PHYS 122
Introductory Physics II
Dr. Eric C. Anderson
UMBC • Spring • 2017
Syllabus

• Getting ready •

Prerequisites• You must have completed Phys 121, and Math 152 (or be enrolled in it this semester.)

Workload• Experience shows that success requires at least 8-10 hours per week of intensive effort outside of class - more for those lacking strong preparation and study techniques. Be sure that you can dedicate the time and concentration required for success.

The book and other required items• Principal source: *FlipItPhysics* by Gary Gladding et al, ISBN: 9781429272438. Supplemental source: *Physics for Scientists and Engineers* by Tipler. RF LCD Clicker + Turning Account. Scientific calculator.

Enrolling in *FlipIt Physics*• Provided through Course Materials Initiative (CMI). In Blackboard, click on Start here/FlipIt Physics access and use the course access key and payment code found there.

Accessing supplemental source (Tipler)• Provided through CMI. In Blackboard, click on Start here/ *Physics for Scientists and Engineers*.

Blackboard (BB)• Access between classes for course materials, discussion forums, your grades, helpful advice, and announcements.

Registering your clicker• See Blackboard/Syllabus folder.

Class• MWF 11-11:50 PM in Engineering 027 and weekly discussion (check your schedule).

• Learning goals •

General education program (GEP) goals: *This course addresses the GEP's functional competency* Scientific and Quantitative Reasoning. *It has been approved to meet the GEP* Sciences *distribution requirement.*

1. Understand and use mathematical and scientific methods of inquiry, reasoning, processes, and strategies to investigate and solve problems.
2. Organize, interpret, draw inferences, and make predictions about natural or behavioral phenomena using mathematical and scientific models and theories.
3. Recognize that mathematical, statistical, and scientific evidence requires evaluation.

Prerequisite Knowledge: *Newton's laws and energy principles apply to thermal processes and electric and magnetic interactions.*

1. Use trigonometric relations to find vector components and vector sums graphically and analytically; determine scalar products and vector products.
2. Evaluate and interpret derivatives and integrals of polynomials, trig functions, and inverse functions.
3. Apply Newton's laws and kinematic relationships to infer motion of particles.
4. Apply work and energy principles to particles and systems of particles.

Course goals:

Thermodynamics: *The first law of thermodynamics constrains thermal processes based on conservation of energy; the second law of thermodynamics gives the direction of thermal processes*.

1. Apply the first law of thermodynamics, ideal gas law, and ideas of molar heat capacity to thermal processes with ideal gases.
2. Analyze the performance of thermodynamic cycles.

Electricity: *Charged particles create electric fields; electric fields exert forces on moving charged particles.*

3. Use Coulomb's law and the principle of superposition to find electric fields of charged particles and determine forces on charged particles.
4. Apply Gauss's law to find electric fields of symmetric charge distributions and infer charge distributions on conductors.

5. Qualitatively and quantitatively reason with electric potential and electric potential energy; determine electric potential difference from electric field.

DC circuits: *Potential difference across a conductor results in electric current.*

6. Apply the definition of capacitance and Kirchoff's rules to find charges and voltages in circuits containing batteries and capacitors.
7. Apply Ohm's law and Kirchoff's rules to find currents, voltages, and power in circuits containing batteries and resistors.
8. Analyze charging and discharging processes in circuits containing batteries, resistors, and capacitors, i.e, determine charges, currents, and voltages as a function of time and in limiting cases of small and large times.

Magnetism: *Electric currents create magnetic fields; magnetic fields exert forces on moving electric charges.*

9. Determine the magnetic force on a moving charged particle and its resulting motion, the magnetic force on a current-carrying wire, and apply ideas of torque and potential energy to current loops in magnetic fields.
10. Apply results of the Biot-Savart law and the superposition principle to determine magnetic fields due to infinite straight wires and current loops.

Faraday's law and Inductors: *Changing magnetic flux results in an* emf.

11. Apply Faraday's law to determine the *emf* arising from a changing magnetic flux.

• Methods •

Prelectures and checkpoints • Access multimedia learning modules (MLMs) through the *FlipItPhysics* website, generally before each Mon and Wed class. Complete checkpoints – multiple-choice questions checking your understanding of the MLM content - no later than 10 minutes before class. Earning 80% of possible points corresponds to full credit.

