MICROWAVE ENGINEERING

University of Texas at El Paso
College of Engineering
Department of Electrical and Computer Engineering

Course Syllabus for

Microwave Engineering

COURSE INFORMATION

Course Prefix and Number:	EE 4380 (5390)
Course Title:	Microwave Engineering
Meeting day and time:	M/W, 4:30pm – 5:50pm
Room:	Liberal Arts, Room 207
Final exam:	Monday, December 5, 4:00pm – 6:45pm
CRN:	18199 (16831)
Credit hours:	3
Lecture hours:	3

Catalog Description – Primarily a senior level undergraduate course concerning distributed-elements analysis and design of electric circuits at microwave frequencies. Topics include transmission lines, waveguides, two-port microwave circuits, matching, tuning, resonators, dividers, and directional couplers.

INSTRUCTOR INFORMATION

Dr. Raymond C. Rumpf
Office: ENGR A-337
Office Hours: M/W, 10:30am – 11:30am & 3:00pm – 4:00pm
Telephone: (915) 747-6958
E-Mail: rcrumpf@utep.edu

COURSE MATERIALS

The following items are required for this course:

- TI85 scientific calculator, or equivalent
- Access to MATLAB 2013 or above. A manual for this tool is available at: http://www.mathworks.com/help/techdoc/
- Ruler, compass, engineering graph paper and blank Smith Charts for homework
- Writing utensils, multiple colors preferred.
- Textbook: Microwave Engineering, 4th Edition
  David M. Pozar
  Copyright 2012, John Wiley & Sons
  ISBN 978-0-470-63155-3
- Course website: http://emlab.utep.edu/ee4380microwave.htm
- Binder/notebook with syllabus, course notes, homework, exams, and other handouts.

PREREQUISITES

By Course (with grade of "C" or better):

- MATH 2326 – Differential equations
- EE 2353 – Continuous Time Signals and Systems
- EE3321 – Fields and Waves

By Topic:

- Differential equations
- Electromagnetic field theory
- MATLAB

COREQUISITES

None.

LEARNING OUTCOMES

By the end of the semester, the student will demonstrate the ability to:

- Have a solid understanding of basic electromagnetic theory.
- Understand and analyze transmission line and waveguide devices.
- Use a Smith chart.
- Understand how microwave devices contribute to communications.
- Have a basic understanding of special topics and emerging areas in microwaves such as metamaterials.

Contribution to Professional Component

EE-4380 is a senior level core course that builds on topics covered primarily the junior level course EE-3321 Electromagnetic Field Theory.

Relationship to (ABET) Program Outcomes

- Ability to apply knowledge of mathematics, science, and engineering:
  Students use concepts from physics and calculus in the analysis of microwave problems.
- Ability to identify, formulate, and solve engineering problems:
  Students solve problems and observe simulations of microwave problems.
- Ability to communicate effectively:
  Students solve problems and give oral individual presentations summarizing their work.
- Ability to use computers to enhance problem solving:
  Students will use MATLAB to solve problems and visualize solutions.

COURSE POLICIES

Attendance Policy

Attendance is required and is assumed and expected. Students missing more than two lectures should seriously reflect on their commitment to this course, as missing classes is highly correlated with poor performance. Students absent from lecture are still

held responsible for all information discussed, homework assigned, and exams administered during that missed lecture. In some special cases, absence can be forgiven if coordinated with the course instructor well before the lecture is missed.

Exam Policy

Exams during the semester will be given in class. No exam will be given earlier than scheduled. Duration of the exams will be strictly limited to the duration of the class. Students are permitted to have a calculator and a standard 8.5×11" sheet of paper (i.e. cheat sheet) with whatever they wish to have on it.

Exams will contain multiple choice, true/false questions, short answers (5 to 6 sentences), and some longer problems. Information tested on the midterm exams will be mostly focused on the material covered since the last exam. The final exam will be comprehensive.

A missed exam can be made-up ONLY IF: (1) the reason for missing the exam is beyond the student's control, e.g. such as a medical excuse, jury duty, death in the family or automobile accident, or (2) prior consent must be obtained from the instructor for missing the exam based on a non-frivolous excuse, e.g. such as a job interview or out-of-town job related travel. In either case, the student must submit a written and signed statement describing the reasons for missing the exam, with appropriate documentation, and petition for a makeup exam. **A missed exam will carry zero grade if these conditions are not met**.

Homework Policy

Homework will be assigned on a weekly basis and graded on a 100 point scale. **Show all work!** Homework is due by midnight on the assigned due date. In order to provide solutions in a timely manner, no homework assignments will be accepted after three days following the due date and 10 points will be deducted for every day late. Homework must be completed with a high level of professionalism and be formatted properly. Points will be deducted for sloppy work, incorrect formatting, or if not all of the work is shown.

