

## **Chris Haufler KU Core Achievement Award**

**Nominated Innovative Approach: ALPaCA Grading System for Course Assessment**

**KU Core Goals:** Goal 1, Goal 3, (and in the future Goal 5)

**Department:** Physics and Astronomy

**Contact:** Professor Hume Feldman (chair); feldman@ku.edu

**Introduction:** Many introductory courses in the Department of Physics and Astronomy satisfy KU Core Goal 3. A subset of these courses satisfy KU Core Goal 1.1 and/or KU Core Goal 1.2, and we also have a sequence of separate courses that satisfy Goal 5. Since applying for these courses to join the KU Core, we have sought ways to assess effectively whether students in these courses are achieving the learning outcomes of the KU Core goals to which these courses are assigned. Toward that aim, we have developed a process to link each graded assignment/activity explicitly to course learning objectives that also map directly to KU Core learning objectives. This provides faculty with quantitative data for the assessment of student competencies and the students with an explicit mapping of the course learning objectives to the KU Core learning objectives (as well as degree program learning objectives). We have refined this process through analysis of KU Core Goal 1 and 3 achievement by our calculus-based introductory physics sequence (PHSX 211 + PHSX 212) and have started implementing it in our laboratory sequence, starting with PHSX 216 and PHSX 236. Our long term goal is to use a common set of objectives for the objective-based grading in our KU Core Goal 5 sequence, which includes PHSX 150 and the following series of laboratory courses: PHSX 216 + PHSX 236 + PHSX 316 + PHSX 516. We further hope that other STEM departments will introduce objective-based grading in their introductory courses (lectures and laboratories) so that a common set of objectives could be identified, which could then span the introductory curricula of several STEM degree programs.

**Innovative course or experience design:** The assessment system we use is a modified version of competency-based grading or proficiency-based grading that we denote as **Assessment of Learning Proficiency and Competency Achievement (ALPaCA)**. In ALPaCA, we assign each graded activity (exams, homework, in-class assignments, *etc.*) or portion of each activity to one or more specific learning objectives for the course. For example, a specific assignment (or portion of an assignment) might require students to analyze and evaluate assumptions in order to select and implement the appropriate interpretive tools (KU Core Goal 1.1), or apply mathematical principles and quantitative methods in problem solving (KU Core Goal 1.2), or demonstrate basic competence in the principles, theories, and analytic methods used physics (KU Core Goal 3N). A student's grade in the course is then determined by the extent to which she or he has demonstrated proficiency or competency with each learning outcome.

Professor Fischer piloted ALPaCA grading in PHSX 212, General Physics II, during the fall 2017 semester. Although PHSX 212 is a KU Core Goal 3N course, Professor Fischer also used course learning objectives reflecting critical thinking or quantitative and computational goals as student performance in PHSX 212 is also part of the degree level assessment for the Physics and Astronomy degree programs. Professor Rogan further modified this procedure during the spring 2018, and a common policy has been in place since then. Professor Rush introduced objective-based grading in PHSX 211, General Physics I, during summer 2018. Her procedure is based on what is used in PHSX 212, thereby providing continuity for students across this course

sequence. We note that PHSX 211 satisfies KU Core Goal 1.1, KU Core Goal 1.2, and KU Core Goal 3N.

The learning objectives for PHSX 211 are:

- Objective #1: Kinematics (linear and rotational, constant and non-constant acceleration)
- Objective #2: Energy, energy conservation, and energy-based mechanics
- Objective #3: Oscillatory motion
- Objective #4: Newton's laws (forces, mechanics, moving objects)
- Objective #5: Momentum conservation (linear and rotational)
- Objective #6: Thermodynamics
- Objective #7: Homework
- Objective #8: In-Class Participation

The learning objectives for PHSX 212 are:

- Objective #1: Fields, Forces, Potentials, and Potential Energies (Gravitational, Electric, Magnetic) for Point Particles
- Objective #2: Fields, Forces, Potentials, and Potential Energies of Continuous Systems (using calculus)
- Objective #3: Gravitational, Electric, and Magnetic Flux and Gauss's Law
- Objective #4: Ampère's Law, Ampère-Maxwell Law, Faraday's Law, and EMF
- Objective #5: DC and AC Circuits
- Objective #6: Electromagnetic Waves
- Objective #7: Homework
- Objective #8: In-Class Participation

As clarified in the attached syllabi, students received points in each of these ALPaCA objectives by answering correctly questions on exams; both group and individual exams occur. The number of points achieved in each objective determine the course grade according to the recipes shown in the syllabi.

**Alignment of learning outcomes with demonstration of student learning:** The goal of ALPaCA grading is to match student learning assessment directly with learning outcome assessment. Therefore, there is a perfect alignment between student learning outcomes and the demonstration and assessment of student learning. In the table below we show a mapping of KU Core learning outcomes with the ALPaCA objectives for PHSX 211 and PHSX 212.

| <b>KU Core Learning Outcomes</b> | <b>PHSX 211 ALPaCA Objectives</b> | <b>PHSX 212 ALPaCA Objectives</b> |
|----------------------------------|-----------------------------------|-----------------------------------|
| Goal 1.1                         | 2, 3, 5, 6, 7, and 8              | 2, 4, 7, and 8                    |
| Goal 1.2                         | 1 - 8                             | 1 - 8                             |
| Goal 3N                          | 2, 4, 5, 7, and 8                 | 1, 2, 3, 4, 6, 7, and 8           |

We can use the assessment information obtained from the ALPaCA grading data for each course to directly evaluate student proficiency in the learning outcomes of the KU Core goals. Shown in the tables below are the number of students (and corresponding percentage of total course population) who demonstrated different levels of proficiency at each KU Core Goal during the Fall 2018 semester using the ALPaCA recipe shown above.

| <b>PHSX 211: Fall 2018</b>  |                 |                 |                |
|---|-----------------|-----------------|----------------|
| <b>Number of Students (and percentage) achieving different competencies in KU Core Goal learning objectives</b> |                 |                 |                |
| <b>Proficiency</b>  | <b>Goal 1.1</b> | <b>Goal 1.2</b> | <b>Goal 3N</b> |
| Excellent   | 52 (68.4%)      | 45 (59.2%)      | 40 (52.6%)     |
| Very Good   | 10 (13.2%)      | 18 (23.7%)      | 23 (30.3%)     |
| Satisfactory  | 9 (11.8%)       | 9 (11.8%)       | 7 (9.2%)       |
| Unsatisfied   | 2 (2.6%)        | 2 (2.6%)        | 3 (3.9%)       |
| Failed  | 3 (3.9%)        | 2 (2.6%)        | 3 (3.9%)       |

| <b>PHSX 212: Fall 2018</b>  |                 |                 |                |
|---|-----------------|-----------------|----------------|
| <b>Number of Students (and percentage) achieving different competencies in KU Core Goal learning objectives</b> |                 |                 |                |
| <b>Proficiency</b>  | <b>Goal 1.1</b> | <b>Goal 1.2</b> | <b>Goal 3N</b> |
| Excellent   | 150 (50.8%)     | 92 (31.2%)      | 157 (53.2%)    |
| Very Good   | 115 (39%)       | 137 (46.4%)     | 124 (42%)      |
| Satisfactory  | 20 (6.8%)       | 44 (14.9%)      | 4 (1.4%)       |
| Unsatisfactory  | 3 (1%)          | 5 (1.7%)        | 3 (1%)         |
| Failed  | 7 (2.4%)        | 7 (2.4%)        | 7 (2.4%)       |

The calculation in the tables above involved an averaging of the results of each ALPaCA objective corresponding to each KU Core objective and equating a rounded average of 'A' to 'Excellent', 'B' to 'Very Good', 'C' to 'Satisfactory', 'D' to 'Unsatisfactory', and 'F' to 'Failed'. As shown in these tables, the majority of students in these courses demonstrated 'Excellent' or 'Very Good' proficiency at the KU Core learning objectives.

