Syllabus

Applied Physics 50b — Physics as a Foundation for Science & Engineering — is the second part of a project-based introductory physics course sequence for engineering students. Applied Physics is at the intersection of physics and engineering. Physicists build to understand; engineers understand to build. In AP50 you will be doing both. The goal in AP50 is to provide a one-year long introduction to physics and at the same time help you develop — in a friendly community of peers — skills that will be useful in your career regardless of your field: team work, design skills, discussion skills, evaluations skills. This course is for you if you are interested in:

- learning by doing rather than by listening
- exchanging ideas with others
- seeing how science applies to the real world, and enjoy
- working in teams to solve problems and build things

As the instructor for this course, I am ready to help you gain a better understanding of how science applies to the real world and develop skills that will be useful in your career. My goals are to promote self-directed study of basic physics, explore physics in the context of real-world applications, improve collaborative and communication skills in team-driven activities, and develop research skills by working on projects.

I look forward to getting to know you this coming semester. I take my teaching duties very seriously and will work very hard so as to attain the above goals and make AP50 an enjoyable, rewarding, and useful experience for you. I will make myself as accessible as possible — I do want to interact with you both in and out of class. I encourage you to stop by my office or call; my contact information appears below. Call or text me at the number below any time I can help.

This document is meant to help you make the most of this course. I always welcome feedback and hope you will let me know if I am meeting your expectations and needs.

I am excited to work with you this semester!

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What this course promises you

Most likely, the majority of the courses you have taken so far involved you listening to lectures and taking exams. As you are progressing in your studies here at Harvard, you might have a number of important questions. How does what you learn relate to the real world and to your future career? What are the skills that will make you successful in your career? How can the work you do now help you continue to grow after you graduate?

In this course, I will help you obtain answers to these questions. You will have an opportunity to explore physics by engaging in physics through projects. In the process, you will obtain insight into the thought processes that underlie most of science and engineering. You will also hone skills that will be beneficial to you, regardless of your career path. How do you design something? Take data and analyze them? Convince others of your thought processes? How do you learn on your own, for your own benefit? How do you work with others and convince them that what you are doing, or thinking, is relevant and important?

How will these promises be fulfilled?

There are no lectures and no examinations in AP50. Instead, to realize these promises, you must take responsibility for your own learning and actively participate in the learning process — what you get out of this course depends very much on what you put in! In general, the best way to learn something is by engaging in the material and by interacting with others. For this reason, the core of the course is a set of three, month-long projects on which you will work in teams. During the course of the semester, you will apply electrostatics to build a generator, design and build an electromagnetic safe, and design and build an imaging spectrometer. At the same time, the best way to develop important skills, such as collaborative skills, is by engaging in these skills. In other words, you will be learning by doing and I promise you that it will be both rewarding and fun!

COURSE GOALS

After successful completion of this course, you will be able to… (within the context of introductory physics)

1. Engage in **self-directed learning** by:
    - identifying and addressing your own educational needs in a changing world, including awareness of personal attributes, fluency in use of information sources, planning, and problem solving
    - using independent study and research to tackle problems, especially ill-defined or open-ended ones.
    - using a variety of techniques to get a handle on problems: represent the problem visually or graphically, perform order of magnitude estimates, use dimensional analysis and proportional reasoning, recognize symmetries, evaluate limits, and/or relate the problem to cases with known solutions
    - explaining and justify any assumptions made
    - “thinking critically,” both positively and negatively, about any situation or the solutions to any problem.
    - evaluating the correctness of a solution

2. Demonstrate **content mastery** by:
    - meeting the content learning goals specified in the project briefs
    - applying your knowledge of physics to solve problems
    - taking data, analyzing, and interpreting them

3. Engage in productive **team work** by:
    - contributing effectively in a variety of roles on diverse teams.
    - conveying information and ideas effectively, using written, oral, and visual and graphical communication.

4. Exhibit **professionalism** in your conduct by
   - acting in a manner that is respectful to your teammates and the teaching staff
   - being punctual and participating fully in all classroom activities
   - taking decisions and executing actions that are fair and honest, and that are consistent with accepted standards of conduct.

