

**ECE 305: Electromagnetic fields and Waves I: Spring 2016**

**Instructor:** Prof. Shanker Balasubramaniam (you can call me Prof. Shanker)(email: bshanker@egr.msu.edu)

**Classes:** 11:30-12:20; MTuWTh: 1145 EB;

**Grader/TA:** Steve Hughey & Jennifer Byford

**Hughey Office Hrs:** Monday 12:30-2pm, Friday 12-1:30pm in EB2234

**Byford Office Hrs:** Wed 2:30-4:00 in EB2234

**Balasubramaniam Office Hrs:** Wed 4:00-5:30pm, 2234 EB

**Recitation:** Tuesday, 6:00-7:30pm, EB 2245

**Class Website:** D2L

**Final Exam:** Thursday, May 5 2016, 10:00am - 12:00pm in 1145 EB

**Required Text:**

1. D. K. Cheng, Field and Wave Electromagnetics, Addison-Wesley, 1992

**Other Books:**

1. N. N. Rao, Elements of Engineering Electromagnetics,
2. U. S. Inan and A. S. Inan, Engineering Electromagnetics, Addison-Wesley, 1999.
3. C. T. Jonk, Engineering Electromagnetic Fields and Waves, Wiley, 1988.

**Notes, Concepts/Examples & Cheat Sheets**

1. Written notes that will be, more or less, followed have been posted
2. Concept outlines will be be posted before class; please print these out. Examples worked out during class will use these outlines and will **not** be posted online immediately. They will be posted on a weekly basis.
3. There will a common cheat sheet for the exam and will be available well before each exam.

**Class Policies:****1. Grade Distribution**

- (a) Homework: 15% (drop lowest grade)
- (b) Quiz: 15% (drop lowest grade)
- (c) 3 One hour exams: total 45%
- (d) Final: 25%

**2. Grading:** Grading will be done on a STRAIGHT SCALE in keeping with the following grading scale:

Grade	4.0	3.5	3.0	2.5	2.0	1.5	1.0	0.0
Score	90+	90-85	85-77.5	77.5- 65	65-60	60-55	55-50	≤ 50

The instructor reserves the right to tweak the grading scale. You may check your grade in D2L at anytime.

**3. How to succeed:** Here is how to do well and ACE this class

- Know your ECE280 material—the vector calculus portion

- Attend the first recitation session on vector calculus (1/12)
  - Prepare for class (even if it is 10 mins to refresh what was covered the previous class)
  - Attend all classes
  - Ask questions in class/participate
  - Take notes
  - All quizzes and exams (when possible) will be on Thursdays – use office hrs/recitation sessions throughout the week to prepare.
  - Either the instructor or the TAs holds office hours/recitation meetings 4/5 days in the week. Use them.
  - Attend recitation classes—problems will be worked out here
4. **Classroom Behavior:** You are expected to show up to class on time and prepared. The lecture notes might be posted on D2L prior to class. If so, please print them out and bring them to class. Make sure to take notes during the lectures. Quizzes given will rely on both homework and classroom lectures. The classroom lectures may not have been posted by the time you take quizzes.
  5. **Electronic leash:** You are not allowed to use any cell phones, laptops or tablets during class.
  6. **Attendance:** You are not required to attend lectures. However, I will take attendance approximately once per week on an unannounced day and at an unannounced time during the lecture. If I have started taking attendance, latecomers will be marked absent. If you have one or fewer absences on attendance day, you will be allowed to drop your lowest test grade on one of the 3-1hour exams. Illnesses (with a doctors excuse) and other excused absences will be handled on a case-by-case basis.
  7. **Homework:** Homeworks will be assigned **Wednesday** and are due at the beginning of class. No late homework will be accepted unless prior arrangements have been made. There will be approximately 10 homework assignments, and the lowest score will be dropped. If you have any questions, please make it to the office hours or set up an appt. I find this to be much much better than a long and laborious email exchange. Even so, feel free to send me email regarding homework questions; I will devote some portion of the day to answering these.
  8. **Quiz:** Approximately 10, 10 minute quizzes may be given to check your understanding of concepts, and there will be about 1-2 problems on each quiz. They will be closed book, and closed notes. As before, the lowest score will be dropped. Quizzes will be administered on **Thursday**. You will not be allowed to make-up any quiz.
  9. **Exam Policy:** There will be **no** make up exam. If you must miss an exam, you must make appropriate arrangements **before** the exam period. If arrangements have not been made, you will receive a **ZERO** on the exam.
  10. **Exams:** There will be 3 one hour exams and one final. As before, all exams are closed book and closed notes. You will have a common cheat-sheet. Dates for the exams are in the syllabus. Please bring a pencil **ONLY**. You will **NOT** need calculators. All examination will be held on **Thursdays**, whenever possible.
  11. **Final Exam:** The final exam will be scheduled in accordance with MSU policies and will be comprehensive. Students who request a rescheduled ECE 305 Final Exam based on the MSU “3-exam in 1 day policy and/or due to special needs must request rescheduling in advance. There will be **NO** make-up exams given in ECE 305. If you must miss an exam, you must make appropriate arrangements before the exam period. If arrangements have not been made, you will receive a **ZERO** on the exam. Please see the instructor if you have any questions.

