

# *The ARC's Frosh Guide to Academics*

2023 - 2024 Edition

[arc.caltech.edu](http://arc.caltech.edu)



Caltech ARC

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## INTRODUCTION

**TLDR: This guide is super helpful for picking classes, learning how Caltech works, familiarizing yourself with the resources here, and more! We know it can be a bit long, so please make sure you read the section about [first term registration](#) before picking your fall classes and feel free to take the summer to read the rest of it!**

Hello, soon-to-be-Techer!

We hope you're enjoying your summer and looking forward to the upcoming school year! This fall, you will embark on a challenging academic journey that we hope you will also find fun and rewarding. Caltech is a great place to learn and grow, but it is also a place that can overwhelm you if you're not careful. Luckily, you have resources to help you out and people looking out for you. You also have two terms of pass/fail where you can hone and refine your skills without penalty.

**So what's this?** This frosh guide to academics, created by students for students, contains information and tips to help you navigate your first year in college. It contains basic information about Caltech's academic structure, resources to help you out, specific option (major) related advice, thoughts on research and industry opportunities, and more! Also, keep an eye out for programs that will help you throughout your first year. Please note that the [Caltech Catalog](#) is the authoritative word on academics at Caltech. If there are any discrepancies, the Catalog supersedes what is found here, and feel free to follow up with us.

**Who are we?** We're the ARC (undergraduate Academics and Research Committee), the academic branch of [ASCIT](#), Caltech's undergraduate student government. We work to improve your academic experience at Caltech by creating and maintaining academic and research opportunities for students. You can learn more about the ARC's programs for students and what we do at [arc.caltech.edu](http://arc.caltech.edu).

The ARC consists of one student elected from each House, additional student representatives, a secretary appointed by the committee, and a chair elected by the undergraduate student body. We are a resource for students, available to give academic advice and help you understand rules and procedures regarding various academic issues that may come up.

**Questions?** If you have questions after reading this guide, want to learn more about the ARC, or are interested in getting involved, feel free to contact all of us at [arc@caltech.edu](mailto:arc@caltech.edu) or talk to the ARC chair, Alex Burr ([aburr@caltech.edu](mailto:aburr@caltech.edu)). Additionally, feel free to contact the current ARC reps listed on the Roster on the last page of this guide and on the [Roster page of our website](#). We also meet every weekend and our meetings are open to the Caltech community, so feel free to drop by!

If you have any feedback for the ARC about what programs you'd like to see or any issues with a class you're having, you can also submit a comment on [the ARC feedback form on Donut](#).

Happy Reading!

Cheers,  
The ARC

# Letter from the ARC Chair

**TLDR** (even though you should read it all!):

Caltech cannot be done alone:

- Collaborate with other students
- Don't wait to reach out for help
- Try not to compare yourself to others
- Focus on learning, not grades
- Take advantage of the resources available to you
- Find some form of work-life balance
- Embrace failure

Hello prefrish! The ARC is so excited to welcome you to Caltech. We hope this guide can offer you advice that helped us navigate our frosh year. If you ever have any questions or concerns, please reach out to us. These concerns don't just have to be academic related! We are here to support you as an individual. If you have worries or general questions, please feel free to shoot any of us a message through email/messenger/discord etc. One characteristic to note about Caltech is that we are a tight-knit and open community, and you should never be afraid to reach out to a fellow peer.

Academics at Caltech, especially frosh year, require collaborating with your peers. In high school most of us were able to get by without help from peers or teachers. At Caltech, it is very hard, if not impossible, to get through classes alone. Students here come from all kinds of backgrounds and we support each other through Caltech's collaborative nature. Our relationships are not transactional, and there is a lot to be learned from the amazing people you find yourself around. Reaching out for help is not an indication of your academic ability and there are no "stupid" questions. Students need to reach out for help and work with others in order to achieve their full potential, although you should always attempt sets yourself first before you ask for help. So go find that group of students that you work well with, a TA that you like, a dean's tutor, or even a professor, and ask your questions! (Within collaboration guidelines of course). Please don't wait until it is too late. The moment you start struggling is the moment you should utilize the resources we referenced in this guide (and trust us, that even the 'smartest' person at Caltech has struggled with the difficulty of their courses and needed help too).

Another tip: comparison is the thief of joy. Like I said, students come from all different backgrounds and we all have different paths through Caltech. It is perfectly okay to go study abroad, to underload, to overload, to take a different course schedule than other people in your major, to do a SURF instead of an internship, etc. That does not make you "less than" other students or any less deserving to be here. Imposter syndrome is real but you DO deserve to be here, even if you take a different route through Caltech than 'everyone else'. Please try to avoid comparing yourself to others. Do things because they interest you and try not to focus on your grades. It is so much more important to learn the material than to just go through the motions in a course aiming for an A. At the end of the day, graduate schools, fortune 500 companies, startups, and the businesses you create will not care if you got a "B+" or an "A-"

in ACM 95 - they're going to care whether you can apply what you learned to the problems of the real world. Take advantage of pass-fail to find out a work-life balance and study plan that works for you. If you can't thoroughly complete every question of your homework and know with certainty that you've aced it, that's okay. Your mental and physical health are more important. We have a wellness center, athletic department, and occupational therapy center with free sessions and resources available to all students. Making sure you eat, sleep, and exercise enough will help you tremendously in the classroom and in the lab. The grades will come with the knowledge, and in the grand scheme of things, they don't really matter anyway as long as you pass enough units to graduate. Just focus on being a better you.

Lastly, embrace failure. I'm serious. I'm not talking about failing out of all your classes on purpose (please do not try that). But you should embrace the possibility that you will not be able to do everything all at once, that you will probably fail a quiz, that you might bomb a midterm, that you might turn in something late. These 'failures' will happen - every upperclassman can tell you about their experience with these - but none of them make you 'a failure'. Put yourself out of your comfort zone. Try challenging classes that just look interesting. Join clubs and sports teams. There are so many interesting things to do throughout your 4 years here. Go sign-up for that hackathon, find cool things to do in LA, join in Interhouse sports, reach out to a professor whose research is really cool, email that upperclassman to go grab coffee and ask questions about their internship, etc. There are so many resources available to you on campus. You should try to take advantage of as many as possible. You might not always be successful, but you'll quickly realize that it's not the end of the world to mess up. Just try again tomorrow.

Caltech isn't an easy place, but it can be rewarding, fulfilling, and downright fun. If you run into trouble of any kind and don't know who to reach out to, please talk with one of our reps and we can direct you to the right people. Don't be afraid to say hi on campus :)

Go Beavers!!

Sincerely,  
Alex Burr  
ARC Chair & ASCIT VP of Academic Affairs

P.S. We are always happy to have new students join our committee, so be on the lookout for sign-ups in the fall for frosh-reps!

# What You Should Know When Registering For Courses

## FIRST-TERM REGISTRATION

During your first-term, most of your classes are pre-decided for you, but you still have a few options depending on your interests and background. You will probably be enrolled in 42-45 units (which corresponds to 42-45 hours / week of work on average). You also have the ability to change courses up until Add Day a few weeks into term, so don't worry too much about making sure you have the 'perfect' schedule figured out ahead of time!

### TYPICAL FIRST-TERM SCHEDULE

Course Title	Course Description	Units
Ma 1a	Proof-based Single Variable Calculus	9
Ph 1a	Physics - Mechanics	9
Ch 1a	General Chemistry	6
Frosh Hum	A humanities course with a number <50 (see below)	9
Elective	Lots of options! (see below)	9
Pizza Class	Faculty lunches that meet once per week to expose you to research areas within a chosen discipline (see below)	1

Total Units: 43

Unless you placed out of math, physics, or chemistry (most people don't, see [here](#) if you have), your schedule is required to include Ma 1a, Ph 1a, and Ch 1a, putting you at 24 academic units. From there, you have the option to keep adding classes until you hit a maximum of 45 academic units.

### HUMANITIES

For all new frosh, we **HIGHLY** recommend taking a frosh humanities course (hum). To graduate you need to take two frosh hums, which are courses that are labeled 'Hum' and numbered below 50. The two courses must be listed under different disciplines (options: English, History, Philosophy, Visual Culture). It can be difficult to get into a Frosh Hum as an upperclassman (and even as a s'more), and as a new frosh you are given priority to enroll in one, so **please** make sure you take advantage of that and enroll in one that interests you first term!

Note: If you were placed into Wr 2, you can find more info [here](#). It is still a good idea to register for a frosh hum if your schedule allows.

## FROSH ELECTIVES

Overall info on the frosh electives offered in the fall can be found [here](#). In general, your options for an elective class are CS 1, a freshman seminar, an introductory lab, or Bi 1. If you placed out of CS 1 or some of core, you may also consider enrolling in Ma/CS 6a or CS 13 (Discrete Math).

CS 1 is a requirement for many options and all undergraduates must take two introductory labs to graduate, so it is a good idea to take one of these. Freshman seminars can be rewarding if you are interested in the topic but note that they only count towards the general 486 graduation units and don't count towards any core or option requirements. Please refer [here](#) for more information on biology course options.

If you will be on a fall sports team, are enrolled in Ma 8 and/or Wr 2 and/or research units, or are otherwise worried about the workload, it is also totally ok to not take an elective! It can be hard to adjust to the workload and schedule as a new frosh, especially if you have additional time constraints such as practice, research, volunteering, or additional courses, so do not feel bad if you choose to take fewer academic units first term.

### CS 1

- This course satisfies a requirement for Computer Science, Applied and Computational Math, Information and Data Science, Bioengineering, Biology, Computation and Neural Systems, Materials Science, Mechanical Engineering, Engineering and Applied Science, Planetary Science, Astrophysics, and Physics
- Useful to take regardless of option, especially if you have limited coding experience coming into Caltech.
- Also offered third term, so if you are more interested in other courses first term, leaving CS 1 for third term is also a good option.

### FROSH LABS

- First term has the most diverse selection of frosh labs of any term
- All are 6 units. Common selections include Ch3a/x, ME 8, EE/ME 7, & EE/Aph 9a.
- See the section on frosh labs [here](#).

### PIZZA CLASSES

Pizza classes are a great way to expose yourself to the awesome research offered at Caltech! They are only one unit and consist of going to one 1-hour professor talk per week (where pizza is provided :)), so they are easy to add to any freshman schedule. Find more info about pizza classes [here](#).



## SECOND-TERM REGISTRATION

During your second-term, most of your classes are pre-decided for you, but you still have a few options depending on your interests and background. You will probably be enrolled in 42-48 units (which corresponds to 42-48 hours / week of work on average).