The activities in AP50 are designed to contribute to the development of the following general competencies:

- **Qualitative Analysis**: The ability to analyze and solve problems in science and engineering and other disciplines qualitatively, including estimation, analysis with uncertainty, and qualitative prediction and visual thinking.
- **Quantitative Analysis**: The ability to analyze and to solve problems in science and engineering and other disciplines quantitatively, including use of appropriate tools, quantitative modeling, numerical problem solving, and experimentation.
- **Diagnosis:** The ability to identify and resolve problems within complex systems through problem identification, formation and testing of a hypothesis, and recommending solutions.
- **Design:** The ability to develop creative, effective designs that solve real problems though concept creation, problem formulation, application of other competencies, balancing tradeoffs, and craftsmanship and which integrate knowledge, beliefs and modes of inquiry from multiple and diverse fields of study.
- **Teamwork**: The ability to contribute effectively in a variety of roles on teams, including diverse teams, while respecting everyone's contributions. You will develop collaborative skills that may include questioning, listening, and identifying multiple approaches and points of view.
- **Communication**: The ability to convey information and ideas effectively, using written, oral, and visual and graphical communication.
- **Lifelong Learning**: The ability to identify and address your own educational needs in a changing world, including awareness of personal attributes, fluency in use of information sources, planning, and self-directed learning. The ability to "think critically," both positively and negatively, about any situation or the solutions to any problem.
- **Ethics**: The ability to take decisions and execute actions that are fair and honest, and that are consistent with accepted standards of conduct.

COURSE LOGISTICS

Prerequisites

AP50a or equivalent. A solid knowledge of multivariable calculus at the level of Applied Math 21a or Math 21a is strongly recommended. Mathematics 21a can be taken concurrently.

Class meetings

The class meets twice a week and is scheduled from 9 am to 11:45 am on Tuesdays and Thursdays, in Pierce 301, a classroom designed for interactive, team-based learning. The schedule of activities during this class time is shown on the course schedule. When no activities are planned, you can use class time to work with your team mates on your projects.

We won't lecture you during the class meetings. Instead, you'll have an opportunity to work in teams on class activities that are designed to help you master the relevant physics and get you started on the projects. For details on these activities, see Course Activities below. See also *AP50 Quick Reference*.

In addition to these two class meetings, you need to sign up for a time slot during which you will be available to meet with your team members to work on your project. These meetings can take place at any place that works for your team or, when you need to construct things, in the Learning Labs on the ground floor in Pierce Hall. To prevent congestion in the Learning Labs, the teams will be distributed over the following four time slots:

Thursday 1:30–2:45 pm
Friday 9–10:15 am
Friday 12–1:15 pm
Friday 3–4:15 pm

For each month-long project you **must indicate your availability for at least two** of these four project time slots so we can assign time slots to teams. If you anticipate this to be a problem, please contact us as soon as possible.

Textbook

AP50b uses the same (electronic) textbook as AP50a, *Principles and Practice of Physics* by Eric Mazur (Pearson) via the *Perusall* platform (details below). If you took AP50a this fall, you should be all set. If you didn't take AP50a this fall, you can access Chapters 22–26 of the book without buying access. When you access Chapter 27 (we'll get there by the middle of February) or beyond, you will be prompted to purchase access to the book; you can choose either perpetual access (no time limit) or a 180-day rental. As I am the author of the book, I will be donating the royalties of this book collected by the publisher for this class.

Technology

You need a laptop or tablet in this course. First of all, you will need one to access the textbook. Secondly, a number of class activities are completed using a web-based electronic response system. Please bring your device and its charger to each and every class. You might be able to use a smartphone, but the small screen may be limiting. If you do not own a compatible device, we will work on finding a way to accommodate you.

The electronic response system is called *Learning Catalytics*. To subscribe to the system, point your browser at http://LearningCatalytics.com and create a student account with the access code **HSSLCS-BAZOO-VETCH-BLOBS-SARTO-ROSES** (at no cost). We will explain in class how to use the system.

Getting help

Because we are not lecturing you, we can make our time available to help you and provide personal assistance, both in and out of the class. Never hesitate to contact us — our contact information includes our numbers and you are free to call us anytime; you will never disturb us. We all hold office hours (see Teaching Staff list), but we are happy to schedule a meeting at any time that is convenient to you and to us. In addition to our office hours, your team will be assigned a Team Mentor for each project cycle. The Team Mentor will be your go-to person for help with any aspect of the course. You will check in with your Team Mentor twice weekly in class, and s/he will be offering you and your teammates feedback throughout all aspects of the course.

