UNIVERSITY of NICOSIA

Course Code	Course Title	ECTS Credits
ECE-440	Microwave Circuits	6
Department	**Semester**	**Prerequisites**
Engineering	Fall or Spring	ECE-342
Type of Course	**Field**	**Language of Instruction**
Elective	Engineering	English
Level of Course	**Year of Study**	**Lecturer(s)**
1st Cycle	4th	Dr Anastasis Polycarpou
Mode of Delivery	**Work Placement**	**Co-requisites**
Face-to-face	N/A	None

Objectives of the Course:

The main objectives of the course are to:

- Introduce students knowledge and fundamental principles of microwave circuit analysis and design
- Provide understanding of transmission lines including analytical and graphical tools for analysis and design
- Introduce main concepts of network analysis and signal flow graphs
- Introduce impedance matching techniques and tuning including multi-section matching transformers and tapered lines
- Provide a complete understanding of waveguide propagation, modes, and attenuation
- Provide the main principles and operation of power dividers, directional couplers, and hybrids
- Introduce techniques for the design of microwave filters
- Introduce software and tools for the analysis and design of microwave devices

Learning Outcomes:

After completion of the course students are expected to:

- Formulate electromagnetic theory to model wave propagation in dielectric/lossy media
- Use transmission-line theory for the analysis and design of microwave devices including analytical and graphical tools such as the Smith chart
- Design microstrip lines, striplines, and microwave filters according to certain specifications
- Explain wave propagation in waveguides and solve related problems for the calculation of wave attenuation, phase velocity, supporting modes, single-mode bandwidth, etc.
- Design simple and complex matching/tuning networks for different types of loads
- Design directional couplers, hybrids, and power dividers

- Use network analysis techniques to design and analyze microwave circuits

Course Contents:

- Introduction to microwaves and relevant applications
- An overview of electromagnetic theory including Maxwell's equations, fields in different media, boundary conditions, wave equation, polarization, energy and power, lossless and lossy material
- Introduction to transmission-line theory ranging from transmission-line parameters and the Smith Chart to quarter-wave transformer, generator and load mismatch, loss mechanisms and transient analysis
- Different types of transmission lines and waveguides including parallel-plate waveguides, rectangular and circular waveguides, coaxial cables, striplines, microstricps, propagating modes, wave velocity, dispersion, and attenuation
- Microwave network analysis: Impedance and admittance matrices, scattering matrix, and transmission matrix (ABCD). Two-port networks, signal flow graphs (Mason's rules), and modal analysis
- Impedance matching and tuning using lumped elements, single and double stub matching, quarter-wave transformer, binomial and Chebyshev multi-section matching transformers, and tapered lines
- Power dividers, directional couplers and hybrids including the T-junction power divider, the Wilkinson power divider, the waveguide directional coupler, the coupled line directional coupler, and the 90- and 180-degree hybrid
- Microwave filter design and analysis using analytical tools and software packages

Learning Activities and Teaching Methods:

Lectures, in-class examples, exercises, experiments

Assessment Methods:

Homework, exams, Project, final exam.

Required Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
David M. Pozar	Microwave Engineering	John Wiley & Sons	2005	0471448788

Recommended Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
S. Liao	Microwave Devices and Circuits	Prentice Hall	1990	0135832047
S. Harsany	Principles of Microwave Technology	Prentice Hall	2005	0130268623