Suggested Textbooks and/or Resource Materials


Course Description and Prerequisites

Topics covered include: introduction to metamaterials, metamaterials in electromagnetics, characterization and design of metamaterials, metamaterial properties, EM waves in periodic structures: photonic crystals and negative refraction, optical metamaterials, dispersion in complex media, chiral metamaterials, metamaterial applications: perfect lenses, invisible cloaks, metamaterial-based microwave and RF applications, metamaterials in high frequency, fabrication/measurement techniques and data treatment of metamaterials.

Pre or Co-requisites: ELEE 3315 (Electromagnetics Engineering)

Learning Objectives/Outcomes for the Course

To acquaint students with recent research activity, ideas and results in the field of Metamaterials - artificially structured materials with engineered electromagnetic properties. Recently, exciting and extremely promising advances have been achieved, such as the first realization of materials with negative refractive index, perfect lenses, drug discovery, and invisible cloaks.

Learning Objectives for Core Curriculum Requirements

To learn basic principles of artificial electromagnetic materials, including:

- a. Fundamental definitions and conventions
- b. Fundamental laws governing electromagnetics metamaterials
- c. Analysis of metamaterial structures
- d. Analysis of electromagnetic waves in metamaterial structures
- e. Analysis of metamaterial application
- f. Fabrication, measurement techniques, and data treatment of metamaterials

This course satisfies a core curriculum requirement and matches the following outcomes set by the Texas Higher Education Coordinating Board (THECB) outcomes: Critical Thinking Skills, Communication Skills, Empirical and Quantitative Skills, Teamwork, Social Responsibility, and Personal Responsibility.
Grading Policies
1. Midterm 30%
2. Final 30%
3. Project Presentation 20%
4. Homework 10%
5) Quizzes and Class Participation 10%

The grades for this course will be assigned according to the following scale:

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Contents/Calendar: Subject to change as the semester progresses.

<table>
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<tr>
<th>WEEK</th>
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| 1    | Introduction: The Age of Metamaterials
         How Metamaterials Started |
| 2    | Metamaterials in Electromagnetics |
| 3    | Characterization of Metamaterials I: Complex Media |
| 5    | Response of Small Scatters
         Effect of Geometry, including Well-known Metamaterial Structures
         EM Waves in Periodic Structures: Photonic Crystals and Negative Refraction
         Structure Surfaces as Optical Metamaterials |
| 6    | Design of Metamaterials |
| 7    | Midterm Exam (Take Home) |
| 8    | Dispersion in Complex EM Media:
         Kramers-Kronig Relations, Lorentz, Drude, Debye |
| 9    | Chiral Metamaterials and Applications |
| 10   | Perfect Lenses and Negative Refractive Index Materials |
| 11   | Invisible Cloaks and Microwave and RF Applications of Metamaterials |
| 12   | Metamaterials in THz and Higher Frequency Regimes |
| 13   | Experimental Techniques and Data Treatment of Metamaterials |
| 14   | Project Presentation |
| 15   | Final Exam (Take Home) |

Calendar of Activities
Include in this section a table or list that provides information for students regarding important dates, assignments or activities. The UTRGV academic calendar can be found at [https://my.utrgv.edu/home](https://my.utrgv.edu/home) at the bottom of the screen, prior to login. Some important dates for Fall 2017 include:

- **August 28**: First day of classes
- **August 31**: Last day to add a course or register for fall 2017
- **September 4**: Labor Day – NO classes
- **November 15**: Last day to drop a course; will count toward the 6-drop rule
- **November 23 – 26**: Thanksgiving Holiday – NO classes
- **December 6**: Last day of classes
- **December 7**: Study Day – NO class
- **December 8 - 14**: Fall 2017 Final Exams
- **December 15-16**: Commencement Ceremonies
UTRGV Policy Statements

The UTRGV disability accommodation, mandatory course evaluation statement and sexual harassment statement are required on all syllabi. Additional policy statements are optional, such as those covering attendance, academic integrity, and course drop policies.

STUDENTS WITH DISABILITIES:
Students with a documented disability (physical, psychological, learning, or other disability which affects academic performance) who would like to receive academic accommodations should contact Student Accessibility Services (SAS) as soon as possible to schedule an appointment to initiate services. Accommodations can be arranged through SAS at any time, but are not retroactive. Students who suffer a broken bone, severe injury or undergo surgery during the semester are eligible for temporary services. Brownsville Campus: Student Accessibility Services is located in Cortez Hall Room 129 and can be contacted by phone at (956) 882-7374 (Voice) or via email at ability@utrgv.edu. Edinburg Campus: Student Accessibility Services is located in 108 University Center and can be contacted by phone at (956) 665-7005 (Voice), (956) 665-3840 (Fax), or via email at ability@utrgv.edu.

MANDATORY COURSE EVALUATION PERIOD:
Students are required to complete an ONLINE evaluation of this course, accessed through your UTRGV account (http://my.utrgv.edu); you will be contacted through email with further instructions. Students who complete their evaluations will have priority access to their grades. Online evaluations will be available:
- Fall 2017 Module 1 Oct. 5 – Oct. 11
- Fall 2017 Module 2 Nov. 29 – Dec. 5
- Fall 2017 (full semester) Nov. 15 – Dec. 6

ATTENDANCE:
Students are expected to attend all scheduled classes and may be dropped from the course for excessive absences. UTRGV’s attendance policy excuses students from attending class if they are participating in officially sponsored university activities, such as athletics; for observance of religious holy days; or for military service. Students should contact the instructor in advance of the excused absence and arrange to make up missed work or examinations.

SCHOLASTIC INTEGRITY:
As members of a community dedicated to Honesty, Integrity and Respect, students are reminded that those who engage in scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and expulsion from the University. Scholastic dishonesty includes but is not limited to: cheating, plagiarism (including self-plagiarism), and collusion; submission for credit of any work or materials that are attributable in 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. Since scholastic dishonesty harms the individual, all students and the integrity of the University, policies on scholastic dishonesty will be strictly enforced (Board of Regents Rules and Regulations and UTRGV Academic Integrity Guidelines). All scholastic dishonesty incidents will be reported to the Dean of Students.

SEXUAL HARASSMENT, DISCRIMINATION, and VIOLENCE:
In accordance with UT System regulations, your instructor is a “Responsible Employee” for reporting purposes under Title IX regulations and so must report any instance, occurring during a student’s time in college, of sexual assault, stalking, dating violence, domestic violence, or sexual harassment about which she/he becomes aware during this course through writing, discussion, or personal disclosure. More information can be found at www.utrgv.edu/equity, including confidential resources available on campus. The faculty and staff of UTRGV actively strive to provide a learning, working, and living environment that promotes personal integrity, civility, and mutual respect that is free from sexual misconduct and discrimination.

COURSE DROPS:
According to UTRGV policy, students may drop any class without penalty earning a grade of DR until the official drop date. Following that date, students must be assigned a letter grade and can no longer drop the class. Students considering dropping the class should be aware of the “3-peat rule” and the “6-drop” rule so they can recognize how dropped classes may affect their academic success. The 6-drop rule refers to Texas law that dictates that
undergraduate students may not drop more than six courses during their undergraduate career. Courses dropped at other Texas public higher education institutions will count toward the six-course drop limit. The 3-peat rule refers to additional fees charged to students who take the same class for the third time.