TEAMWORK

Teamwork creates synergy. Because the combined effect of an effective team is significantly greater than the sum of individual efforts, teams can tackle problems that are too big to solve for any individual. In the professional world, effective teamwork is paramount. For this reason, AP50 uses a team-based approach that will help you develop collaborative skills, that will help you work effectively in a team, and that will maximize your learning. As in the professional world, three important features affect your productivity and success in a team: your own effort, the effort of people you depend on, and the way you work together.

Throughout the term, you will work closely with three or four of your classmates, as part of a project team. The teams will change for each of the projects, so as to provide an opportunity for you to become better acquainted with your peers and also to develop the interpersonal skills you need in the professional workforce where you are likely to encounter a diverse ensemble of people.

The activities in AP50 are designed so that no one individual can successfully complete them alone. It is therefore very likely that on the parts you work on alone, your performance will be significantly worse than in a course that does not involve teamwork. Don't let that discourage you, as individual activities are always followed by a phase where you get to work as a team on that same activity, permitting you to improve your performance with others (and learn in the process).

To be successful in AP50, therefore, you need to first try your best on each of the activities on your own and then tackle those activities and the projects as a team. While it is expected that you will divide and conquer when working as a group, each individual is responsible for the whole product.

Research on teamwork suggests the following good team practices:

- **Come to class prepared**. Before working as a team, read any relevant material(s) and formulate your own approach to the task at hand.
- **Actively participate** and contribute to all activities when the team is together (both in and out of class). When even one team member checks out and starts working individually (or starts checking email, text messages, etc.) instead of engaging with the team, the overall performance of the team is adversely affected.
- In all team activities, be prepared to **share** three things with your teammates: (a) what approach you chose as an individual, (b) why you chose that approach, and (c) how confident you are about your approach.
- Be **respectful** and listen and evaluate other people's points of view.
- **Deliberate as long as time permits**. Regardless of the make-up of the team, teams that deliberate longer do better in team activities.

Failure — the unavoidable price of success

Throughout your education, you have probably been led to view mistakes and failure as something that is unfavorable and that negatively affects you — something to be ashamed of. However, success is not possible without taking calculated risks, which inevitably means failing sometimes. The road to creativity and innovation, in particular, is littered with failure. "If you haven't failed, you're not trying hard enough," goes a well-known saying. Failure is a problem only if it is your end point. On the way to finding a solution, failure can be very productive as it can teach you a lot (what doesn't work, what might work, and what you might want to explore in greater detail) and lead you to success.

In AP50 we want to create a culture that encourages creativity and calculated risk taking. Also, we design all of the activities in AP50 so that they leave ample room for errors for anyone (including the staff) and your intermediate scores may be lower than you are used to in other courses. Only then can we guarantee that everyone's learning will be maximized and that you will learn to feel comfortable with the (productive) failures that go hand-in-hand with creativity. See them as learning opportunities, not negatives, as stepping-stones to success, not the end point. So be bold and take risks, both as an individual and as a team — failure, even repeated failure, is a healthy and necessary part of becoming successful. Also, rest assured that the assessment in AP50 does not penalize you the failures you may encounter on the way to success!

Peer Assessment

It is important to provide positive feedback to people who truly worked hard for the good of the team and to also make suggestions to those you perceived not to be working as effectively on team tasks. Three times during the semester you will provide an online assessment of the contributions of the members of your team (including yourself) to all the activities in class and to the project. The feedback you provide should reflect your judgment of each team members':

preparation – were they prepared when they came to class?
contribution – did they contribute productively to the team discussion and work?
respect for others' ideas – did they encourage others to contribute their ideas?
flexibility – were they flexible when disagreements occurred?

Your teammates' assessment of your contributions and the accuracy of your self- and peer-assessments play an important role in your final grade for the course — see *Assessment* below.