**Incorporation of student engagement or active learning strategies:** All of our department's introductory courses are taught in a hybrid style in which the students routinely participate in active learning exercises. In addition to regular reading assignments, students are tasked with watching videos and/or completing pre-class quizzes online (through Blackboard) before coming to class. These reading assignments, videos, and quizzes are designed to cover general background material, and thus allow for class-time to be focused on the active learning exercises in which the students apply these principles to answering conceptual quiz questions and solving problems in small groups; on occasion, students also perform "micro-experiments" using springs, balls, plastic cups, *etc.* in their small groups. This course format also affords the students more effective

opportunities to develop their proficiencies in KU Core learning outcomes: Goal 1.1 and 1.2 through in-class active learning exercises, and Goal 3 by completing online content.

**Process for determining achievement of learning outcomes, including a feedback loop for course improvement:** All assessment material for all courses, either as part of the KU Core assessment or the program assessment, are reviewed by the department's Undergraduate Committee, and, ultimately, by the Departmental Assembly. The faculty teaching these courses, the course GTAs, and the UTAs then work on adjustments to the courses in response to the feedback obtained from these groups. Furthermore, during the regular meetings between the instructor, GTAs, and UTAs, the latter two groups provide feedback about the current status of the course to the instructor. As we implement ALPaCA grading in more courses we will include within this feedback loop analysis of student performance in subsequent semester courses (if applicable) in our degree program sequence. For example, we can use data about student proficiencies in General Physics II to inform course improvement in General Physics I, and *vice-versa*. We can also use data about student proficiencies in both of these introductory courses to modify/improve content and instruction in subsequent upper-level courses in our degree programs. Toward this latter goal we seek to develop common objectives to be shared between courses so that student development over time (*i.e.*, through different courses) can also be monitored. This final point is particularly important for our future plans to implement ALPaCA grading for KU Core Goal 5 across several courses (see below).

**Plan for, or presentation of, quantitative data:** The department's undergraduate committee is responsible for analyzing the data collected as part of the assessment protocol described above. The conclusions of this analysis are available to the entire department, and posted on Blackboard for ready access by all faculty, so that improvements or modifications to course format/pedagogy can be made. Our department would also be happy to provide additional presentations of the data (in different venues and/or formats) as needed/desired.

**Plan for, or evidence of, sharing results with faculty colleagues who teach KU Core courses meeting the same learning outcome or courses that build on foundational skills and knowledge taught in the course:** Our department maintains a dedicated Blackboard site where all course assessment information (KU Core assessment data, degree level assessment data, course syllabi, ALPaCA objectives together with sample test and homework questions, *etc.*) are stored. This information is then available to all faculty teaching these courses for their use in KU Core or program assessment. Furthermore, since our department has multiple classes satisfying the same KU Core Goal (*e.g.*, PHSX 211 and ASTR 394 both satisfy Goal 1.1) this database allows for synergistic development of new assessment techniques/approaches between different classes. Furthermore, this database enables a standardized assessment of student performance and instruction by allowing all instructors to use similar problems linked to a universal set of course objectives.

Our department is also committed to the widespread dissemination of the results of our course transformations to other faculty/departments at KU. Several faculty, postdocs, and graduate students in the department are regular participants in the C21 workshops and seminars on campus where they interact directly with other students and faculty from other departments. Our department also recently joined the CTE-led Benchmarks for Teaching Excellence Project, which aims to improve the processes of teaching evaluation on campus. We hope to incorporate ALPaCA grading as part of our department's revised teaching assessment (*i.e.*, as a quantitative and hopefully objective measure of instructor proficiency at helping student achieve course outcomes.).

**Conclusions and Future Work:** This approach to grading also allows for the direct determination of which specific topics cause the most difficulty for the students and, by extension, in which areas the instructor can improve instruction. For example, in both PHSX 211 and PHSX 212 students struggle more with the use of calculus than the use of trigonometry or the understanding physics concepts. Delving deeper, while most students are able to solve *directed* problems involving calculus (students must only manipulate or solve using calculus equations given to them), a smaller fraction of students can solve *undirected* problems involving calculus (students must employ calculus skills and reasoning to develop a solution on their own); this is particularly acute in PHSX 212 where the course content is more focused on student-led solutions. This information points to students' inability to transfer skills from calculus courses into physics courses, and provides concrete targets for improvement in instruction. Specifically, we are now developing new mathematics supplements for the PHSX 211 and PHSX 212 curricula to give students more practice with these skills.

Our next step is to develop ALPaCA grading for KU Core Goal 5 that we can apply across all courses of our Goal 5 sequence. We have already started this process by implementing ALPaCA grading in our introductory physics laboratory courses, PHSX 216 and PHSX 236. The ALPaCA objectives for these courses are:

Objective #1: Lab Reports

Objective #2: Graphs and Uncertainty Online Quizzes

Objective #3: Accurately Predict a Value within Uncertainty

As with PHSX 211 and PHSX 212, students earn points toward each objective from grading assignments (lab reports, attendance, online quizzes, *etc.*) and final course grades are determined from the number of points earned in each objective (see syllabus for details). While none of these objectives map to KU Core Goal 5, we hope that the success of this initial effort to implement ALPaCA grading across PHSX 216 and PHSX 236 will lay the groundwork for developing an ALPaCA objective for KU Core Goal 5 that we could implement across the entire KU Core Goal 5 course sequence.

## PHSX 211 (General Physics I) – M 1:00-1:50 PM, WF 12:30-1:45 PM in 1146 CDS1 (aka ISB)

Introduction to classical mechanics and thermodynamics. Designed for students in engineering and physical science majors. Prerequisite: MATH 116 or MATH 125 or MATH 145; co-requisite MATH 126 or MATH 146; courses in high school physics and/or chemistry are recommended.

Satisfies: Goal 1 Outcome 1 (GE11), Goal 1 Outcome 2 (GE12), Goal 3 Natural Sciences (GE3N), Lab and Field Experiences (LFE), N Natural Science (N), NP Physical Sciences PC (NP)

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Instructor: Sarah (LeGresley) Rush, Ph.D.

