



University of Texas at El Paso
EE 5390 – 21st Century Electromagnetics
Spring 2014

COURSE INFORMATION

Meeting day and time:	M/W, 6:00pm – 7:20pm
Room:	Business Bldg. 330
Final exam:	Wednesday, May 14, 7:00pm – 9:45pm
Course designation:	EE 5390 Special Topics
CRN:	23940
Course website:	http://emlab.utep.edu/ee5390em21.htm
Credit hours:	3
Lecture hours:	3

Course Description – This course is intended to teach students about electromagnetic devices and how they may look and operate in coming decades. Special attention will be paid to periodic structures, metamaterials, and structures fabricated by 3D printing. Devices will be designed and analyzed using tools developed during the prerequisite course “Computational Electromagnetics” as well as some new tools developed in this course.

INSTRUCTOR INFORMATION

Dr. Raymond C. Rumpf

Office: ENGR A-337
Office Hours: M/W, 8:00am – 10:00am
Telephone: (915) 747-6958
E-Mail: rcrumpf@utep.edu

COURSE MATERIALS

The following items are required for this course:

- Access to the internet.
- MATLAB 2009 or above. Manual available at:
<http://www.mathworks.com/help/techdoc/>
- Large binder/notebook with course notes.
- No textbook!

Students should maintain a well-organized notebook that archives their syllabus, lecture notes, homework, solutions, projects, and quizzes.

PREREQUISITES

By Course:

- MATH 2313 – Calculus III
- MATH 2326 – Differential equations
- EE 3321 – Electromagnetic Field Theory
- EE 5390 “Computational Electromagnetics” with a grade of C or better.

By Topic:

- Basic electromagnetic theory
- Solution to Maxwell’s equations using:
 - Transfer matrix method
 - Scattering matrices
 - Finite-difference frequency-domain
 - Plane wave expansion method
 - Rigorous coupled-wave analysis
- Differential equations and linear algebra
- MATLAB
- Computer programming

COREQUISITES

None.

COURSE OUTLINE

Topics covered in this course include:

1. Electromagnetic properties of materials
2. Finite-difference analysis of transmission lines
3. Coupled-mode theory
4. Theory of periodic structures
5. Gratings and guided-mode resonance
6. Metamaterials and band gap materials
7. Effective medium theory
8. Spatially variant lattices
9. Interfacing MATLAB with CAD
10. Frequency selective surfaces
11. Surface waves
12. Transformation electromagnetics
13. Slow waves

COURSE OUTCOMES

- **ELECTROMAGNETIC MATERIALS** – Students will obtain a solid background in the electromagnetic properties of materials. This will cover the Lorentz model for dielectrics, Drude model for metal, anisotropic materials, metamaterials, and spatially dispersive materials.



- **PERIODIC STRUCTURES** – The student will learn the theory and calculus being periodic structures including metamaterials and electromagnetic band gap materials. This will lead into some theory from solid state physics including classification of periodic structures, band diagrams, and more.
- **SYNTHESIS OF ADVANCED ELECTROMAGNETIC STRUCTURES** – The student will learn the calculus behind synthesizing periodic structures as well as reading and writing STL files from MATLAB. This will include generating and simulating spatially variant structures.
- **ADVANCED ELECTROMAGNETIC THEORY AND DEVICES** – The student will be exposed to other advanced topics in electromagnetics. This will include coupled-mode theory, guided-mode resonance filters, thin film optical filters, negative index materials, and more.

By the completion of this course, students will demonstrate a rich and deep understanding of 21st century electromagnetics. Further, they will have practiced the skills to independently study and design advanced electromagnetic devices.

Contribution to Professional Component

This is a follow-on course to “Computational Electromagnetics” that teaches the most advanced topics in electromagnetics with specific attention to metamaterials and 3D printed electromagnetics.

REMOTE STUDENTS

THIS IS NOT AN ONLINE CLASS!!!!

Some lectures and course materials may be made available through the internet to accommodate remote students, but this not an online class. Provision of these materials is not guaranteed and quality may be insufficient for learning the course material. Remote students will be held to the same standards as non-remote students and should be prepared to learn the course material and complete homework assignments independently. All policies apply equally to remote and non-remote students including due dates for projects and assignments as well as dates and duration of exams. Non-remote students will not be given access to recorded lectures and are expected to attend class.

RULES AND POLICIES

Grading

Student achievement in the course objectives will be assessed using a combination of homework, exams, a final project, and class participation. Participation includes attendance, asking and answering questions, and providing honest and useful feedback to the instructor during lectures. 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	40%	90% – 100% →	A
Exams	30%	80% – 89% →	B
Final Project	20%	70% – 79% →	C
Participation	10%	60% – 69% →	D
		0% – 59% →	F

Homework Policy

Homework will be assigned on an approximately weekly basis and graded on a 100 point scale. **Show all work!** 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. Your homework must be your own work. Students suspected of cheating or copying homework will be submitted to the Office of Student Conduct and Conflict Resolution and will remain part of your permanent record at UTEP. Homework is due at the beginning of lecture on the assigned due date. Late assignments will not be accepted and will be given a grade of zero.

Format – Unless otherwise indicated, all homework assignments will be submitted as a single document stapled in the upper left corner with no additional binding. Remote students shall submit their assignments via e-mail as a single MS Word or PDF document. The first page must be a cover sheet with the student’s name, 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. Work for the homework questions must be provided in the order they were asked and the final answer(s) must be clearly boxed and given proper units.

Project Policy

The purpose of the project for this class is to learn something outside of what is taught in the class or to apply what is taught in class to something not discussed in class. Project topics and the submission materials must be approved by the instructor by the middle of the semester. Unless otherwise approved by the course instructor, the project and results will be summarized in an MS PowerPoint and presented to the class at the end of the semester. The level of detail should be sufficient that another student in the class can understand and reproduce your work.

Exam Policy

Exams for this class are take-home because they require the use of MATLAB. The policies for exams are the same as for homework, but the student must do their own work without the help of anyone else including the course instructor.

Missed Exams – 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 is obtained from the



instructor for missing the exam based on a non-frivolous reason, e.g. such as a job interview, conference, 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. Medical excuses require a note from the doctor. **A missed exam will carry zero grade if these conditions are not met.**

Attendance Policy

Students are required to attend class and to show up to lectures on time. The course instructor reserves the right to turn away late comers and to withdraw students from the course that repeatedly absent. 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 cases, absence can be forgiven if the reason is not frivolous and coordinated with the course instructor well before the lecture is missed.

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.
- Read assigned sections of the book.
- 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 a good quality notebook. Keep everything well organized. This will be inspected periodically during the semester and will count heavily in the participation grade.

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.

IMPORTANT DATES

Jan 21	Classes begin
Mar 10-14	Spring Break – University closed
Mar 31	Cesar Chavez Day – University closed
May 9	Dead Day
May 14	Final Exam, 7:00pm – 9:45pm