COURSE ACTIVITIES

I. PRE-CLASS: reading assignments and annotations (*Perusall*)

Purpose:	Provide you with a first exposure to the material so we can spend the class time doing activities that help you better understand the concepts
What you need to do:	Access the reading assignments in *Perusall* (see *Technology* above) via Canvas (Assignments > Reading Assignments). Read and annotate the chapters according to the class schedule; enter your questions, comments, and/or responses to others' questions and comments. Reading assignments are typically due at 11:59 pm the day before class.
Evaluation:	Your annotations will be evaluated on quality (thoughtfulness), quantity, timeliness, and distribution. See the *Annotation Rubric* for details

Details: Because there are no lectures in this class, you are responsible for familiarizing yourself with the physics principles involved in the projects by reading the relevant sections of the textbook before coming to class. The course schedule includes required weekly readings — you are free to study ahead, but the schedule ensures that you are prepared for the activities in class and any assignments.

The goal of the pre-class reading is to gain sufficient knowledge to be able to participate in the class activities in a meaningful way. Annotate the text in the *Perusall* system to interact asynchronously with your classmates and to get help when other people are not nearby. From the data we have obtained over the past years we find that **people who do the following tend to do better** in AP50:

- read for **understanding**, not memorization
- interact with others online by contributing **thoughtful** annotations
- help others by **upvoting** good questions and helpful answers
- don't wait until the deadline, but **start reading early**
- don't read the entire assignment in one sitting but **come back often** for shorter readings.

The goal of the pre-class reading is not to master every little detail — the in-class activities are designed to reinforce your understanding of the important principles before you begin to apply them in the projects. And you certainly won't ever need to memorize any information because we will never deprive you of access to the text (or any other source of information, including the Internet). However, by reading with attention and with an inquiring

mind, you take ownership of your learning. Additionally, your annotations help us determine how to best tailor the in-class activities to improve your understanding of the material.

II. IN-CLASS ACTIVITIES

Instead of presenting the textbook content to you, we will use the time in class to expand on your initial reading of the text and address any difficulties you express in the annotations using six types of interrelated activities that build on each other: Learning Catalytics, Tutorials, Estimation Activities, Experimental Design Activities, Problem Set Reflections, and Readiness Assurance Activities (details below). In addition, time will be allocated for project work. The class schedule shows the scheduled timing of these activities (white = project work).

Learning Catalytics (LC)

Purpose:	Probe and deepen your understanding of the course content
What you need to do:	Bring your laptop or other compatible device so you can log on to LC
Evaluation:	Your performance on these questions is recorded and can be reviewed by you. While the correctness of your responses to these questions is never considered in the evaluation scheme, your participation contributes to your professionalism score.

Details: During this activity, which lasts 90 minutes, the instructor will pose questions, which you first answer individually using your device, then discuss with your team members (effectively teaching each other), and then answer again. If an issue remains, you can always review the work done in class later or ask someone from the staff for a clarification. The skills you develop in this activity will improve your performance on the Problem Sets and Readiness Assurance Activities.

Tutorials

Purpose:	Address common misconceptions in the course content
What you need to do:	All materials for this activity will be supplied.
Evaluation:	Your work is neither corrected nor scored, however your active participation in this activity is evaluated by both your teammates and the teaching staff and this evaluation will factor into your professionalism score.

Details: During this activity, which lasts 60 minutes, you will work with your team on a worksheet that will explore your thinking about the more difficult concepts in the material. The teaching staff will contribute to the team discussions. Check in with your Team Mentor before ending this activity to make sure that you and your team members have resolved any misunderstandings. The skills you develop in this activity will improve your performance on the Problem Sets and Readiness Assurance Activities.

Estimation Activity (EA)

Purpose:	Develop estimation skills that are essential for problem solving
What you need to do:	All materials for this activity will be supplied
Evaluation:	The activity is run like a competition among teams, and while it is not graded, your active participation in this activity is evaluated by both your teammates and the teaching staff and this evaluation will factor into your professionalism score.

Details: Your team will receive a list of two or three unknown quantities to be determined to the nearest order of magnitude (see Chapter 1 of the text). You should estimate (not guess or Google!) the quantities using the estimation procedures discussed in the text. Spend the first five minutes thinking *individually* about a strategy,

then go at it with your team. There are only 20 minutes, so think fast! One or two teams will be selected at the end of this 20-minute period to present their estimates to the class. The skills you develop in this activity will improve your performance on the Problem Sets and Readiness Assurance Activities.