Lecture • Course content is delivered via MLMs; lectures offer opportunities for you to deepen your understanding by working through questions posed by your instructor independently and with your peers. Find the pdf lecture outline before each class on BB under *Course Documents*. Print it out and take notes or annotate it on your tablet. Bring your clicker to each class. Your clicker grade is based on the number of days in which you respond to clicker questions – never on getting the right answers.

Discussion • Expect collaborative problem solving practice and feedback in your weekly discussion session. Your TA will collect your work on discussion problems at the end of each session. Grading is based on both completeness/effort, and correctness (one randomly selected item.)

Homework • HW assignments are designed to build conceptual understanding, develop scientific reasoning skills, and provide practice and feedback with systematic problem solving. Due (online, through *FlipItPhysics*) most Tuesdays and Thursdays at midnight. Earning 80% of possible points corresponds to full credit. *FlipIt* offers additional feedback at the deadline. HW assignments offer a second deadline a week later for 80% credit. Keep a careful written record of your work for future studying.

Exams and quizzes • Given most Fridays, quizzes provide practice and feedback for exam preparation. 3 class exams and a comprehensive final. Expect to solve problems and respond to conceptual multiple-choice items. Needed quantitative relationships will be provided (see BB/*Course Documents*). Calculator allowed. *Class exams given at 8 AM, in multiple lecture halls; check BB for your assigned lecture hall and seat.*

• Policies •

Grading • 5% (20 pts) for prelectures/checkpoints, 7.5% (30 pts) for homework, 7.5% (30 pts) for best 10 of 13 discussion grades, 5% (20 pts) for clickers, 12.5% (50 pts) for best 10 of 13 quizzes, 12.5% (50 pts) for each of 3 exams, 25% (100 pts) for final exam. 360 pts (out of 400 possible) required for A, 320 pts for B, 280 pts for C, and 240 pts for D.

Reclaiming and reviewing work • Exams, quizzes, and discussion materials are returned to you in discussion. Exam solutions are posted in BB/*Course Documents* at 5 PM after each exam. Please review graded work right away, and check that we enter your grades in BB correctly. *Notify us of any grading mistakes within a week*: Contact your discussion TA about discussion grade mistakes. Get exams to me directly, or through the Physics Department office (Physics 221), along with a note describing the mistake. (For errors in

assigning partial credit, make sure that you've examined the posted solutions and the grading scheme revealed therein, and that your note explicitly addresses the discrepancy. Your entire exam will be regraded.)

Making up work• If you must miss an exam due to officially sanctioned UMBC activities, illness, family emergency, detention by authorities, or another difficulty, contact me as soon as possible. At my discretion, I'll request written verification of the cause of your absence and arrange a makeup over the same material. The final exam must be taken at the scheduled time. No quiz or discussion makeups; we drop grades to allow for illness and other difficulties. No late prelectures/checkpoints; get an early start in case of technical or other difficulties. FlipItPhysics homework may be completed up to a week late for 80% credit. Your participation grade allows 5 free days to account for absences for any reason and clicker malfunctions; no individual accommodations are possible.

Academic integrity• All instances of academic misconduct will be addressed according to the UMBC Policy on Academic Integrity (http://www.umbc.edu/integrity/students.html). Examples include attempting to make use of disallowed materials on quizzes and exams, attempting to communicate with anyone other than the instructor or TA during an exam, altering graded work and submitting it for regrading, asking someone else to take an exam in your place, copying another's work on homework, asking someone else to do homework and representing it as your own, and permitting or assisting another student to carry out any of the above. Penalties range from a grade of 0 on a homework or exam to an F in the course (at my discretion), and from denotation of academic misconduct on the transcript to expulsion (as determined by official hearing of the Academic Conduct Committee.)

Courtesy• Electronic devices in class only to assist with learning physics please (e.g., viewing/annotating class materials, researching)

•Getting help•

Contact me• Eric C. Anderson, Physics 320. Office hours M 12:00-12:50, W 2:00-2:50, Th 12:30-1:50 through 16 May. (Check BB for updates.) Phone 455-5823, email andersoe@umbc.edu. Please email me through BB or use your UMBC email and give your full name and your class. *If you seek HW help or have a general course question, please post to the appropriate discussion forum on Blackboard, so that others might benefit*.

