AEEE516 - Microwave Engineering

Course Title	Microwave Engineering				
Course Code	AEEE516				
Course Type	Technical Elective				
Level	MSc (Level 2)				
Year / Semester	1 or 2				
Teacher's Name	Dr. Photos Vryonides				
ECTS	7	Lectures / week	3	Laboratories/week	
Course Purpose	The aim of the course is to give the students at an advance level a thorough coverage of the fundamental principles of the broad area of RF & microwave engineering. It also introduces the students to RF/microwave analysis methods and design techniques. Scattering parameters are defined and used to characterize devices and system behavior. Passive and active devices commonly utilized in microwave subsystems are analyzed and studied. Design procedures are presented along with methods to evaluate device performance.				
Learning Outcomes	By the end of the course, students must be able to: 1. Identify maxwell's equations, wave solutions, TEM, TE and TM wave propagation modes, and account for the relevant propagation modes for transmission lines 2. Appreciate the concept of plane waves in different transmission media, polarized plane waves and plane wave reflection in mathematical form 3. Compare the electromagnetic theory with transmission line theory in order to describe transmission lines from the point of view of either field theory or the circuit model 4. Explain Smith Chart to design lumped or distributed microwave networks 5. Appreciate different concepts of impedance matching, i.e., narrow- and broadband impedance matching 6. Describe, analyse and design basic passive and active microwave circuits such as couplers, amplifiers, mixers, oscillators 7. Describe, analyse and model on system level common microwave systems .				
Prerequisites		Corequisites			
Course Content	**The Wave Equation:** Plane Waves, Losses in conductors and dielectrics. **Microwave Transmission Lines:** The distributed circuit representation of transmission lines, transient response of transmission lines, phase and group velocity, dispersion, TEM, TE, TM waves, parallel- plate transmission line, dielectric slab waveguide, coaxial cable, stripline, microstrip, coplanar waveguide.				

	Microwave Resonators: Series and parallel resonators, the Q-factor, coupling to resonators. **Matching Networks:** L and PI matching networks, single and double stub matching, RF transformers, scattering matrix, the scalar and vector network analyzer/ theory of calibration. **3-Port RF Devices:** Power combiners/dividers, the Wilkinson divider, circulators and isolators. **4-Port RF Devices:** Directional couplers, the 90- degree hybrid, the 180-degree ring hybrid. **Coupled Lines and Devices:** Coupled lines as a four port, coupled line directional couplers, the lange coupler. **Microwave Filters:** Periodic structures, the insertion loss method, the Kuroda identities, stepped impedance filters, coupled- line filters.
Teaching Methodology	Students are taught the course through lectures (3 hours per week) in classrooms or lectures theatres, by means of traditional tools or using computer demonstration. Auditory exercises, where examples regarding matter represented at the lectures, are solved and further, questions related to particular open-ended topic issues are compiled by the students and answered, during the lecture or assigned as homework. Topic notes are compiled by students, during the lecture which serve to cover the main issues under consideration and can also be downloaded from the e-learning platform or the lecturer's webpage. Students are also advised to use the subject's textbook or reference books for further reading and practice in solving related exercises. Tutorial problems are also submitted as homework and these are solved during lectures or privately during lecturer's office hours. Furthermore, design projects may be assigned to the students, where literature search is encouraged to identify a specific problem related to some issue, gather relevant scientific information about how others have addressed the problem, implement to implement the design and report the results in written or orally..
Bibliography	**Textbooks:** • David Pozar, **Microwave and RF Design of Wireless Systems,** John Wiley and Sons, 2012. **References:** • RF Microelectronics by Behzad Razavi, Prentice Hall, 2014 • High Frequency Techniques: An Introduction to RF and Microwave Engineering, by Joseph F. White, IEEE Press, 2004
Assessment	The taught part of course is delivered to the students by means of lectures, conducted with the help of computer presentations. Lecture notes and presentations are available through the web for students to use in combination with the textbooks. The structure of the course teaching is based on lectures (3 hours per week) in a classroom. During the lectures several related exercises are solved on the board with

	participation of the students. Several problems are left unfinished for the students to complete at home. Other problems are used as assignments. Topic notes are compiled by students, during the lecture which serve to cover the main issues under consideration. Students are also urged to use the textbook assigned to the course. Related homework problems are also assigned from the textbook as a turn in assignment or for homework practice. Also, students are advised to use the reference books for further reading and practice in solving related exercises. • Assignments 20% • Tests: 30% • Final Exam 50%
Language	**English**