Experimental Design Activity (EDA)

Purpose:	Develop experimental and/or analytical skills that are important for the current project
What you need to do:	Bring your laptop or other compatible device
Evaluation:	Your work is neither corrected nor scored, however your active participation in this activity is evaluated by both your teammates and the teaching staff and this evaluation will factor into your professionalism score.

Details: The projects require you to take measurements, analyze data, carry out simulations, etc. The Experimental Design Activities help you master the skills that are required for successful completion of the projects.

Problem Sets (pre-class) and Problem Set Reflection (in-class)

Purpose:	Develop problem-solving skills; self-assessment of your knowledge and skills
What you need to do:	Before class: solve all problems, giving them your best effort and following the instructions given on the Problem Set Rubric. In class: work with your team to correct your solutions, resolve conceptual difficulties, and identify areas that need to be reviewed.
Evaluation:	Your work is evaluated on the effort you put into the application of problem-solving steps and the accuracy of your self-evaluation. You will receive a Problem-Solving Rubric with the first Problem Set.

Details: Learning to develop problem-solving strategies is an important goal for this course. Good problem-solving practices include:

- articulating your expectations for the solution to a problem before diving into the details
- breaking down longer problems into smaller, more manageable pieces
- checking your solution by justifying the reasonableness of your solution, checking the symmetry of your solution, evaluating limiting or special cases, relating your solution to situations with known solutions, checking units, dimensional analysis, and/or checking the order of magnitude of the answer.

You can hone these skills on five problem sets, each of which involves two phases:

1. You work on the problem set **ALONE**, before coming to class when it is due, giving it your best effort.
2. You work in class with your team members on correcting your work, comparing it to the solutions we hand out to you, and completing a self-evaluation form. You hand in this form together with your marked-up work.

Treat the problem set as an open-book take-home exam, even though **you will not be evaluated on the correctness of your answers**. Instead, your work will be assessed on the individual effort you put in solving the problem set before coming to class and the correct evaluation of your own level of understanding.

You should see the problem sets as an opportunity to learn. For example, you might give the entire problem set your best effort without getting it all correct, but by accurately identifying your difficulties in understanding, you will earn full credit and we can put you on a productive path forward that will maximize your learning. Please note that completing the individual portion of the problem set in class (rather than before coming to class) will be considered academic dishonesty.

Readiness Assurance Activity (RAA)

Purpose:	Assessment of content-specific goals and problem-solving skills
What you need to do:	Bring your laptop or other compatible device so you can log on to LC
Evaluation:	Your RAA performance is determined by a combination of your individual score (50%) and your team's score (50%).

Details: To assure that everyone is on track in the learning of the basic concepts we will have five RAAs over the course of the semester. During the first half hour of each RAA you will work alone to solve a set of problems similar to the preceding problem set (individual round). You are free to consult the text or the Internet, but not other people. During the remaining hour of the RAA you get to discuss the problems with your team members (team round). The goal for your team is to use the combined knowledge of the team to maximize the entire team's RAA score. This team round provides an opportunity to learn in a collaborative environment, consolidate your knowledge, hone your team-building skills to achieve the best possible scores, and receive immediate feedback on your performance.

We design the RAAs in such a way that the average score in the individual round is around 50% and nobody can score 100%. Typically, teams figure out the correct answers to all questions in the team round. The team round thus provides an opportunity for everyone to improve their scores and — most importantly — to learn.

If you fully participate in all in-class activities, and if you are fully conscientious with the relevant problem sets and annotations, then you will be well prepared for the RAAs without having to "study" for them like you do for an exam.

If you wish to practice your knowledge in order to be better prepared, you can

1. review the Checkpoints in the text (solutions are in the back of the textbook) and do the Worked Examples in the text (before looking at the solution). Typically, there are around 60 Checkpoints and 30 Worked Examples for each RAA unit.
2. Use the Practice Volume (second part of the textbook). Review the worked and guided problems in the Practice Volume. Also, for the odd-numbered problems you can check your answers.
3. Review the Tutorials which contain most of the major concepts.

III. PROJECTS

Purpose:	Transfer your learning and understanding of concepts to a real-world context
What you need to do:	Work with your team to produce a project presentation and a project report
Evaluation:	Your team's project presentation and project reports will be evaluated separately. In addition, your team members will evaluate your relative contribution to the project. A rubric will be distributed with each project.

