ECE 3690 ENGINEERING ELECTROMAGNETICS

1. **ECE 3690 – ENGINEERING ELECTROMAGNETICS**
2. Four credit hours – three 50 minute classes and one 2 hr. practicum per week.
3. Course Instructor(s)
   a. Lecture
   Robert Caverly, Ph.D.*
   433 Tolentine
   610 -519-5660
   robert.caverly@villanova.edu
   Office Hours on Zoom by appointment
   b. Practicum
   Ahmad Hoorfar, Ph.D.
   434 Tolentine
   610 –519-7223
   ahmad.hoorfar@villanova.edu
   Office Hours on Zoom by appointment

4. SCHEDULE (TENTATIVE)

Topics
Introduction
Complex and Vector Algebra
Maxwell's Equations
Uniform Electromagnetic Waves (Part 1)
****** TEST #1 ******
Uniform Electromagnetic Waves (Part 2)
Reflection and Transmission of Waves
****** TEST #2 ******
Waveguides and Resonators
Transmission Lines
Smith Chart and Transmission Line Circuits
****** TEST #3 ******
Transmission Lines and Antennas
Review
Final Exam

5. TEXTBOOK
   a. Shen, Liang Chi and Kong, Jin Au, Applied Electromagnetics, 3rd edition, PWS, 1995.
   b. Class Notes

* Course Coordinator

6. SPECIFIC COURSE INFORMATION
   Catalog Description
   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..
   a. Prerequisites: Physics 2402 and Math 2500
   b. Required for B.S. Electrical Engineering

7. COURSE – SPECIFIC GOALS
   a. Electromagnetic fields and waves affect all of us in many ways throughout our daily lives. Some examples are microwave, wireless and lightwave systems that allow us to communicate over vast distances. On the other hand, these same electromagnetic fields, such as those caused by rapid signal switching in personal computers, can cause interference with other nearby electronic systems. Knowledge of the underlying physical aspects of electromagnetic fields and waves helps the well-rounded engineer understand the way systems are designed, and provides the background for designing future systems. This understanding of electromagnetic field phenomenon will be accomplished in this course by first reviewing vector algebra, the fundamental mathematics of electromagnetic theory, and electro- and magnetostatics. Maxwell's Equations will be studied in the context of unconstrained and constrained (that is guided) wave phenomenon. The discussion of unconstrained waves will focus on uniform plane waves as well as wave transmission and reflection at conducting and non-conducting boundaries. Included in the guided wave discussion will be presentations on waveguides and other types of transmission lines and transmission line design tools such as the Smith Chart. The Smith Chart will be used to aid in the design and analysis of simple transmission line circuits. As time permits, antenna fundamentals will be covered.
   b. Upon completing the course, among the various outcomes students will achieve are:
      1) to mathematically predict the behavior of electromagnetic waves at various boundaries;
      2) the use of modern software packages such as MATLAB and Quickfield to solve a variety of static and dynamic electromagnetics problems;
      3) the use of the Smith Chart to solve impedance transformation and matching transmission line problems; and
      4) the ability to write a paper based on technical research on a current topic related to electromagnetics

   c. ABET OUTCOMES

Student Outcomes						
1	2	3	4	5	6	7
X		X	X			

8. LIST OF TOPICS TO BE COVERED
    1. Introduction
    2. Complex and Vector Algebra
    3. Maxwell's Equations
    4. Uniform Electromagnetic Waves
    5. Reflection and Transmission of Waves
    6. Waveguides and Resonators
    7. Transmission Lines
    8. Smith Chart and Transmission Line Circuits
    9. Transmission Lines and Antennas

9. GRADING POLICY

    Your final grade will be determined from the following:
    a. Tests: 50% (Three tests)
    b. Homework/Homework Quizzes: 10%
    c. Practicum assignments, the practicum write-ups and a final course paper and project presentation: 20%
    d. Final Exam: 20%
    e. The scale used to assign letter grades is:

Numerical Grade	**Letter Grade**	**Numerical Grade**	**Letter Grade**
A	93 to 100	**C**	73 to 76
A-	90 to 92	**C-**	70 to 72
B+	87 to 89	**D+**	67 to 69
B	83 to 86	**D**	63 to 66
B-	80 to 82	**D-**	60 to 62
C+	77 to 79	**F**	Less than 60

10. HOMEWORK, PRACTICUM and REPORT SUBMISSION POLICY

    We strongly encourage you to do the homework because much of electromagnetic theory is the understanding of the mathematics and mathematical manipulations involved. Only homework whose answers are available will be assigned. This should assist you in choosing the path to follow in correctly answering the problems and will help you when performing the homework quizzes. Practicum assignments are due one week as a Bb upload after the practicum has completed. The final project presentation/report due date will be announced later in the semester. The final exam will be held during the regularly scheduled university time.

11. EXAMINATION POLICY

    You are allowed a calculator as well as the supplied “note sheets” but no other material. College of Engineering testing policies will apply. The Respondus Lockdown browser with Webcam Monitoring will be used.

12. POLICIES MANDATED BY COLLEGE/UNIVERSITY: ACADEMIC INTEGRITY, STUDENT CODE of CONDUCT, ATTENDANCE, LSS & ODS ACCOMMODATIONS, LEARNER'S STUDIO.

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 here: https://www1.villanova.edu/villanova/provost/resources/student/policies/integrity.html.

The College of Engineering has adopted the following exam guidelines:

- Students must arrive before the start of the exam. Under exceptional circumstances a student may need to arrive late, but he/she can enter the exam no later than 5 minutes after the start of the exam.
- All cell phones must be turned off and stored away until the student exits the exam room.
- The official Villanova class attendance policy must be followed when requesting excuses for absences or lateness to an exam.
- Each student must write and sign the following statement, "*I have neither given nor received any unauthorized assistance in the completion of this exam.*"
- Students can work together on homework, but each person must turn in a copy in their own handwriting.

Adherence to the Student Code of Conduct and the CARITAS Commitment

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.

Students, faculty, and staff are expected to comply with the CARITAS Commitment. Students must wear masks, practice social distancing and good hygiene, wipe down their work area upon arrival and departure, and request an excused absence if they are not feeling well.

Online Expectations

To foster a professional environment, please wear appropriate clothes, mute if you are not talking to cut down on background noise, refrain from eating, and select an appropriate setting when we are meeting online.

Students with Disabilities

It is the policy of Villanova to make reasonable academic accommodations for qualified individuals with disabilities. If you are a person with a disability please contact me after class or during office hours to make arrangements.

If you have a non-physical disability you need to register with the Learning Support Office by contacting 610-519-5176 or at learning.support.services@villanova.edu as soon as possible. Registration is needed to receive accommodations.

The Office of Disability Services 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 disabilities 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 @ 610-519-3209 or visit the office on the second floor of the Connelly Center.

The Learner's Studio

Villanova's Learners' Studio provides free 1:1 and small group (max of 10 students) content tutoring for over 100 courses on campus (excludes writing, math, and entry level VSB courses). From quick homework clarification questions to prep for final exams, we can help! Their peer tutors are each endorsed by two faculty members and are trained according to CRLA national standards. Pop in as-needed or book a regular weekly session to supercharge your academic success. Sessions can be 30 or 60 minutes in length. They are located in Old Falvey 301.

Walk-ins welcome, or book in advance online:

1. Visit Villanova.mywconline.com
2. Register for an account and select "The Learners' Studio" from the drop-down menu on the sign-in page
3. Use the "limit to" menu to locate your course by code (For example, PHY 2400). This feature will sort the schedule and show you all tutors approved to cover your class
4. White boxes represent available sessions. Click any white box to book

Don't see your class listed? Request a tutor for a missing subject with this link: tutorrequest.villanova.edu

For more information, contact juliana.studer@villanova.edu 610-519-5862.

Electronics Policy

The use of electronic devices, such as phones, laptops, tablets, etc., during class is generally fine, unless you become a disturbance to others. Use of these devices is not allowed during quiz or testing taking. 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.

Copyright Policy

The materials used in Villanova University courses ("Course Materials") generally qrepresent 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, PowerPoints, 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 material. 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 permission of the copyright owner.

