ECE 305: Electromagnetic Fields and Waves I
FALL 2013

TIME & ROOM: M, W, F: 11:30 a.m. - 12:20 p.m. (2400 Engineering Building)
Tu: 11:30 a.m. - 12:20 p.m. (2250 Engineering Building)

PRE-REQ: (ECE 280) and (MTH 235 or concurrently or LSB 119 or concurrently or MTH 255H or concurrently) and (PHY 184 or PHY 184B or PHY 234B) and (ECE 202 or concurrently)

INSTRUCTOR: Dr. Prem Chahal
2214B Engineering Building
Email: chahal@egr.msu.edu
Phone: 517-355-0248

OFFICE HRS: Wed.: 3:30 – 5:30 p.m and Fri. 3:30 – 5 p.m (grader), Room: EB 2220
I am also available by appointment as needed. Please email or call at least two hours prior to meeting.

OTHER COURSE PERSONNEL: A grader for homeworks is assigned. All questions related to homework grading should be directed to the grader (contact info.: Jennifer Byford, byfordje@msu.edu).

COURSE WEB SITE: The primary web site is via the ANGEL Course Management System. Please point your browser to the following URL: https://angel.msu.edu and log-in with your MSUNet ID and password.


TOPICS COVERED: Transient and steady-state transmission lines, wavelength, phase velocity, attenuation, impedance, bounce diagrams, static fields, time-harmonic fields, boundary conditions, energy and power, plane waves, guided waves.

COURSE OBJECTIVES:
This is an introductory course in engineering electromagnetics. Emphasis is placed on time-varying topics, such as transmission lines, Maxwell’s 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:

a. Solve problems involving lossless transmission lines with transient excitation. Understand the concepts of traveling waves, reflection, and characteristic resistance.
b. Solve problems involving transmission lines with time-harmonic excitation. Understand the concepts of standing waves, reflection coefficient, impedance, attenuation and power transfer.
c. Use Smith charts to solve transmission line problems.
d. 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.
e. Apply Maxwell’s equations and fundamental concepts from dynamic electromagnetic fields, including Faraday’s law of induction, time-harmonic fields, boundary conditions, wave equations, and Poynting’s power-balance theorem.
f. 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.
g. Understand the properties of simple guiding wave systems such as a parallel plate waveguide.
In addition, lecture notes (generated by Prof. Edward Rothwell in 2003) will be available as PDF files that can be downloaded from the course web site.

SUPPLEMENTAL:

CLASS PARTICIPATION: Classroom attendance is expected.

GRADING weights are as follows:
• Two 50-minute exams: 25%
• Final exam: 20%
• Homeworks: 25% (Lowest Grade Dropped)
• Quizzes: 30% (Lowest Grade Dropped)
• Attendance/Participation: Extra Credit

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<thead>
<tr>
<th>GPA assigned to total score (%)</th>
<th>90 -100</th>
<th>80 – 90</th>
<th>72.5 - 80</th>
<th>65 – 72.5</th>
<th>60 – 65</th>
<th>55 – 60</th>
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THERE IS NO CURVE IN THIS COURSE! The instructor reserves the right to adjust the grading scale.

HOMEWORK POLICY: Homework is generally assigned on Monday’s and due the following week on the same day. **Homework is due at the start of class and no late homework is accepted unless prior arrangements have been made.** There will be 9-to-11 homework assignments, and the lowest score will be dropped. Only a set number of problems in a given homework will be graded. Working in groups on the problem sets is permitted, but each student should prepare his/her own version to hand in. All students are encouraged to attempt homework’s on their own, as there is a strong correlation between homework effort and exam performance. Solutions will be made available via the course web page.

QUIZZES: On days homework’s are turned in, 15-minute quizzes may be given to check your understanding of the subject. These quizzes will always be assigned at the start of class, and they will be closed book and closed notes. Lowest quiz score will be dropped.

EXAM POLICY: There will be two 50-minute exams and one final exam. **All exams are closed book and closed notes.** You will have a common cheat-sheet (provided by the instructor).