Details: There will be three approximately month-long projects over the course of the semester. At the beginning of each project, you will receive a project brief that describes the learning goals and guidelines for that project. Be sure to carefully read the entire project brief before embarking on your project. The project brief includes project requirements and evaluation rubrics for the project presentation and the project report. Project materials will be made available in class. In certain cases, you will receive a budget for your project and your task is to stay within that budget. At the end of each monthly project cycle we will have a project fair where teams present their results.

Approximately a week after each project fair your team must submit a project report, using guidelines detailed in the project brief. After the report is evaluated and returned to you, you will have a few days to improve your report and your evaluation of the report.

COURSE POLICIES

Assessment and final grade

Unlike most courses, there are no exams or essays at the end of the course to evaluate your overall performance in AP50. Instead, your grade is determined by the continuous assessment of the activities that are part of AP50. All of these activities — all your work in AP50 — are evaluated on the same 3-point scale:

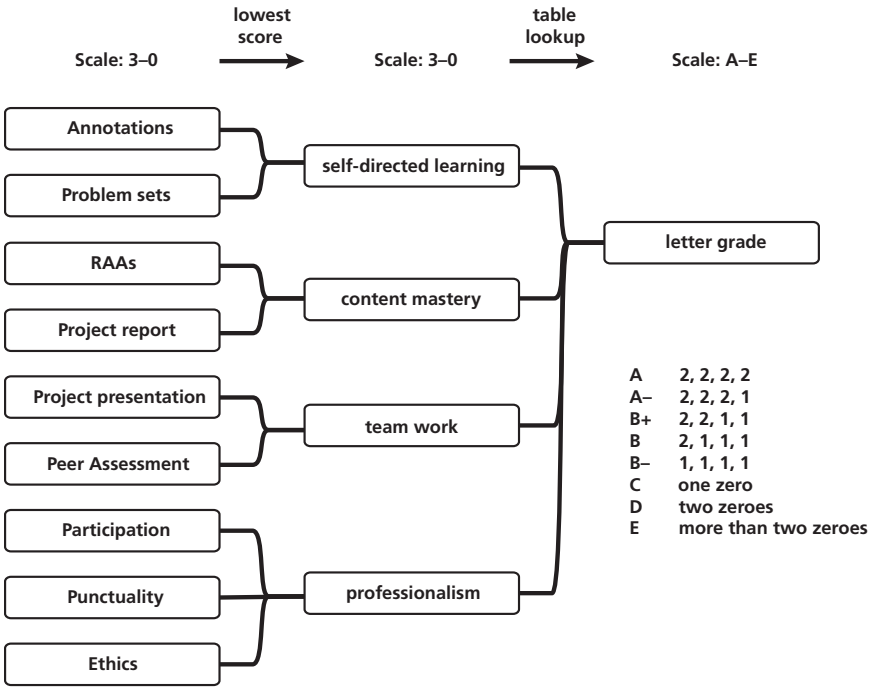
3 = significantly exceeds expectations (given only in the most exceptional cases)
2 = meets expectations
1 = improvement needed
0 = deficient

Your final grade is determined by how well you do in the following four domains *during the entire course of the semester*.

Domain	**Contributing activities**
Self-directed learning	1. **Textbook annotations:** We assess the extent to which your annotations reflect reading and thoughtful interpretation of the text. 2. **Problem Sets**: We assess your ability to solve problems using a four-step procedure, to evaluate your own work, and to determine what you need to review.
Content Mastery	1. **Readiness Assurance Activities**: At the end of each unit, we assess your ability to correctly solve 8–11 problems, first on your own, then in collaboration with others. 2. **Project Reports**: We assess the content and mechanics of the reports you submit at the end of each project.
Teamwork	1. **Project Presentation:** A panel of external judges assesses your team's presentation and discussion of each project 2. **Peer Assessment:** Your teammates assess your relative contribution to the project and your effectiveness as a team member. You are also assessed on how accurately you assess yourself and others.
Professionalism	1. **Participation:** Three variables factor into this assessment: your participation in the Learning Catalytics sessions, your team members' assessment of your participation in team activities, and your Team Mentor's evaluation of your engagement in the classroom activities that are not graded. 2. **Punctuality**: Your team members and your Team Mentor assess your punctuality. 3. **Ethics**: We assess your conduct in all activities relative to accepted ethical standards.

