

# Electricity and Magnetism I: 3811

Professor Jasper Halekas Van Allen 301 MWF 9:30-10:20 Lecture

# E&M on One Coffee Cup



# **Electricity and Magnetism on One Slide**

#### Formulation in SI units

Name	Integral equations	Differential equations	Meaning
Gauss's law	$\oint \!$	$\nabla \cdot \mathbf{E} = \frac{\rho}{\varepsilon_0}$	The electric field leaving a volume is proportional to the charge inside.
Gauss's law for magnetism	$\oint \!$	$\nabla \cdot \mathbf{B} = 0$	There are no magnetic monopoles; the total magnetic flux piercing a closed surface is zero.
Maxwell–Faraday equation (Faraday's law of induction)	$\oint_{\partial \Sigma} \mathbf{E} \cdot \mathrm{d}\boldsymbol{\ell} = 0$	$ abla  imes {f E}={f 0}$	The voltage accumulated around a closed circuit is proportional to the time rate of change of the magnetic flux it encloses.
Ampère's circuital law (with Maxwell's addition)	$\oint_{\partial \Sigma} \mathbf{B} \cdot \mathrm{d}\boldsymbol{\ell} = \mu_0 \iint_{\Sigma} \mathbf{J} \cdot \mathrm{d}\mathbf{S}$	$ abla  imes \mathbf{B} = \mu_0 \left( \mathbf{J} \right)$	Electric currents and changes in electric fields are proportional to the magnetic field circulating about the area they pierce.

No time derivatives this semester...

#### **Vector Analysis**



# **Electrostatics**



#### **Potentials**



### **Electric Fields in Matter**



# Magnetostatics



# **Magnetic Fields in Matter**



# **Contacts/Office Hours**

- Instructor:
- Office:
- Phone:
- E-mail:
- Office Hours:
  - Wednesday 1:30-3:30 pm,
  - Thursday 2:00-3:00 pm
  - Or by Appointment

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#### **Resources: Web Pages**

- Web Pages:
  - Main Web Page
    - http://www.physics.uiowa.edu/~jhalekas/teaching/ eandm1\_2019/index.html
      - Hosts syllabus, schedule, class notes, assignments, etc.
  - ICON:
    - https://uiowa.instructure.com/courses/110838
      - Links to main site, syllabus, schedule, etc.
        - All grades will be posted here

#### **Resources: Class Notes**

- Notes from each class (both slides and blackboard material) will be merged and placed online in PDF form within one day after the class
  - Can be found on the main class web page, on the "Notes" tab

### **Resources: Textbook**

**Copyrighted Material** 

#### INTRODUCTION TO ELECTRODYNAMICS

Fourth Edition



DAVID J. GRIFFITHS

The textbook can be purchased anywhere Make sure you get the Fourth Edition.

We will use the same textbook next semester as well.

**Copyrighted Material** 

# Reading

- Reading should be completed before lecture
- There are no graded quizzes
  - There will be some ungraded "quizzes"/problemsolving sessions
- Reading ahead is highly recommended, and will make lecture and discussions more productive
  - It will also make you better prepared for exams

#### Homework

- Weekly homework assignments will be hand-written and hand-graded. Assignments are due in class on Fridays (or before). If you do your homework in electronic form please print it out.
- You are allowed to work with other students on the homework, but each student must write out a full set of solutions.
- Solutions must clearly show all work. Full credit will not be given for incomplete work. Partial credit may be assigned for correct logic on intermediate steps even if you don't get the final answer.
- The lowest scoring of the 11 homework assignments will be dropped – i.e. you get a "freebie"

# **Homework Grading Rubric**

- Solid attempt = 50% credit
- Correct approach but errors = ~75% credit
- Fully correct solution = 100% credit
- Copy of online solutions = o% credit
- Late homework = <<100% credit</p>

#### Exams

- Midterm exams will be held during regular class hours. The final exam will be two hours, scheduled during finals week at a time to be announced.
- Exams will be closed book, long-form, hand-graded
  - You will be provided with an equation sheet, which you can annotate as you see fit
  - Questions will require symbolic or text answers no calculators needed
- No make-up exams other than in legitimate extenuating circumstances with prior approval!

