SIU Carbondale  ECE 375 Syllabus Fall 2016

Instructor: Professor Harackiewicz  Office/Lab: EGR E-120 & E-128  
Email: fran1@siu.edu  Office Phone: 453-7031  
Office Hours: MTWR 9:30-11am  
Lecture: TR 8-9:15am EGR A208  
Lab Instructor: Santosh Timilsina  Office/Lab: EGR E127  
Email: santosh.timilsina@siu.edu  Office/Phone: 453-7850  
Office Hours: R 10-11am and 1-4pm  
Lab: R 11am-12:50pm, EGR E-215 North

Grading:  Letter grades: 100≥ A ≥90; 89≥ B ≥80; 79≥ C ≥70; 69≥ D ≥60; 59≥ F ≥0;  
Assignments/quizzes (in class or at home)  10%  
Graded Labs/Projects (~8)  25%  
Graded Exams (4 highest of 5)  50%  
Final Exam (1)  15%

Homework: There are many practice problems in the textbook and most of them have answers given in the book. Students are expected to work on these first and then ask questions.

Anticipated Exam dates: Exam 0: 8/25 [Not Graded, Evaluation Only]; Exam 1: 9/20; Exam 2: 10/6; Exam 3: 11/3; Exam 4: 11/17; Exam 5: 12/8; Final Exam: 12/13 8-10am

Classroom Policies:  
• Attendance Policy: Attendance is mandatory for every lab session. Failure to attend the lab session will result in a zero for the assignment. Students are responsible for all announcements made in class and/or posted to D2L.  
• Late Homework/Missed Exams: Late work, including lab work, is not accepted. The lowest Exam (excluding the final) and Lab assignment grade will be dropped to accommodate unforeseen circumstances.  
• Mobile Technology Policy No electronic communication devices such as cell phones or music players are permitted to use in the class. If you have some family emergency, you have to mention to the instructor to keep your cell phone in silent mode before the class start time. Any student using a cell phone will be asked to leave the class.  
• Exam Policy: Exams typically take place a minimum of one week following the end of each chapter. The exam dates are subject to change based on material progress. For exams conducted at SIU Testing Services, students are responsible for completing the required registration of each exam before the exam date. Students may take an exam any time within the business hours of SIU Testing Services on the exam date.  
• Lab Policy: Labs occur when enough material has been covered in lecture for the subject matter of the lab. Labs will consist of learning new software through design and learning new hardware through experimentation. Lab attendance is required to obtain a grade. A Lab report outlining the design, experiment, and results is required to obtain a grade. The lowest Lab assignment grade is dropped.  
• Academic Dishonesty Policy: Any form of academic dishonesty will result in a zero for the work and the course.  
• UNIVERSITY SYLLABUS ATTACHMENT, PLEASE SEE  

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1. **Course number and name:** ECE 375 Introduction to Electromagnetic Fields
2. **Credits and contact hours:** 3 credits, two 75-minute sessions per week, one 120-minute lab session per week
3. **Course Committee:** Harackiewicz, Sayeh, Hatziadoniu
4. **Text book(s), title, author, and year:**

   **References or other supplemental materials:**

5. **Specific course information**
   a. ((Catalog description): 375-3 Introduction to Electromagnetic Fields. Elementary electromagnetic field theory, vectors, static, quasi-static and time-harmonic fields, transmission lines and materials, Smith charts, Maxwell’s equations in integral and differential forms, force, energy and power, plane waves, engineering tools and applications. Lecture and laboratory. Lab fee: $110 to help defray cost of software licenses.
   b. Prerequisites or co-requisites: ECE 235, Mathematics 251 and Physics 205B.
   c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required for EE majors
   d. Professional Component {Credit Hours}
      |-------------|---------|-------------|--------------|-------------|
      | 0           | 0       | 0           | 4            | 0           |

6. **Instructional Objectives (with SO's), ex. The student will be able to explain the significance of current research about a particular topic. (a,b,c)** The student is expected to:
   a. Find impedance of terminated transmission lines graphically, analytically and numerically (a)
   b. Find the voltage standing wave ratio, position of the voltage maximum and minimum, and impedance and by using Smith chart. (a)
   c. Design a matching circuit for a transmission line to a load. (a, c)
   d. Solve problems with vectors in rectangular, cylindrical, and spherical coordinates. (a)
   e. Apply Coulomb’s Law to find electric field intensity due to continuous, point, linear and sheet charge distributions. (a)
   f. Use Gauss’ Law, the del operator, and divergence to solve charge distribution and electric flux density problems with simple geometry. (a)
   g. Find the energy in electric fields. (a)
   h. Find the electrostatic potential gradient for problems with simple geometry. (a)
   i. Solve problems relating to conductivity, current, current density, and charges on conductors. (a)