Email: sarah.rush@ku.edu

Office Location: 1075 Malott

Office Hours: MTWR 2:30 – 3:30 PM and by appointment (email to schedule a time)

### PHSX 211 Required Course Materials

- Textbook: *The Energy of Physics, Part I: Classical Mechanics and Thermodynamics* by Christopher J. Fischer
- Homework: Blackboard
- CATME Team Maker Survey: TBD
- It is recommended that you have a basic-function, scientific calculator

### Course Goals

This course is the first semester of a sequence of introductory calculus-based physics courses that are designed primarily for students in the physical sciences and engineering. The main subjects covered this semester are classical mechanics and thermodynamics, which involve describing how and why things move. As such, this course has four principal objectives:

1. ***Develop an understanding of the principles and methods of physics.*** In this course you will be presented with concepts and theories central to all of physics. You will need to be able to (a) understand the development and range of applicability of these theories, and (b) discuss how these principles and methods can be applied to contemporary problems.
2. ***Develop your ability to apply mathematical principles and associated quantitative reasoning to solving problems.*** This course will emphasize the direct application of the physics concepts we learn to quantitative problem solving. Homework assignments and exams will require the use of numerical techniques (direct calculation) and non-numerical techniques (algebra, trigonometry, and calculus).
3. ***Practice your ability to think abstractly about mathematics.*** Of particular emphasis in this course will be the application of calculus to physics both for understanding concepts and for solving problems. As such, you will be learning (and in some cases re-learning) techniques and continually developing your ability to apply mathematics correctly in your problem solving approaches.
4. ***Develop and practice your capacity for critical thinking.*** Throughout this course you will be tasked with solving many different problems using a few basic physical laws. This will require you to: (a) analyze the information given in a problem; (b) assess the validity of any assumptions required for the application of a particular concept, equation, or approach; and (c) test the validity of your solution either by demonstrating that it makes physically realistic predictions under certain limits or by deriving it through an independent approach.

## Expectations and Rules

The Department of Physics and Astronomy considers all meetings for this course (lectures, office hours, *etc.*) to be a place where you will be treated with respect as a human being – regardless of gender, race, ethnicity, national origin, religious affiliation, veteran status, sexual orientation, gender identity, political beliefs, age, or ability. Additionally, diversity of thought is appreciated and encouraged, provided you can agree to disagree. It is our department's expectation that **ALL** students experience meetings for this course as a safe environment and adhere to the following rules:

- Respect others' rights to hold opinions and beliefs that differ from your own. Challenge and criticize ideas, not the person.
- Listen carefully to what others are saying, even when you disagree with what is being said. Comments that you make (asking for clarification, sharing critiques, expanding on a point, *etc.*) should reflect you have paid attention to the speaker's comments.
- Be courteous. Don't interrupt or engage in private conversations while others are speaking.
- Allow everyone a chance to talk. If you have much to say, try to hold back a bit; if you are hesitant to speak, look for opportunities to contribute to discussion.
- Respect the purpose of this class and others' time – restrict discussions to topics related to the course content.
- You don't know what you don't know – strive for Intellectual Humility.

## Textbook

*The Energy of Physics, Part I: Classical Mechanics and Thermodynamics* by Christopher J. Fischer is the required text. The chapter and section(s) of assigned readings for each class are listed in advance in the course schedule.

## Class Format

This course will be taught in a hybrid format. You will be assigned reading from the textbook before coming to class. There will be no formal lecture during class. Instead, class time will be devoted to active learning exercises; specifically, discussion and problem solving (in groups). Your task is to learn as much as you can from the reading material before coming to class, and then use time during class to practice what you have learned by solving problems. You are, of course, encouraged to ask me, the UTA, and/or your peers questions during class to clarify the material and/or the associated problem solving strategies.

The **motivation for the hybrid format of the course** is to give you the maximum amount of time possible to practice solving problems in the presence of me and the UTA, and to get help specifically tailored to your needs. Although the concepts of physics are relatively easily to learn and memorize, the *application* of these concepts to solving problems takes a lot of practice. Your problem solving skills will improve the most by actually solving problems, rather than watching me solve a problem for you, or reading solutions in a textbook.

When you attend class, please participate appropriately and do not distract others. Examples of behavior that I classify as distracting are: talking with other students about material not pertinent to the class/homework; browsing the web; sending email, text messages or tweets; playing games; reading the newspaper; cooking; conducting animal sacrifices; *etc.* Please keep in mind that material on the exams may well be drawn from the material covered in class so it would be helpful for you to attend and participate in the discussions.

Attending class also provides you an excellent opportunity to work on the homework with your peers and to get assistance with the homework from me, the GTAs, and the UTAs. The hybrid format of the course allows for the course to be structured to help you specifically, so please take advantage of it.

### **Quizzes and Example Problems**

At the beginning of almost every class there will be a qualitative quiz on physics concepts, or an interactive discussion of an example problem or new concept. You will use the ABCD cards to “vote” for the correct answer to questions. You will not receive a grade for any of these questions. Rather, the motivation is to give you an opportunity to reflect on your understanding of the concepts in the course and to practice your critical thinking skills. Discussion will follow voting – if necessary – to ensure that the class comes to a consensus on the correct answers. The material associated with this portion of the class will be posted on Blackboard after each one.

### **In-Class Assignments**

A set of problems will be handed out during each class. This in-class assignment will consist of qualitative and/or quantitative problems based upon the reading assignment for that day. You will solve each problems in small groups, or with me (if necessary). Always check your answers before leaving. Our goal is for everyone to have the correct answers (and hopefully the correct solutions) at the end of each class.

### **Teams**

You will be assigned to teams of no more than 3 people for the conceptual quizzes, in-class assignments, and team exams. Feel free to contact the professor or the TA(s) if you are having problems with your team.

### **Homework Assignments**

The homework is an opportunity for you to practice your problem solving skills. Homework will be completed online using Blackboard. Each day’s homework assignment will be made available at least 24 hours before class so that you can prepare for each class by completing the assigned reading and starting on the homework assignment.

#### **Here is the strategy I want you to follow when working on the homework:**

1. Complete the reading assignment before starting the homework.
2. Allow yourself **no more than 5 to 7 minutes per problem** on the homework assignment (set a timer, if necessary, to keep yourself on schedule). Of course, you are encouraged to reference the textbook and your formula sheet as you work through the problems. If you feel as though you are not making **significant** progress toward a solution in those 5 to 7 minutes, move on to the next problem.
3. After working through all the problems. Take a break from your assignment (at least 15 or 20 minutes).
4. Start working through the problems again. As before, **allow just 5 to 7 minutes to solve each problem** (and use the textbook and formula sheet as a reference). If you are still not making **significant** progress toward a solution in those 5 to 7 minutes, circle the problem, and then move on to the next problem. When you have



worked through all the problems, stop working on the assignment until you have talked with me or the UTAs about each of the problems you circled on the assignment.

5. Ask me or the UTAs about all of your circled problems during my office hours and/or during class. As mentioned previously, time will be reserved during each class for working on that day's homework assignment. You are encouraged to use this time to discuss the homework with your peers, the UTAs, or me. Although it is perfectly acceptable for you to work alone, I encourage you to work in groups. Also, feel free to get up and move around the classroom to talk with other students. It is likely better to interact with different students than to always work within the same group.

**You should not spend more than ~2 to 3 hours on reading and homework outside of class for each hour during class.**

You are welcome to use computer programs such as Wolfram Alpha, MatLab, Mathematica, *etc.* for solving homework problems. I am not nearly as interested in your ability to solve an integral by hand as I am in your ability to set up the integral.

The **motivation for assigning homework** is that although it is often easy to learn the concepts in this course either from attending class or from reading the textbook, learning how to solve problems is best achieved by actually solving problems. Your problem solving and critical thinking skills won't develop too much if you simply read through solutions in textbooks (or online) or watch me (or someone else) solve problems for you. Similarly, the **motivation for encouraging you to work in groups** is that explaining your solution/reasoning to someone else is an excellent way of testing whether you truly understand the material.