## **Tests/Grading**

#### Exam Schedule:

- Wednesday, Oct. 2
   Ch. 1-2
- Wednesday, Nov. 6
   Ch. 3-4
- Final Exam, TBD Date

#### Grading:

- Homework
- Two Midterms
- Final Exam

25% 20% Each 35%

Ch. 1-6

# **Grading: How it Works**

#### Student A has the following scores:

Category	Score	Percentage	Weight	<b>Class Points</b>
Homework	900/1000	.900	25	22.5
Midterm 1	65/100	.65	20	13.0
Midterm 2	72/100	.72	20	14.4
Final	68/100	.68	35	23.8
Total				73.7/100

Student A has 73.7 class points. These will determine his/her class rank, which will be used to determine his/her grade.

## **Grading: How it Works**

- CLAS recommends the following grade distribution for advanced courses:
  - A 22%, B 38%, C 36%, D 3%, F 1%.
  - A similar curve will be used in assigning final grades – this curve may be adjusted slightly depending on the overall performance of the class
- For example:
  - If 73.7 translated to a class rank of 9/18 = 50<sup>th</sup> percentile, Student A would get a B by this curve.

# Cheating

#### Don't!

- Cheating is a major disservice to you and your classmates
- Cheating will affect your grade, and you could face disciplinary action
- Copying homework solutions from anywhere is not fair play
  - If you don't work out your homework yourself, it will very likely hurt your performance on exams

### Communication

- Please let me know if you have questions, comments, complaints, or are struggling with particular concepts. This class is for you, and I am here to help.
  - Students may communicate with me by phone, e-mail, or in person
  - Students with issues or questions should if possible raise them in person by attending office hours or by scheduling an appointment
  - If you prefer to give me anonymous feedback there is a comments envelope on my door

### **Ask Questions!**

- If you have a question, others likely have the same question
- Don't be afraid to speak up!

# What I Care About (And Don't Care About) as an Instructor

- I care about:
  - Developing a strong conceptual understanding
  - Learning how to approach problems of different types and apply appropriate problem-solving techniques
- I don't care about:
  - Rote memorization of facts or equations
- As you progress in physics, you will never be able to remember every equation
  - You don't need to that's what reference material is for!
  - If you remember concepts and remember how to approach problems of different types, you will be a good physicist

# Schedule

#### Physics 3811 Electricity and Magnetism I 2019 Schedule

Dates	Week	Reading	HW Due	Notes
		(Due Monday	Friday	
		unless noted)		
Aug. 26-30	Week 1	Ch. 1.1-1.2	No HW	
Sep. 2-6	Week 2	Ch. 1.3-1.4 (Wed)	HW 1	Labor Day Holiday 9/2
Sep. 9-13	Week 3	Ch. 1.5-2.1	HW 2	
Sep. 16-20	Week 4	Ch. 2.2-2.3	HW 3	
Sep. 23-27	Week 5	Ch. 2.4-2.5	HW 4	
Sep. 30-Oct. 4	Week 6	No Reading	No HW	Midterm #1 Wed 10/2
				Chapters 1-2
Oct. 7-11	Week 7	Ch. 3.1-3.2	HW 5	
Oct. 14-18	Week 8	Ch. 3.3-3.4	HW 6	
Oct. 21-25	Week 9	Ch. 4.1-4.2	HW 7	
Oct. 28-Nov. 1	Week 10	Ch. 4.3-4.4	HW 8	
Nov. 4-8	Week 11	No Reading	No HW	Midterm #2 Wed 11/6
				Chapters 3-4
Nov. 11-15	Week 12	Ch. 5.1-5.2	HW 9	
Nov. 18-22	Week 13	Ch. 5.3-5.4	HW 10	
Nov. 25-29	Thanksgiving	No Reading	No HW	Turkey Week!
	Recess			
Dec. 2-6	Week 14	Ch. 6.1-6.4	HW 11	
Dec. 9-13	Week 15	No Reading	No HW	
Dec. 16-20	Finals Week	No Reading	No HW	Final Exam
				TBA on Ch. 1-6

Vectors  $\overline{A} = [A_x, A_y, A_z] = bold face$ =  $A_x \widehat{x} + A_y \widehat{g} + A_z \widehat{z}$  A in text  $|\overline{A}| = A = \sqrt{A_x^2 + A_y^2} + A_z^2$  $\hat{A} = \bar{A}/(\bar{A})$ 

Addition

 $\overline{A} + \overline{B} = [A_X + B_X, A_y + B_y, A_z + B_z]$ 



 $\overline{A} - \overline{B} = \overline{A} + (-\overline{B})$ 

Ā-0 /-0 Scalar Multiplication aA = [aAx, aAy, aAz]