Format – Unless otherwise indicated, all homework assignments will be submitted as a single document stapled in the upper left corner with no additional binding. The first page must be a cover sheet with the student's name, student's 800 number, date of the assignment, course information, and assignment number. No problems or work should appear on the cover sheet. Homework shall be neat, well organized, and the writing clear. Answers to the homework questions must be provided in the order they were asked. Final answer(s) must be clearly boxed and given proper units. Finish all calculations. For example, answer with '±4' instead of $\pm\sqrt{5^2-9}$. Students may include computer codes if they wish, but the codes must be placed at the end of the assignment in an appendix.

Participation Policy

The following items are expected from students as part of their participation grade:

- Ask questions*!* Despite how "silly" or "dumb" you may think your question is, it is very likely that other students have the same question. Confusion on even small

details in course material can cause bigger problems and hold you back. If you are truly embarrassed by your question, send an anonymous e-mail to the course instruction. I promise I will respond*!*

- Respond honestly to poles and provide real-time feedback to instructor about the course. This will contribute greatly to the quality of the course and your success in it.
- Visit the course instructor during office hours, or by appointment, if needed.
- Treat e-mail correspondence as a professional exchange of information.
- Turn off cell phones, pagers, or anything else that may distract the class.
- Complete any reading assignments before class.
- Bring all of your course materials (text book, course notes, pens/pencils, paper, etc.) to every class.
- Show proper etiquette during class. Do not talk, make excessive noise, or otherwise distract the class. You will be asked to leave and it will affect your grade.
- Maintain your notebook. Keep everything well organized. This may be inspected periodically during the semester and will count toward your participation grade.

Grading

Student achievement in the course objectives will be assessed using a combination of homework and exams as well as class attendance and participation. Student grades are protected by the Privacy Act of 1974. Your course grade will be determined by your weighted performance in the following categories:

Homework 30%	90% – 100%→ **A**
Participation 10%	80% – 89% → **B**
Midterm Exam #1 ..... 20%	70% – 79% → **C**
Midterm Exam #2 ..... 20%	60% – 69% → **D**
Final Exam 20%	0% – 59% → **F**

Homework – Each assignment will be graded out of 100 points. Homework is due by midnight on the due date. Late assignments will be deducted 10 points per 24 hours late and will be given zero points after 72 hours.

ACADEMIC DISHONESTY

As an entity of The University of Texas at El Paso, the Department of Electrical and Computer Engineering is committed to the development of its students and to the promotion of personal integrity and self responsibility. The assumption that a student's work is a fair representation of the student's ability to perform forms the basis for departmental and institutional quality. All students within the Department are expected to observe appropriate standards of conduct. Acts of scholastic dishonesty such as cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in the whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student, or the attempt to commit such acts will not be tolerated. Any case involving academic dishonesty will be referred to the Office of the Dean of Students. The Dean will assign a Student Judicial Affairs Coordinator who will investigate the charge and alert the student as to its disposition. Consequences of academic dishonesty may be as severe as dismissal from the University.

See the Office of the Dean of Students' homepage (Office of Student Life) at http://studentaffairs.utep.edu/dos for more information.

You can also refer to the IEEE website for information on our code of ethics: http://www.ieee.org/about/corporate/governance/p7-8.html

AMERICAN DISABILITIES ACT

The UTEP Disabled Student Services Office was established for the purpose of providing appropriate and reasonable accommodations as mandated in Section 504 of the Rehabilitation Act of 1973 (http://www.dol.gov/oasam/regs/statutes/sec504.htm) and the Americans with Disabilities Act (http://www.ada.gov/). If you have needs regarding learning disabilities, please help by reporting your special needs to the course instructor the first week of classes.

For addition help, contact the Center for Accommodations and Support Services (CASS):

(915) 747-5148
cass@utep.edu
http://sa.utep.edu/cass/

DISCRIMINATION

I do not discriminate, nor will I allow discrimination, on the basis of age, gender, color, ethnicity, national origin, religion, disability, sexual orientation, or favorite sports team. Members of the UTEP community are protected from discrimination and harassment by the State and Federal Laws.

COURSE SCHEDULE AND OUTLINE

Important Dates

Sep 5	Labor Day Holiday – University closed
Nov 24,35	Thanksgiving Holiday – University closed
Dec 5	Final Exam, 4:00pm – 6:45pm

Schedule of Topics

1. Review of basic electromagnetic theory
2. Electromagnetic properties of materials
3. Transmission lines
4. Smith charts
5. Waveguides
6. Microwave circuit design
7. Communications and link budgets
8. Special topics