## Exams

There will be three section exams for this course and one final exam. Each of the three section exams will include an individual portion and a team portion. The final will only be an individual exam.

## Grading

Your grade in the course will not depend on the results of any one exam, but rather on how many points you accumulate in each of following six different learning objectives:

- Objective #1: Kinematics (linear and rotational, constant and non-constant acceleration)
- Objective #2: Energy, energy conservation, and energy-based mechanics
- Objective #3: Oscillatory motion
- Objective #4: Newton's laws (forces, mechanics, moving objects)
- Objective #5: Momentum conservation (linear and rotational)
- Objective #6: Thermodynamics

Each exam question is associated with one of these six objectives, and a correct answer will earn points for that objective. Points towards each objective will accumulate and be determined by the following:

- A. Individual Exam: 3 points for each correct answer (Exams 1 – 3 and the Final Exam) and
- B. Team Exam: 1 point for the difference between the team and individual scores (Exams 1 – 3)

Example: On Exam #1A (individual exam) you answer three (of the four) questions on objective #1 correct. You have earned 9 (individual) points. On Exam #1B (team exam) you answer all four questions on objective

#1 correct. You have earned 1 (team) point because the difference in your team and individual score is 1. Your total points for Exam #1 Objective #1 is 10 points.

Shown in the table below are the number of questions for each objective that will be on each exam.

| Category     | Number of Questions From Each Objective Per Exam |        |        |       |       | POINTS |
|--------------|--|--------|--------|-------|-------|--------|
|              | Exam 1   | Exam 2 | Exam 3 | Final | TOTAL |        |
| Objective #1 | 4  | 2      | 2      | 3     | 11    | 33     |
| Objective #2 | 4  | 2      | 2      | 3     | 11    | 33     |
| Objective #3 |  | 4      | 2      | 3     | 9     | 27     |
| Objective #4 |  | 4      | 2      | 3     | 9     | 27     |
| Objective #5 |  |        | 4      | 3     | 7     | 21     |
| Objective #6 |  |        | 4      | 3     | 7     | 21     |

The number of points you accumulate by the end of the course in an objective is converted to a grade as follows (the minimum number of points per each grade are shown):

| Category               | Index (i) | Grade (s <sub>i</sub> ) |           |           |           |       |
|------------------------|-----------|-------------------------|-----------|-----------|-----------|-------|
|                        |           | 5 (A)                   | 4 (B)     | 3 (C)     | 2 (D)     | 1 (F) |
| Objective #1 Points    | 1         | 20                      | 17        | 14        | 11        | ≤ 8   |
| Objective #2 Points    | 2         | 20                      | 17        | 14        | 11        | ≤ 8   |
| Objective #3 Points    | 3         | 15                      | 12        | 9         | 6         | ≤ 3   |
| Objective #4 Points    | 4         | 15                      | 12        | 9         | 6         | ≤ 3   |
| Objective #5 Points    | 5         | 10                      | 8         | 6         | 4         | ≤ 2   |
| Objective #6 Points    | 6         | 10                      | 8         | 6         | 4         | ≤ 2   |
| Homework Score         | 7         | 75% - 100%              | 60% - 74% | 45% - 59% | 30% - 44% | ≤ 29% |
| In Class Participation | 8         | 75% - 100%              | 60% - 74% | 45% - 59% | 30% - 44% | ≤ 29% |

Your final grade is **NOT** simply the average of the individual objective grades and homework scores. Rather, it corresponds to the geometric average of these eight individual scores (s<sub>i</sub>). Specifically:

$$Score = S = (s_1 \times s_2 \times s_3 \times s_4 \times s_5 \times s_6 \times s_7 \times s_8)^{\frac{1}{8}}$$

Your final grade is assigned from the above score according to this table:

| Score              | Course Grade |
|--------------------|--------------|
| $S \geq 4.6$       | A            |
| $3.9 \leq S < 4.6$ | B            |
| $2.6 \leq S < 3.9$ | C            |
| $1.6 \leq S < 2.6$ | D            |
| $S < 1.6$          | F            |

Please note that you do not need to acquire points for a given objective in a single exam – once an objective is covered in class there will be questions associated with it appearing on every individual exam that follows, such that the final exam will include questions from all of the objectives. **This means you will have multiple chances to acquire all of the points you need to get the grade that you want, particularly for objectives covered earlier in the course.**

$$S = (5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5)^{\frac{1}{8}} = 5.00 \quad \Rightarrow \quad \text{Final Grade is 'A'}$$

$$S = (5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 3)^{1/8} = 4.69 \quad \Rightarrow \quad \text{Final Grade is 'A'}$$

$$S = (5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 2)^{1/8} = 4.46 \quad \Rightarrow \quad \text{Final Grade is 'B'}$$

$$S = (5 \times 5 \times 4 \times 4 \times 3 \times 3 \times 2 \times 2)^{1/8} = 3.31 \quad \Rightarrow \quad \text{Final Grade is 'C'}$$

It is your responsibility to confirm that results of exams are entered correctly into Blackboard. Following the test there will be a 1 week period during which you may petition for re-grading or checking that grades were entered correctly – *no changes will be made after this deadline has past.*

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### Tips for Success in this Class

Being successful in this class will require effort on your part. Here are a few tips as to how best to approach this class:

- Complete the reading assignments before coming to class. If time permits, start work on the homework assignment associated with the reading assignment.
- Attend every class and bring with you to class paper, a pen or pencil, your ABCD voting card, your formula sheet, and a calculator.
- **Ask questions during class!** If you don't understand something, ask about it. This is true whether we just talked about it, or we discussed it a week ago.
- **Come to office hours *immediately* when you start to have trouble in the class.** Don't put off getting help, since that will likely result in you falling even farther behind. If you cannot attend office hours, you can always arrange an appointment to meet with the professor or a TA at an alternative time.
- **Don't cram for exams or homework at the last minute!** This is not an effective strategy for learning the material. Rather, work continuously throughout the semester. This is much more effective than cramming for 15 hours for the exam.

Disclaimer: If it becomes necessary to modify any information in this syllabus, you will be notified in class and/or in Blackboard.

**Academic Misconduct:** A student discovered cheating in any aspect of the course will be charged with Academic Misconduct and a written report will be sent to the Dean of the student's school. There are severe penalties for Academic Misconduct, including the possibility of receiving a failing grade in the course. Examples of Academic Misconduct include, but are not limited to: submission of material done by or copied from someone else; cheating on exams; using unauthorized material during the exam (such as having extra notes on the formula sheet). Students should review the university policy on Academic conduct at: <http://policy.ku.edu/governance/USRR#art2sect6>

Pursuant to the University of Kansas' [Policy on Commercial Note-Taking Ventures](#), commercial note-taking is not permitted in PHSX 211. Lecture notes and course materials may be taken for personal use, for the purpose of mastering the course material, and may not be sold to any person or entity in any form. Any student engaged in or contributing to the commercial exchange of notes or course materials will be subject to discipline, including academic misconduct charges, in accordance with University policy.

**Please note:** note-taking provided by a student volunteer for a student with a disability, as a reasonable accommodation under the ADA, is not the same as commercial note-taking and is not covered under this policy.

**Accommodations:** The Academic Achievement and Access Center (AAAC) coordinates academic accommodations and services for all eligible KU students with disabilities. If you have a disability for which you wish to request accommodations and have not contacted the AAAC, please do so as soon as possible. They are located in 22 Strong Hall and can be reached at 785-864-4064 (V/TTY). Information about their services can be found at <http://www.access.ku.edu>. Please contact me privately in regard to your needs in this course.

