COURSE SYLLABUS

1 ECE 3690 - Engineering Electromagnetics

2 Meeting Information

4 credits, 5 contact hours Three 50-minute lectures & One 100-minute Practicum Session

a. **Section 001:**
Lecture: MWF from 01:55 pm to 02:45 pm Location: Tolentine 316, **Tolentine 316**
Lab: MWF from 01:55 pm to 02:45 pm: Tolentine 316, **Practicum: Tuesday from 03:00 pm to 04:40 pm: Tolentine 316**

3 Course Instructor(s), TA(s)

a. **Section 001:**

Class Instructor:	Tommaso Cappello
Office Hours:	Monday and Thursday 15:00 - 16:00, other times by appointment, or by appt.
Lab Instructor:	Ahmad Hoorfar
Office Hours:	, or by appt.
TA(s):	
TBA	
Office Hours:	, or by appt.

4 Textbook

Shen, Liang Chi & Kong, Jin Au, *Applied Electromagnetism, 3rd edition*, Brooks/Cole. , 1995. ISBN: 0-534-94722-0. REQUIRED.

a. **Other Supplemental Materials:** Other Supplemental Materials: Extensive 'Hand-Out' Notes & CAD software tools and accompanying documentation

b. **References:**
F. T. Ulaby "Electromagnetics For Engineers", Prentice Hall, 2005.

5 Specific Course Information

a. **Catalog Description**
Maxwell's equations, plane waves, dissipative media, reflection and transmission of waves at an interface, metallic and optical waveguides, transmission lines, linear and array antennas. Practicum includes computer projects, laboratory demonstrations and problem solving. Three lecture hours and a two-hour practicum per week.

b. **Prerequisites:** MAT 2500 and PHY 2402; **Co-requisites:** None

c. Required for B.S. Electrical Engineering

6 Learning Objectives

a. Upon completing the course, among the various student outcomes will achieve are: 1) use the basic theoretical principles of classical time harmonic electromagnetic field theory as given by the Maxwell equations in the solution of electromagnetics problems.; 2) apply these theoretical principles to modern engineering problems in wave propagation in dielectric media, metallic and dielectric waveguides, coaxial lines and optical fibers 3) use the Smith Chart to solve impedance transformation and impedance matching problems; and 4) perform literature surveys in modern RF, microwave and radar related topics, and write technical reports and present finding based on the analysis, design and simulation of electromagnetic fields in free-space as well as in microwave guiding structures.

b.

ABET Student Outcomes														
1a	1b	2a	2b	2c	2d	3	4a	4b	4c	5	6a	6b	7a	7b
X	X	X	X	X	X	X	X	X	X					

The above student outcomes are defined by the Accreditation Board for Engineering and Technology (ABET) as:

1a. an ability to identify and formulate complex engineering problems by applying principles of engineering, science, and mathematics

1b. an ability to solve complex engineering problems by applying principles of engineering, science, and mathematics

2a. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare

2b. an ability to apply engineering design to produce solutions that meet specified needs with consideration of cultural and social factors

2c. an ability to apply engineering design to produce solutions that meet specified needs with consideration of global and economic factors

2d. an ability to apply engineering design to produce solutions that meet specified needs with consideration of environmental factors

3. an ability to communicate effectively with a range of audiences

4a. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global and societal contexts

4b. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in economic contexts

4c. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in environmental contexts

7 List of Covered Topics

1. Introduction, Complex and Vector Algebra
2. Maxwell's Equations
3. Electrostatics and Magnetostatics

4. Uniform Electromagnetic Waves
5. Wave Propagation in Lossy Media
6. Boundary Conditions
7. Reflection and Transmission of Waves
8. Waveguides and Resonators
9. Transmission Lines
10. Smith Chart and Impedance Matching
11. Antennas (if time permits)

8 Tentative Schedule

Tentative schedules for all sections follow. Be sure to refer to the schedule for your specific section, if more than one is provided.

Tentative Schedule for **All Sections**

Week	**Topics**
1	Introduction, Complex and Vector Algebra
2	Maxwell's Equations
3	Electrostatics and Magnetostatics
4-5	Uniform Electromagnetic Waves and Polarization
6	Wave Propagation in Lossy Media
7	Boundary Conditions
7-8	Reflection and Transmission of Waves
9-10	Waveguides and Resonators
11	Transmission Lines
12-13	Smith Chart and Impedance Matching
14	Introduction to Antennas (if time permits)

9 Grading Policy

Homework Quizzes 10 %
Practicum & computer projects 15 %
Research paper & PowerPoint presentation 8 %
3 Tests 15 % each
Final Exam 22 %

No make-up tests will be given for any reason. Instead, the percentage of the final grade associated with each test missed (15 % each test) will be added to the final examination percentage (for example, if you miss one test, your final exam will be worth 37 % of your final grade, etc.). The

two lowest homework quiz grades will be dropped. No credit for late assignments will be provided.

