University of Texas at El Paso

EE 3321 – Electromagnetic Field Theory
Spring 2022

Course Information

Course Website:  
https://empossible.net/academics/emp3302/
Meeting day and time:  
MW, 12:00pm – 1:20 pm
Room:  
Liberal Arts (LART) 107
Final Exam:  
Friday, May 13, 1:00 pm – 3:45 pm
Course designation:  
EE 3321
CRN:  
21906
Credit hours:  
3
Lecture hours:  
3

Catalog Description:  Fundamental laws and concepts of static and time-varying electromagnetics, wave propagation in free space and lossy media, wave reflections, transmission lines, basic radiation sources and arrays.

Instructor Information

Jesus J. Gutierrez, Ph.D.  
Assistant Professor of Instruction
Office:  
ENGR A-338
Office Hours:  
TR 1:00 pm – 5:00 pm or by appointment (virtual also available).
E-mail:  
jjgutierrez4@utep.edu

Course Materials

• Textbook (Main):
  Fundamentals of Applied Electromagnetics (7th or 8th Edition)  
  Fawwaz T. Ulaby & Umberto Ravaioli  
  Pearson Education, 2015, 528 pages
  Companion Website:  https://em8e.eecs.umich.edu/

• Textbook (Optional):
  Elements of Electromagnetics (7th Ed.)  
  Matthew N. O. Sadiku  
  Oxford University Press, 2018, 920 pages

• TI-85 scientific calculator or equivalent (no TI-89 or Nspire)
• Mobile device (laptop/phone) with access to the internet and Blackboard
• Access to MATLAB

Some course content will be delivered through Blackboard. Class announcements will be delivered via Blackboard and/or e-mail. Please make sure your UTEP e-mail is working, and you have stable access to the internet.
You can install MATLAB on your laptop or computer following the UTEP link: https://www.utep.edu/technologysupport/ServiceCatalog/SOFTWARE_PAGES/soft_matlab.html. You will be required to create a Mathworks account to download both the software and the license using your UTEP username and password.

If a student has no computer with access to the internet, from UTEP’s Technology Support Center has borrowing services for laptops and tablets: https://www.utep.edu/technologysupport/TSCenter/TSC_EQ_LaptopsTablets.html
UTEP’s Technology Support center also helps for technological needs beyond your scope of troubleshooting, so make sure you contact them if you encounter technical difficulties.

Students should maintain a well-organized notebook that archives their syllabus, lecture notes, homework problems, and tests. Students are also encouraged to purchase a USB Drive or use a cloud service like Dropbox or OneDrive to save their homework, lecture notes, tests, and other digital work.

**Prerequisites**

By Course (with grade of “C” or better):
- MATH 2313 – Calculus III
- MATH 2326 – Differential equations
- EE 2350 – Electric Circuits I
- PHYS 2421 – Introductory Electromagnetism

By Topic:
- Fundamental laws of electricity and magnetism
- Differential equations
- Vector calculus
- Basic knowledge of electromagnetic fields and waves

**Course Outline**

Topics covered in this course include:
1. Review of vectors and vector calculus
2. Maxwell’s equations
3. Electrostatics
4. Magnetostatics
5. Electromagnetic Waves
6. Transmission lines

**Course Outcomes**

By the end of the semester, the student will demonstrate the ability to:
- Use vector calculus to solve basic electrostatic problems. Understand and analyze devices based on electrostatic principles like capacitors and resistors.
- Use vector calculus to solve basic magnetostatic problems. Understand devices based on magnetostatic principles like inductors and current-carrying conductors.
- Describe and characterize electromagnetic wave propagation in lossless and lossy media using physics principles involving differential equations.
- Characterize the reflection and transmission behavior of electromagnetic waves incident on plane boundaries at normal and oblique incidences.
**Contribution to Professional Component**

EE 3321 is a junior level core course that builds on topics covered primarily in sophomore courses.