### TYPICAL SECOND-TERM SCHEDULE

Course Title	Course Description	Units
Ma 1b	Linear Algebra - Practical or Analytical	9
Ph 1b	Physics - Electricity and Magnetism	9
Ch 1b	General Chemistry	9
Frosh Hum	A humanities course with a number <50 (see below)	9
Elective	Lots of options! (see below)	9
Pizza Class	Faculty lunches that meet once per week to expose you to research areas within a chosen discipline (see below)	1

Total Units: 46

Unless you placed out of math, physics, or chemistry (most people don't, see [here](#) if you have), your schedule is required to include Ma 1b, Ph 1b, and Ch 1b, putting you at 27 academic units. From there, you have the option to keep adding classes until you hit a maximum of 45 academic units.

### MA1B/PH1B - PRACTICAL OR ANALYTICAL?

At the start of winter term, you will have the option of taking either the practical or analytical track of Ma1b and Ph1b. Please see the section [here](#) on this topic. In short, taking either track is perfectly ok!

### HUMANITIES

For all new frosh, we **HIGHLY** recommend taking a frosh humanities course (hum). To graduate you need to take two frosh hums, which are courses that are labeled 'Hum' and numbered below 50. The two courses must be listed under different disciplines (options: English, History, Philosophy, Visual Culture). It can be difficult to get into a Frosh Hum as an upperclassman (and even as a s'more), and as a new frosh you are given priority to enroll in one, so **please** make sure you take advantage of that and enroll in one that interests you, especially if you didn't first term!

### FROSH ELECTIVES

Overall info on the frosh electives offered in the winter can be found [here](#). In general, your options for an elective class are Bi 8, Bi 1, an intro social science, a freshman seminar, or an introductory lab.

All undergraduates must take two introductory labs and two intro SS courses to graduate, so it is a good idea to take one of these. Freshman seminars can be rewarding if you are interested in the topic but note

that they only count towards the general 486 graduation units and don't count towards any core or option requirements.

If you will be on a winter sports team, are enrolled in Ma 1d and/or Wr 50 and/or research units, or are otherwise worried about the workload, it is also totally ok to not take an elective! It can be hard to adjust to the workload and new schedule as a new frosh, especially if you have additional time constraints such as practice, research, volunteering, or additional courses, so do not feel bad if you choose to take fewer academic units.

### **FROSH LABS**

- All are 6 units and introductory. Common selections include Ph 3 and Ch3a/x winter term.
- See the section on frosh labs [here](#).

### **Bi 8 AND Bi 1**

In general, if you are considering majoring in biology, CNS, and bioengineering you should definitely take Bi 8 winter term. If you are considering majoring in chemistry or chemical engineering, or considering a minor in neurobiology, you should at least consider taking Bi 8 winter term. Most other majors choose to take Bi 1 instead. More discussion of this topic can be found under the option specific recommendations [here](#).

### **PIZZA CLASSES**

Pizza classes are a great way to expose yourself to the awesome research offered at Caltech! They are only one unit and consist of going to one 1-hour professor talk per week (where pizza is provided :)), so they are easy to add to any freshman schedule. This is a great chance to find potential SURF mentors winter term. Find more info about pizza classes [here](#).

## THIRD-TERM REGISTRATION

During your third-term, you have more options as to what courses you want to take depending on your interests and background. You will probably be enrolled in 42-48 units (which corresponds to 42-48 hours / week of work on average). Now is a great chance to talk to the ARC or upperclassmen in your major to get help deciding what courses to take! This is also your first term on grades instead of p/f only.

### TYPICAL THIRD-TERM SCHEDULE

Course Title	Course Description	Units
Ma 1c	Proof-based Single Variable Calculus	9
Ph 1c	Physics - Mechanics	9
Menu Course	A few options! (see below)	9
Elective	Lots of options! (see below)	9
Elective	Lots of options! (see below)	9

Total Units: 45

Unless you placed out of math or physics (most people don't, see [here](#) if you have), your schedule is required to include Ma 1c and Ph 1c, putting you at 18 academic units. From there, you have the option to keep adding classes until you hit a maximum of 45 academic units.

### MA1C/PH1C - PRACTICAL OR ANALYTICAL?

At the start of spring term, you will have the option of taking either the practical or analytical track of Ma1c and Ph1c. Please see the section [here](#) on this topic. In short, taking either track is perfectly ok! You should continue whichever track of physics you took winter term in most circumstances.

### FROSH ELECTIVES

Overall info on the frosh electives offered in the spring can be found [here](#). In general, your options for an elective class are Bi 1, Bi 9, an intro social science, a freshman seminar, or an introductory lab.

All undergraduates must take two introductory labs and two intro SS courses to graduate, so it is a good idea to take one of these. Freshman seminars can be rewarding if you are interested in the topic but note that they only count towards the general 486 graduation units and don't count towards any core or option requirements.

If you will be on a spring sports team, are enrolled in research units, or are otherwise worried about the workload and your first term on grades, it is also totally ok to not take an elective! It can be hard to adjust to the workload and new schedule as a new frosh, especially if you have additional time constraints such as practice, research, volunteering, or additional courses, so do not feel bad if you

choose to take fewer academic units.

## **FROSH LABS**

- All are 6 units and introductory. Common selections include Ph 3, Bi1x, Bi 10, and Ch3a/x spring term.
- See the section on frosh labs [here](#).

## **Bi 1, Bi 1x, AND Bi 9**

In general, if you are considering majoring in biology, CNS, and bioengineering you should definitely take Bi 9 spring term. If you are majoring in bioengineering, you should also take Bi1x spring term. If you are considering majoring in chemistry or chemical engineering, or considering a minor in neurobiology, you should at least consider taking Bi 9 spring term. Most other majors choose to take Bi 1 spring term instead. More discussion of this topic can be found under the option specific recommendations [here](#).

## **MENU COURSES**

All undergraduates are required to take a menu course, and it is easiest to fit this into your schedule frosh or s'more year. They are only offered third term. Options include: EE 1, Ay 1, Ge 1, IST 4, and ESE 1. See more information [here](#).

## **OTHER ELECTIVES SPRING TERM**

Depending on which hums and intro SS courses you've taken so far, you might be able to start registering for advanced hums or advanced SS courses. If you haven't taken an intro SS course yet, now is a great time to do so! Many frosh choose to take Ch3a/x or an intro lab third term. CS 1, ACM 11 and CS 3 are popular elective courses too (see option specific recommendations [here](#)).

# THE BASICS

## LECTURES

For most of Core, you will be in a large classroom with at least half of your class, and a professor will stand at the front of the class and lecture. Lectures are generally less interactive than your classes in high school might have been, but feel free to ask questions! Additionally, you can ask the professor questions after class or during office hours. Professors are aware of who regularly attends lectures, especially in smaller courses. Going to lecture is a great way to show the professor and TAs that you care about the class and to get help understanding course material.

## RECITATION

Many large classes have smaller recitation sections with about 20 students each. Recitation sections are typically led by a teaching assistant (TA), who can be a graduate student, an undergraduate who excelled in the course, or occasionally even a professor. Recitation sections can clarify material, cover new materia, go over example problems, provide guidance for homework, and/or go over quiz problems. Recitations can be similar to smaller lectures, or can be “flipped”, where students work through practice problems while TAs assist. Typically, many students talk to their friends about the different sections and TAs and sometimes even sample a few different recitation sections to see which section works best for them. Additionally, if you miss your normal section one week, you can usually attend a different one. If you find that you prefer a section more than your current section, most classes allow you to easily switch by emailing the TAs and/or switching your section on REGIS.

## OFFICE HOURS

Outside of recitation, TAs (and some professors) hold office hours, which are times set aside specifically to work with students to answer questions. Students can attend any/all office hours for a class, regardless of section TA. Office hours are usually announced at the beginning of a course and posted on the class website. It is a good idea to look at a problem set prior to attending office hours so that you know what questions to ask. Office hours are also a great time to go over old quiz material and to prepare for future quizzes. You should feel free to ask a TA to help with anything from reviewing concepts to walking you through practice problems. Office hours are also a great time to form an academic relationship with a TA or professor, which is useful when you're looking for research or recommendations.

## PROBLEM SETS

Many classes at Caltech assign problem sets, which is what we call the assigned homework problems. Many problem sets will have difficult questions designed for student collaboration. Seeking help when you are stuck on a problem by working with other students (see the paragraph below on collaboration policies) or visiting the professor/TA is strongly encouraged. Often problem sets are released weekly and are due the following week. Courses will utilize Canvas or Gradescope for homework submission, as well list the date and time they are due. It is beneficial to start early on problem sets so that you have time to work on them independently and prepare questions for office hours or your peers.

Classes have collaboration policies that dictate which resources you can and cannot consult when working on a problem set/quiz/exam. For example, a class may allow students to consult the textbook or discuss a problem with a friend, but forbid use of the internet or previous years' solutions. Many courses cover these policies on the class website, in the syllabus, or during the first lecture. It is your duty as a student to know the collaboration policy for each course you're in and follow it appropriately throughout. If you're ever unsure about a resource, feel free to email the professor or a TA and ask!

When a problem set allows collaboration among students, the professor usually expects students to work with others, and it is extremely difficult to get through Caltech alone. Some people prefer working on sets in groups, while others prefer looking over the set alone first, and then discussing answers with others. Experiment with what style of collaboration works best for you! Remember to seek out collaboration groups early in term and remember that you can always change your group as you learn which of your peers you work best with. A good way to find collaborators is to go to office hours, where you may find peers who have similar questions as you, and you are able to work on the set together as you wait for the TA to come by. Realize that you are expected to utilize collaboration to help you thoroughly understand concepts, not just to know how to solve the problem.

## UNITS

Units are supposed to represent an estimate of the amount of time per week you should spend on a course. Each unit is equivalent to one hour a week. When you sign up for a course, the units listed for the course are divided into: (hours in class) - (hours in lab) - (hours on outside work), e.g. a 3-0-6 unit class is 3 hours of class, no lab component, and 6 hours of outside work/homework. This leads unit numbers to typically be around three times the number of credits that classes are worth at other schools. Generally, you must register for a minimum of 36 units per term, and you may not register for more than 48 units during frosh year. For more information on unit requirements, refer to the [Academic Eligibility](#) section.

Keep in mind that units are not always accurate, and schedules with the same number of units can have dramatically different workloads. As such, don't feel pressured to take classes just to be on a certain number of units. It's useful to ask upperclassmen who have taken a class before what the workload will be like and check out the reviews for classes with their [TQFRs](#) (Teaching Quality Feedback Reports) to ascertain the difficulty of your class load. Classes that require more time than the unit allocation are called "under-united" and those that generally take less time are called "over-united". You need to complete 486 units to graduate.

