Department of Electrical and Computer Engineering

New Jersey Institute of Technology

ECE 461: Microwave & Integrated Optics (3 credits, 3 contact hours)

Instructor: Gerald Whitman; email:whitman@njit.edu; Tel.: 973-596-3232

Text books:
G. Gonzalez, *Microwave Transistor Amplifiers, 2nd ed.*, Prentice Hall, 1997. ISBN 0-13-254335-4

Reference Texts:

D. Pozar, *Microwave Engineering, 4th ed.*, Wiley, 2011. ISBN 978-0-470-63155-3
D. Cheng, *Field and Wave Electromagnetics,2nd ed.*, Addison-Wesley, 1989. ISBN: 0-210-12819-5

Catalog Course Description:

The analysis and design of microwave transistor amplifiers and oscillators using scattering parameter techniques. Topics include transmission line theory, scattering parameters, matching networks, signal flow graphs, amplifier design considerations (power gain stability, noise and band width), and negative resistance oscillator design.

Course Description:

This course introduces students to basic principles and techniques of microwave engineering which includes transmission line theory, scattering theory, matching techniques, passive components and fundamentals of amplifier design.

Prerequisite: ECE362 **Co-requisite**: none

Specific course learning outcomes (CLO): The student will be able to

1. gain an appreciation of the microwave engineering field.
2. solve Maxwell's equations in uniform waveguides to determine the mode structure in uniform waveguides and to model uniform waveguides using transmission line equations. Specific application will be to find the cutoff frequency of TE and TM modes in rectangular waveguides.
3. use frequency domain transmission line theory and the Smith Chart to solve waveguide problems.
4. use scattering parameters to analyze and predict the behavior of linear microwave passive and active networks.
5. implement matching techniques for microwave components and devices using ell networks, quarter wave transformers and single stub tuning networks using microstrip waveguides.
6. analyze using scattering parameters a number of passive microwave components such as directional couplers and power dividers.
7. design power amplifiers using scattering parameters.

Relevant student outcomes (ABET criterion 3):

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (CLO 1-7).

6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions (CLO 1-7)

7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies (CLO 1-7)

Computer assisted design and course specific software: None

Tentative Course Schedule	**Weeks**
Introduction to microwave engineering	1
Transmission Line Theory	2
Uniform waveguides and TE,TM and TEM Modes	3-4
Scattering Parameters	5
The Smith Chart Impedance	6
Impedance Matching Review	7
and Examination I	8
Passive Microwave Components Microwave	9-10
Transistor Amplifier Design Noise Figure	11-13
Circles	14
Final	15

Formula Sheets: Two for exam I, four for exam II, six for final.
Rules: In own handwriting, no derivations, no worked out examples, no calculations, no illustrative examples.
Permitted: Definitions, units, formulas, geometry that define parameters in formulas; equivalent circuits.

Homework Policy: The problems will be assigned and checked. Students are expected to solve **all** assigned problems. Solutions will be provided and discussed in class. The text contains numerous examples. Students are required to study these examples for practice.

Attendance: Required at class lectures and problem solving sessions.
Lateness to class: Unacceptable.
Cellular phones and Beepers: Shut off or in quiet mode.

Updates and Assignments to be distributed via e-mail.

Office Hours: to be announced as well as by appointment.

Grading policy: Two class examinations: 30%, 30%; Final examination: 40%. Homework, quizzes class, participation: 0- 10% (add or subtract);

Honor Code: The NJIT Honor Code will be upheld; any violations will be brought to the immediate attention of the Dean of Students.

Office: MIC Bldg., Room 405
Prepared by: G. Whitman