Welcome to Engineering Electromagnetics Principles. The goals of this course are: 1) to familiarize you with the mathematics and physical concepts of electromagnetics and 2) to give you practice in translating this knowledge to analyze practical phenomena and real-world devices.

Course learning objectives. Some of the benefits you will gain from active engagement and completion of the course assignments are:

1. An appreciation for the role that analysis and modeling play in engineering physics.
2. Analytical skills for evaluating problems in electromagnetics.
3. An understanding of the foundational concepts and equations in electromagnetics.
4. Ability to communicate about systems using mathematical, verbal, and visual means.
5. An intuitive feel and questioning mind about electromagnetic devices and applications.


Readings. Readings and homework will be assigned from the primary textbook for the course, which is available for purchase at the Washington University Campus Store:


It is expected that you read the material before the class session with which it is associated, as noted in the schedule below.

Announcements and resources. Class announcements and resources will be e-mailed and posted on Blackboard.

Grading. Course grades will be computed as follows:

- Homework: 20%
- Quizzes: 20%
- Midterm exam: 30%
- Final exam: 30%
I will make a decision about curving grades for the course after the final exam. If a curve is applied, it will only increase students’ final grades, i.e., the cutoff for an A- will not be higher than 90%; the cutoff for a B- will not be higher than 80%, etc.

**Midterm and final exams.** The tests will consist of an 80-minute midterm exam and one final exam. The midterm will cover the first half of the semester, and the final exam will only cover the last half of the semester.

Both exams are closed book and notes. A list of formulas will be provided with both exams, and a copy of this list will be available on Blackboard before the exams. If you decide that you need additional formulas, you will need to memorize them. Calculators are NOT allowed.

**Homework.** Weekly homework sets will be assigned throughout the semester with a few exceptions (see schedule below). Homework is meant to provide students with practice for test material and to stimulate questions for class discussion.

One problem from each homework set, denoted by an “X”, will be posted to the “Assignments” folder on Blackboard and be handed in for grading. This graded homework problem is due at the beginning of lecture on Mondays. You may also turn in homework to the ESE 330 Homework Box on the 1st floor of Green Hall (near the connection to Brauer Hall). Late homework will receive half credit if it is handed in within 48 hours of the due date; no credit will be given otherwise. Your lowest homework grade will be dropped at the end of the semester.

Here are some basic requirements for graded homework:

1. Work problems on standard 8½” x 11” paper (ruled, quadrille, blank, or otherwise).
2. Staple multiple homework pages together in the upper left-hand corner; write your name and the homework problem number in the upper right-hand corner.
3. Show your work. An “answer” placed on paper is not considered an acceptable solution without supporting work. This supporting work generally includes a drawing, list of assumptions, and supporting calculations. Be neat and write legibly.
4. Place a box around your answers. For a numerical answer, include units and the appropriate number of significant figures.

Practice problems (not graded):

Homework 1: Ch. 4(7,25,26,32)  
Homework 2: Ch. 4(51,62); Ch. 5(4,7)  
Homework 3: Ch. 5(37,39b,39c); Ch. 6(5,9)  
Homework 4: Ch. 6(34,35) Ch. 7(7,9)  
Homework 5: Ch. 7(22,27,29,39)  
Homework 6: Ch. 8(29,31,46,48)  
Homework 7: Ch. 9(1,25,39,41)  
Homework 8: Ch. 10(1,25,30,32)  
Homework 9: Ch. 10(33,46,55[a,b])  
Homework 10: Ch. 10(75), Ch. 11(2,21,26,29)  
Homework 11: Ch. 11(27), Ch. 13(1,3)  
Homework 12: Ch. 13(11,19,21,32,34)

In order to perform well on the exams, it is vital that you do the homework problems that are not graded.

**Quizzes.** Weekly quizzes will be held in class on Wednesdays except when noted in the schedule below. The material covered will be primarily from lectures since the last quiz, although homework with posted
solutions may also be covered. At the end of the semester, your lowest quiz grade will be dropped. Quizzes are closed book and notes.

**Makeup exams.** Makeup exams are only offered in advance and only to students who have *an urgent and documented reason* for requesting the makeup exam. Do NOT wait until after the exam to request a makeup. If your emergency is last-minute by nature, send me an e-mail with details of your emergency. If the emergency is justified, you may be granted a makeup exam.

**Attendance and participation.** Attendance and class participation are entirely up to you. No grades will be given for these items. However, I welcome you to ask questions and speak up during class. In-class Socrative exercises will require a Wi-Fi enabled device: navigate to b.socrative.com and use the room name “ESE330”.

**Course schedule.** Topics are in regular font. *Readings are in italics.* Due dates for graded work are underlined.

<table>
<thead>
<tr>
<th>WEEK</th>
<th>MONDAY LECTURE</th>
<th>WEDNESDAY LECTURE</th>
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<tbody>
<tr>
<td>1: 8/29</td>
<td>Vector analysis, Coulomb’s Law, electric field <em>Ch. 1-3, Sec. 4.1-4.3</em></td>
<td>Electric flux, Gauss’s Law <em>Sec. 4.4-4.5</em></td>
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<tr>
<td>2: 9/5</td>
<td><strong>No lecture: Labor Day</strong></td>
<td>Gauss’s Law, electric potential <em>Sec. 4.6-4.7</em></td>
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  *Quiz 1*

| 3: 9/12 | Electric potential, electric dipole, energy density *Sec. 4.8-4.10* | Materials, currents, conductors *Sec. 5.1-5.4* |

  *Homework 1.X due*

  *Quiz 2*

| 4: 9/19 | Polarization, dielectrics, continuity equation, boundary conditions *Sec. 5.5-5.6, 5.8-5.9* | Poisson’s and Laplace’s Equations *Sec. 6.1-6.2, 6.4* |