## DROPPING/ADDING CLASSES

Adding and dropping classes is a fairly easy process, as long as you follow the standard procedure. You can add courses and change sections until add day (usually on the 3<sup>rd</sup> Friday of term) and drop classes up until drop day (usually the 8<sup>th</sup> Wednesday of term - check the calendar on the [registrar's website](#) for the exact day each term) on REGIS. Prior to adding/dropping a class on REGIS, you should let the professor and your adviser know in advance.

## PASS/FAIL (CATALOG P 33)

As a first or second term frosh, all of your frosh classes are automatically graded on pass/fail (P/F, colloquially pronounced "piff") and cannot be taken on grades. As a result, you will not have a GPA

during your first two terms.

Starting third term frosh year, your courses will be on grades unless (1) the course is only offered pass-fail (eg. PE classes, CS 11), (2) the class is offered either P/F or letter grades and you choose to take it P/F. Courses taken on P/F will never count toward your GPA regardless of term or grade in the class. Your grade will appear on your transcript as either P or F\*. When deciding whether to take a class P/F optionally, students will usually consider what grade they're likely to get based on how they're doing by drop day. **The deadline for electing to take a course on P/F is drop day of that term.**

Some restrictions on optional pass-fail **after your first two terms**:

1. You can elect to take up to 2 courses per term and up to 90 units total on pass-fail after second term frosh year (classes only offered as P/F don't count toward that total)
2. In general you cannot P/F option requirements. (See the section for your option in the catalog)
3. You cannot take your advanced social science, advanced hums, or writing intensive HSS classes on P/F (Catalog P 232). You can still take intro (frosh) hums, intro SS, and the 36 units of "additional HSS" on P/F.
4. Any course offered only on letter grades cannot be taken pass-fail. This will be indicated on the course schedule by the marker LETTER on the course schedule and sometimes in the course's catalog listing as "not offered on pass-fail basis".

<b>CS 013</b>	3-0-6	Mathematical Foundations of Computer Science			
01	Blank, A	<i>pending faculty board approval</i>	MWF 13:00 - 13:55	105 ANB	LETTER
<b>CS 019A</b>	1-0-1	Introduction to Computer Science in Industry			
01	Ralph, C		M 12:00 - 12:55	105 ANB	PASS-FAIL
<b>CS 024</b>	3-3-3	Introduction to Computing Systems			
01	Blank, A		MWF 14:00 - 14:55	105 ANB	

*Example: [schedule listing](#) indicating CS 19a (a pizza class) is automatically p/f while CS 13 is automatically on letter grades. CS 24 could optionally be taken on p/f by non-CS majors taking the course out of interest, but a CS major couldn't take it on p/f if they wanted it to count towards their option requirements. Again, your frosh courses the first two terms will be on p/f only.*

## DECLARING AN OPTION

Around the third week of the third term you will be asked to declare an option. The registrar will email out a form in which you will indicate your selection of major as well as any specific focus in that field. If you know a professor who you would like as your option adviser, you can also include that in the form. The option representative will then assign you to an adviser. Don't stress about declaring your major! You are allowed to switch majors and/or advisers later, although the earlier you switch, the easier the change might be.

## **MORE COMPLICATED STUFF...**

### **PRACTICAL VS ANALYTICAL TRACKS OF MATHEMATICS AND PHYSICS 1B & 1C**

As the core curriculum is taken by all frosh, it must accommodate various intended options and levels of interest. For this reason, math and physics during second and third term (1bc) consist of two different tracks: a practical track and an analytical track. In general, the analytical tracks more rigorously teach principles of the subject, while the practical tracks teach techniques and application. Analytical tracks are geared towards students in the option, while practical tracks are for those outside of the field. Regardless of track taken, the course will be identical on all records/transcripts.

It is possible to switch tracks during term until drop day, and between second and third term. Most often, students switch from analytical to practical. As the analytical track demands more rigor, students may find this course more demanding. However, students with a particular affinity for math or physics may find the practical track overly applied/tedious in its problems. That said, the analytical track is an option for all students regardless of option. Both courses are rigorous, so don't feel obligated to choose courses based on claims of difficulty. In general, choice of track will not influence future coursework.

#### **MATHEMATICS ANALYTICAL VS. PRACTICAL (MA)**

Ma 1b covers linear algebra, while Ma 1c covers multivariable calculus. The practical track of both 1bc covers more applications of the material, while the analytical track focuses on proofs and more abstract concepts. Both tracks cover the material in a similar logical order at roughly the same pace by topic, so switching tracks between second and third term is generally possible. The analytical track spends more time developing concepts and includes a deeper discussion of topics beyond the scope of the practical track (topology in the beginning of 1c, for instance). The practical track, on the other hand, spends more time on problem solving techniques, for example in solving systems of equations (1b), optimization, and integration (1c). Some proofs are presented in the practical track, but are less common on problem sets than in the analytical track. If you are considering majoring in Math, ACM or IDS, it is important to note that these three options strongly recommend the analytical track of math.

#### **PHYSICS ANALYTICAL VS. PRACTICAL (PH)**

Physics 1bc covers special relativity and electricity and magnetism (E&M). Unlike math, topics are not covered in the same order between tracks. The analytical track covers special relativity first in 1b, then uses it to derive magnetism analytically from electricity in 1c. The practical track covers E&M first in 1b, followed by relativity in 1c. Generally it is not recommended to switch between the tracks between winter and spring term. Both tracks cover similar material, with the analytic track focusing on derivations and practical on numerical problems. If you are considering majoring in Physics, Astrophysics, or Applied Physics, it is unofficially recommended to take the analytical track.

#### **MA 13**

Ma 13 is an intro course on multivariable calculus offered during the winter term to complement classes such as Ph 1bc analytical track. Ph1bc analytical assumes background in basic multivariable calculus concepts, which are only covered in a short bootcamp during Ph1b. Ma 13 is best for learning or



brushing up on dot/cross products, line integrals, vector fields, and more multivariate calculus concepts you will need while taking Ph1b.

## PLACEMENT TESTS

**Diagnostic tests for math and writing are mandatory for everyone.** These tests are required to place you in appropriate classes based on your high school background. These are distinct from the exams needed to place out of core classes.

You should take placement exams if you can. Having the option to place out of classes doesn't hurt. That being said, if for whatever reason you can't take them, don't worry- it's not a big deal. Feel free to brush up on some material before taking the placements, but don't feel pressured to study for them. The **VAST** majority of students do not test out of classes, so don't feel like you're behind for not testing out of a course- you will still have plenty of room to take courses out of interest on top of your requirements.

### MATH PLACEMENT (MA)

Math 1a is meant to teach both proofs and calculus. As such, if you place out and are comfortable with proofs, there is likely no reason to take the course. If you are not familiar with proofs, it is worth thinking about your future course selection. For example, the analytical track of Ma1bc requires prior proof familiarity at the level of Ma1a. If you place out of Ma 1bc, you definitely have the skills taught in the practical track. If you have not encountered concepts from the analytical track, you may want to consider the course, but there will likely be other courses which teach you that material, allowing you to use the units from ma1bc for other classes instead. If you place out of some part of Ma 1, you should have the skill set required to take Ma2/3. However, if either course proves more difficult than expected, it is completely fine to wait until sophomore year to take it with your peers when you are better prepared. If you are able to place out of Ma 2 or Ma 3, there is little point in taking either of those courses. Feel free to take higher level courses in those topics (i.e. ACM 95a or ACM 116) or use the units for other courses of interest.

### PHYSICS PLACEMENT (PH)

If you place out of Ph 1a, there's no need to take the class, as the placement test is very thorough. Take something else instead! If you place out of Ph1a, you are then able to take the placement test for Ph1bc (separate tests for each), which is offered at the end of fall term. Ph 1bc teaches concepts not covered in the vast majority of high school E&M - relativity, for instance. If you place out of Ph1b and/or 1c, there's not much point in taking Ph 1, especially if your option does not require Ph 2. If you are a physics major or are in an option which requires more physics classes, you can take Ph 2 or 12, focusing on waves, quantum mechanics, and statistical mechanics. **However do not** take Ph 2/12 unless you have a **solid understanding** of linear algebra, multivariable calculus, and E&M. Otherwise, you will be very sad.

### CHEMISTRY PLACEMENT (CH)

The chemistry placement test goes significantly beyond the material of AP/IB Chem. If you pass the test, you're fine to skip Ch 1ab. If you are in a chem-adjacent option, see [Chemistry](#) and [ChemE](#) under "Classes You Could Consider Taking" for what to take in place of Ch 1, but Ch 41 is always a good choice.

## COMPUTER SCIENCE PLACEMENT (CS)

CS 1 goes over the basics of programming in Python. Memory management, data structures, algorithms, etc, are not covered. If you took AP Computer Science A in high school or have significant programming experience, taking the CS 1 Placement exam is recommended. There are three possible outcomes of the placement exam: (1) you are placed out of CS 1 entirely, (2) you are placed into CS1x, a 6-unit course for students with prior experience, (3) you do not place out and are recommended to take CS 1.

CS 1x is an intermediate course on computer programming taught in Java which focuses on more advanced topics including recursion, exception handling, and object-oriented programming. If you were placed in this section (this only applies to about 15 people) you will receive an email from Professor Vanier with more information.

If you place out of CS 1, there are several alternative higher level CS classes available first term. Ma/CS 6a or CS 13 can be **very helpful in developing proof-based thinking** and is *often recommended as an unofficial prerequisite for CS 21*. CS 11 offers 3 unit classes in various topics, with tracks including C, C++, Rust, and more depending on the year.

## BEYOND THAT...

You might want to consider taking a Freshman Seminar (see [below](#)). If you place out of classes more advanced than those covered here, there's not a whole lot of standard advice to give. Feel free to reach out to the ARC and we can find people who have been in similar situations, but at this level, you will likely be ready to take more advanced classes. Much of placement beyond core is at the department's discretion, and they generally have a good idea of the rigor required and would be great people to direct any specific questions towards as well.

## MATH 1D AND MATH 8

Math 1a Section 1 is a separate class from Math 1a, that covers the same material as the other sections of Math 1a with the exception of series and sequences. It is designed for students who would benefit from a stronger foundation in calculus prior to entering into proof-based calculus.

Math 1d is a 4 unit class taught during winter term, which goes over series and sequences, that is taken concurrently with Ma 1b. If you are placed into Math 1a Section 1, you will be automatically enrolled in Math 1d winter term. You can elect to switch into Math 1a section 1 from a different section of Math 1a if you think you need the extra help.

Math 8 is a 3 unit class offered during first term that gives students enrolled in Math 1a (any section) extra practice with problem solving. It is somewhat like a more in-depth additional recitation that many students are placed in and find helpful.