**Relationship to (ABET) Program Outcomes**

- Ability to apply knowledge of mathematics, science, and engineering:  
  *Students apply physics and mathematical principles in the analysis of electromagnetic phenomena.*
- Ability to identify, formulate, and solve engineering problems:  
  *Students solve problems and observe simulations regarding electromagnetic phenomena.*
- Ability to communicate effectively:  
  *Students solve problems in class and discuss their findings in groups.*
- Ability to use computers to enhance problem solving:  
  *Students use MATLAB to visualize electromagnetic fields and related phenomena.*

**Rules and Policies**

**Grading**

Student achievement in the course objectives will be assessed using a combination of homework, exams, class work and participation.  

Student grades are protected by the Privacy Act of 1974.  

Your course grade will be determined by your weighted performance in the following categories:

<table>
<thead>
<tr>
<th>Category</th>
<th>Weight</th>
<th>Range</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework (6)</td>
<td>30%</td>
<td>90% − 100%</td>
<td>A</td>
</tr>
<tr>
<td>Class Participation</td>
<td>20%</td>
<td>80% − 89%</td>
<td>B</td>
</tr>
<tr>
<td>Midterm Exams (2)</td>
<td>30%</td>
<td>70% − 79%</td>
<td>C</td>
</tr>
<tr>
<td>Final Exam</td>
<td>20%</td>
<td>60% − 69%</td>
<td>D</td>
</tr>
<tr>
<td><strong>Total Grade</strong></td>
<td>100%</td>
<td>0% − 59%</td>
<td>F</td>
</tr>
</tbody>
</table>

**Homework Policy**

- Homework is an integral part of the course. It is crucial that you promptly and effectively do all your homework, as it will be very useful for your learning and preparing for the exams.
- Homework will consist of six (6) assignments, each worth 5% of the final grade.
- Homework will be graded on a 100-point scale. Unless otherwise instructed, solve all problems by hand.
- Show all your work. You may only use a calculator or computer for basic arithmetic and to check your answers. Your solutions must be provided in the proper order and the final answer(s) must be clearly boxed and given proper units.
- Do not box intermediate results.
- Finish all calculations. For example, $3\pi\sqrt{14}$, sin (0.2) are **not** final answers. These should be given as 9.4248, 3.7417, and 0.1987.
- Homework must be completed with a high level of professionalism and be formatted properly. Points will be deducted for sloppy work, incorrect formatting, or shows incomplete work.
- 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.
• **Format** – All homework assignments will be submitted as a single document stapled in the upper-left corner with no additional binding. 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.

~ Missed Homework ~

• If for some reason you cannot finish the homework on the due date, unless you have promptly advised the professor, you can complete it later. However, the grade will be reduced proportionately to the days passed after the due date (10% for each day passed).

**Exam Policy**

• There will be 2 midterm exams, each one accounting for 15% of the final grade.
• The final exam will be held at the time and date shown on this syllabus under “Course Information” and is worth 20% of the final grade.
• Duration of the exam will be the time allotted for the class, but no longer.
• Full work must be shown for full credit. Work must be neat and well organized.
• The final answer must be boxed and given proper units.
• Students suspected of cheating will be submitted to the Office of Student Conduct and Conflict Resolution and will remain part of your permanent record at UTEP, along with a zero (0) grade for the test.
• The tentative schedule for the exams and the covered topics is shown in the chart below. This may be subject to change:

<table>
<thead>
<tr>
<th>Date</th>
<th>Exam #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wednesday, March 23</td>
<td>Exam #1</td>
</tr>
<tr>
<td>Wednesday, May 4</td>
<td>Exam #2</td>
</tr>
<tr>
<td>Friday, May 13 1:00 pm – 3:45 pm</td>
<td>Final Exam</td>
</tr>
</tbody>
</table>

Some other important dates to keep in mind:

<table>
<thead>
<tr>
<th>Date</th>
<th>Motive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday, March 14 - Friday, March 18</td>
<td>Spring Break (No Classes)</td>
</tr>
<tr>
<td>Friday, April 1</td>
<td>Drop/Withdrawal Deadline (no joke)</td>
</tr>
</tbody>
</table>

~ Missed Exams ~

A missed exam can be made-up IF AND 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.