  *Homework 2.X due*

  *Quiz 3*

| 5: 9/26 | Resistance, capacitance *Sec. 6.5* | Biot-Savart’s Law, Ampère’s Law *Sec. 7.1-7.3* |

  *Homework 3.X due*

  *Quiz 4*

| 6: 10/3 | Ampère’s Law, magnetic flux density *Sec. 7.4-7.5* | Maxwell’s equations, magnetic scalar and vector potentials *Sec. 7.6-7.7* |

  *Homework 4.X due*

  *Quiz 5*

| 7: 10/10 | Magnetic forces, torque, dipole *Sec. 8.1-8.4* | Magnetic materials, boundary conditions, inductors, energy *Sec. 8.5, 8.7-8.9* |

  *Homework 5.X due*

  *Quiz 6*
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| 8: 10/17 | **No lecture: fall break** | **Midterm exam**  
Homework 6.X due |
| 9: 10/24 | Faraday's Law, electromotive force  
*Sec. 9.1-9.3* | Displacement current, Maxwell's equations,  
time-harmonic fields  
*Sec. 9.4-9.5, 9.7* |
| 10: 10/31 | Lossy and lossless dielectrics  
*Sec. 10.1, 10.3-10.4* | Plane waves in free space and conductors  
*Sec. 10.5-10.6* |
| 11: 11/7 | Polarization and Poynting vector  
*Sec. 10.7-10.8* | Reflection at normal incidence  
*Sec. 10.9* |
| 12: 11/14 | Reflection at oblique incidence  
*Sec. 10.10* | Transmission line parameters, equations  
*Sec. 11.1-11.2* |
| 13: 11/21 | Transmission line equations, input  
impedance, power  
*Sec. 11.3-11.4* | **No lecture: Thanksgiving** |
| 14: 11/28 | Transmission line applications  
*Sec. 11.5-11.6* | Hertzian Dipole, half-wave antenna  
*Sec. 13.1-13.3* |
| 15: 12/5 | Quarter-wave, small-loop antennas  
*Sec. 13.4-13.5* | Antenna properties, arrays  
*Sec. 13.6-13.7* |
| 12/12: Homework 12.X due | | |
| 12/21, 1-3 PM: Cupples II L015 | **Final exam** |

**Course feedback.** You can help make the course more effective for you and your classmates by filling out the anonymous survey on Blackboard anytime during the course.

**Academic integrity.** You may discuss homework questions with one another, but all written work must be your own. No collaboration is allowed on the quizzes or exams. Students are expected to abide by the statement on student academic integrity at engineering.wustl.edu/current-students/student-services/Pages/academic-integrity-policy.aspx

**Tutoring.** Undergraduate students in the School of Engineering have access to free tutoring and other academic support services. Engineering undergraduate students may receive up to four hours per week of free one-on-one tutoring for each Engineering course in which they are enrolled. I encourage you to
utilize the Engineering Tutoring Program early and often. E-mail Christopher Ramsay, cramsay@wustl.edu, to request a tutor.

**Students with disabilities.** Washington University is committed to providing accommodations and/or services to students with documented disabilities. Students who are seeking support for a disability or a suspected disability should contact Disability Resources at 935-4153. Disability Resources is responsible for approving all disability-related accommodations for WU students, and students are responsible for providing faculty members with formal documentation of their approved accommodations at least two weeks prior to using those accommodations. I will accept Disability Resources Verification of Individual Student Accommodation (VISA) forms by email and personal delivery. If you have already been approved for accommodations, I request that you provide me with a copy of your VISA within the first two weeks of the semester.

**Accommodations based upon sexual assault.** The University is committed to offering reasonable academic accommodations to students who are victims of sexual assault. Students are eligible for accommodation regardless of whether they seek criminal or disciplinary action. Depending on the specific nature of the allegation, such measures may include but are not limited to: implementation of a no-contact order, course/classroom assignment changes, and other academic support services and accommodations. If you need to request such accommodations, please direct your request to Kim Webb (kim_webb@wustl.edu), Director of the Relationship and Sexual Violence Prevention Center. Ms. Webb is a confidential resource; however, requests for accommodations will be shared with the appropriate University administration and faculty. The University will maintain as confidential any accommodations or protective measures provided to an individual student so long as it does not impair the ability to provide such measures.

If a student comes to me to discuss or disclose an instance of sexual assault, sex discrimination, sexual harassment, dating violence, domestic violence or stalking, or if I otherwise observe or become aware of such an allegation, I will keep the information as private as I can, but as a faculty member of Washington University, I am required to immediately report it to my Department Chair or Dean or directly to Ms. Jessica Kennedy, the University’s Title IX Coordinator. If you would like to speak with the Title IX Coordinator directly, Ms. Kennedy can be reached at 935-3118, jwkennedy@wustl.edu, or by visiting her office in the Women’s Building. Additionally, you can report incidents or complaints to Tamara King, Associate Dean for Students and Director of Student Conduct, or by contacting WUPD at 935-5555 or your local law enforcement agency.

You can also speak confidentially and learn more about available resources at the Relationship and Sexual Violence Prevention Center by calling 935-8761 or visiting the 4th floor of Seigle Hall.

**Bias reporting.** The University has a process through which students, faculty, staff and community members who have experienced or witnessed incidents of bias, prejudice or discrimination against a student can report their experiences to the University’s Bias Report and Support System (BRSS) team. See diversity.wustl.edu/center-diversity-inclusion/brss/.

**Mental health.** Mental Health Services’ professional staff members work with students to resolve personal and interpersonal difficulties, many of which can affect the academic experience. These include conflicts with or worry about friends or family, concerns about eating or drinking patterns, and feelings of anxiety and depression. See shs.wustl.edu/MentalHealth.