Scoring rubrics for the specific activities will be made available as we engage in each activity, so you will always know exactly what the expectations are.

Important: Because all activities are important, the score in each domain is determined by the activity for which you obtained the **lowest** score! The figure below shows how to convert your domain scores into a letter grade.



Midway through the semester you will receive *cumulative* feedback on your performance in each of the four domains, so you know where you stand and what you need to do to improve your learning.

Policy on collaboration

Because teamwork is emphasized in this class, working with others is not only permitted, but even encouraged. Please note the following restrictions, however.

1. During the individual parts of the problem sets and the RAAs you are not allowed to consult others directly or via any electronic means.
2. During the course of the semester, you will complete a number of surveys online. The purpose of these surveys is for us to better tailor the course to your needs and to evaluate how well the course works for you. Your answers will be used only to provide feedback on your learning and make adjustments to the course. They will not affect your grade in any way. You may not consult others during these surveys.

Consulting others includes any form of electronic communication. For this reason, having email or any chat or text messaging software open on your computer screen during the above activities constitutes academic dishonesty. This not only forces us to report to the Honor Council but automatically results in an Ethics score of zero, which causes your Professionalism score to be zero and which, in turn, automatically drops your grade to a C or lower.

Policy on use of materials and software

You are permitted to use information sources, including looking up information in (text)books, consult notes, and carrying out Internet searches. This policy holds true even during the RAAs. Please note the following restrictions, however.

1. During the online surveys mentioned above, we ask that you work without consulting any sources of information (nor other people).

2. When working on your problem sets, you may not copy solutions from the internet or from each other.
3. During the Estimation Activities you should not look up any information, as this would defeat the purpose of the exercise.
4. All your work, including the projects, should be original and not a copy of something that can be found on the internet or elsewhere.

Ethical conduct

We expect everyone to adhere to the highest standards of ethical conduct and respect. For every action/decision you take, subject yourself the "headline test": if your action were printed as the front-page headline in the newspaper and those you care about — your friends, family, your team members, peers, the teaching staff — would read it, how would you feel? If the answer is anything but "good", you are probably not adhering to the highest ethical standards and your Ethics score is likely to be affected. In the extreme, copying work of others, using material found online or in books as your own without proper attribution, interfering with the performance of others or other teams, plagiarizing ideas or work that are copyrighted or in the public domain, communicating in person or electronically during the individual parts of the RAAs, constitute academic dishonesty. Any such dishonesty will be reported in accordance with University policy. Any single such occurrence of academic dishonesty immediately drops your ethics score to 0, which according to the policy outlined in the figure on the previous page **automatically drops your final grade to a C or lower**. Also, bear in mind that for any team assignment plagiarism by one team member affects the score *for the entire team*, as every team member is responsible for the entire content of the assignment, even if the tasks for that assignment were divided among team members. Finally, note that disrespect for anyone in the class — fellow students or teaching staff — will negatively impact your Ethics score (see also *Diversity, inclusivity, and productive teamwork* below).

RAA Appeals

If your team feels strongly about the correctness of an item on an RAA, the team may submit a written appeal. This appeal process must occur immediately following an RAA and only teams, not individuals, may write appeals. Only teams that write successful appeals get credit for that appeal, even if another team missed the same question(s). Appeals are not simply an opportunity to dig for more points. Rather, they are an opportunity for teams to make scholarly arguments for their collective positions. All arguments must be supported by evidence from the text or other source. If the appeal is based on an ambiguously phrased question, the team must suggest wording that is less ambiguous. The decision to grant or refuse an appeal will be made by the instructors after class via e-mail. The following is an example of a successful appeal:

> Argument: "We feel that A, rather than B, should be the correct answer to question 8."
>
> Evidence: "According to Figure 12.42 in the text, friction affects the motion of the objects. The speed of cart 2 decreases over time. Because friction cannot be excluded in question 8, we would expect the same decrease in speed to occur for the cart in this question."

Policy on missed activities and assignments

Due to the collaborative nature of the activities, it is not possible to make up any team activities, such as project work, problem set discussions, RAAs or project fairs. (The same, incidentally, is true in the professional world.) We understand, however, that certain factors may occasionally interfere with your ability to participate. If — for whatever reason — you have to be absent from any team activity (graded or ungraded) your first duty is to **inform your team members** (if you are not there, you cannot help them out). Please ask your team members to inform the Head TF or one of the instructors in class of your absence.