## ACADEMIC ELIGIBILITY

Students must pass at least 27 units in a term to remain eligible for registration for the next term. Once you are off of pass/fail, you need a GPA of at least 1.9 (see Course Catalog to refer to how GPA is calculated) to remain eligible for registration, in addition to passing 27 units per term. Additionally, you must earn an average of 36 units per term over each academic year for a total of 108 units over the

course of three terms. You can be excused from the 27-unit requirement (an Underload) if you file a petition to the Dean or Associate Dean before Add Day.

Under extraordinary circumstances, the Deans can waive the 27-unit requirement after add day, but only once during a student's time at Caltech. Also, financial aid will be adjusted if you are not enrolled as a full-time student, which is defined as taking at least 36 units. If you become ineligible for the first time, you'll meet with one of the Deans, and they'll either reinstate you and let you register for classes normally, or have you petition the Undergraduate Academic Standards and Honors Committee (UASH). UASH will then either choose to reinstate you, or may require you to withdraw from Caltech for two terms. If reinstated by the Deans or UASH, you will be put on academic probation for one term.

Students who fail a core course or fail to complete 36 units will also need to meet with a Dean, although they are not necessarily academically ineligible. For more information on academic eligibility and UASH, visit the UASH website at: <http://www.registrar.caltech.edu/uash/>. You can also talk to one of the UASH undergraduate representatives, or one of the deans, if you have any questions.

### **OVERLOAD**

Anyone wishing to take more than 48 units must have their schedule approved by their adviser. Schedules with more than 51 units must also be approved by the deans. Additionally, no more than 45 units during the first two terms of frosh year can be academic units. The additional units can come from courses such as PEs, performing arts, pizza classes, or research. An overload petition must include a description of the student's proposed schedule and must explain why that student needs an overload. The deans are particularly open to approving overloads for students wishing to participate in a performing arts group or research. Although there are a lot of tempting classes and a seemingly daunting number of requirements to be fulfilled, it is *not* necessary to overload to graduate, especially during frosh year. If you do decide to try, be sure you are fully prepared for it.

Keep in mind that you have 12 terms to earn the 486 total units needed to graduate. This works out to an average of 40.5 units per term, or between 4 and 5 classes per term. Instead of overloading, you can always choose to audit the course instead (see below). Don't feel obligated to overload and remember that completing all your option requirements doesn't necessarily mean that you have met the 486 total units required to graduate.

### **UNDERLOAD**

Underloading is defined as taking fewer than 36 units a term (you must register for at least 36 units to remain a full-time student), though to be academically eligible to register, you must have passed at least 27 units of coursework. There are many reasons that someone might end up underloading. Sometimes a class can be severely under-united, so a 33 unit course load feels like a 42 unit course load. Other times, health issues can complicate completing coursework or extensions on sets start building up, necessitating dropping a class. If you're planning on taking fewer than 36 units a term, you'll need to get an underload petition approved by the Deans before Add Day. Underload petitions can be found on the [registrar's website](#). Underloading is not an indication of your academic ability.

## **WRITING (WR)**

If you are placed in Writing 2 (Wr 2) after taking the placement test, this means that the humanities faculty think you could benefit from taking an additional academic writing class. Oftentimes, a lot of students don't have extensive experience writing academic papers until they come to Caltech, and this class is a chance for you to learn how to write academic papers and receive more one on one feedback.

**Note that this doesn't count as one of your first-year humanities courses but as a "miscellaneous humanities course," so you will still need to take two other freshman humanities courses.** Depending on how you do in Writing 2, you may be required to take additional courses the following term as you move into your first-year humanities coursework. The Writing 2 instructors will explain this from the outset of the course.

## **DOUBLE MAJORING/MINORING**

Caltech is a challenging place for those attempting to complete even one option. Some students still opt to add a minor or a second option, or in rare cases, both. If you are interested in doing this, be sure to prepare and complete requirements in a timely manner to avoid stressful course loads. You do not want to find yourself writing two theses while taking three labs and other advanced classes while planning Ditch Day in your senior year! Also, be aware that second options are typically not granted within the same division, and elective courses are usually not double-counted between your first option and your minor/second option.

Those wishing to add a minor or a second option may do so as early as the beginning of their sophomore year or as late as before the start of their senior year. They will be required to submit a petition for approval which includes their reasons for requesting a second option and a plan to complete all requirements for both options by the end of their fourth year without overloading. This petition must be approved by both option representatives and a faculty adviser in each option.

## RESOURCES

### **I'M STRUGGLING IN A COURSE...WHAT SHOULD I DO?**

Core is tough! There are a couple ways that you can reach out for help.

- 1) If a collaborative question - find some friends that are also working on the problem set. These sets are very difficult and working together in a group can clarify some confusion you may have.
- 2) Go to office hours! These are set times where TAs or professors can help clear up any confusion you have. Oftentimes, people attend office hours when they have questions about their sets or to clarify material that they don't understand from lecture.
- 3) Email your TA or professor - If you can't attend office hours, try emailing one of the TAs or the professor. Note that most instructors will respond to you in 1-2 days so try to reach out in a timely manner. You can also ask questions on the appropriate online resources used by that class ex: Discord, Piazza.
- 4) Deans' Tutoring - If you are thinking that you would benefit most from more one on one tutoring, try finding a Deans' tutor! They are a free resource to you and these students are paid to help you in your classes by the Deans' Office. See below for more details on how to find a tutor.
- 5) And most important, **don't wait until it is too late**. There is a high chance you will struggle while taking classes at Caltech. Don't be afraid or self-conscious about reaching out for help. That is why these resources are here. If you are having trouble with any of these resources, have worries, or have had a bad experience, please reach out to the ARC and we will help you.

### **WHAT HUMANITIES ARE THERE? WHAT DO I NEED TO TAKE?**

There are humanities and social sciences. You need to take two frosh Humanities which are courses that are labeled 'Hum' and numbered below 50. They need to be listed in different topics (ex. History and Visual Culture). See below for the flow chart on humanities classes (very helpful!!).

### **MY COURSELOAD SEEMS TOO ROUGH/LIGHT? WHO DO I TALK TO?**

The first thing you should do is think about what courses are your most time consuming. If you think you need to adjust your courseload you should try talking with your advisor or an ARC rep, as they will likely have suggestions that can help you!

### **I'M INTERESTED IN RESEARCH. WHERE DO I START?**

That's great! The first thing to do to get into research is to find a research group that you would be interested in. The ARC compiles a list on our website ([arc.caltech.edu](http://arc.caltech.edu)) of professors looking for undergraduate students. You can also find groups you are interested in by attending pizza classes, looking through each department's research pages online, or talking to your advisor. Once you find a group you are interested in, you should send an email to the professor with your resume (if they ask) and see if they are open to taking in an undergrad, especially if you are a frosh. An Announcements of Opportunity page will be made available with research projects by Caltech faculty and JPL staff for SURF research opportunities, but it never hurts to reach out to faculty you're interested in working with before then!

## INFORMATION ON GRADUATION AND OPTION REQUIREMENTS

### **REGISTRAR'S OFFICE** [[HTTP://REGISTRAR.CALTECH.EDU/](http://REGISTRAR.CALTECH.EDU/)]

The registrar is in charge of student records. The office keeps a record of your grades, registers you for classes, and prepares the course schedules. On the registrar's website you can find class schedules, textbook lists, the academic calendar, the course catalog, and an option to order transcripts.

### **CALTECH CATALOG** [[HTTP://CATALOG.CALTECH.EDU/](http://CATALOG.CALTECH.EDU/)]

The Caltech catalog holds the academic "rules" at Caltech and it is the authoritative guide on all things academic. Occasionally, there may be small changes made to options and courses after the Catalog is published, but those will usually be announced through department mailing lists and announcements. You can find core requirements, graduation requirements, as well as a listing of all the courses, when they're offered, their units, and their prerequisites.

### **REGIS** [[HTTPS://ACCESS.CALTECH.EDU/REGIS\\_RESP/REGISMENU.DO](https://ACCESS.CALTECH.EDU/REGIS_RESP/REGISMENU.DO)]

REGIS, the Registrar's Information System, is the online system that students log into from access.caltech to perform tasks such as registering for classes and checking grades. This is also where you can see your unofficial transcript, view your degree audit, order an official transcript, and see any other personal academic information. All undergraduates will use REGIS to enroll in courses during the registration period and advisers will approve schedules using REGIS. If you need help navigating REGIS, check out the videos [here](#).

### **DONUT** [[HTTP://DONUT.CALTECH.EDU/](http://DONUT.CALTECH.EDU/)]

Most people use Donut as an undergraduate directory as well as a course scheduler for each term and all four years. You may also submit concerns about your courses through the ['ARC Feedback' form](#) linked under "User Services," where you will also find a flowchart outlining some steps you could take to help resolve your concern. There are additional resources and information available on Donut (SAC room reservations, clubs, etc.), but that deserves a guide on its own. If you do not yet have access, you will be given login information soon. Please check out the entire website, especially the Little T if you have the time!

## ACADEMIC RESOURCES

### **DEANS' TUTORS** [[HTTPS://DEANS.CALTECH.EDU/ACADEMICSUPPORT/PEER-TUTOR-INFORMATION](https://DEANS.CALTECH.EDU/ACADEMICSUPPORT/PEER-TUTOR-INFORMATION)]

One notable service that the deans provide is student tutors, **free of charge**. The tutors are undergraduates who have met certain requirements for performance in the class, and who can give you one-on-one attention. The Deans' Office pays these students for their time, so it's a win-win! For certain core and large classes, study sessions in Caltech Hall with tutors present are also available, times TBD. Updates on the Caltech Hall study sessions are usually posted on the Class Facebook page.

### **DEANS' OFFICE** [[HTTP://WWW.DEANS.CALTECH.EDU/](http://WWW.DEANS.CALTECH.EDU/)]

While many students only visit the deans to get course petitions approved, the deans can be very useful to you in other ways during your time at Caltech. You can talk to the deans about any concerns or problems you may be having, personal or academic. The deans have experience helping students and

can refer you to other people who may be better suited to help you. For instance, if you become sick or if a family issue arises the deans can help you obtain extensions in your classes.

### **CAEL** [[HTTPS://CAREER.CALTECH.EDU/UNDERGRADS](https://career.caltech.edu/undergrads)]

You can read more about the Career Development Center below. The Career Advising and Experiential Learning (CAEL) center provides students with counseling, information, and contacts to help them make decisions at any phase of their career development. They help students develop and implement effective career plans with resources on career paths, jobs, internships, and graduate programs.

### **OCCUPATIONAL THERAPY** [[HTTPS://WELLNESS.CALTECH.EDU/OT/SERVICES](https://wellness.caltech.edu/ot/services)]

The Occupational Therapy office can also help you succeed academically by helping you with time management, procrastination, sleep schedules, life coaching, goal setting, transitions, and more! Log onto the student wellness portal or call the wellness center phone number to schedule an appointment.

