Sonoma State University
Department of Engineering Science

EE 430 Electromagnetic Theory and Applications – Spring 2020

Units: 3.0 (lecture)

Schedule/Location: MW, 13:00–14:15 / Salazar 2001

Instructor: Mohamed Salem
Office: Salazar 2010B
Phone: (707) 664-3543
Email: mohamed.salem@sonoma.edu (Please add [EE430] to email subject)
Web: https://www.sonoma.edu/users/s/salemmo
Hours: MW, 14:30–15:30; T, 16:00–17:00 (drop by/email – open door policy)

Prerequisites: PHYS 214, MATH 261.

Co-requisites: None.

This textbook is easy to follow with many illustrative examples. Student surveys over the past years support this statement.
https://dealoz.com/isbn/9780133356816

Course Page: https://canvas.sonoma.edu/courses/18895

Description: Electrostatics, magnetostatics, electric currents, electromagnetic induction, electric and magnetic fields in matter, Maxwell's equations, retarded potentials radiation reaction, light emission, simple scattering and antenna theory, properties of waveguides, relativistic formulation of electrodynamics, Fourier decomposition of fields.

This reference has a different organization, but covers roughly the same topics. Coverage is not as user-friendly as textbook, but contains complementary analyses.
https://dealoz.com/isbn/9780073380667

This reference contains solved examples. Good for practicing solution methods.
https://dealoz.com/isbn/9780071831475
Course Policies

Classwork (not graded):

- You are expected to attend all classes and be on time. Inform the instructor of your absence.
- Attendance is taken in class. Unexcused absence for 3 classes may result in failing the class.
- You are highly encouraged to actively participate in class and give feedback after class or anonymously online.

Homework (graded):

- Approximately one homework assignment every other week with total points scaled to ten (10).
- Homework is due at the beginning of session one week after its assignment.
- Late assignments will be awarded up to five (5) points if received within five days of due date.
- Assignments must be completed neatly in pen or pencil, preferably on engineering paper.

Quizzes (graded):

- Quizzes may be given at the discretion of the instructor.
- Quizzes will be awarded up to two (2) points and added to homework grade.
- No make-up quizzes.

Project (graded):

- One project to be completed by the end of the semester.
- Project should reflect one of the aspects and main concepts of material.
- Project to be completed in groups, to be assigned in class.
- Total points for each project is 100.
- Late projects may be awarded up to 80 points if submitted within one (1) week of due date.
- A malfunctioning project may be awarded up to 80 points is accompanied by a report explaining the source of the malfunction.

Exams (graded):

- Two mid-term exams scheduled after completing Chapter 2, and after completing Chapter 5.
- Total points for each exam are scaled to 100.
- One comprehensive final exam scheduled between 14:00-15:50 on Wednesday, May 13, 2020.
- Total points for the final exam are scaled to 200.
- No exam may be taken outside scheduled time without prior arrangement with instructor.
- No exams can be made up if student does not show up at the scheduled or arranged time.
- No electronic devices other than an approved calculator may be used while taking any exams.
Assessment and Grading:

- No late work will be accepted after 17:00, Friday, May 08, 2020.
- It is the student's responsibility to communicate late submission with instructor.
- Illegible, stained, or scribbled on assignments may receive partial or no credit.
- Final grade is based on the weighting shown below.

<table>
<thead>
<tr>
<th>Component</th>
<th>Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>8 × 2%</td>
</tr>
<tr>
<td>Project</td>
<td>20%</td>
</tr>
<tr>
<td>Mid-term exams</td>
<td>2 × 20%</td>
</tr>
<tr>
<td>Final exam</td>
<td>24%</td>
</tr>
</tbody>
</table>

Grade scale that will be used for total percentage points and corresponding letter grade are given below:

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 59</td>
<td>F</td>
</tr>
<tr>
<td>60 - 62</td>
<td>D−</td>
</tr>
<tr>
<td>63 - 66</td>
<td>D</td>
</tr>
<tr>
<td>67 - 69</td>
<td>D+</td>
</tr>
<tr>
<td>70 - 72</td>
<td>C−</td>
</tr>
<tr>
<td>73 - 76</td>
<td>C</td>
</tr>
<tr>
<td>77 - 79</td>
<td>C+</td>
</tr>
<tr>
<td>80 - 82</td>
<td>B−</td>
</tr>
<tr>
<td>83 - 86</td>
<td>B</td>
</tr>
<tr>
<td>87 - 89</td>
<td>B+</td>
</tr>
<tr>
<td>90 - 94</td>
<td>A−</td>
</tr>
<tr>
<td>95 - 100</td>
<td>A</td>
</tr>
</tbody>
</table>

Note: Passing grades start at C (73%).

Evaluation of Teaching Effectiveness and Feedback

Towards the end of the semester you will be notified by e-mail and provided with a link to follow to complete the Student Evaluation of Teaching Effectiveness (SETE) survey on line outside of class. Your feedback on the course is extremely valuable to the instructor, the department, and the administration. In particular, your comments are taken very seriously and are used to improve the course. Your evaluation is completely anonymous and is never delivered to the instructor before the course grades are due. Please do fill out a course evaluation when you receive the e-mailed link at the end of the semester. For more information on the SETE survey, please refer to:

https://www.sonoma.edu/aa/sete/

In addition to the SETE, please use the anonymous feedback link on Canvas to provide free-form anonymous feedback at any time during the semester. Your anonymous feedback will be used to improve the learning environment during the semester.