Missed Classes. Teamwork requires working and learning together as a team. It is therefore important to be there for your team. If you need to miss class, please inform your team and discuss how to make up for your absence.

Note that if you repeatedly miss class, your team is likely to negatively rate your team contribution, which affects your grade.

Missed Problem Set Reflection. If you have to miss one of the Problem Set Reflections, but you are **able to do the work** before the Problem Set Reflection takes place, please:

1. Scan your solutions and email them to the Head TF before 9 am on the day of the Reflection, explaining why you will not be in class. The Head TF will email you an official solution and a Reflection Sheet.
2. Mark up your solutions and complete the Reflection sheet. You may only use a **red pen** to add anything to your solutions after you have scanned them.
3. Hand in the marked solutions and the completed Reflection sheet to the Head TF within two days of the original due date (or let the Head TF know of any extenuating circumstances).

We will review your work and your grade will be based on your individual work only.

If you are **not able to do the work** before the Problem Set Reflection takes place, please let us know as soon as possible and obtain an official note from the University explaining any extenuating circumstances. As far as your grade is concerned, provided you submit **proper documentation of the extenuating circumstances**, we will not give you any grade for that problem set and exclude this problem set in the computation of your final grade. Otherwise your grade for that problem set will be **zero**. We will discuss with you how to catch up with the class.

Missed RAA. If you have to miss one of the RAAs, obtain an official note from the University explaining any extenuating circumstances. Upon submitting proper documentation, we will ask you to come and take a make-up RAA by yourself (45 minutes; individual round only). You must do this before the following RAA in order to be able to participate in the following RAA. As you will not have a team score, we will average your individual score with the score obtained by your team (without you). If **no proper documentation of the extenuating circumstances** is provided, your grade for that RAA will be **zero**.

Missed Project Fair. If you have to miss one of the Project Fairs, obtain an official note from the University, explaining any extenuating circumstances. Upon submitting that note to the Head TF, we will give you your team's grade for the Project Fair presentation. If **no proper documentation of the extenuating circumstances** is provided, you will receive **zero** for the Project Fair presentation.

All other work must be done according to the posted schedule regardless of any extenuating circumstances, as all deadlines and all work are posted well in advance.

Accessibility

If you have a documented disability (physical or cognitive) that may impair your ability to complete assignments or otherwise participate in the course and satisfy course criteria, please meet with us at your earliest convenience to identify, discuss, and document any feasible instructional modifications or accommodations. You should also contact the Accessible Education Office (AEO) to request an official letter outlining authorized accommodations. All discussions will remain confidential, although AEO may be consulted to discuss appropriate implementation.

Diversity, inclusivity, and productive teamwork

Great teams tend to be diverse (so each team member can provide a unique perspective) and inclusive (so everyone can contribute equally). The best teams need to have a range of voices, experiences, viewpoints and skills in the room when decisions need to be made or projects need to be completed. For that reason, creating a team culture that supports a diversity of thoughts, perspectives and experiences, and honors your identities (including race, gender, class, sexuality, religion, ability, etc.) is likely to lead to the best possible learning outcome for all. The teaching staff will treat everyone in the class with equal respect so that students from all diverse backgrounds and perspectives benefit from this course. Respect is perhaps be the most fundamental principle in

all of ethics and I therefore expect everyone in the class display respect for others, as doing so will maximize the outcome of this course for all.

My goal is to provide an environment in which everyone's learning needs are addressed — in class and out of class. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups.

GETTING STARTED

To get started in AP50, you need to:

1. Create a student account (if you do not already have one) at http://LearningCatalytics.com using access code: **HSSLCS-BAZOO-VETCH-BLOBS-SARTO-ROSES**.

2. Complete *General* and *E&M Background* surveys on Learning Catalytics (Access codes are **54871989 and 99103561**, respectively) by Wednesday Jan 29 at 5 pm.

3. Complete the reading assignment on Chapter 22 posted on Canvas by midnight Jan 29th and on Chapter 23 by midnight Feb 3rd (see Annotation Rubric for details)

NOTE: If the course is oversubscribed, admittance to AP50 will be based on your completion of these three items.