Form or join a study group• Perhaps with the help of the *Forming study groups* forum on BB.

Attend PASS sessions• A successful peer from last semester leads weekly study sessions and exam reviews; more info to follow on BB.

Troll the discussion board• Post a question to a forum on Blackboard, or post an answer to another's question.

Attend the help sessions (HS)• Offered before each class exam (see day-by-day guide below).

Contact the Learning Resource Center (LRC)• At http://www.umbc.edu/lrc/ or 455-2444 and inquire about small group tutoring.

• Day-by-day guide •

Principal source: **FlipIt Physics**. Supplemental source: (Tipler)

Week of:	Monday	Discussion	Wednesday	Friday
30 Jan-3 Feb	Introduction to the course	Mechanics review	*Thermodynamics* **Unit 1** Introduction to thermodynamics	**Unit 2** Heat and temperature (17.1-2, 18.1-5)
6-10 Feb	**Unit 3** Ideal gas (17.3-4, 18.6-8)	Ideal gases and the first law of thermodynamics	**Unit 4** Equipartition, heat capacity, and conduction (20.1, 4)	Review Quiz 1 (Ch 1 and 2)
13-17 Feb	**Unit 5** Heat engines (19.1)	Equipartition	**Unit 6** Reversible processes (19.2-7, 18.9)	Review Quiz 2 (Ch 3 and 4)
20-24 Feb	*Electricity* **Unit 7** Coulomb's law (21.1-3)	Heat engines and heat pumps	**Unit 8** Electric fields (21.4-6, 22.1)	Review Quiz 3 (Ch 5 and 6) Help session 12-1:50 in BIOL 120
27 Feb-3 Mar	**Exam 1 (*Thermodynamics*, 8 AM in assigned room and seat; see BB)**	Coulomb's law and electric field	**Unit 9** Electric flux and field lines (22.2)	Review Quiz 4 (Ch 7 and 8)
6-10 Mar	**Unit 10** Gauss' law (22.3-5)	Gauss's law	**Unit 11** Electric potential energy (23.6)	Review Quiz 5 (Ch 9)
13-17 Mar	**Unit 12** Electric potential (23.1-5)	Electric potential	**Unit 13** Conductors and capacitance (24.1-2)	Review Quiz 6 (Ch 10-11)
20-24 Mar				
27-31 Mar	*DC Circuits* **Unit 14** Capacitors (24.3-4)	Capacitors	**Unit 15** Electric current (25.1-4)	Review Quiz 7 (Ch 12-13) Help session 12-1:50 in BIOL 120
3-7 Apr	**Exam 2 (*Electricity*, 8 AM in assigned room and seat; see BB)**	A model for circuits	**Unit 16** Kirchoff's rules (25.5)	Review Quiz 8 (Ch 14-15)

10-14 Apr	**Unit 17** RC circuits (25.6)	Kirchoff's rules and RC circuits	*Magnetism* **Unit 18** Magnetism (26.1-2)	Review Quiz 9 (Ch 16)
17-21 Apr	**Unit 19** Forces and torques on currents (26.3-4)	Magnetic force and torque	**Unit 20** Biot Savart law (27.1-2)	Review Quiz 10 (Ch 17-18)
24-28 Apr	**Unit 21** Ampere's law (27.4)	Biot-Savart law and Ampere's law	*Faraday's law and Inductors* **Unit 22** Motional emf (28.4)	Review Quiz 11 (Ch 19-20)
1-5 May	**Unit 23** Faraday's law (28.1-3)	Faraday's law	**Unit 24** Induction and RL circuits (28.6-8)	Review Quiz 12 (Ch 21-22) Help session 12-1:50 in BIOL 120
8-12 May	**Exam 3 (*DC circuits and Magnetism*, 8 AM in assigned room and seat; see BB)**	Inductors and RL circuits	**Unit 25** LC and RLC circuits (29.4)	Review Quiz 13 (Ch 23)
15-19 May	Review	No discussion		
As late as 24 May	**Final exam (Comprehensive: *Electricity, DC circuits, Magnetism*, extra weight to *Faraday's law and Inductors)* Time and date TBA in assigned room and seat; see BB). Date could be as late as 24 May.**			