**Class Participation Policy**

• 20% of your total grade is based on your participation in class. Participation will be comprised mainly of questions asked by the professor, small group discussions and in-class assignments, and participation through student response systems (iClicker, Mentimeter).
• Participating in class does not necessarily mean talking a lot or asking a lot of questions. Some of the most helpful things you can do to enrich participation in class is bringing a new resource/information to the classroom, doing class work, answer questions asked by the professor in a thoughtful manner, or ask a question or make a comment that shows interest in what another fellow classmate said.

• There are also multiple ways quieter learners can participate, like honest and serious participation through student response systems, participate in class assignments and discuss the in-class assignments with your fellow classmates.

• The grading rubric for class participation will be based on the frequency and quality of contributions to the class:
  o (18-20%): Attends class regularly and often contributes to class participation by raising thoughtful questions or asks for clarification if something is not clear, responds seriously and honestly to surveys and questions on iClicker or Mentimeter, builds on other students’ ideas or questions, and actively participates in class assignments by working in groups to solve problems or to explain/help a fellow classmate.
  o (15-17%): Attends class regularly and sometimes contributes to class participation in the aforementioned ways.
  o (11-14%): Attends class regularly but rarely contributes to class participation in the aforementioned ways.
  o (<10%): Attends class regularly but never contributes to class participation in the aforementioned ways.

**Attendance Policy**
Students are required to attend class and to show up to lectures on time. Attendance will be taken at the beginning of each lecture. The course instructor reserves the right to turn away late comers and to withdraw students from the course that are 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.

**Etiquette**
The following items are expected from students as part of being a student in the class:
• Ask questions if you are confused or a concept is not clear! Despite how “silly” or “dumb” you may think your question is, it is 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 instructor. I promise I will respond!
• Respond honestly to polls and provide real-time feedback to instructor about the course. This will contribute greatly to the quality of the course and to 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.
• Limit your use of cell phones, laptops, or mobile devices to only class work and participation.
• Purchase the textbook with the correct edition and read the assigned sections before class.
• Bring all your course materials (textbook, notebook, pens/pencils, calculator) to class.
• Show proper etiquette during class. Do not talk if not encouraged to do so, make excessive noise, or otherwise distract the class. You will be asked to leave and it will affect your grade.
Course Calendar

This is a tentative schedule of the course topics, homework, and tests, and might change.

<table>
<thead>
<tr>
<th>W</th>
<th>Dates</th>
<th>Topic</th>
<th>HW, Date</th>
<th>Exam, Date</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jan 17, 19</td>
<td>Vector Calculus</td>
<td></td>
<td></td>
<td>MLK Day/Jan. 17</td>
</tr>
<tr>
<td>2</td>
<td>Jan 24, 26</td>
<td>Vector Calculus</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3</td>
<td>Jan 31, Feb 2</td>
<td>Vector Calculus</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4</td>
<td>Feb 7, 9</td>
<td>Maxwell's Eqs.</td>
<td>HW #1, Feb 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Feb 14, 16</td>
<td>Maxwell's Eqs.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Feb 21, 23</td>
<td>Electrostatics</td>
<td>HW #2, Feb 21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Feb 28, Mar 2</td>
<td>Electrostatics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Mar 7, 9</td>
<td>Magnetostatics</td>
<td>HW #3, Mar 9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Mar 14, 16</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Spring Break</td>
</tr>
<tr>
<td>10</td>
<td>Mar 21, 23</td>
<td>Magnetostatics</td>
<td>Exam #1, Mar. 23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Mar 28, 30</td>
<td>Magnetostatics</td>
<td>HW #4, Mar 28</td>
<td></td>
<td>Drop/Withdrawal Deadline Apr. 1</td>
</tr>
<tr>
<td>12</td>
<td>Apr 4, 6</td>
<td>EM Waves</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>13</td>
<td>Apr 11, 13</td>
<td>EM Waves</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>14</td>
<td>Apr 18, 20</td>
<td>Wave Scattering</td>
<td>HW #5, Apr 18</td>
<td></td>
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<tr>
<td>15</td>
<td>Apr 25, 27</td>
<td>Wave Scattering</td>
<td></td>
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<tr>
<td>16</td>
<td>May 2, 4</td>
<td>Wave Scattering</td>
<td>HW #6, May 2</td>
<td>Exam # 2, May 4</td>
<td>Dead Day, May 6</td>
</tr>
</tbody>
</table>

