

**INSTRUCTOR:** Dr. Aleck W. Leedy, P.E.  
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 Office Hours: MWF 10:20 a.m. – 11:30 a.m., or other times by appointment

**DEPARTMENT:** Engineering and Physics

**COURSE PREFIX:** EGR

**COURSE NUMBER:** 460

**CREDIT HOURS:** 3

**I. TITLE: ELECTRICITY AND MAGNETISM I**

**COURSE DESCRIPTION AND PREREQUISITE(S): EGR 460 Electricity and Magnetism I (3).** Electric fields, potential, dielectrics, magnetic fields, and electromagnetic induction.

**Prerequisite(s):** PHY 255 Electricity, Magnetism, and Light and MAT 411 Ordinary Differential Equations

**II. COURSE OBJECTIVES:**

The student will be able to

- A. use Maxwell's equations for static fields.
- B. compute the curl of a vector field.
- C. apply the divergence theorem.
- D. analyze and solve electromagnetics problems using MATLAB.

**III. CONTENT OUTLINE:**

A Content Outline / Tentative Schedule is as follows:

	<b>Topic</b>	<b>Chapter / Section</b>
a.	Introduction to Electromagnetics	1
b.	Vector Algebra	1
c.	Scalars and Vectors, Unit Vector, Vector Addition and Subtraction	1.3-1.5
d.	Position and Distance Vectors, Vector Multiplication, Vector Components	1.6-1.8
e.	Coordinate Systems and Transformation	2
f.	Cartesian Coordinates, Cylindrical Coordinates, Spherical Coordinates	2.2-2.4
g.	Vector Calculus	3
h.	Differential Length, Area, and Volume	3.2
i.	Line, Surface, and Volume Integrals	3.3
j.	The Del Operator, Gradient of a Scalar	3.4, 3.5
k.	Divergence of a Vector and the Divergence Theorem	3.6
l.	Curl of a Vector and Stokes's Theorem	3.7
m.	Laplacian of a Scalar	3.8
n.	Electrostatic Fields	4

o.	Coulomb's Law and Field Intensity	4.2
p.	Electric Fields Due to Continuous Charge Distributions	4.3
q.	Electric Flux Density	4.4
r.	Gauss's Law	4.5, 4.6
s.	Electric Potential	4.7
t.	Electric Fields in Material Space	5
u.	Properties of Materials, Convection and Conduction Currents	5.2, 5.3
v.	Conductors, Polarization in Dielectrics, Dielectric Constant	5.4-5.6
w.	Boundary Conditions	5.9
x.	Electrostatic Boundary-Value Problems	6
y.	Poisson's and Laplace's Equations	6.2
z.	Uniqueness Theorem, General Procedure for Solving Poisson's or Laplace's Equations	6.3, 6.4
aa.	Resistance and Capacitance	6.5
bb.	Magnetostatic Fields	7
cc.	Biot-Savart's Law	7.2
dd.	Ampere's Law	7.3, 7.4
ee.	Magnetic Flux Density	7.5
ff.	Maxwell's Equations for Static Fields	7.6
gg.	Magnetic Forces, Materials, and Devices	8
hh.	Forces Due to Magnetic Fields	8.2
ii.	Magnetic Torque and Moment	8.3
jj.	Magnetization in Materials	8.5
kk.	Magnetic Boundary Conditions	8.7
ll.	Inductors and Inductances, Magnetic Energy, Magnetic Circuits	8.8-8.10
mm.	Force on Magnetic Materials	8.11

#### IV. INSTRUCTIONAL ACTIVITIES:

Lectures, Homework, and Exams

#### V. FIELD, CLINICAL, AND/OR LABORATORY EXPERIENCES:

NONE.

## VI. TEXT(S) AND RESOURCES:

Elements of Electromagnetics, 5<sup>th</sup> Edition, Matthew N.O. Sadiku, Oxford University Press, Inc., NY: 2010.

Semester: Spring 2015

Time: MWF 9:30 a.m. – 10:20 a.m.