**Concealed Carry:** Individuals who choose to carry concealed handguns **are solely responsible to do so in a safe and secure manner in strict conformity with state and federal laws and KU weapons policy**. Safety measures outlined in the KU weapons policy specify that a concealed handgun:

- Must be under the constant control of the carrier.
- Must be out of view, concealed either on the body of the carrier, or backpack, purse, or bag that remains under the constant control of the carrier.
- Must be in a holster that covers the trigger area and secures any external hammer in an un-cocked position
- Must have the safety on, and have no round in the chamber.

**Nondiscrimination:** The University of Kansas prohibits discrimination on the basis of race, color, ethnicity, religion, sex, national origin, age, ancestry, disability, status as a veteran, sexual orientation, marital status, parental status, retaliation, gender identity, gender expression and genetic information in the University's programs and activities. Please contact the University's Title IX Coordinator at [IOA@ku.edu](mailto:IOA@ku.edu) with any inquiries.

**Religious Observances:** Should the examination schedule for this course conflict with your mandated religious observance, please contact me at the beginning of the semester so that we can schedule a make-up exam at a mutually acceptable time. In addition, students will not be penalized for absence from regularly scheduled class activities which conflict with mandated religious observances. Students are responsible for initiating discussion with the instructor to reach a mutually acceptable solution.

**MySuccess:** This course participates in MySuccess, an early warning initiative at the University of Kansas to increase student retention. Throughout the academic term, you will receive a message from MySuccess through your official KU email address. MySuccess operates through Blackboard. Your instructor may communicate about your course performance by triggering a flag to indicate a low test or assignment score or a "kudos" for above average or improved performance. You may set up additional preferences and features by going to your profile tab. MySuccess has additional features to help you be a successful student at KU. There is a Success Network that lists a directory of KU resources as well as an online appointment scheduler system that allows you to make appointments with your instructor or assigned academic advisor that have activated their calendars to

work with MySuccess. For more information about MySuccess, please visit [www.mysuccess.ku.edu](http://www.mysuccess.ku.edu) and click on the Students tab.

**KU Counseling and Psychological Services (CAPS)** – CAPS can help students with issues related to adjusting to college and other psychological, interpersonal, and family problems. Individual and group sessions are available. You can find more information at <https://caps.ku.edu/> Phone is 785-864-2277 and hours are M, W, F 8-5 and T, H 8-6. CAPS is located in Watkins Memorial Health Center

**KU Office of Multicultural Affairs (OMA)** – OMA provides direction and services for current and prospective students from underrepresented populations. In addition, through collaborative partnerships it offers diversity education programs that foster inclusive learning environments for all students. OMA's programs and services enhance the retention of successful matriculation of students, while supporting their academic and personal development. You can find more information at: <https://oma.ku.edu/about> Phone is 785-864-4350 OMA is located in the Sabatini Multicultural Resources Center next to the Union.

**KU Academic Access and Achievement Center (AAAC)** – AAAC offers many services and programs to assist students in their academic success and to enhance their collegiate experience at KU. Choose from learning strategy consultations, group workshops or general or course-specific academic assistance, by appointment or on a walk-in basis. Feel free to talk with AAAC and ask for information or direction about academic and personal issues. You can find more information at: <https://achievement.ku.edu/> Phone is 785-864-4064 The AAAC is located in Rm 22 Strong Hall.

**KU Public Safety** – Public safety is dedicated to providing a safe and secure environment for the thousands of students, faculty, staff and visitors that are on campus each day. Public Safety's website (<https://publicsafety.ku.edu/>) contains practical information that can protect you from becoming a victim of a crime, help you recognize and report suspicious activity, and guide you in the event of an emergency.

**KU Emily Taylor Center for Women & Gender Equity (ETC)** – The ETC provides leadership and advocacy in promoting gender equity and challenge gender-related barriers that impede full access, inclusion, and success. The ETC provides services, assistance, advocacy and support to campus community members of all genders. We also provide consultation, information and resources to Edwards and KUMC campus members, parents of KU students and the community by request. Appointments are recommended, but not necessary. Services are private. In situations involving discrimination and violations of Title IX, ETC staff report information to campus authorities. Center programs and facilities are also accessible to individuals with disabilities. For those requesting accommodations, please contact KU Student Access Services at 785-864-4064 or [achieve@ku.edu](mailto:achieve@ku.edu). The ETC is located in 4024 Wescoe Hall

**KU Writing Center** - The Writing Center offers a variety of ways for students and members of the community to get feedback on their writing. It offers face-to-face consultations, online appointments, and an eTutoring appointments. Information regarding each type of appointment and a tool for scheduling can be found at <http://writing.ku.edu/> The Writing Center has multiple locations on campus.

**KU Student Involvement & Leadership Center (SILC)** – SILC prepares students to become contributing members of society by providing meaningful co-curricular experiences. SILC is responsible for coordinating registered university organizations and providing leadership education experiences for students in addition to providing programs and services to specific target populations including fraternity/sorority members, non-traditional students, and students of all gender identities, gender expressions and sexual orientations. More information can be found at <https://silc.ku.edu/>. A notable program of SILC is the Safe Zone Training, which aims to reduce homophobia, transphobia, and heterosexism on our campus to make KU a safer and freer environment for all members of our community, regardless of sexual orientation, gender identity, or gender expression. By agreeing to become a Safe Zone ally, the participant agrees to undergo training and to serve as a

resource for people seeking clarification on issues of sexuality and gender diversity. SILC is located in the Sabatini Multicultural Resources Center.

**Sexual Assault CARE Coordinator** - Watkins Health Services provides support to victims of sexual and domestic violence. Merrill Evans, LSCSW, is our CARE (Campus Assistance, Resource, and Education) Coordinator whose primary role is to coordinate support for individuals (both victim and alleged perpetrators) impacted by sexual violence including incidents of sexual assault, sexual battery, partner violence, dating violence and stalking. The CARE Coordinator is a confidential position and is not required to report incidents to University officials or organizations. If you or someone you know has been affected by any form of sexual violence, please do not hesitate to contact Merrill or stop by Watkins Health Center Room 2615 during normal business hours. If WHS is closed, the Sexual Trauma & Abuse Care Center is available 24 hours for victim assistance at 785-843-8985. <https://studenthealth.ku.edu/sexual-assault>

**Sexual Assault Prevention and Education Center (SAPEC)** - SAPEC promotes social change and the elimination of sexual violence through prevention education, inclusive programming, and campus-wide collaboration. SAPEC is located at 116 Carruth O'Leary; Phone 785-864-5879; email: [sappec@ku.edu](mailto:sappec@ku.edu). <http://sappec.ku.edu/>

**Institute of Institutional Opportunity & Access (IOA)** - The Office of Institutional Opportunity and Access (IOA) is responsible for administering the University of Kansas equal opportunity and non-discrimination policies and procedures, as well as, encouraging a campus climate of respect and understanding of all aspects of the human experience. To accomplish these duties, the IOA offers assistance and protective measures to students, faculty, and staff who report acts of harassment, discrimination, sexual misconduct, sexual violence, and retaliation; provides information about health, safety, advocacy, and support resources for members of the Lawrence and Edwards campuses; performs formal investigations to detect, discontinue, and prevent violations of the Non-Discrimination Policy and Sexual Harassment Policy; and ensures University compliance with state and federal civil rights laws. IOA is located at 153A Carruth-O'Leary; Phone 785-864-6414; email: [ioa@ku.edu](mailto:ioa@ku.edu); <http://ioa.ku.edu/>.