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 is 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 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 Center for Accommodations and Supports Service (CASS) 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 additional help, contact CASS: (915) 747-5148, e-mail: cass@utep.edu website: http://sa.utep.edu/cass/
**Discrimination Statement**

I do not discriminate, nor will I allow discrimination, on the basis of race, color, national origin, sex, religion, age, disability, genetic information, veteran’s status, sexual orientation, or gender identity. Members of the UTEP community are protected from discrimination and harassment by State and Federal Laws.

**COVID-19 Statement/Precautions**

Due to the ongoing global situation, please stay home if you (1) have been diagnosed with COVID-19, or (2) are experiencing COVID-like symptoms. If you are feeling unwell, let me know as soon as possible, and alternative instruction will be provided. The Student Health Center, located in the Union Building East, is equipped to provide COVID-19 testing.

The Centers for Disease Control and Prevention recommends that people in areas of substantial or high COVID-19 transmission wear face masks when indoors in groups of people. The best way that Miners can take care of Miners is to get the vaccine. The vaccine is widely available in the El Paso area. For more information about local rates, testing, and vaccinations, please visit [www.epstrong.org](http://www.epstrong.org)

**University Resources**

UTEP provides a wide variety of student services and support:

**Technology Resources**

- **UTEP Technology Support**: Students experiencing technological issues or challenges (e-mail, Blackboard, software, etc.) can submit a ticket to the UTEP Helpdesk for assistance. [www.utep.edu/technologysupport](http://www.utep.edu/technologysupport)

- **UTEP Engineering Technology Center (ETC)**: Provides laptop and computer repair services for engineering students, as well as service requests for software. [www.utep.edu/engineering/etc/](http://www.utep.edu/engineering/etc/)

**Academic Resources**

- **UTEP Library**: Access to a wide range of resources including online, full-text access to thousands of journals and e-Books, plus reference services and librarian assistance for enrolled students. [www.utep.edu/library/](http://www.utep.edu/library/)

- **Math Resource Center for Students (MaRCS)**: Ask a tutor for help (including remotely) and explore available math resources like formula sheets, tables, and videos. [www.utep.edu/science/math/marcs](http://www.utep.edu/science/math/marcs)

- **Advancement Center for Engineering Students (ACES)**: Students serving other students. Hybrid tutors provide tutoring for a wide range of topics including engineering, math and science, and also manages room reservations. [www.utep.edu/engineering/student-resources/student-resources-aces.html](http://www.utep.edu/engineering/student-resources/student-resources-aces.html)

**Individual/Well-Being Services**

- **Military Student Success Center**: Assists personnel in any branch of service to reach their educational goals. [www.utep.edu/student-affairs/mssc](http://www.utep.edu/student-affairs/mssc/)

- **Counseling and Psychological Services**: Provides a variety of counseling services including individual, couples, and group sessions, as well as career and disability assessments. [www.utep.edu/student-affairs/counsel](http://www.utep.edu/student-affairs/counsel)