### **TQFRs** [[HTTPS://ACCESS.CALTECH.EDU/TQFR/REPORTS/LIST\\_SURVEYS](https://access.caltech.edu/tqfr/reports/list_surveys)]

Teaching Quality Feedback Reports are reports of course feedback from students over the years. A link can be found from access.caltech. TQFRs contain data like the average time spent on homework and the average grade for classes, as well as the quality of teaching and course material, etc. TQFRs also have a section containing comments from students who have taken the course, which are often quite helpful. The TQFRs are written by students! Therefore, at the end of term, please fill out the TQFRs for the classes you took as a way of helping future Caltech students, TAs, and Professors!

Two ways to evaluate the quality of a class are by looking at TQFRs and by talking to upperclassmen, *although, remember that their opinions are only that—opinions*. Be particularly wary of upperclassmen's opinions on a course if the professor listed is different from the one they had. It can often be helpful to look at multiple years of TQFRs to get a better idea of what the class is usually like. As always, feel free to check in with the ARC about any questions you might have.

### **CALTECH LIBRARY** [[HTTPS://WWW.LIBRARY.CALTECH.EDU/](https://www.library.caltech.edu/)]

The Caltech Library has a great number of resources that can help with a variety of research-related tasks including locating and accessing books, journals and databases. The Library also has a guide to help students find information in specific subjects and disciplines. If you need a resource for an HSS or STEM class (such as a book or journal article), the Caltech Library can help you access and (in some cases) buy the resource for you.

### **HIXON WRITING CENTER** [[HTTPS://WRITING.CALTECH.EDU/](https://writing.caltech.edu/)] & [[HTTPS://WRITING.CALTECH.EDU/RESOURCES](https://writing.caltech.edu/resources)]

Throughout summer 2023, Caltech students, postdocs, and summer researchers can meet with professional writing specialists in the Hixon Writing Center to discuss their writing. Appointments can be booked by visiting access.caltech.edu and logging in to the "Writing Center Scheduling" application. Students can use the Hixon Writing Center to receive feedback or help on humanities papers, presentation practice, SURF application writing, CVs, and more.

### **HSS FLOW CHART** [[HTTPS://DRIVE.GOOGLE.COM/FILE/D/1uXDpsMGs5BAECCPBjNWsWfKfL5JEXs9J/VIEW](https://drive.google.com/file/d/1uXDpsMGs5BAECCPBjNWsWfKfL5JEXs9J/view)]

Oh the humanities and social sciences! The HSS requirements for core can be rather confusing. This is a

helpful chart on the ARC website that diagrams out exactly what you need to take. Our biggest piece of advice is to avoid getting behind on HSS classes (especially frosh hums) whenever possible.

#### **FREE SOFTWARE [[SOFTWARE.CALTECH.EDU](https://software.caltech.edu)]**

You can use your access.caltech credentials to download software like Mathematica and Matlab for free. This site also includes anti-virus software and tools like ChemDraw and Adobe Acrobat. Be sure to check it out before buying something yourself! Keep in mind that you need to be on a campus network or using a VPN to download software. You can find more information about getting a VPN here: <https://www.imss.caltech.edu/services/wired-wireless-remote-access/Virtual-Private-Network-VPN>

#### **REGISTRATION & GENERAL RESOURCES**

[\[HTTPS://SITES.GOOGLE.COM/SITE/ARCCALTECH/RESOURCES/GENERAL-RESOURCES?AUTHUSER=0\]](https://sites.google.com/site/arccaltech/resources/general-resources?authuser=0) &  
[\[HTTPS://SITES.GOOGLE.COM/SITE/ARCCALTECH/RESOURCES/REGISTRATION-RESOURCES?AUTHUSER=0\]](https://sites.google.com/site/arccaltech/resources/registration-resources?authuser=0)

Please take a look at these tabs on the ARC's website for more information!



# People

## INSTRUCTORS

While professors and lecturers are very busy people and may be more difficult to get a hold of than TAs, they are very worthwhile people to get to know. Most professors are more than happy to have students come talk to them, whether about a class or about research. Typically professors have office hours for their classes or will allow you to schedule an appointment with them.

The 3:1 student-to-faculty ratio is more than just a number! There are plenty of opportunities to get to know your professors outside of class and office hours. The ARC runs several student faculty interaction programs throughout the academic year. In addition to ARC programs, many options also have clubs or organizations dedicated to increasing student-faculty interaction. Option clubs may host socials, seminars, or other events to help you get to know your professors or identify possible research mentors. Houses may also have non-resident faculty associate members and you can invite professors to House dinners as well.

These are the people who will most likely be writing letters of recommendation for you in the future and introducing you to new labs and opportunities, so it is a good idea to get to know your professors early in your Caltech experience and forge these connections throughout your stay. If you are having trouble with a professor, please reach out to the ARC and we will help you.

## TAs

Teaching assistants can be graduate students, undergraduate students, or even emeritus professors. TAs are in charge of recitation sections and also typically write (and grade) problem sets, quizzes, and finals. If you are struggling in a class or have questions about a problem set, feel free to attend their office hours (usually posted on the course website). If you can't attend the scheduled office hours because of a conflict, feel free to email any TA you feel comfortable talking to to set up another meeting time.

## ADVISERS [[HTTP://REGISTRAR.CALTECH.EDU/ADVISING](http://registrar.caltech.edu/advising)]

Entering frosh are all assigned a frosh adviser independent of their intended option. Your frosh adviser is probably the first faculty member you will have the opportunity to forge a personal bond with. Your adviser's administrative responsibilities include approving your schedule (and any overloads) and signing add/drop or conflict cards. **Make sure you meet with your adviser at least once each year before spring registration, or else you will not be allowed to register for classes.** You should also take advantage of your adviser as a knowledgeable resource who can help guide you in any decisions you may be making. For more details on the roles and responsibilities of an adviser, visit the registrar's advising arena. Keep in mind that after you declare your option during the third term of frosh year, you will be assigned an option specific adviser for your next three years at Caltech. Finally, don't forget that your academic adviser can be one of your best networking tools. Aside from delivering sound academic advice, your adviser can suggest who among his or her colleagues might be the best research adviser or SURF mentor for you.

## **ARC REPS**

Each House has one - ask around if you are unable to find yours. You should also feel free to reach out to any member of the ARC! Our [full roster](#), along with contact information, is at the end of this guide. You can also follow us on instagram [@caltecharc](#) and check out our [snazzy website!](#)

If you're interested in joining the ARC, we will be appointing frosh representatives in October - keep an eye out for the announcement. Also, meetings are open to the public, so feel free to drop by! We will be holding meetings in Hameetman/Red Door on Sundays, and you can message any ARC rep for more info.

## **OMBUDSPEOPLE**

The majority of core classes and other large classes will assign ombudspeople. Often, one person is assigned from each house. Ombuds meet with the professor and TAs a few times a term to go over how people are responding to the class. Becoming an ombudsperson is a great way to get involved early on! These people are often your easiest point of contact for classes. If your class doesn't have an ombudsman, please let us know and we can reach out to the instructor. We host ombuds training every term to prepare students who are interested in those positions.

## **UPPERCLASSMEN**

They've been through all this and can advise you pretty well! For the most part, upperclassmen love helping frosh, but be aware that the catalog changes every year (one of the advantages of a small school!), so they might not be up to date on recent catalog/course changes. As such, it is important to seek a diverse set of opinions before making an academic choice, and it's a good idea to double check with the catalog, the Registrar's office, the ARC, or your adviser for anything important. Again, it is more important to move at your own pace and create an academic plan that you are interested in than it is to strictly follow the advice of an upperclassman in your major.

# Classes You Could Consider Taking

## GENERAL CLASSES

### PIZZA (FRONTIERS) CLASSES

These classes are low-unit classes (typically 1-3 units, and always PF) that meet once a week, usually during lunch (pizza is provided!), and are intended to introduce you to current research in a particular field. They are a great way to learn about the current research done by professors and find a field of interest. Some of these pizza classes are required by certain options (e.g. ME 10 for mechanical engineering), so if you are interested in an option, consider taking the class! There is also an [online guide](#) on pizza classes on the ARC website. The pizza classes that will be offered in 2023-2024 are:

- **BE 2:** Bioengineering, *second term*
- **BEM/Ec/PS 80:** Social Sciences, *second term*
- **Bi 2:** Biology, *first term*
- **ChE 10:** Chemical Engineering, *second term*
- **Ch 10 ab:** Chemistry, *first, second terms*
- **CS 9:** Computer Science, *first term*
- **CS 19 ab:** Computer Science, *first term*
- **EE 2:** Electrical Engineering, *second term*
- **E 2:** Engineering, *first term*
- **Ge 10:** Geological and Planetary Science, *second term*
- **Hum 80:** Humanities, *third term*
- **IDS 9:** Information and Data Science, *second term*
- **Ma 20:** Math, *first term*
- **ME 10:** Mechanical Engineering, *first term*
- **Ph 10:** Physics, *first term*

### CS 1

CS 1 goes over the basics of programming in Python. Memory management, data structures, algorithms, etc, are not covered. While it is an excellent class for learning programming, someone with the knowledge to place out should take a different course instead. If you have taken AP Computer Science A in high school or have other significant programming experience, taking the CS 1 Placement exam is highly recommended. There are three possible outcomes of the placement exam:

1. You place out of CS 1 entirely
2. You are placed into a 6-unit course called CS 1x for students with some experience
3. You do not place out and are recommended to take CS 1.

CS 1x is an intermediate course on computer programming taught in Java which focuses on more advanced topics including exception handling and object-oriented programming. If you were placed in this section (this only applies to about 10 people) you will receive an email from Professor Vanier with more information.

If you place out of CS 1, there are several alternative higher level CS classes available first term. Ma/CS 6a

or CS 13 can be very helpful in developing proof-based thinking and is often recommended as an unofficial prerequisite for CS 21. CS 11 is another good choice.

CS 1 is a required course for the following majors:

- Computer Science
- Applied and Computational Math
- Information and Data Science
- Bioengineering (requires 9 units from: CS 1, CS 2, CS 3, CS 21, CS 24, and CS 38)
- Computation and Neural Systems (requires CS 1, CS 2, AND either CS 3 or BE 103; or “approved alternative course”)
- Materials Science (or “approved alternative course”)
- Mechanical Engineering (requires 9 units from: ACM 11, CS 1, CS 2, CS 11)
- Engineering and Applied Science (or “approved alternative course”)

CS 1 is a recommended course for the following majors:

- Biology
- Planetary Science
- Astrophysics and Physics

Note that many options don’t explicitly require CS 1 but some SURFs and internships look for a basic programming background.