Letter grade scale: A(93–100), A–(90–92), B+(87–89), B(83–86), B–(80–82), C+(77–79), C(73–76), C–(70–72), D+(67–69), D(63–66), D–(60–62), F(<60)

Please note that classes may be extended beyond the usual time in order to make up time for instructor travel.

10 HW Assignment and Laboratory Report Submission Policy

1) Practicum:
Practicum sessions will include computer projects and student project presentations. Some of the practicum sessions may be allocated to problem-solving sessions and/or tests.

2) Homework Quizzes:
It is extremely important that the homework problems be worked regularly - not only for the sake of the homework quiz grade, but also to ensure sufficient facility in problem solving so that you can perform well within the constraints of the tests or final exam.

3) Miscellaneous (please read this carefully!)
Please note that group study for working out solutions to problems and computer projects is acceptable, and helpful to many students. However, the problems or project report you turn in should be written out on your own, and not copied verbatim from another student's work or from the material found online. It should reflect your understanding of the material. Practicum reports which are turned in and found to be verbatim copies of each other will be given zero credit, regardless of which is the original work. All work on an exam or test is to be entirely on your own. The use of artificial intelligence technologies such as ChatGBT to generate text is not allowed and will be treated as an academic integrity violation.

4) Masking
Masks are optional in both lecture and practicum. Please respect each person's decision on whether to wear a mask.

11 Attendance Policy

General Rules

The full version of the official Villanova class attendance policy is posted at https://live-villanova-catalog.cleancatalog.io/class-attendance, but the main points are as follows.

Attendance at lectures and practicum sessions is strongly advised. Absences may be excused if they follow the procedures outlined in the Excused Absence section. You are responsible for whatever is presented in the class. Attendance is required for all tests, quizzes and the final exam (please see grading policy for missed tests and quizzes).
Please note: Unauthorized use of all laptops, tablets, smart phones, cell phones, and iPAD or PDAs, are prohibited during lecture hours.

Whenever possible, students should inform the instructor if they plan to be late or absent from class. In all cases, documentation is required to petition for *excused* absences to the Associate Dean

for Student and Strategic Programs, Dr. Stephen Jones. The excused absence form is posted at: https://forms.office.com/r/H2kbHKLUmw.

Excused absences do not count towards a failure in the course for first year students. Absence from class does not release the student from assigned work. Students who miss an in-class obligation such as an exam, a presentation, etc., due to an excused absence will not be penalized - the instructor may offer a make-up test, arrange an alternative time for a presentation, exempt a student from the assignment, or provide another arrangement. In the case of illness or injury, the form must be submitted within 24 hours of missing a class. The University's list of excused absences for all students includes the following:

1. Participation in NCAA athletic competitions
2. Participation in special academic events such as: conferences, field trips, project competitions, etc., and in official university business such as student representatives attending meetings related to university governance
3. Attendance at significant events of the immediate family such as: funerals, weddings, etc.
4. Religious holidays - see the University's policy on Religious Holidays
5. College-approved participation in placement activities such as: job interviews, graduate school interviews, job fairs
6. Legally required absence such as: jury duty, court appearance, short-term military service
7. Documented serious illness or disability

Personal Days

Personal Days are NOT allotted for laboratory sessions and courses that meet once a week. For all other courses that meet at least twice a week, students are entitled to excused absences for any reason that may contribute to their personal wellness. The following rules apply.

Students must advise the instructor by email *before* class of their intent to utilize a Personal Day as the reason for their absence. A Personal Day will not be approved retroactively. Students may, but are not required, to provide additional information regarding their absence. A Personal Day does not grant an automatic extension for items due. Students remain responsible for all assignments, exams, presentations, etc. due on that date. The instructor may apply her/his discretion on a case-by-case basis to determine whether an extension on a deliverable item is appropriate.

For classes that meet thrice a week (50 mins $\times$ 3), TWO personal days are allowed in the semester. These personal days may not be used ...

1. on consecutive class days
2. in the same week
3. immediately preceding or following a University holiday or break period, and
4. on days when exams, presentations or other major assignments are scheduled.

For classes that meet twice a week (75 mins $\times$ 2), ONE personal day is allowed in the semester. This personal day may not be used ...

1. immediately preceding or following a University holiday or break period, and
2. on days when exams, presentations or other major assignments are scheduled.

12 Examination Policy

The College of Engineering has adopted the following general examination guidelines:

1. Students must arrive before the start of the examination. Under exceptional circumstances a student may need to arrive late, but he/she can enter the examination room no later than five (5) minutes after the start of the exam.
2. Cell phones must be turned off until the student exits the examination room.
3. The official Villanova class attendance policy must be followed when requesting excuses for absences or lateness to an examination.
4. Each student must write and sign the following statement, "I have neither given nor received any unauthorized assistance in the completion of this examination."
5. For online examinations, the instructor may implement video proctoring or other measures to ensure academic integrity. For consent purposes, the instructor will inform students in advance if (s)he plans to use any form of video-proctoring and whether the examination will be recorded.