### **Formal KU Policies**

Students should be aware of KU's academic policies, available at the KU policy library: academic. While the policies are numerous, key policies to be aware of include:

Academic Misconduct (<http://policy.ku.edu/governance/USRR#art2sect6>),

Final Examination Schedules (<http://policy.ku.edu/governance/USRR#art1sect3>), and

The Grading System (<http://policy.ku.edu/governance/USRR#art2sect2para3>)

The secret of freedom lies in educating people, whereas the secret of tyranny is in keeping them ignorant.  
--- Maximilien Robespierre

## **PHSX 212: General Physics II**

**Fall 2018**

### **Lecture Information**

MWF 2:00 to 2:50                      or                      MWF 3:00 to 3:50  
1154 CDS1 (aka ISB)                      1154 CDS1 (aka ISB)

### **Instructor Contact Information**

Office: 2056A Malott  
Office hours: MWF noon to 1:00  
                    By appointment<sup>1</sup>  
Campus Phone: 864-4579  
Email: shark@ku.edu

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### **Course Goals and Objectives**

This course is the second semester of a sequence of introductory calculus-based physics courses that are designed primarily for students in the physical sciences and engineering. The main subjects covered this semester are electricity, magnetism, and applications of these interactions. As such, this course has four principal objectives:

1. ***Develop an understanding of the principles and methods of physics<sup>2</sup>.*** In this course you will be presented with concepts and theories central to all of physics. You will need to be able to (a) understand the development and range of applicability of these theories, and (b) discuss how these principles and methods can be applied to contemporary problems.
2. ***Develop your ability to apply mathematical principles and associated quantitative reasoning to solving problems.*** This course will emphasize the direct application of the physics concepts we learn to quantitative problem solving. Homework assignments and exams will require the use of numerical techniques (direct calculation) and non-numerical techniques (algebra, trigonometry, and calculus).
3. ***Practice your ability to think abstractly about mathematics.*** Of particular emphasis in this course will be the application of calculus to physics both for understanding concepts and for solving problems. As such, you will be learning (and in some cases re-learning) techniques and continually developing your ability to apply mathematics correctly in your problem solving approaches.
4. ***Develop and practice your capacity for critical thinking.*** Throughout this course you will be tasked with solving many different problems using a few basic physical laws. This will require you to: (a) analyze the information given in a problem; (b) assess the validity of any assumptions required for the application of a particular concept, equation, or approach; and (c) test the validity of your solution either by demonstrating that it makes physically realistic predictions under certain limits or by deriving it through an independent approach.

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<sup>1</sup> I realize that these office hours might not work for everyone's schedule so please feel free to contact me to make an appointment for a different time if necessary.

<sup>2</sup> KU Core Goal 3, Natural Sciences

Your ability to think critically, employ quantitative reasoning, and apply mathematical principles is essential to your success in this course since they form the basis of all the problem solving you will do.

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## Expectations and Rules

The Department of Physics and Astronomy considers all meetings for this course (lectures, office hours, *etc.*) to be a place where you will be treated with respect as a human being – regardless of gender, race, ethnicity, national origin, religious affiliation, veteran status, sexual orientation, gender identity, political beliefs, age, or ability. Additionally, diversity of thought is appreciated and encouraged, provided you can agree to disagree. It is our department's expectation that **ALL** students experience meetings for this course as a safe environment and adhere to the following rules:

- Respect others' rights to hold opinions and beliefs that differ from your own. Challenge and criticize ideas, not the person.
- Listen carefully to what others are saying, even when you disagree with what is being said. Comments that you make (asking for clarification, sharing critiques, expanding on a point, *etc.*) should reflect you have paid attention to the speaker's comments.
- Be courteous. Don't interrupt or engage in private conversations while others are speaking.
- Allow everyone a chance to talk. If you have much to say, try to hold back a bit; if you are hesitant to speak, look for opportunities to contribute to discussion.
- Respect the purpose of this class and others' time – restrict discussions to topics related to the course content.
- You don't know what you don't know – strive for Intellectual Humility.

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## Text

We will be using *The Energy of Physics, Part II: Electricity and Magnetism* by Christopher J. Fischer. This textbook can be purchased directly from the publisher through the following website:

<https://students.universityreaders.com/store/>

Please contact me if you are unable to purchase the book online through this link.

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## Course Format

This course will be taught in a hybrid format. You will be assigned reading from the textbook (and often a video to watch) before coming to class. There will be only brief formal lecture during class. The majority of class time will be devoted to active learning exercises; specifically, discussion and problem solving (in groups). Your task is to learn as much as you can from the reading material and videos before coming to class, and then use time during class to practice what you have learned by solving problems. You are, of course, encouraged to ask me, the TAs, and/or your peers questions during class to clarify the material and/or the associated problem solving strategies.

The **motivation for the hybrid format of the course** is to give you the maximum amount of time possible to practice solving problems in the presence of me and the TAs, and to get help specifically tailored to your needs.



Although the concepts of physics may be relatively easily for you to learn/memorize, the *application* of these concepts to solving problems takes practice. Your problem solving skills will improve the most by actually solving problems, rather than watching me solve a problem for you, or reading solutions in a textbook.

When possible, I will include demonstrations during class.

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## In-Class Assignments

A set of problems will be handed out during each class. This in-class assignment will consist of qualitative and/or quantitative problems based upon the reading assignment for that day. You will solve each problems in small groups, or with me (if necessary). Always check your answers before leaving. **Our goal is for everyone to have the correct answers (and hopefully correct solutions) at the end of each class.**

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## Groups

You will self-organize into groups of  $3 \pm 1$  people for the in-class assignments and group exams. You are free to change group membership for each class. Feel free to contact me or a TA is you are unable to find a group.

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## Homework Assignments

The homework is an opportunity for you to practice your problem solving skills. Homework will be completed online using ExpertTA. You can follow this link to sign-up for this class:

<http://goeta.link/USF18KS-61F26A-1RL>

Each day's homework assignment will be made available at least 24 hours before class so that you can prepare for each class by completing the assigned reading and starting on the homework assignment.

## Here is the strategy I want you to follow when working on the homework:

1. Complete the reading assignment (and watch any associated videos) before starting the homework.
2. Allow yourself **no more that 5 to 7 minutes per problem** on the homework assignment (set a timer, if necessary, to keep yourself on schedule). Of course, you are encouraged to reference the textbook and your formula sheet as you work through the problems. If you feel as though you are not making **significant** progress toward a solution in those 5 to 7 minutes, move on to the next problem.
3. After working through all the problems. Take a break from your assignment (at least 15 or 20 minutes).
4. Start working through the problems again. As before, **allow just 5 to 7 minutes to solve each problem** (and use the textbook and formula sheet as a reference). If you are still not making **significant** progress toward a solution in those 5 to 7 minutes, circle the problem, and then move on to the next problem. When you have worked through all the problems, stop working on the assignment until you have talked with me or the TAs about each of the problems you circled on the assignment.
5. Ask me or the TAs about all of your circled problems during my office hours and/or during class. As mentioned previously, time will be reserved during each class for working on that day's homework assignment. You are encouraged to use this time to discuss the homework with your peers, the TAs, or me. Although it is perfectly acceptable for you to work alone, I encourage you to work in groups. Also,

feel free to get up and move around the classroom to talk with other students. It is likely better to interact with different students than to always work within the same group.