## **FRESHMAN LABS**

As part of Core, students must take 12 units of laboratory classes, 6 units of which must be Ch3a or Ch3x. They are all of approximately equal difficulty. Note that currently Ch 3a is only limited to 10 students and priority is given to students in chemistry and chemical engineering, as well as premedical students (Ch 3a teaches the foundational skills that are useful for later labs in chemistry and chemical engineering). It is recommended that students take the introductory chemistry classes during their frosh year and complete the lab requirement by the end of their second year. Note that for the Class of 2025 onwards, Ch3a and Ch3x are on pass/fail for first-years and sophomores only. It is recommended you take Ch3x if you are not pursuing a chemistry-related major.

The additional 6 introductory lab units must be chosen from one of the following:

- APh/EE 9ab: Analytical Techniques Laboratory, (6 units), *first term*
- APh 24: Introductory Modern Optics Laboratory, (6 units), *third term*
- Bi 1x: The Great Ideas of Biology: Exploration through Experimentation, (9 units); *third term*
- Bi 10: Introductory Biology Laboratory, (6 units), *third term*
- Ch 4ab: Synthesis and Analysis of Organic and Inorganic Compounds, (9 units per term), *second, third term*
- Ch 8: Procedures of Synthetic Chemistry for Premedical Students, (9 units), *first term*
- Ch/ChE 9: Chemical Synthesis and Characterization for Chemical Engineering, (9 units), *third term*
- EE/ME 7: Introduction to Mechatronics, (6 units), *first term*
- Ge 116: Analytical Techniques Laboratory, (9 units), *second term*
- ME 8: Introduction to Robotics, (6 units), *first term*

- Ph 3: Introductory Physics Laboratory, (6 units), *first, second, third term*
- Ph 5: Analog Electronics for Physicists, (9 units), *first term*
- Ph 8bc (6 units) *second, third term*
- or a more advanced laboratory.

[A list of introductory labs](#) is available on the ARC website.

## BIOLOGY OPTIONS

In general, if you are considering majoring in biology, CNS, or bioengineering you should definitely take Bi 8 winter term and Bi 9 spring term. If you are considering majoring in chemistry or chemical engineering, or considering a minor in neurobiology, you should at least consider taking Bi 8 and Bi 9. If you are majoring in bioengineering, you are required to take Bi 1x spring term in addition to Bi 9. Most other majors choose to take Bi 1 fall, winter, or spring term instead.

## FRESHMAN SEMINARS

These seminars are a great opportunity to take a class where the professor teaches whatever they think is really cool. They provide an intimate setting to interact with professors, and you get to know a professor outside of a large lecture hall setting. **Note that these classes don't fulfill core or option requirements, and only count towards the overall 486 unit requirement.** That doesn't mean you shouldn't take them if you're interested, though!

## MENU CLASSES

These are only offered third term and must be completed before the end of sophomore year. You are **required to take one menu class** during your time at Caltech, **in a field outside of the field of study you had declared at the time.** These are fun, interesting, exploratory classes in fields that students generally have not been exposed to in high school. Keep in mind that menu courses taken in your currently declared option will not fulfill the menu class requirement! Current menu classes include:

- **Ay 1** (astronomy)
- **EE 1** (electrical engineering)
- **ESE 1** (environmental science and engineering)
- **Ge 1** (geology)

These courses are not all offered every year so you will want to check with the catalog.

## CH 10

Frosh interested in chemistry and chemical engineering can enroll in Ch10. Ch10 is a three term class that is essentially a pizza course the first two terms and a lab third term. Ch10a and Ch10b are 1 unit each while Ch10c is 6 units third term.

## PH 11

In the fall, 5 to 9 frosh will be selected for this admission-based class based on their solutions to two "hurdles". Hurdles are open-ended, challenging problems with no "right" answer that will be released during first term for all frosh to try. Although it is intended for physics majors, anyone is welcome to apply.

Throughout the year, the class meets once a week to discuss real-world questions and develop interesting models to answer them. In addition, Ph 11 students are offered automatic research support for the summer after their frosh year, similar to a SURF, without having to write a SURF proposal or fill out the application to get a SURF approved. Ph 11 students are paired up with a professor in any subject they are interested in to work on a project for the summer.

Ph 11 is a 6-unit class, part of your non-academic unit allocation. It meets for 3 terms, the winter and spring terms of frosh year and the fall term of sophomore year, and the Deans are generally flexible in allowing students to fit the class in their schedules with their regular workload. The class is truly a rewarding experience, and it is highly recommended for frosh to try the hurdles. If you have any questions, feel free to reach out to any Ph 11 alums. More information about the hurdles will come in the fall term around early October.

### **IN SPECIFIC OPTIONS**

This section discusses classes in specific options that frosh may consider taking. In some cases, these classes are officially recommended or required by the Caltech course catalog. In other cases, you should only consider taking the class if you've placed out of a core or prerequisite class.

#### **APPLIED AND COMPUTATIONAL MATHEMATICS**

The ACM option strongly recommends that students take the analytic track of both Ma 1b and Ma 1c.

MA 6 - All 3 terms of Ma 6 are required for the ACM option. Most ACM majors take these courses sophomore year, but some elect to take 6a and 6b frosh year. Ma 6a provides an introduction to discrete math. Ma6b is focused on graph theory, and Ma6c is an introduction to mathematical logic. These topics do not require Ma1abc, though some experience with proof writing is probably recommended.

CS 1/1X - This is required for the option. See more details on CS 1 above

ACM 11 - The ACM option requires ACM 11, a 6 unit course offered in the spring that presents a survey of computational methods and works as an introduction to MATLAB. This is very important to take frosh year as many early ACM requirements work primarily in MATLAB.

#### **BIOENGINEERING**

Bi 1x - This is an introductory lab course offered in the spring that teaches techniques used in biology and bioengineering research. This class satisfies the Core biology requirement. In addition, the Bioengineering option requires Bi1x, so if you are thinking about majoring in that, it is good to take Bi1x in the spring to see if you'll want to continue the path down the Bioengineering option.

Bi 8/Bi 9 - Both of these classes are required for the Bioengineering option. Many students take Bi 8 frosh year second term, and Bi1x and Bi9 third term. See the Biology section for more details.

#### **BIOLOGY**

Bi 8/Bi 9 - Frosh planning on majoring in biology are recommended to take Bi 8 (winter term) and Bi 9 (spring term) their frosh year. This is advantageous for anyone planning to take advanced biology courses

as Bi 8 and Bi 9 are common prerequisites. Keep in mind that Bi 8 is a very important introductory biology course that builds the foundations for future courses. Some students make the mistake of not taking the material as seriously, since Bi 8 is a second-term class and therefore taught while frosh are still on pass/fail.

Bi 10 - This is a 6 unit cell biology lab meant to be taken alongside Bi9 in the spring term. This counts as one of your intro lab courses.

Bi 23 - This is a three unit class that is offered second term. Different sections are focused on different topics in biology, ranging from DNA nanotechnology to current research in developmental biology to bioethics. Sign up for whichever section interests you most! This class can count towards your total biology units if you are a biology major but is not required.

## **CHEMICAL ENGINEERING**

Take CS 1 as a frosh (you'll need to be comfortable with Mathematica/MATLAB/python for many of your classes, and this is a nice intro to programming). Although not recommended in the catalog, many students suggest taking CS 1 before ChE 15.

Ch 3A/x- It's a prerequisite to Ch/ChE 9 which you'll take third term s'more year, so taking it your frosh year is a good idea. Ch 3a teaches skills that are important to future chemistry labs so take Ch 3a over Ch 3x if at all possible.

ChE 10 - Introduction to Chemical Engineering, second term, 1 unit. This is the chemical engineering **pizza** taco course, where you can hear from the ChemE profs, postdocs, and grad students about the latest in their research. The ChemE faculty are pretty close-knit, and this is a great way to see if you would like to join any of their labs. Not required and does not count for anything, but you should definitely take it!

*If you tested out of Ch1...*

Ch 41 - The first two terms are required for ChemE. See the "Chemistry" section.

## **CHEMISTRY**

Ch 3A/x- It's a prerequisite to Ch 4ab which you'll take second and third term s'more year, so taking it your frosh year is a good idea. Ch 3a teaches skills that are important to future chemistry labs, so take Ch 3a over Ch 3x if at all possible.

Ch 10ABC - Ch 10ab (first and second term - 3 units) is a pizza class with talks at lunch each week by a different chemistry faculty member. After taking both Ch 10a and Ch 10b, students have the option of taking Ch 10c and working in a chemistry lab (almost always starting work for a SURF) third term. The class Ch 10c (third term - 6 units) consists of spending some time in the lab each week, and giving a presentation of the research you are starting on. If Ch 10c is taken frosh or sophomore year, the class counts towards one of the (currently 5) terms of chemistry lab required for chemistry majors.

Bi 8/Bi 9 - Frosh interested in chemistry are encouraged (not required) to take Bi 8 and Bi 9 instead of Bi 1

as the core biology requirement. Bi 8 and Bi 9 are often listed as prerequisites for higher level biochemistry and chemical biology electives and are required for the biochemistry track of the chemistry option.

*If you tested out of Ch 1...*

CH 41 - Organic Chemistry, first, second, third terms, 9 units. This is usually a sophomore course, but should you have the opportunity to take this frosh year, it is a useful requirement to fulfill. Note that the series, unlike Ph 2abc, must be taken in order.

The chemistry department allows the option of taking Ch 41 (organic chemistry) or Ch 21 (physical chemistry). Almost all students deciding between the two should take Ch 41. If you're not a chemist and have exposure to quantum mechanics, Ch 21 might work, but most frosh are not prepared for Ch 21 because you need to have taken or concurrently take Ph 2a and Ma 2. Even for chemists, Ch 41 is usually a sophomore year class and Ch 21 is a junior year class.

## **COMPUTER SCIENCE**

CS 1/1x - Introduction to Computer Programming (6 or 9 units) is a popular computer science class offered in the first term. This class is required for the computer science option, and is typically taken frosh year. For more details, see the description of [CS 1](#).

Ma/CS 6a or CS 13 (Discrete Math) - See ACM and Ma. This class is also good preparation for CS 21 and fulfills a requirement for the CS option. This year, the class is being split in half, Ma/CS 6a is more math and theory heavy and fulfills CS, IDS, ACM, and Math requirements. CS 13 is more focused on computer science and applications, and fulfills CS and IDS requirements.

CS 2 - Introduction to Programming Methods (9 units) is offered second term, and is a requirement for CS majors. This class is taught in Java, and covers data structures and algorithms. This course is considerably more demanding than CS 1, and requires CS 1 (or placing out) as a prerequisite. CS 2 is also a prerequisite for later CS classes, such as CS 3 and CS 24. This course is typically taken frosh year.