12. **Religious Observance:** If any exam, assignment or project conflicts with a religious observance, let me know ahead of time and we will make other arrangements.
13. **Academic Honesty:** Article 2.3.3 of the Academic Freedom Report states: “The student shares with the faculty the responsibility for maintaining the integrity of scholarship, grades, and professional standards.” In addition, this instructor adheres to the University regulations, policies, and ordinances on academic honesty and integrity, as specified in General Student Regulation 1.0, Protection of Scholarship and Grades; the all-University Policy on Integrity of Scholarship and Grades; and Ordinance 17.00, Examinations, all of which are available on the MSU Web site ([www.msu.edu](http://www.msu.edu)).
14. **Accommodation for students with disabilities :** Students with disabilities should contact the Resource Center for Persons with Disabilities to establish reasonable accommodations. For an appointment with a disability specialist, call 353-9642 (voice), 355-1293 (TTY), or visit [MyProfile.rcpd.msu.edu](http://MyProfile.rcpd.msu.edu).
15. **Important Dates**
  - Monday 01/11/2016 Classes Begin.
  - Friday 01/15/2016 Online open add period for spring semester ends at 8pm.
  - Monday 01/18/2016 Martin Luther King Day - University open, classes cancelled.
  - Monday 01/18/2016 to Friday 01/22/2016 enrollment changes. (Late adds, section changes)
  - Friday 02/05/2016 End of 100% Tuition Refund
  - Wednesday 03/02/2016 Middle of Semester. Last day to drop a course without a grade being reported.
  - Monday 03/07/2016 to Friday 03/11/2016 Spring Break
  - Friday 04/29/2016 Last day of classes.
  - Final: Thursday, May 5 2016, 10:00am - 12:00pm in 1145 EB

Topics	Vector algebra, vector calculus. Charge distributions, Coulombs law, electric field, Electric potential, electric dipole, Gauss law, electric properties of materials, boundary conditions
Exam 1	2/4
Topics	Electrostatic energy, capacitance, Laplaces equation, Poissons equation, steady current, continuity equation, Ohms law, relaxation, resistance, Joules law, Amperes force law, Biot-Savart law, vector potential, Amperes circuital law, magnetic dipole
Exam 2	3/17
Topics	Magnetic properties of materials, boundary conditions, inductance, Faradays law, Maxwells equations, Poyntings theorem, Transient T-lines, bounce diagrams
Exam 3	4/14
Topics	Steady-state T-lines, Terminated T-lines, standing waves, power, Smith charts, wave equations, plane waves, properties of plane waves
Final	5/5

Table 1: Topics and Exam Schedule

**COURSE OBJECTIVES:** This is an introductory course in engineering electromagnetics. Emphasis is placed on time-varying topics, such as transmission lines, Maxwells equations, and plane and guided waves. The basic concepts of electromagnetic fields, including field vectors, potentials, energy, boundary conditions and material effects will be covered. At the completion of this course the student should be able to:

1. Understand the fundamental nature of static fields, including steady current, static electric and magnetic fields, potentials, resistance, capacitance, inductance, stored energy, materials, and boundary conditions.
2. Apply Maxwells equations and fundamental concepts from dynamic electromagnetic fields, including Faradays law of induction, time-harmonic fields, boundary conditions, wave equations, and Poyntings power-balance theorem.
3. Describe the properties of plane waves in unbounded space. Understand such concepts as wavelength, phase velocity, attenuation, and skin depth for waves in various media. Solve problems involving reflection of plane waves from different material interfaces.
4. Solve problems involving lossless transmission lines with transient excitation. Understand the concepts of traveling waves, reflection, and characteristic resistance.
5. Solve problems involving transmission lines with time-harmonic excitation. Understand the concepts of standing waves, reflection coefficient, impedance, attenuation and power transfer.
6. Use Smith charts to solve transmission line problems.