Classroom: 170 Blackburn Science Building

## VII. EVALUATION AND GRADING PROCEDURES:

GRADING: 3 Exams (20 % each)	60 %
Homework	10 %
Final Exam	30 %

Grading Scale:

A = 90 – 100

B = 80 – 89

C = 70 – 79

D = 60 – 69

E = below 60

EXAM DATES:

Exam 1	Friday, February 13, 2015
Exam 2	Wednesday, March 25, 2015
Exam 3	Friday, April 24, 2015
Final Exam	Tuesday, May 5, 2015, 8:00 a.m. – 10:00 a.m.

**EXAMS:** All exams will be closed book and closed notes. Laptop computers are not allowed during exams. Other electronic devices such as cell phones may not be used as calculators or clocks during exams. A full-featured scientific calculator will be allowed during all exams. However, the instructor reserves the right to randomly check calculators for stored formulas. The final exam will be a comprehensive exam. A pencil must be used to complete all exams.

**EXAM ATTENDANCE:** Failure to take an exam during the assigned class period will result in a grade of zero being assigned for that exam. Make-up exams will be given only in the case of university-approved activities or documented emergencies. A written excuse from the proper authority must be presented to the instructor before a make-up exam will be administered.

**HOMEWORK POLICY:** A homework set will normally be assigned weekly. The set is due at the beginning of the lecture period one week from the day it is assigned. **No late homework will be accepted. Note: homework is considered late if it is turned in after the instructor asks for it at the beginning of class.** The only exceptions are university-approved activities or documented emergencies. A written excuse from the proper authority must be presented to the instructor before homework will be graded. **Students may drop their lowest homework grade.**

HOMEWORK FORMAT: Each student must adhere to the following homework format requirements:

1. Use 8.5" x 11" paper (regular wide ruled paper or engineering paper is preferred).
2. Write only on the front side of each sheet of paper submitted.
3. Use a pencil for all work submitted. No homework written in ink will be accepted.
4. Presentation of your solutions to assigned problems should be neat, legible, technically correct, and well organized.
5. Staple your homework and leave all sheets of paper submitted flat (do not fold).
6. Place your name, course number, homework number, and date on the top of the first page. Be sure to place your name on each additional page submitted.

**Failure to adhere to the homework format will result in a loss of points.**

**VIII. ATTENDANCE POLICY:**

Students are expected to adhere to the MSU Attendance Policy outlined in the current *MSU Bulletin*. Attendance at lecture classes is strongly recommended. The student is responsible for all business conducted during class time. Any change in exam dates, homework assignments, etc. will be made during the class period.

**IX. ACADEMIC HONESTY POLICY:**

Murray State University takes seriously its moral and educational obligation to maintain high standards of academic honesty and ethical behavior. Instructors are expected to evaluate students' academic achievements accurately, as well as ascertain that work submitted by students is authentic and the result of their own efforts, and consistent with established academic standards. Students are obligated to respect and abide by the basic standards of personal and professional integrity.

**Violations of Academic Honesty include:**

**Cheating** - Intentionally using or attempting to use unauthorized information such as books, notes, study aids, or other electronic, online, or digital devices in any academic exercise; as well as unauthorized communication of information by any means to or from others during any academic exercise.

**Fabrication and Falsification** - Intentional alteration or invention of any information or citation in an academic exercise. Falsification involves changing information whereas fabrication involves inventing or counterfeiting information.

**Multiple Submission** - The submission of substantial portions of the same academic work, including oral reports, for credit more than once without authorization from the instructor.

**Plagiarism** - Intentionally or knowingly representing the words, ideas, creative work, or data of someone else as one's own in any academic exercise, without due and proper acknowledgement.

Instructors should outline their expectations that may go beyond the scope of this policy at the beginning of each course and identify such expectations and restrictions in the course syllabus. When an instructor receives evidence, either directly or indirectly, of academic dishonesty, he or she should investigate the instance. The faculty member should then take appropriate disciplinary action.

Disciplinary action may include, but is not limited to the following:

- 1) Requiring the student(s) to repeat the exercise or do additional related exercise(s).
- 2) Lowering the grade or failing the student(s) on the particular exercise(s) involved.
- 3) Lowering the grade or failing the student(s) in the course.

**If the disciplinary action results in the awarding of a grade of E in the course, the student(s) may not drop the course.**

Faculty reserve the right to invalidate any exercise or other evaluative measures if substantial evidence exists that the integrity of the exercise has been compromised. Faculty also reserve the right to document in the course syllabi further academic honesty policy elements related to the individual disciplines.