CS 3 - Introduction to Software Design (9 Units) is offered third term. It is a requirement of both the CS option and minor, and it is a strict, enforced requirement for CS 24. The class is offered on grades, taught in C (with no prior knowledge of the language required), and covers the basics of software design, such as documentation, code reviews, and structural design. Students spend the first few weeks working with a partner and finish the course with a larger project in a group of four. This class is roughly comparable to CS 2 in terms of difficulty.

CS 12 - Student Taught Topics in Computing (each 3 Units) is offered every term. Each section covers a topic in computing with associated sets or projects. Sections are designed and taught by an undergraduate student under the supervision of a CMS faculty member. This past year, it included sections focused on Tensorflow, Algorithmic Ethics, and Technical Interview Prep. CS 12 may be repeated for credit of up to a total of nine units and is graded P/F.

### For Students with an Extensive Programming and Mathematics Background

Prospective CS majors with extra space in their schedule and an *extensive* background in advanced mathematics may consider taking CS 21 or CS 38 during their frosh year. CS 21 (Decidability and Tractability) is a *very* rigorous class offered second term that covers the formal foundations of computer



programming and it is highly recommended that one takes Ma/CS 6a before CS 21 although Ma/CS 6a is not an official prerequisite for the course. CS 38 is offered third term and covers algorithms. Please note that CS 21 and CS 38 are all sophomore/junior level classes, and there is no need to take these courses frosh year to graduate on time. Only students with a *rigorous, extensive* background comparable to the material taught in prerequisites for these courses should consider taking these courses their frosh year.

## **COMPUTATION AND NEURAL SYSTEMS (CNS)**

CS 1/1x - Introduction to Computer Programming (6 or 9 units) is a popular computer science class offered in the first term. This class is required for the CNS option, and is typically taken frosh year. For more details, see the description of [CS 1](#).

CS 2 - Introduction to Programming Methods (9 units) is offered second term, and is a requirement for CNS majors. This class is taught in Java, and covers data structures and algorithms. This course is considerably more demanding than CS 1, and requires CS 1 (or placing out) as a prerequisite. This course is typically taken frosh year.

CS 3 - Introduction to Software Design (9 Units) is offered third term, and is a requirement for CNS majors. The class is offered on grades, taught in C (with no prior knowledge of the language required), and covers the basics of software design, such as documentation, code reviews, and structural design. Students spend the first few weeks working with a partner and finish the course with a larger project in a group of four. This class is roughly comparable to CS 2 in terms of difficulty.

Bi 8/Bi 9 - Frosh planning on majoring in CNS are recommended to take Bi8 (winter term) and Bi9 (spring term) their frosh year. This is advantageous for anyone planning to take advanced biology and CNS courses as Bi8 and Bi9 are common prerequisites.

## **ELECTRICAL ENGINEERING**

EE 2 - This pizza class is required for the EE major. EE 2 second term is a pizza class which specifically focuses on EE. This is a fun way to learn about current research in the field first-hand from electrical engineering faculty.

EE/ME 7 - This fall term class fulfills the freshman lab requirement and is a good introduction to practical electronics. The class focuses on lab assignments involving building things like DC motors and winches and playing around with batteries and sensors. The class culminates in a two-week project (most recently, an autonomous car that can track an ultrasound beacon, and a similar autonomous boat in past years). You also learn soldering in this class. This class is not required for the EE option, but is a good general introduction to a lot of core electronics skills.

EE 13 - This class provides no credit for the EE option. This is a fall term course in which you make a printed circuit board for a small electronics project. This class is a fairly easy way of learning some practical EE skills (PCB design software, soldering, debugging) that might be useful in later EE coursework or applying to SURFs or internships. This class is fairly popular among EE students. Note that EE majors cannot fit this course into a typical fall term schedule without overloading.

EE/CS 10<sub>AB</sub> - This course is required for the EE option, but is very rigorous and is typically taken sophomore year. EE10ab is offered second and third term and focuses on digital electronics, CPU design, and programming microprocessors. While these are technically introductory classes, they can be incredibly time-consuming, and you may decide to prioritize core, frosh hums, Ch 3, and/or the menu class during frosh year instead. However, for students who are committed to the EE major track, taking EE 10 during the frosh year would provide more flexibility in their sophomore year schedules.

## **INFORMATION AND DATA SCIENCE**

CS 1/1x & CS 2 - See CS. CS 1/1x and CS 2 are required for the IDS option, and it is recommended they be taken your first year.

Ma/CS 6ab - See ACM/CS for more info. The IDS option requires all three terms of Ma 6, and some IDS majors will choose to take 6ab their frosh year, although most take it their sophomore year.

CS 21/CS 38 - Prospective IDS majors with extra space in their schedule and an *extensive* background in advanced mathematics may consider taking CS 21 or CS 38 during their frosh year. CS 21 (Decidability and Tractability) is a *very* rigorous class offered second term that covers the formal foundations of computer programming and it is highly recommended that one takes Ma 6a before CS 21 although Ma 6a is not an official prerequisite for the course. CS 38 is offered third term and covers algorithms. Please note that CS 21 and CS 38 are all sophomore/junior level classes, and there is no need to take these courses frosh year to graduate on time. Only students with a *rigorous, extensive* background comparable to the material taught in prerequisites for these courses should consider taking these courses their frosh year and be warned that these classes can be very challenging and time-consuming.

## **MATH**

If you tested out of Ma 1a, see the “placement tests” section above.

The department strongly suggests taking the analytical sections of Ma 1b/c.

Ma 5 - If (and, for the most part, only if) you have solid experience with proof-based mathematics (e.g. you took a college-level Number Theory, Analysis, or rigorous Linear Algebra course, or participated in proof-based math competitions like the USAMO and USAMTS), you may wish to consider taking the Ma 5 sequence. This is a year-long course on Abstract Algebra (each term is a prerequisite for the subsequent terms). It is a requirement for the math option, an elective for physics majors, and very interesting if you enjoy proof-based math. You sometimes need to obtain the instructor’s approval to begin taking the class first term. Otherwise this is usually a sophomore class.

Ma/CS 6 - The first and third terms of Ma 6 are requirements for the math option (but can be exchanged for higher level classes on the same topic). Of the math option required classes (Ma 5, Ma 6, Ma 108, Ma 109), the Ma 6 sequence is usually considered the most accessible. Ma 6a also fulfills one of the requirements for the CS and ACM majors, along with the CS and IDS minors.

Ma 20 - Frontiers in Mathematics. This one-unit course is the math pizza class, offered first term. Professors and post-docs give presentations on their research each week. It’s a good way to get a short

introduction to lots of different fields of mathematics.

## **MECHANICAL ENGINEERING**

ME 13 - This course is required for the ME option and is the introductory machine shop class. The class teaches you how to safely use several major machines in the machine shop (Spaulding sub-basement) including the lathe, mill, 3D printer, laser cutter, and waterjet. The class includes weekly hour-long demonstrations and creating a small trophy using these machines. A small part of the class also includes an introduction to Solidworks. This class is a low-intensity way of learning practical skills that are useful for more advanced ME classes (ME 14, ME 72, etc.), project teams, and SURFs/internships. Additionally, taking this class grants you shop access, allowing you to use the shop for mechanical design work for clubs, personal projects, and more. If you are interested in mechanical engineering, try to take this class as early as possible.

ME 8 - This fall term class fulfills the freshman lab requirement. This class is designed as an introduction to basic robotics with no experience necessary. You will work in a small group on a couple small mini-projects exploring concepts from CAD to basic robotic systems. While it is not required in the ME core, this class introduces skills useful for machining (ME 13, 14, 72) and robotics (ME 129, 133ab, 134, 169) so it's definitely something to consider!

EE/ME 7 - This fall term class fulfills the freshman lab requirement. While this class is not required for the mechanical or electrical engineering major, it is an interesting practical class in which you investigate the cross-section of electrical and mechanical engineering. You will learn about motors and sensors as well as learn skills such as electronics prototyping and soldering that might be useful in ME project classes.

ME 10 - This pizza class is a requirement for the mechanical engineering option. The class brings in both professors and people from industry and is a wonderful way to learn about applications of mechanical engineering to both academia and industry. (Note: most of the speakers are from industry, so if you are especially interested in academia and mechanical engineering, visit the [MCE faculty page](#) and check out what research MCE faculty at Caltech are involved in.)

ACM 11 - This class fulfills 6 of the 9 units for the computing requirement for the ME option. This class introduces MATLAB programming through hands-on projects in computational simulations and mathematics. While CS 1 is an alternate option to this course, it may be worth considering ACM 11 if you have never programmed in MATLAB before, as more advanced ME requirements (mainly ACM95ab and ME50ab) will require extensive use of MATLAB programming.

ME/CS/EE 129 - This class is an advanced ME elective on the robotics track. This class is a laboratory class focused on introductory robotics. You will select a group of teammates and will build and program a robot together to complete a task. This is not inherently designed to be a frosh class! Only take this if you have suitable experience programming in Python (at least CS 1). That being said, this course is doable as a frosh and will provide necessary background going into more advanced robotics courses (ME/CS/EE 133ab, 134, 169) and the capstone design course (ME 72).

## **PHYSICS & ASTROPHYSICS**

PH 1B/C - Take the analytical track if at all possible.

PH 11 HURDLES - See the [Ph 11 section](#) under “general classes” section above.

PH 10 - The pizza class for physics. It is offered first term and meets weekly for two hours during lunch, generally with an hour of reading to prepare outside of class. Presentation topics range from theoretical astrophysics to the physics of banjos.

PH 20/21/22 - The physics 20 sequence is a track of classes that teach computational skills from a physics perspective. Starting with Ph 20, students learn various techniques and tools that are commonly used in physics research: Linux environments, numerical techniques of solving differential equations, integral approximations, etc. After Ph 20, students can go on to take Ph 21 or 22, or even both. As of the 2015-16 catalog, CS 1 is required as a prerequisite for Ph20. Currently, the entire sequence is 6 units per class. Ph 21 fulfills a requirement for the physics option and Ph 22 counts as physics elective credit. Ph 20 is offered first and second term, Ph 21 is offered second and third term, and Ph 22 is offered third term.

## RESEARCH

Caltech is widely known for its world-class research and you may have come to Caltech to contribute to these research endeavors. Fortunately, with the sheer volume of research at Caltech, there are many ways for undergraduates to get involved. You can do research during the academic year, sometimes for credit or for pay. Some options, like Chemistry and Chemical Engineering, let you use research units towards your option requirements, so check the catalog to see how your option treats research units. Otherwise, you can ask your PI (principal investigator) for pay, which is a cool way to do work study if you have it. If you are unsure what research is happening at Caltech, a great way to get started is to check out the [list of labs looking for undergraduates on the ARC's website](#) or by checking out the [research seminars](#) that happen throughout the year in every department.

