 – Introduction 6.2 – Propagation modes 6.2.1 – Rectangular waveguide 6.2.2 – Circular waveguide 6.2.3 – Square waveguide 6.2.4 – Other waveguides (coaxial, ridge) 6.3 – Polarization of an electromagnetic wave 6.4 – Discontinuities in rectangular waveguides 6.5 – Aperture couplings in waveguides 6.6 – Waveguide circuits 6.6.1 – Transformers/transitions 6.6.2 – Phase shifters 6.6.3 – Junctions (3 and 4 ports) 6.6.4 – Couplers 6.6.5 – Filters and diplexers 6.6.6 – Orthomode transducers (OMT) 6.6.7 – Polarizers 6.7 – Examples of waveguide systems 6.7.1 – Multi-port antenna feed systems 6.7.2 – Polarimeters for radio astronomy 6.7.3 – Tracking systems

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Practice 1	Work	No	Yes	26,67
Practice 2	Work	No	Yes	26,67
Practice 3	Work	No	Yes	26,67
Exam	Written exam	No	Yes	19,99
TOTAL				100,00

Observations

Continuous assessment: continuous assessment presupposes class attendance, both theoretical and practical sessions in the laboratory, as well as assessment tests.

All the practices and assessment test can be recovered in the written exam of the ordinary call, or extraordinary call if applicable.

The final grade is the weighted average of the partial grades obtained in the different practices and the exam . If the pass is not achieved in the subject (minimum grade 5), this subject may be recovered in the written exam of the ordinary call on the date set by the school. Likewise, if the grade of passing is not achieved in the ordinary call, it can be recovered by means of a written exam in the extraordinary call on the date set by the school.

Remote evaluation of the work, practical laboratory exercises and written tests are foreseen, in the event that a new health alert due to COVID-19 makes it impossible to carry out the evaluation in person.

Observations for part-time students

For these students, their particular situation will be appropriately addressed as long as it is duly justified.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

K.C. Gupta: Microstrip Lines and Slotlines, Artech House 1996
Peter A. Rizzi: Microwave Engineering, Prentice-Hall 1988
J. Uher: Waveguide Components for Antenna Feed Systems: Theory and CAD, Artech House 1993.
David M. Pozar, “Microwave Engineering”, 4rd Ed., Wiley, 2012.
David M Pozar, “Microwave and RF Design of Wireless Systems”. John Wiley & Sons, 2001.