**5. You should not spend more than ~2 to 3 hours on reading and homework outside of class for each hour during class.**

You are welcome to use computer programs such as Wolfram Alpha, MatLab, Mathematica, *etc.* for solving homework problems. I am not nearly as interested in your ability to solve an integral by hand as I am in your ability to set up the integral.

The **motivation for assigning homework** is that although it is often easy to learn the concepts in this course either from attending class or from reading the textbook, learning how to solve problems is best achieved by actually solving problems. Your problem solving and critical thinking skills won't develop too much if you simply read through solutions in textbooks (or online) or watch me (or someone else) solve problems for you. Similarly, the **motivation for encouraging you to work in groups** is that explaining your solution/reasoning to someone else is an excellent way of testing whether you truly understand the material.

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## Exams

There will be six section exams for this course and one final exam. Three of the section exams will be group exams (groups of  $3 \pm 1$ ) and other three section exams will be individual exams. The final will also be an individual exam.

You may bring along your formula sheet to each exam. With the exception of the designated areas where you are to write down an additional equation, you are **NOT** allowed to make additional notes on these formula sheets. You are **NOT** allowed to attach any additional sheets to the formula sheets, **NOR** are you allowed to bring any other reference material or notes to the exams. **You are allowed to bring a pencil and a calculator.**

The TAs will confiscate formula sheets containing extra notes.

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## Class Participation

When you attend class, please participate appropriately and do not distract others. Examples of behavior that I classify as distracting are: talking with other students about material not pertinent to the class/homework; browsing the web; sending email, text messages or tweets; playing games; reading the newspaper; cooking; conducting animal sacrifices; *etc.* Please keep in mind that material on the exams may well be drawn from the material covered in class so it would be helpful for you to attend and participate in the discussions.

Attending class also provides you an excellent opportunity to work on the homework with your peers and to get assistance with the homework from me and the TAs. **The hybrid format of the course allows for the course to be structured to help you specifically, so please take advantage of it.**

## Academic Misconduct

A student discovered cheating in any aspect of the course will be charged with Academic Misconduct and a written report will be sent to the Dean of the student's school. There are severe penalties for Academic Misconduct, including the possibility of receiving a failing grade in the course. Examples of Academic Misconduct include, but are not limited to: submission of material done by or copied from someone else; cheating on exams; using unauthorized material during the exam (such as having extra notes on the formula sheet).

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## Grading

Your grade in the course will not depend on the results of any one exam, but rather on how many points you accumulate in each of following six different learning objectives:

- Objective #1: Fields, Forces, Potentials, and Potential Energies (Gravitational, Electric, Magnetic) for Point Particles
- Objective #2: Fields, Forces, Potentials, and Potential Energies of Continuous Systems (using calculus)
- Objective #3: Gravitational, Electric, and Magnetic Flux and Gauss's Law
- Objective #4: Ampère's Law, Ampère-Maxwell Law, Faraday's Law, and EMF
- Objective #5: DC and AC Circuits
- Objective #6: Electromagnetic Waves

Each exam question is associated with one of these five objectives, and a correct answer will earn points for that objective (**one point per question on group exams, three points per question on individual exams**). While the group exams will focus on the new objectives covering since the last exams, the individual exams will be cumulative.

Shown in the table below are the number of questions for each objective that will be on each exam.

| Number of Questions From Each Objective Per Exam |           |   |   |   |   |   |
|--|-----------|---|---|---|---|---|
| Exam   | Objective |   |   |   |   |   |
|  | 1         | 2 | 3 | 4 | 5 | 6 |
| Exam 1 Group                                     | 4         | 4 | 0 | 0 | 0 | 0 |
| Exam 1 Individual                                | 4         | 4 | 0 | 0 | 0 | 0 |
| Exam 2 Group                                     | 0         | 0 | 4 | 4 | 0 | 0 |
| Exam 2 Individual                                | 2         | 2 | 4 | 4 | 0 | 0 |
| Exam 3 Group                                     | 0         | 0 | 0 | 0 | 4 | 4 |
| Exam 3 Individual                                | 2         | 2 | 2 | 2 | 4 | 4 |
| Final  | 3         | 3 | 3 | 3 | 2 | 2 |

The number of points you accumulate by the end of the course in an objective is converted to a grade as follows (the minimum number of points per each grade are shown):

| Category               | Index (i) | Grade (s <sub>i</sub> ) |           |           |           |       |
|------------------------|-----------|-------------------------|-----------|-----------|-----------|-------|
|                        |           | 5                       | 4         | 3         | 2         | 1     |
| Objective #1 Points    | 1         | 22                      | 16        | 10        | 6         | ≤ 6   |
| Objective #2 Points    | 2         | 22                      | 16        | 10        | 6         | ≤ 6   |
| Objective #3 Points    | 3         | 19                      | 13        | 9         | 3         | ≤ 3   |
| Objective #4 Points    | 4         | 19                      | 13        | 9         | 3         | ≤ 3   |
| Objective #5 Points    | 5         | 16                      | 10        | 6         | 3         | ≤ 3   |
| Objective #6 Points    | 6         | 16                      | 10        | 6         | 3         | ≤ 3   |
| Homework Score         | 7         | 75% - 100%              | 60% - 74% | 45% - 59% | 30% - 44% | ≤ 29% |
| In-Class Participation | 8         | 85% - 100%              | 70% - 84% | 55% - 69% | 40% - 54% | ≤ 39% |

Your final grade is NOT simply the average of the individual objective grades and homework scores. Rather, it corresponds to the geometric average of these seven individual scores ( $s_i$ ). Specifically:

$$\text{Score} = S = (s_1 \times s_2 \times s_3 \times s_4 \times s_5 \times s_6 \times s_7 \times s_8)^{\frac{1}{8}}$$

Your final grade is assigned from the above score according to this table:

| Score              | Course Grade |
|--------------------|--------------|
| $S \geq 4.6$       | A            |
| $3.9 \leq S < 4.6$ | B            |
| $2.6 \leq S < 3.9$ | C            |
| $1.6 \leq S < 2.6$ | D            |
| $S < 1.6$          | F            |

Please note that you do not need to acquire points for a given objective in a single exam – once an objective is covered in class there will be questions associated with it appearing on every individual exam that follows, such that the final exam will include questions from all of the objectives. **This means you will have multiple chances to acquire all of the points you need to get the grade that you want, particularly for objectives covered earlier in the course.**

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## Students with Disabilities

The KU office of Disability Resources coordinates accommodations and services for all students who are eligible. If you have a disability for which you wish to request accommodations and have not contacted DR, please do so as soon as possible. Their office is located in 22 Strong Hall; their phone number is 785-864-2620 (V/TTY).

Information about their services can be found at <http://disability.ku.edu>. Please also contact me privately in regard to your needs in this course.

## Sexual and Racial Harassment

The University has strong rules against any ethnic, racial, or sexual harassment, as described in the Student Handbook. The chair of the department of physics and astronomy is also happy to share with you the specific department rules and regulations concerning harassment. **Please contact me and/or the department chair if you are ever harassed or otherwise made to feel uncomfortable in this class or outside of this class.**

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## How to Succeed

Being successful in this class will require effort on your part. Here are a few tips as to how best to approach this class.