Academic Integrity

You are responsible to behave ethically and honestly. Copying, cheating, forgery, and other unethical or dishonest actions are not tolerated, will result in a zero grade, and may be reported to SSU authorities. For more information on SSU policy on academic cheating and plagiarism please refer to:

http://www.sonoma.edu/uaffairs/policies/cheating_plagiarism.htm

Classroom Learning Civility Clause

In any environment in which people gather to learn, it is essential that all members feel as free and safe as possible in their participation. To this end, it is expected that everyone in this course will be treated with mutual respect and civility, with an understanding that all of us (students, instructors, professors, guests, and teaching assistants) will be respectful and civil to one another in discussion, in action, in teaching, and in learning.

Should you feel our classroom interactions do not reflect an environment of civility and respect, you are encouraged to meet with your instructor during office hours to discuss your concern. For additional information and resources, please refer to SSU policy on civility and tolerance at:

https://www.sonoma.edu/about/diversity/civility-and-tolerance
Disability Support Services

Reasonable accommodations are available for students who have documented temporary or permanent disabilities. All accommodations must be approved through Disability Support Services located in Salazar Hall, Room 1049 in order to notify your instructor(s) as soon as possible regarding accommodation(s) needed for the course.

- Phone: (707) 664-2677
- Email: disability.services@sonoma.edu
- Web: http://www.sonoma.edu/dss/students/dss_services.html

For more information on SSU policy on disability access for students, please refer to: http://www.sonoma.edu/uaffairs/policies/disabilitypolicy.htm

Other Policies

Be sure you understand the policies that specifically affect you as a student of this course, such as:

- Add/Drop Policy: http://web.sonoma.edu/registration/#additional-reg-info
- Grade Appeal Policy: http://www.sonoma.edu/policies/grade-appeal-policy
### Class Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Monday</th>
<th>Wednesday</th>
</tr>
</thead>
</table>
| 1. 01/20, 01/22 | No Class | Introduction / Overview  
Syllabus. Overview of topics and policies. |
| 2. 01/27, 01/29 | Waves and Phasors (Ch. 1)  
Nature of electromagnetism, waves | Waves and Phasors  
Complex numbers, phasors |
| 3. 02/03, 02/05 | Transmission Lines (Ch. 2)  
Lumped-element model, TL equations | Transmission Lines  
Wave propagation, lossless transmission |
| 4. 02/10, 02/12 | Transmission Lines  
Wave impedance, lossy transmission | Transmission Lines  
Power flow, Smith chart |
| 5. 02/17, 02/19 | Transmission Lines  
Smith chart, impedance matching | Transmission Lines  
Impedance matching, review |
| 6. 02/24, 02/26 | Mid-term Exam 1 | Electrostatics (Ch. 4)  
Maxwell equations, vector algebra and calculus |
| 7. 03/02, 03/04 | Electrostatics  
Charge and current distributions, Coulomb's and Gauss' | Electrostatics  
Scalar potential, conductors, dielectrics, capacitors |
| 8. 03/09, 03/11 | Electrostatics  
Potential energy, image method | Magnetostatics (Ch. 5)  
Magnetic forces, Biot-Savart |
| 9. 03/16, 03/18 | Spring Break – No Class | |
| 10. 03/23, 03/25 | Magnetostatics  
Vector potential, permeability | Magnetostatics  
Inductance, magnetic energy |
| 11. 03/30, 04/01 | Mid-term Exam 2 | Maxwell’s Equations (Ch. 6)  
Faraday’s and Ampere’s, displacement current |
| 12. 04/08, 04/10 | Maxwell’s Equations  
Time-varying fields, boundary conditions | Maxwell’s Equations  
Boundary conditions, electromagnetic potentials |
| 13. 04/15, 04/17 | Plane-Waves (Ch. 6 and 7)  
Steady-state solutions, plane-waves in lossless media | Plane-waves  
Poynting theorem |
| 14. 04/22, 04/24 | Plane-Waves  
Polarization | Plane-Waves  
Propagation in lossy media, skin effect |
| 15. 04/29, 05/01 | Plane-Waves  
Reflection and transmission | Radiation and Antennas (Ch. 9)  
Antenna properties, short dipole |
| 16. 05/06, 05/08 | Radiation and Antennas  
Short dipole, long dipole | Radiation and Antennas  
Friis transmission formula |
| 17. 05/13 | Final Exam | |

Note: schedules are subject to change.
ABET Requirements

Course Learning Objectives (CLOs)

By the end of this course, the student should be able to:

A. Understand principles of waves and phasors
B. Model transmission lines as two-port networks
C. Apply relevant electrostatics and magnetostatic equations with appropriate boundary conditions
D. Understand how electromagnetic fields are derived from scalar and vector potentials
E. Understand concepts of losses and polarization in relation to plane-wave propagation
F. Calculate the reflected and transmitted waves at a planar interface
G. Understand the principles of electromagnetic radiation

Student Learning Outcome

<table>
<thead>
<tr>
<th>ABET Students Outcomes</th>
<th>Assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics</td>
<td>Y</td>
</tr>
<tr>
<td>2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors</td>
<td></td>
</tr>
<tr>
<td>3. an ability to communicate effectively with a range of audiences</td>
<td></td>
</tr>
<tr>
<td>4. 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, economic, environmental, and societal contexts</td>
<td></td>
</tr>
<tr>
<td>5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives</td>
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<tr>
<td>6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions</td>
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</tr>
<tr>
<td>7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies</td>
<td></td>
</tr>
</tbody>
</table>

Assessment Methods

Assessment of student learning:

1. Examination (final exam)

Assessment of course quality:

1. Student survey and anonymous feedback
2. Student verbal and peer instructor feedback