A student may appeal the decision of the faculty member with the department chair in writing within five working days. Note: If, at any point in this process, the student alleges that actions have taken place that may be in violation of the Murray State University Non-Discrimination Statement, this process must be suspended and the matter be directed to the Office of

Institutional Diversity, Equity and Access. Any appeal will be forwarded to the appropriate university committee as determined by the Provost.

## **X. NON-DISCRIMINATION POLICY AND STUDENTS WITH DISABILITIES:**

### Policy Statement

Murray State University endorses the intent of all federal and state laws created to prohibit discrimination. Murray State University does not discriminate on the basis of race, color, national origin, gender, sexual orientation, religion, age, veteran status, or disability in employment, admissions, or the provision of services and provides, upon request, reasonable accommodation including auxiliary aids and services necessary to afford individuals with disabilities equal access to participate in all programs and activities. For more information, contact the Executive Director of Institutional Diversity, Equity and Access, 103 Wells Hall, (270) 809-3155 (voice), (270) 809-3361 (TDD).

### Students with Disabilities

Students requiring special assistance due to a disability should visit the Office of Student Disability Services immediately for assistance with accommodations. For more information, students should contact the Office of Student Disability Services, 423 Wells Hall, Murray, KY 42071. 270-809-2018 (voice) 270-809-5889(TDD).

## **XI. Other Information**

**PLEASE NOTE:** The following information items are also relevant to this course:

**SPECIAL ACCOMMODATIONS:** Students needing special accommodations are requested to make an appointment with the instructor during the first or second week of the semester. A memo from the Office of Student Disability Services should be brought to this meeting. Accommodations for each exam should be arranged one week in advance.

**COMPUTER USAGE:** Students are encouraged to use MATLAB, Excel, PSPICE, etc. to help solve homework problems.

**EMAIL:** E-mail is considered an official means for communicating with students. All students are responsible for checking their Murray State University issued e-mail account on a regular basis during the semester.

**CELL PHONE AND ELECTRONIC DEVICE POLICY:** All cell phones and electronic devices such as MP3 players (iPods), etc. should be stored in backpacks or book bags out of sight during class. Students should switch cell phones to “silent” mode before entering the classroom. This practice will ensure that other students and the instructor are not disturbed during lectures. Any student that answers a cell phone during class will be asked to leave the classroom. The student will not be allowed to return until the next class meeting. Cell phones or other electronic devices may not be used as calculators or clocks during exams.

**COMPUTER POLICY:** Laptop computers and tablets may be used during class for note taking only. Laptops and tablets should not be used during class time to surf the internet. If a student is caught surfing the internet during class time, the instructor at his discretion may decide to ask the student not to use their laptop / tablet during class the remainder of the semester. Laptops / tablets are not allowed during exams.

**Relationship of Course Objectives to Program Outcomes:**

This course will address ABET criteria a, e, and k.

Course Objectives	Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
1. To be able to use Maxwell's equations for static fields.	X				X						
2. To be able to compute the curl of a vector field.	X										
3. To be able to apply the divergence theorem.	X										
4. To be able to analyze and solve electromagnetics problems using MATLAB.					X						X

Course objectives 1, 2, and 3 will address criterion:

- a. an ability to apply knowledge of math, science and engineering

Course objectives 1 and 4 will address criterion:

- e. an ability to identify, formulate and solve engineering problems

Course objective 4 will address criterion:

- k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

This course is intended to fulfill program educational objectives A, B, and C.

The Engineering Physics program at Murray State University produces graduates who:

- A. are equipped to function as productive, qualified engineering professionals in entry-level corporate research, development, and production positions. This includes the ability to communicate effectively, work collaboratively, and solve problems creatively.
- B. are able to practice engineering in areas where traditional science and engineering disciplines overlap, utilizing their ability to incorporate significant computational, analytical, and experimental skills in accomplishing the engineering task.
- C. are prepared to successfully enter and complete programs of graduate study in one of several engineering fields as well as in physics.
- D. Are aware of their responsibility to contribute to society as ethical, socially conscious practitioners of their profession.