Many students will have their first research experience at Caltech. Entering this new exciting world can be intimidating, but the ARC is committed to helping students navigate the research landscape. Recently, the ARC compiled a list of frequently asked questions from students. These questions are addressed on our website at: <https://sites.google.com/site/arccaltech/resources/research-faq>.

The ARC has recently developed an interactive tool to help undergraduates find professors who have expressed interest in taking on undergrads. The listing is actively being updated: <https://sites.google.com/site/arccaltech/resources/interactive-research-list>.

Your frosh advisor can help you navigate the research world or introduce you to other Caltech faculty. In general, you can look up any Caltech professor to learn about their research through the Caltech directory or a quick Google (or Google Scholar) search; if someone's research catches your interest, feel free to reach out to them! *The best way to get involved in research at Caltech is to take initiative.*

Most people start doing research the summer after the frosh year. SURFs (Summer Undergraduate Research Fellowships) are a popular way to get involved, and the SFP (Student-Faculty Programs) office has many resources for [summer research](#), including [how to contact a potential mentor](#). Perks of doing research over the summer include spending more time in the lab. Plus, academic year research often continues into summer research and vice versa. Again, an Announcements of Opportunity page will be made available closer to the summer with research projects by Caltech faculty and JPL staff for SURF research opportunities ([http://announcements.surf.caltech.edu/index.cfm?event=ShowAOPublicList&inFrame&type=SURF&formType=AO\\_CIT](http://announcements.surf.caltech.edu/index.cfm?event=ShowAOPublicList&inFrame&type=SURF&formType=AO_CIT)).

If you are considering pursuing graduate school in the future, getting involved in academic year research or summer research (e.g. through the SURF program) is one of the best ways to test out research and hone your research skills. The SFP office hosts events and scientific communications workshops for SURF students to develop into new scientists and engineers. Note that each lab is different, so just because you didn't vibe with a given lab doesn't mean you won't be able to do research with a different lab.

## Career Fair, interviews, and Internships

Caltech's Career Development Center (CDC) can help you with your job or internship search. The CDC provides walk-in and scheduled one-on-one appointments for general and pre-health career advising. The CDC helps with finding opportunities and work-study positions, mock interviews, and workshops on a wide range of topics from resume building to LinkedIn profiles! Definitely check out the [CDC](#). Additionally, be sure to explore [Next Steps](#), which helps you schedule appointments and apply for positions. We highly suggest working with the CDC office to build your resume during first term for internship and research applications.

Twice a year, the CDC will host career fairs, one in October and one in February. The fairs are open to all undergraduate students, and there is generally pre-registration for the fairs. Hundreds of companies set up booths at the fair, recruiting students for full-time positions and summer internships in a wide variety of fields. If you are interested in working in industry or just looking for experiences in your field outside of academia, the career fair is definitely the place to go. As an added incentive, companies also hand out free swag at their booths! These career fairs have recently been hosted online on platforms like Handshake and Brazen. Upload your resume to Caltech's Simplicity and Handshake job search platforms to get information from companies and recruiters.

At a career fair, students talk to recruiters and hand out resumes. Even if you're a frosh and might not have as much experience, most recruiters are happy to talk to you and often accept your resumes. Local companies are willing to take students with less experience and many larger companies have frosh-targeted internship programs. Even showing interest this early can go a long way when you apply to the company in the future. Some tips for preparation include a good resume and having a 1-minute elevator pitch introducing yourself, showing your prior experience, and showing your interest. Leaving recruiters with a good impression will definitely help in getting contacted by companies. After that, most companies will have interviews potentially involving coding questions (many CS positions), logic puzzles (common for finance), questions about your research and classes (some Biotech companies), and general behavioral questions. Good luck with the job search and feel free to reach out to upperclassmen, recruiters, alumni, and the CDC to prepare!

## FAQ

### **There are pizza classes, menu classes, and freshman seminars. I'm confused!**

All three of these are designed to be fun ways to learn about various different fields, but menu classes are a core requirement while the other two are not. Pizza classes are 1 to 3 units and have a low workload. They generally meet during lunch and are offered throughout the year, although departmental pizza classes are usually offered during specific terms. (Their official name is "frontier classes", but they are referred to as pizza classes because many come with free pizza). Pizza classes usually meet once a week, and every week, different speakers (usually professors) come and talk about their research. Freshman seminars, on the other hand, are first and second term and are generally six units. They are generally laid back compared to other classes and since they are very small, they can be a fun way to get to know a professor. The goal of freshman seminars is to learn about a professor's research and/or new developments in a field in a thorough yet understandable manner for frosh. Lastly, menu classes are third term and are nine units. They often require a good amount of time, but they are designed to expose students to fields they may not have considered. In fact, the menu class you take to fulfill the core requirement has to be outside of your option.

### **Does it matter what section I am assigned to?**

In most cases, no. You are free to attend any section you would like. While you may initially be assigned to a particular section, you can usually switch sections. Students can switch sections for various reasons, for example if the time is more convenient or if they like the teaching style of a particular TA more. The exception to this is Math 1a Section 1 (see above).

### **What is core? What courses do I need to take to graduate?**

Core is the name we give to the general education requirements that all students must take to graduate from Caltech. Most (but not all of core) is completed during a student's frosh year. The best resource for figuring out what classes you need to take is the catalog. If you are confused, you can consult your adviser, talk to upperclassmen, or ask the ARC.

### **If the catalog changes, do I need to meet the new requirements?**

The requirements for your core classes will be the requirements from the catalog you entered with. So, don't put off taking core because it won't change for you! For your option requirements, you may use any catalog requirements released during your time at Caltech. This means that if option requirements change you don't need to worry, as the catalog year you entered under is sufficient. And, if the option requirements change, you can choose to follow either the old set or the new set of requirements. However, you cannot "mix and match" requirements in your option unless you have approval from your option representative.

### **How do prerequisites work?**

Prerequisites for all courses can be found in the course catalog. If you do not meet the prerequisite requirements but still want to take a class, be sure to talk to the instructor and get approval. Prerequisites for most classes are well thought out, and students should be confident that they have the skills/knowledge that the prereqs give before side-stepping them. Even though professors will grant

permission in most cases, you should seriously consider whether you will be adequately prepared. Furthermore, be sure to read the [TQFRs](#) for a class to see whether students who have previously taken it recommend helpful prior classes that are not official prerequisites.

### **What is an elective?**

There are several types of elective requirements at Caltech. Generally, an “elective requirement” is a requirement that can be satisfied by many different courses. “General elective credit” refers to credit that does not satisfy any requirements other than the institute requirement of 486 credits for graduation. “Departmental elective credit” refers to classes taken in a department which are not used to satisfy another requirement in a particular option for graduation. In the case of double-majors, sometimes credit satisfying a specific requirement of one option can be used to satisfy an elective requirement of another. However, this is often not permitted. Be sure to check with both option representatives in order to determine what will happen.

### **Which classes are good?**

This will vary for every individual depending on your option and interests. Ultimately, this can only be decided by you at the end of the term. It is best to read the description of the course before enrolling in it and talk to the professor listed for it if you have any concerns.

Two ways to evaluate the quality of a class is by looking at TQFRs and by talking to upperclassmen, *although, remember that their opinions are only that—opinions*. Be particularly wary of upperclassmen’s opinions on a course if the professor listed is different from the one they had. It can often be helpful to look at multiple years of TQFRs to get a better idea of what the class is usually like. As always, feel free to check in with the ARC about any questions you might have.

### **Which classes have the heaviest and lightest workloads?**

You can find this information yourself on the [TQFR website](#). Generally, you should be able to estimate how much time each course takes by the units. However, some classes give more work than the units predict (we call this under-united) and others less (over-united). In general, HSS courses tend to be over-united and option requirements tend to be under-united.

### **Are you required to take at least one humanities class for all three terms of frosh year?**

While no one enforces when you take them, it is highly recommended that you take your two frosh hums during your frosh year, as you will not be able to register for advanced humanities classes until you have done so. Keep in mind that you will have to take 12 humanities/social science classes to graduate, which averages to one a term during your four years at Caltech. If you put off your frosh hums you will have to double up on HSS courses in subsequent years. (See the [HSS flow chart](#)).

### **Do language classes count toward your Advanced Humanities requirement?**

No, they do not. But they do count towards the 36 units of “additional HSS” classes you need. (See the [HSS flow chart](#)).

### **Is it easy to change classes once term starts? Would you get behind if you switch into a class?**

It is advantageous to add the course sooner rather than later to avoid getting behind. If you’re unsure about a class, you can audit the class and then add the class before add day, and you still have until drop day to drop the class (see the [Dropping/Adding Classes](#) section for more information).



**How do I request an extension?**

If you need a one-off extension, reach out to the prof or head TA for the class, explaining the circumstances. In cases of disabilities or extenuating circumstances, you should register with [CASS](#) (Caltech Accessibility Services for Students). If you are having trouble with CASS assistance in your classes, please reach out to us and we will put you in contact with the appropriate people.

# 2023 - 2024 ARC Roster

To email any rep, add @caltech.edu to the email username given on the last row of each entry.

## Chair

Alex Burr  
Biology  
Class of 2024 (Venerable)  
aburr

## Secretary

Jena Alsup  
Computer Science  
Class of 2026 (Lloyd)  
jalsup

## Avery Rep

Akshar Ramkumar  
Math  
Class of 2026  
aramkuma

## Blacker Rep

Alicia Zhang  
Computer Science  
Class of 2025  
axzhang

## Dabney Rep

Annika Viswesh  
Computer Science  
Class of 2026  
aviswesh

## Fleming Rep

Aidan Hamner  
Mechanical Engineering  
Class of 2026  
ahamner

## Lloyd Rep

Catherine Deng  
Electrical Engineering  
Class of 2025  
cdeng

## Page Rep

Robert Morgan  
Physics  
Class of 2026  
rbmorgan

## Ricketts Rep

Gigi Pistilli  
Chemistry  
Class of 2026  
vpistill

## Venerable Rep

Lynn Yang  
Information + Data Science  
Class of 2024  
lynnyang

## At-Large Rep

Kevin Gauld  
Electrical Engineering  
Class of 2024 (Lloyd)  
kgauld

## At-Large Rep

Ritvik Teegavarapu  
Applied Computational Math  
Class of 2026 (Bechtel)  
rteegava

## At-Large Rep

Sidd Ojha  
Applied Computational Math  
Class of 2026 (Fleming)  
sojha

## At-Large Rep

Sascha Goldsmith  
Mechanical Engineering  
Class of 2025 (Blacker)  
sgoldsmi

## At-Large Rep

Jeb Brysacz  
Applied Computational Math  
Class of 2025 (Page)  
jbrysacz

## Emeritus Chair

Gabriella Twombly  
Computer Science  
Class of 2024 (Fleming)  
gtwombly