ELEN 3371 Electromagnetics I
Fall Semester 2013

Catalog Description: Vector analysis, coordinate systems, static and quasi-static electric fields, electric potential, dielectrics, capacitance, current, conductance, magnetic vector potential, electromagnetic forces. Maxwell's Equations, plane waves, transmission lines and Smith chart analysis.

Prerequisites:  
By course: MATH 3328 Linear Algebra, MATH 3301 Ordinary Differential Equations, MATH 3435 Calculus & Analytic Geometry III, ELEN 2411 Circuits I, and PHYS 2426 Calculus Based Physics II with grade of C or better.  
By topic: DC and AC Circuits; Calculus-Based Physics in Electricity and Magnetism; Analytic Geometry and Calculus II including Vector Analysis and Vector Calculus; Differential Equations; Calculus III including Partial Derivatives, Double and Triple Integrals, Vector Fields, Stoke's Theorem; and Linear Algebra.

Courses that require this as a prerequisite: ELEN 3441 Fundamentals of Power Engineering

Credits: 3

Offered: Fall Annually

Meetings: MWF 9:10-10:05; Room 2631C

Instructors:  
Primary: Gleb Tcheslavski; gt.lamar@gmail.com  
Secondary: Staff

Office hours: By appointment

Final Exam: December 6, 2013; 8:00 a.m.


References:  
Electromagnetics for Engineers, Ulaby, Pearson Prentice Hall, 2005
Electromagnetics for Engineers, Schwarz, Oxford University Press, 1990
Introduction to Electric Fields, Rogers, McGraw Hill Publishers

**On-line access:** The course syllabus, assignments, solutions, and supplementary materials will be available through the EE web server at [http://www.ee.lamar.edu/gleb/em/Index.htm](http://www.ee.lamar.edu/gleb/em/Index.htm)

**Objectives** (with corresponding student learning [ABET Criteria/outcomes](#): Ensure students:

- Understand how electromagnetics broadly permeates electrical engineering disciplines such as circuits, electronics, VLSI, communications, power systems, computer engineering, controls, antennas, electromagnetic transmission lines, and optical engineering. (Criterion 3(f),(h))
- Garner an appreciation for the need for vector calculus concepts in applying Maxwell's Equations to the design of electrical engineering equipment and systems. Become attentive to the assumptions that are implicit in these developments and where these assumptions are no longer valid extend this appreciation to the appropriate mathematical formulations. (Criterion 3(a),(b))
- Be able to write Maxwell's Equations in differential form and the constitutive relations between the flux densities and field intensities of the electric and magnetic fields. (Criterion 3(a))
- Recognize the Helmholtz wave equations in its various forms and the wave nature of their solutions for time-harmonic waves. Acquire an appreciation for the physical form of the corresponding wave (such as plane wave, spherical wave and their direction of travel) by simply observing the form of the wave phasor. (Criterion 3(a),(b))
- Acquire an understanding of guided waves and the development and use of the Smith Chart for electromagnetic transmission-line analysis. Be able to work transmission-line problems through the "stub matching ". (Criterion 3(b),(c),(e))
- Appreciate the concepts of scalar and vector potential fields and their applications to electromagnetic antennas. Acquire an understanding of the basic Hertzian dipole and various other antennas that stem from it. Become aware of various antenna patterns and how they can be used in antenna design and applications. (Criterion 3 (b),(c),(e))
- Appreciate how electromagnetic concepts provide the foundations for optical engineering such as fiber optic communications and holography. (Criterion 3(b),(c),(e))
- Recognize and appreciate how electromagnetics concepts may be applied to individual topics of interest by preparing an engineering presentation to the class on a specific area of interest. (Criterion 3(e),(g),(h))

**Topics** (approximate number of 50-minute lectures):

- Introduction to Electromagnetics I with review of vector calculus. (4)
- Static Fields. (2)
- Boundary Value problems. (2)
- Time-varying Electromagnetic Fields. (4)
- Maxwell's Equations. (6)
- The Helmholtz Wave Equations and Plane Waves. (6)
• Reflection and Transmission of Waves. (2)
• Electromagnetic Transmission Lines and the Smith Chart. (5)
• Antennas: linear, loop, array antennas. (4)
• Individual topics in field and waves in modern communications. (4)
• Review (1)

Structure: Three 50-minute lectures per week. Homework, two exams, and final comprehensive exam.

Grading Policy: Grades will be determined on the basis of overall performance on the midterm exams, the final exam, and homework. Curving/averaging may be used. The specific weights for the assignments and the cut-off points for the grades are to be determined.

Attendance policy: Class attendance is mandatory with exceptions for medical, family, and other emergencies.

Make-ups: make-ups for the tests may be granted if the instructor is notified in advance about the absence and its reasons; the appropriate documentation may be needed.

Special needs: Students with special needs or circumstances (religious, conflicts, disabilities, etc.) are encouraged to meet with the instructor during his office hours to arrange the necessary accommodations. Also, students with disabilities may contact the office of Services for Students with Disabilities (P.O. Box 10087 Communication 105) for further assistance.

Academic Dishonesty:

Academic misconduct and dishonesty include copying, cheating, plagiarism, dual submission and items purchased with the intent of deception (i.e. term papers purchased on the internet). Students are expected to do original work, including class assignments, exams and labs. Penalties include failure of the assignment (a grade of zero) and possible stricter penalties, where appropriate. Such action could result in the failure of the course or suspension from the university. Refer to Student Handbook of Lamar University for clarification on Academic dishonesty.

Policy: Homework is due one week after they have been assigned, before the class time. No late homework will be accepted.

Honor Code: You are encouraged to work together on homework assignments; however, it should be your work that is submitted. You may thus claim credit only for your own work. All graded work is covered by the Academic Honor Code; violations will be prosecuted. You should consult the Lamar Student Handbook for the definitions of cheating, plagiarism, and other instances of Academic Dishonesty. The consequences for violating the Honor Code may range from assigning the zero grade for the particular assignment to issuing the failing grade for the course and are determined by the instructor.
It is your responsibility to know all exam dates and arrival times for the exams. Exam rules: There will be no borrowing of any item and no use of transmitting/receiving devices during the exams.

Emergency Procedures:

Many types of emergencies can occur on campus; instructions for severe weather or violence/active shooter, fire, or chemical release can be found at: http://www.lamar.edu/about-lu/administration/risk-management/index.html. Following are procedures for the first two:

Severe Weather:

- Follow the directions of the instructor or emergency personnel.
- Seek shelter in an interior room or hallway on the lowest floor, putting as many walls as possible between you and the outside.
- If you are in a multi-story building, and you cannot get to the lowest floor, pick a hallway in the center of the building.
- Stay in the center of the room, away from exterior walls, windows, and doors.

Violence/Active Shooter (CADD):

- **CALL** - 8-3-1-1 from a campus phone (880-8311 from a cell phone). Note: Calling 9-1-1 from either a campus phone or cell phone will contact Beaumont City Police Dispatch rather than University Police.
- **AVOID** - If possible, self-evacuate to a safe area outside the building. Follow directions of police officers.
- **DENY** - Barricade the door with desks, chairs, bookcases or any other items. Move to a place inside the room where you are not visible. Turn off the lights and remain quiet. Remain there until told by police it is safe.
- **DEFEND** - Use chairs, desks, cell phones or whatever is immediately available to distract and/or defend yourself and others from attack.