13 Academic Integrity Policy

The College of Engineering is committed to creating an environment of academic integrity and ethical decision-making that we hope is reflected in the actions of our students and graduates. As Villanova students, integrity is central to the University mission. As engineers, our code of conduct requires us to place honor and integrity at the forefront of everything we do. As engineering students, it is expected that you will begin to adopt these values and instill them into your work habits. Students violating the academic integrity policy will receive a zero on that assignment or exam and the violation will be reported to the Associate Dean for Academic Affairs. The University's academic integrity policy can be found on the following web page:
https://live-villanova-catalog.cleancatalog.io/academic-integrity-0.

14 Adherence to the Student Code of Conduct

Students are expected to act in a professional and respectful manner to their fellow students, faculty, and staff. Students should become acquainted with and understand the responsibilities set forth in the Student Handbook, especially those in the sections on Policy and Regulations. Adherence to university regulations is expected and required for successful completion of the program of studies. Enforcement within the classroom of policies regarding classroom behavior is the responsibility of the faculty member. All other discipline problems are to be referred to the Dean of Students.

15 Inclusive Classroom

This classroom is a place where you will be treated with respect; we welcome individuals of all ages, backgrounds, beliefs, ethnicities, gender, gender identities and expressions, sexual orientation, and other visible and non-visible differences. All members of this class are expected to contribute to a respectful, welcoming, and inclusive environment to allow all among us to learn and flourish.

16 Students with Disabilities

It is the policy of the university to make reasonable academic accommodations for qualified individuals with disabilities. If you are a person with a disability (non-physical) please register with

the office of Learning Support Services (LSS) by emailing Learning.support.services@villanova.edu or by phoning 610-519-5176 as soon as possible. Registration is *required* in order to receive accommodations. In addition, please contact the instructor during office hours in order to make the appropriate arrangements.

The Office of Disability Services (ODS) collaborates with students, faculty, staff, and community members to create diverse learning environments that are usable, equitable, inclusive and sustainable. The ODS provides Villanova University students with physical the necessary support to successfully complete their education and participate in activities available to all students. If you have a diagnosed disability and plan to utilize academic accommodations, please contact and register with Gregory Hannah, advisor to students with disabilities at 610-519-3209 or visit the office on the second floor of the Connelly Center.

17 Tutoring Services

Villanova's tutoring services include The Writing Center, The Learner's Studio, and The Center for Speaking and Presentation. These services are offered free of charge to students. Drop in as-needed or book a regular weekly session to supercharge your academic success. Sessions can be 30 or 60 minutes in length.

Register for an account and book sessions in advance at villanova.mywconline.com. If you don't see your class listed, request a tutor for a missing subject at: tutorrequest.villanova.edu For more information, contact Juliana Struder at juliana.studer@villanova.edu or at 610-519-5862.

18 Online Expectations

Some or all sessions of this class may be recorded for educational purposes and for later playback. In order to foster a professional environment, please wear appropriate clothes, refrain from eating, mute your microphone when you are not talking so as to eliminate background noise, and select an appropriate setting free of distractions. You may turn off your webcam for privacy reasons unless explicitly instructed not to do so by the instructor (such as during the conduct of online examinations).

19 Electronics Policy

The use of electronic devices, such as phones, laptops, tablets, calculators, etc., during class is generally allowed, unless their use causes a disturbance to others. During examinations, the use of any electronic device is prohibited, unless it is expressly authorized by the instructor.

Students are prohibited from making any audio or visual recordings (including taking photographs) of lectures, discussions, or other classroom activities, unless a student (1) has written permission in advance from the instructor, or (2) is permitted to record under terms and conditions as approved by the University's Office of Disability Services or Learning Support Services. Students who have received approval to record classes as an academic accommodation must provide supporting documentation from the Office of Disability Services or Learning Support Services in advance of any recording. Students may use authorized recordings only for the purposes of individual study in the course, and may not disseminate or share them with a wider audience without explicit permission.

20 Copyright Policy

The materials used in Villanova University courses ("Course Materials") generally represent the intellectual property of course instructors, third parties and/or the university which may not be disseminated or reproduced in any form for public distribution (e.g., sale, exchange, etc.) without the written permission of the course instructor. Course materials include all written or electronic documents and materials, including syllabi, current and past examination questions/answers, and presentations such as lectures, videos, slides, etc., provided by a course instructor. Course materials may only be used by students enrolled in the course for academic (course-related) purposes.

Published course readings (book chapters, articles, reports, etc.) available in "Blackboard" are copyrighted materials. These works are made available to students through licensed databases or fair use. They are protected by copyright law, and may not be further disseminated or reproduced in any form for distribution (e.g. uploading to websites, sale, exchange, etc.) without the permission of the copyright owner.

Follow these links for more information on Intellectual Property, Copyright, and Computer Acceptable Use.

21 Professorial Duties

It is important to note that teaching is one of the many duties that professors perform as part of their job responsibilities. In addition to teaching, professors perform research, advise graduate students, edit journals and review journal articles, serve on committees for the university and professional societies, travel to conferences to remain abreast of current developments and to present their results... to name just a few commitments.