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j. Solve problems relating to boundary conditions for conductors and dielectric materials. (a)

k. Find the capacitance of simple arrangements of conductors and dielectric materials. (a)

l. Use Biot-Savart Law, Ampere’s Law, Stokes’ Theorem, and the curl to find magnetic field intensity and magnetic vector potential for steady state currents. (a)

m. Be able to find forces due to uniform currents. (a)

n. Use the physical properties of magnetization and permeability. (a)

o. Apply magnetic boundary conditions. (a)

p. Find the energy in a magnetic field. (a)

q. Be able to apply Maxwell’s equations to a given electromagnetic configuration. (a)

r. Be able to solve problems relating to the propagation of uniform plane waves. (a)

s. Use industry software to design simple devices (k)

t. Use industry hardware to conduct experiments on simple devices (b, k)

u. Write laboratory reports (b, f, g)

v. Write technical project reports (f, g, h, i, j) and design a simple device (e)

7. **Brief list of topics (class, lab and project) to be covered (with hours)**

   a. Classroom Topic (Approximate Hours)

      • Vector algebra, scalar and vector fields, Rectangular, cylindrical, and spherical coordinate systems, Calculus, Integrals, Divergence theorem, Stoke’s theorem \(0\)

      • Transmission lines \(7\)

         Tx Model, Line Parameters, Coaxial Cable \(1\)

         Wave Propagation, Reflection \(1\)

         SWR, Voltage Max and Min, Input Impedance, Impedance Matching \(3\)

         Smith Chart \(2\)

      • Electric Fields \(7\)

         o Charge & Current Densities, Force on an Electron\(1\)

         o Coulomb’s Law\(1\)

         o Gauss’s Law \(1\)

         o Voltage, Conductors, Dielectrics \(2\)

         o Boundary Conditions, Capacitance, Energy \(2\)

      • Magnetic Fields \(5\)

         o Force & Torque, Biot-Savart Law \(2\)

         o Ampere’s Law, Vector Potential, Material Properties, Boundary Conditions \(2\)

         o Inductance, Energy \(1\)

      • Time-Varying Fields in a Circuit \(3\)

         o Faraday’s Law \(1\)

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- Transformer, Motional EMF, Displacement Current, Boundary Conditions {2}
- Plane-Wave Propagation {6}
  - Lossless Wave Propagation {2}
  - Polarization {1} Lossy Wave Propagation, Skin Depth {1}
  - Current Flow, Power Density {1}
  - Wave Reflection & Transmission {1}

b. 2-hour weekly labs (Estimated)
- RF Power Divider (Week 1)
- Antenna as a Complex Load (Week 3)
- Preparation for Simple Impedance Matching (Week 4)
- Simple Impedance Matching (Week 6)
- Accelerometer (Week 7)
- Metal Detector (Week 9) ⊗ Induced EMF (Week 12)
- Plane Wave Propagation (Week 15)
- Transformer (Week 16)

8. CAD/Computer Tools Available for use: CST, Autocad, Matlab, Tx Line, QUCS, apps with textbook


10. Assessment of the Contribution to Student Outcomes

<table>
<thead>
<tr>
<th>Outcome</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
<th>f</th>
<th>g</th>
<th>h</th>
<th>i</th>
<th>j</th>
<th>k</th>
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<tbody>
<tr>
<td>Assessed</td>
<td>x</td>
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Student Outcomes (ABET criteria a-k) are quoted here:

(a) An ability to apply knowledge of mathematics, science, and engineering
(b) An ability to design and conduct experiments, as well as to analyze and interpret data
(c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) An ability to function on multidisciplinary teams
(e) An ability to identify, formulates, and solves engineering problems
(f) An understanding of professional and ethical responsibility
(g) An ability to communicate effectively
(h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) A recognition of the need for, and an ability to engage in life-long learning
(j) A knowledge of contemporary issues
(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

8. University Policies Syllabus Attachment at
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