Course Syllabus
EEL 5482: Fields and Waves Engineering, 2:00-3:15pm, EC 3930
John L. Volakis
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Office: EC3912
Office Hours: Mondays: 3:15 PM- 4:15 PM
TA-Thursdays: 10:00 AM -12:00 PM (or via appointment/zoom)

Prof. John L. Volakis

- Email: jvolakis@fiu.edu
- Homepage
- EC 3912
- Lab: EC 2970 , RFCOM Lab
- Links to an external site.

- Class Hours:

Monday/Wedn (EC3930/ECE Conf room, 3rd Floor of EC Center): 2:00PM -3:15 PM
January 5th (Monday)- April 18th(Saturday)

Office Hours (times may be revised at the start of the semester)
JLV-Mondays: 3: 15 PM- 4:30 PM
TA-Thursdays: 10:00 AM -12:00 PM (or via appointment/zoom)

- TA Contact
- Nathan Chung, nchun013@fiu.edu
- Tatiana Valera, tvalera@fiu.edu

Course Objectives
This is a standard first year graduate course on Fields and Waves. It covers the fundamentals of guided waves, communication links and propagation, including Radio Frequency (RF) sources, waveguides, fiber optics, metamaterials, adv. antennas and arrays, automotive radars, and the basics of well known simulation tools. Moreover, it covers methods to simplify RF/electromagnetic problems into practical set-ups for numerical solutions, including high density RF packages for chips and EMI/EMC applications. The course is a must for expertise in microwaves, antennas, radars, and for electromagnetic interference and compatibility.
At the end of the course, students should be able to have a solid knowledge of established and advanced methods for formulating solving complex problems in EM. A goal is to provide a solid understanding of these approaches (integral, differential and hybrid) to enable the solution of propagation, radiation and radar scattering from a variety of well-know geometries and new ones to be encountered in the future.
Course Description

This course is designed for students who require a better understanding of the underlying principles of advanced electromagnetic methods for modeling and analyzing simple and complex geometries. Course Outcomes:

1) Understanding Maxwell's Equations and their applications to wireless links (propagation), radar scattering, and antennas
2) Understanding of boundary conditions and their use in generating wave solutions
3) Understanding wave expressions and related expression in spherical and cylindrical coordinate systems.
4) Reflection and transmission of waves in dielectric layers
5) Guided Waves in metal waveguides(2D and 3D) and in dielectric layers, including optical fibers
6) Cavity resonators (microwave ovens)
7) Equivalence theorems and their use in solving complex problems.
8) Horn antennas
9) Reflector antennas
10) Introduction to Integral Equation methods (wire antenna solutions)—if time permits
11) Introduction to Finite Element methods (1D solutions) ---if time permits

Prerequisites

It is assumed that you have Grad standing in Engineering and have taken at least one course in Electromagnetics. i.e. students will have a basic understanding of electromagnetic wave propagation and antenna radiation and numerical analysis. The first two weeks will be introductory/reviews.

Topics to be Covered

1. Integral forms of MEs
2. Introduction to Coordinate Systems
3. Differential form of MEs and Coordinate-Free Integrations
4. Time Harmonic Fields
5. Solution of MEs and Simplified forms of ME equations for Guided Modes
6. Solution of MEs for Time Harmonic Fields/Propagation
7. Poynting-Uniqueness-Field Equivalence-Reciprocity-Theorems
8. Equivalence Principles for antenna radiation
9. Reflection from Planar dielectric interface
10. TE & TM parallel plate waveguides
11. Wave propagation in dielectric slab
12. Wave propagation in waveguides & cavities (microwave oven operation)
13. Optical Fibers propagation in dielectric rods
14. Setting up and solving complex problem in radar scattering and radiation (radar and antennas).
15. Horn antennas
16. Reflector antennas---satellite links

17. Introduction to numerical methods—if time permits
    1. Intro to integral equations (2D) ---example problems-if time permits
    2. Intro to finite element methods (1D)---example problems
    3. Intro to finite difference methods

If time permits

18. Radar scattering principles
19. Diffraction by edges

Grading Scheme

Grades for the course will be based upon midterm, final examinations, and homework. Weights are assigned as follows:

Homework	55 %
Midterm	15 %
Project	30 %
Total	**100 %**

a) Grading Scale:

Grade	A	A-	B+	B	B-	C+	C	C-	D	F
Score	> 90	85 - 89	79 - 84	74 - 78	69 - 73	64 - 68	59 - 63	52 - 58	46- 51	0 - 45

b) Exam Policy:

Both the mid-term and final exams are subject to the rules of the Honor Code. Open books and notes are accepted. No discussion among students is permitted during the exams. The instructor is not compelled to give credit for something he cannot read or follow logically. Make-up examinations will be given only in the case of an emergency.

c) Homework Policy:

There will be about five to six problem sets assigned throughout the semester. **Due dates will be listed on the assignment sheet.** These assignments will be available on canvas for download and will not be handed out in class. Working in groups on the problem sets is encouraged but answers must be provided individually and should not be copies of one another. Note that there is a strong correlation between homework effort/completion and exam/course performance. Therefore, completing the homework (s) is expected for good performance in the course. All material presented in class will be examinable. In other words, if classes are missed you won't necessarily have all the material to pass the course.

All lectures will be uploaded in pdf/ppt format on Canvas. The goal is to have the pdf/ppt lectures to be as complete as possible for your studies and homeworks.

The course book by Constantine Balanis (Wiley)

https://www.amazon.com/Advanced-Engineering-Electromagnetics-Constantine-Balanis-ebook/dp/B008R0SABG

Links to an external site.

covers the presented materials. Getting this book is highly recommended.
The lectures on finite element and integral equation books can be found in the books:
1) J.L. Volakis, A Chatterjee and L. C. Kempel
https://ieeexplore.ieee.org/book/5265513
Links to an external site.
https://www.amazon.com/Finite-Element-Method-Electromagnetics-Applications/dp/0780334256
Links to an external site.
John Volakis and Kubilay (Scitech) Sertel contains lectures to be covered in the course:
https://www.bibliovault.org/BV.book.epl?ISBN=9781891121937
Links to an external site.

d) Other:

We are very interested in your opinions on the course pace, content and difficulty. Please feel free to stop by during office hours or other times to let me know your thoughts on the course. Questions in class are strongly encouraged; they give the entire class direct feedback on the issues being addressed at that time. We appreciate your help in the continual improvement of this course.

Honor Rules

a) University's Code of Academic Integrity

Florida International University is a community dedicated to generating and imparting knowledge through excellent teaching and research, the rigorous and respectful exchange of ideas, and community service. All students should respect the right of others to have an equitable opportunity to learn and honestly to demonstrate the quality of their learning. Therefore, all students are expected to adhere to a standard of academic conduct, which demonstrates respect for themselves, their fellow students, and the educational Mission of the University. All students are deemed by the University to understand that if they are found responsible for academic misconduct, they will be subject to the Academic Misconduct procedures and sanctions, as outlined in the Student Handbook. More information can be found at http://academic.fiu.edu/academic_misconduct.html
Links to an external site.

b) Plagiarism:

Please note copying and pasting directly from the resources rather than expressing things in your own words is not allowed and is plagiarism. Please check the FIU's note on plagiarism at the following links: ** http://education.fiu.edu/plagiarism
Links to an external site. ** http://libguides.fiu.edu/plagiarism Links to an external site. **
http://academic.fiu.edu/academicbudget/misconductweb/1acmisconductproc.htm
Links to an external site.

c) Department Regulation Concerning Incomplete Grades

To qualify for an Incomplete, a student:

1. Must contact the instructor or the department senior secretary as to the reasons leading to the request of an incomplete grade.
2. Must be passing the course prior to that part of the course that is not completed
3. Must make up the incomplete work through the instructor of the course
4. All missed work must be finished before last two weeks of the following term.

University policies on sexual harassment, and religious holidays, and information on services for students with disabilities, please visit the following websites: http://academic.fiu.edu/; http://drc.fiu.edu
Links to an external site.

d) Course Policies:

- **Academic Misconduct:** For work submitted, it is expected that each student will submit their own original work. Any evidence of duplication, cheating, or plagiarism will result in at least a failing grade for the course.
- **Deadlines:** Assignments are due on the specified date and time. Assignments submitted the next day or lecture will receive 75% of the full credit and two days after will receive half (%50) credit.
- To get assistance, students are encouraged to see the TA and/or the course instructor by an appointment.
- Students are encouraged to ask questions and to discuss course topics with the instructor and with each other.
- Any work submitted should display Panther ID number and should be signed, as the students' own work, and that no unauthorized help was obtained.
- Cell phones, communicators, MP3 players, head-sets are not allowed to be used in the class.
- The instructor reserves the right to change course materials or dates as necessary and should inform the students if any change is needed.