Students who do not take the final exam will receive a score of 0.0 in the class. 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 EE 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.

POLICY ON RELIGIOUS OBSERVANCES: If any exam, assignment or project conflicts with a religious observance, let me know **ahead of time** and we will make other arrangements.
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). Students who violate these rules may receive a penalty grade, including, but not limited to, a failing grade on the assignment or in the course.

ACCOMMODATIONS 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.

IMPORTANT DATES:
Exam 1: September 30, 11:30 -12:20 pm, 2400 EB
Exam 2: November 4, 1:30 -12:20 pm, 2400 EB
Final Exam: December 12, 10:00AM – 12:00 Noon, 2400 EB

Other Important Dates:
9/2 Labor Day (no class)
9/23 Last day to drop with full refund
10/2-10/3 Career gallery (Breslin Center)
10/16 Last day to drop with no grade reported
11/28-11/29 Thanksgiving break (no class)
12/6 Design day – Engineering Building (no class)
12/9-12/13 Final Exam Week
12/13 Commencements

For additional important dates, please refer to Registrar’s website at: http://www.reg.msu.edu/ROInfo/Calendar/Academic.asp
# Tentative Course Schedule

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<thead>
<tr>
<th>Week</th>
<th>Dates</th>
<th>Topics</th>
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<tr>
<td>1</td>
<td>Aug. 28 - 30</td>
<td>Course Introduction, Transient response of transmission lines</td>
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<td>2</td>
<td>Sept. 2 – 6</td>
<td>Transient response – reflections from terminations, steady state response of transmission lines</td>
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<td>Sept. 2</td>
<td><strong>Labor Day</strong></td>
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<tr>
<td>3</td>
<td>Sept. 9 – 13</td>
<td>Steady state response of transmission lines</td>
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<td>4</td>
<td>Sept. 16 – 20</td>
<td>Smith Chart, Electric charges</td>
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<td>5</td>
<td>Sept. 23 – 27</td>
<td>Coulomb’s law, electric fields</td>
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<td>6</td>
<td>Sept. 30 – Oct. 4</td>
<td>Potential and potential difference, Gauss’s law</td>
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<td>Sept. 30th</td>
<td><strong>Exam 1 (50 minutes)</strong></td>
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<tr>
<td>7</td>
<td>Oct. 7 – 11</td>
<td>Gauss’s law (Continued), Dielectric materials, boundary conditions</td>
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<td>8</td>
<td>Oct. 14 – 18</td>
<td>Electrostatic energy, capacitance, Poisson’s and Laplace’s equations</td>
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<td>9</td>
<td>Oct. 21 – 25</td>
<td>Current density, KCL, Ohm’s law, Boundary conditions, Charge redistribution</td>
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<td>10</td>
<td>Oct. 28 – Nov. 1</td>
<td>EMF and KVL, Joule’s law,</td>
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<td>11</td>
<td>Nov. 4 – 8</td>
<td>Magnetostatics, Ampere’s law, Biot-Savart Law, Vector potential</td>
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<td>Nov. 4th</td>
<td><strong>Exam 2 (50 minutes)</strong></td>
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<td>12</td>
<td>Nov. 11 – 15</td>
<td>Ampere’s circuital law, magnetic dipole, material properties, boundary conditions, inductance</td>
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<td>13</td>
<td>Nov. 18 – 22</td>
<td>Faraday’s Law, Induction, Maxwell’s equations, Boundary conditions</td>
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<td>Nov. 25 – 29</td>
<td>Time-harmonic Maxwell’s equations, Poynting’s theorem</td>
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<td>Nov. 28 - 29</td>
<td><strong>Thanksgiving Break</strong></td>
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<tr>
<td>15</td>
<td>Dec. 2 - 6</td>
<td>Wave equations, time-harmonic plane waves Polarization of plane waves, reflection and transmission, guided waves</td>
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<tr>
<td>16</td>
<td>Dec. 9 – 13</td>
<td>Final Exam Week</td>
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<td>Dec. 12th</td>
<td><strong>Final Exam (10AM – 12Noon, Rm. 2400 EB)</strong></td>
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