Follow these links for more information about intellectual property, copyright, and computer acceptable use.

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.

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.

VILLANOVA UNIVERSITY

EMERGENCY PROCEDURES

GENERAL GUIDELINES

For general emergencies and to report a crime:

- Get to a safe place if possible
- **Call (610) 519-4444**

In an emergency evacuation (including but not limited to a fire alarm):

- Move quickly and safely to the nearest exit
- Close doors and windows if time permits
- Do not use elevators
- Assist disabled individuals who cannot evacuate themselves by proceeding with them
  - Proceed with them to the nearest fire stairway or safe haven and wait inside with the doors closed until rescue personnel arrive to assist. Immediately get word to rescue personnel of the exact location of the disabled individual
- Remain a safe distance from the building and be aware of responding emergency vehicles

MEDICAL EMERGENCIES

- Do not move a seriously injured or ill person unless the situation is life threatening
- Call Public Safety at (610) 519-4444
- Give the dispatcher your name, location, and telephone number and as much information as possible regarding the nature of the injury or illness
- Do not hang up until the dispatcher ends the call
- Administer first aid if you are trained to do so. Otherwise remain with the victim until Public Safety or medical personnel arrive

SHELTER IN PLACE

Shelter in place is design to keep you safe while indoors if dangerous environmental conditions exist, such as extreme weather or a hazardous materials release. **If a shelter in place is ordered:**

- If outside, seek shelter in the nearest building, preferably in an interior room with few windows
- Close all exterior doors, windows and any other openings to the outside
- Avoid overcrowding by selecting several rooms if necessary
- Monitor Nova Alert and email for further instructions
- Report any emergency or unusual condition to Public Safety
- Do not leave the building until receiving the "all clear" from a police officer, Public Safety officer, Nova Alert, email or website communication

UTILITY FAILURES AND ELEVATOR EMERGENCIES

Report utility failures to Facilities Management by calling (610) 519-4420 during normal business hours. After hours, report utility failures to Public Safety by calling (610) 519-4444.

ALCOHOL EMERGENCIES

Consuming too much alcohol can result in serious injury or even death. **Call Public Safety at (610) 519-4444 if a person:**

- Cannot be roused by shaking or shouting
- Has cold, clammy or bluish skin
- Is disoriented, incoherent, or cannot stand, walk or talk
- Sustained a blow to the head or any injury that caused bleeding
- Has shallow or irregular breathing
- Drank alcohol in combination with other drugs

IN AN ACTUAL FIRE

- Activate the fire alarm system by pulling a fire alarm station on your way out of the building
- Leave the building via the nearest exit
- Do not use elevators
- Feel doors before opening, and close doors and windows as you leave if safe to do so
- Report the fire to Public Safety by calling (610) 519-4444 once outside
- If trapped, keep the doors closed and place cloth under them to keep out smoke

  Signal for help by hanging an object (e.g., such as a jacket or shirt) out window to attract attention

LOCKDOWN

An imminent threat of violence may be cause for a lockdown of all or part of campus. Some exterior doors will lock automatically. Emergency responders will lock others manually. The goal is to limit exposure of students, faculty and staff to danger by preventing dangerous persons from entering campus buildings. **If a lockdown is ordered:**

- Stay Inside! Do not leave the building unless an imminently dangerous situation arises inside. If outside, seek shelter in the nearest building
- Take shelter in a lockable room if possible
- Close windows, shades and blinds, and avoid being seen from outside the room if possible
- Monitor Nova Alert and email for updates and further instructions. A description of the actor will be disseminated as soon as possible using these methods
- Report any emergency or unusual condition to Public Safety
- Use discretion in admitting anyone into a secure building. Require that all backpacks and other bags be left outside at least 30 feet from the building. Require that the person seeking shelter open all outer garments for visual inspection before allowing entry
- Once in a secure location, do not leave until receiving the "all clear" from a police officer, Public Safety officer, Nova Alert, email or website communication

Nova Alert is Villanova University's primary emergency communication method. To sign up, go to **alert.villanova.edu**.