- Complete the reading assignments and watch any associated videos before coming to class. If time permits, start work on the homework assignment associated with the reading assignment.

- Attend every class and bring with you to class paper, a pen or pencil, your ABCD voting card, and a calculator.
- **Ask questions during class!** If you don't understand something, ask about it. This is true whether we just talked about it, or we discussed it a week ago.
- **Come to my office hours immediately when you start to have trouble in the class.** Don't put off getting help, since that will likely result in you falling even farther behind. If you cannot attend my office hours, let me know and I will arrange an appointment to meet you at a different time.
- **Don't cram for exams or homework at the last minute!** This is not an effective strategy for learning the material. Rather, work continuously throughout the semester. This is much more effective than cramming for 15 hours for the exam.

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### **Concealed Weapons Policy**

Individuals who choose to carry concealed handguns are solely responsible to do so in a safe and secure manner in strict conformity with state and federal laws and KU weapons policy. Safety measures outlined in the KU weapons policy specify that a concealed handgun:

- Must be under the constant control of the carrier.
- Must be out of view, concealed either on the body of the carrier, or backpack, purse, or bag that remains under the carrier's custody and control.
- Must be in a holster that covers the trigger area and secures any external hammer in an un-cocked position
- Must have the safety on, and have no round in the chamber.

Instructors are allowed by Kansas Board of Regents policy, to require backpacks, purses and other bags be placed at the front of the classroom during exams and quizzes, and as such those items will not be under the constant control of the individual. Students who choose to carry a concealed handgun in a purse, backpack, or bag must review and plan each day accordingly, and are responsible for making alternate arrangements as necessary. The university does not provide appropriate secured storage for concealed handguns.

Individuals who violate the KU weapons policy may be asked to leave campus with the weapon and may face disciplinary action under the appropriate university code of conduct.

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### **Commercial Note-Taking**

Pursuant to the University of Kansas' Policy on Commercial Note-Taking Ventures, commercial note-taking is not permitted in this course. Lecture notes and course materials may be taken for personal use, for the purpose of mastering the course material, and may not be sold to any person or entity in any form. Any student engaged in or contributing to the commercial exchange of notes or course materials will be subject to discipline, including academic misconduct charges, in accordance with University policy.

**Please note:** note-taking provided by a student volunteer for a student with a disability, as a reasonable accommodation under the ADA, is not the same as commercial note-taking and is not covered under this policy.

## **Additional Resources**

Feel free to contact the AAAC to request additional resources for this course.

Supplemental Instruction ([si.ku.edu](http://si.ku.edu))

Peer-led sessions in which course material and study strategies are discussed.

Course-Specific Tutoring ([tutoring.ku.edu](http://tutoring.ku.edu))

A regular schedule of two sessions per week.

Access to Accommodations ([access.ku.edu](http://access.ku.edu))

Resources for students with physical, sensory, medical, psychological, attention, or cognitive disabilities.

## Lab Syllabus

Welcome to physics lab! This lab will be different from your other lab experiences. If you find yourself lost, frustrated or just having a hard time, please come talk with us! A help room is available in Malott 2068 with a schedule posted on Blackboard. Additionally, please feel free to contact your TA or the lab director by email if you have any questions.

### Objectives

There are three objectives to this lab. They are listed below.

O1: Lab Reports

O2: Graphs and Uncertainty Online Quizzes

O3: Accurately Predict a Value within Uncertainty

### Grade

Your lab grade is determined by the following table.

| Objective | D  | C  | B  | A  |
|-----------|----|----|----|----|
| O1        | 16 | 20 | 24 | 28 |
| O2        | 24 | 28 | 32 | 36 |
| O3        | 4  | 6  | 8  | 10 |

**You must achieve all thresholds for a grade to achieve that grade. Your grade is set by the objective in which you score the lowest grade. For example, A's in objectives 1-5, but an F in objective 6 is an F in the lab!**

**Objective 1:** There are 5 points available for objective 1 for each regular lab (including the make up lab) that is not a test. For each report you turn in you must have original data collected from the lab, you may not reuse data for more than one report! Reports using un-original data will receive a zero. Using someone else's data that you did not help to collect are grounds for academic misconduct. Each report must have an experimental plan, a data sheet, at least 2 instrumental and statistical worksheets, at least one propagation of uncertainty worksheet and a prediction sheet. If you are using an analytical formula or you are using a formula you found empirically, a graph sheet showing that formula must also be included. A printed graph is a suitable substitute for the graph sheet in your lab manual.

**Objective 2:** There are a number of quizzes online in the "Quizzes" folder. Each one can earn you points towards objective 2. As you earn passing grades on the starting quizzes, more advanced quizzes will appear. You have unlimited chances on the quizzes. The quizzes will be available until stop day.

**Objective 3:** There is 1 point for objective 3 for each of the labs including the make-up lab. There are 3 points available for objective 3 in each of the tests (not including the final.)

**Reports:** Reports are due 48 hours after the lab. Late reports may be penalized up to half of the earned points for that lab. **Reports without data sheets or any uncertainty calculations (even incomplete ones) are not eligible for ANY points. These two sheets must be turned in with every lab report. YOU MUST BE PRESENT IN LAB TO TURN IN A DATA SHEET FOR THAT LAB. You cannot reuse a data sheet or use someone else's data.**

**Tests and Final:** Tests and the Final will be done alone without a lab partner. You will have 50 minutes to complete the goal stated in the lab manual and denoted with a “t”. You can use your notes, lab reports and lab manuals. Depending on the test, you may also use the computer though for some tests, this may not be the case. The final will be a new experiment that you have not done before. There are 2 points available for objective 3 in each of the tests (not including the final.) The final is worth up to 5 points extra credit. Any points you earn for the final will (like all extra credit) go to whichever objective(s) need it most.

**Grading Rubric:** For the lab reports, 1 point is given for a reasonable attempt that includes original, self-collected data, 2 points for a good attempt with errors or deficiencies and 3 points are given for a perfect or near perfect report that includes all of the required worksheets. TAs may award half points at their discretion. For non-test labs, objective 6 points are only given for a successful prediction. On tests, students are given 1 point for objective 6 for a good attempt and 2 points for objective 6 for a successful prediction.

**Quizzes:** Are online on blackboard in the “Quizzes” folder. These can be retaken to earn a better score. Passing quizzes means that more will appear.

**Extra Credit:** Is offered primarily at the beginning and end of the semester through online quizzes. Extra credit is totaled at the end and will be used to aide whichever objective(s) need it most. This will be done automatically.

**Make Up Lab:** The make-up lab is only for making up points on missed assignments or to redo a poor assignment. There are 8 total “regular” labs (labs that are not tests, the final or the make up itself.) You can only use the scores from 8 attempts at objective 1 and 3 attempts at the “tests”. **What this means is that the make-up lab cannot be used as extra credit.** It will only “swap out” a zero or other previously earned score. However, if you earned a poor score objective 1 or 3, the make-up is a good way to try to get those missed points.

The make-up is available for everyone. There will be only one make up offered. If you miss the final or a test, you can take the make up as a test or final, but will not have the chance at a “regular” make up.

A make up for extenuating circumstances are at the discretion of the lab director and require documentation.