

# College of Engineering

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Carnegie Institute of Technology (CIT), the engineering college of the university, has three main activities - undergraduate education, graduate education, and research. Its continuing goal has been to maintain excellence in all these activities. The degree to which this goal has been achieved is attested to by the demand for its graduates, the success of its alumni, the quality of its students and faculty, the adoption elsewhere of its innovations, and the national and international recognition it receives in educational and research activities.

The college offers the degree of bachelor of science in chemical engineering, civil engineering, electrical and computer engineering, mechanical engineering, and materials science and engineering. All of these programs are accredited by ABET, <http://www.abet.org>.

An engineering student may also choose to pursue a minor in one of the CIT designated minor programs, or a double major in engineering and public policy or biomedical engineering, or to design a minor, additional major or dual-degree programs with other non-engineering departments.

## Educational Objectives

The overarching objective of our engineering curriculum is to provide our students an education that enables them to be productive and fulfilled professionals throughout their careers. Our more specific, measurable objectives for graduates of our engineering curriculum are the following:

- Graduates recognize that they acquired a high quality, rigorous technical education from the College of Engineering at Carnegie Mellon.
- Graduates, in addition to their technical knowledge, recognize that they have acquired a broader body of knowledge that allows them to understand the larger context of the problems that they must address during their career.
- Graduates use their technical foundation and their broader base of knowledge to be successful in a diverse collection of individual careers inside and outside of the engineering profession.

From its earliest days, Carnegie Institute of Technology (CIT) has considered undergraduate education to be the key element in the development of future leaders. In this regard, CIT has adopted a plan for education that is designed to equip students with the capacity to learn and to continue the process of self-education throughout their lives. The present curriculum incorporates this philosophy by providing the opportunity for both breadth in a number of engineering, science, humanities and fine arts areas as well as depth in a major area of concentration. To achieve these goals, our flexible curriculum has been designed to allow students to customize their program to suit their needs and to help each student acquire:

- A thorough and integrated understanding of fundamental knowledge in fields of a students' major interest and the ability to use this knowledge;
- Competence in the orderly way of thinking, which professionals and scientists have always used in reaching sound, creative conclusions, with the goal that after graduation the student can, by such thinking, reach decisions both as a professional and as a citizen;
- An ability to learn independently with scholarly orderliness, so that after graduation the student will be able to grow in wisdom and keep abreast of the changing knowledge and problems of the profession and the society in which he or she participates;
- The philosophical outlook, breadth of knowledge, and sense of values which will increase the student's understanding and enjoyment of life and enable each student to recognize and deal effectively with the human, economic, ethical and social aspects of professional problems; and
- The ability to communicate ideas to others in a comprehensive and understandable manner.

The curriculum encourages students to confront professional problems, accomplished through team and problem-oriented courses, as well as courses which emphasize design or individual projects. These classes stress creativity and independent thought and require the student to define the problem, propose a solution or a design in the presence of technical and socioeconomic constraints, to make judgments among alternative solutions, and to explore innovative alternatives to more conventional solutions.

## First Year for Engineering Students

The Carnegie Mellon engineering education is based on engineering and science fundamentals that give students the skills to face new and challenging situations. The first year in engineering provides a broad foundation upon which students build a curriculum in their eventual major. Since students in CIT do not select a major until the end of the first year, all first year students share a common experience consisting of introductory courses in the engineering majors (one each semester), calculus, physics, other science courses which compliment specific introductory engineering courses, and courses in the College of Humanities and Social Sciences (General Education). This curriculum helps make an informed decision about a final major. Below is an examples of a standard schedule for a first-year engineering student.

Introductory Engineering Elective	12
Restricted Technical Elective	9-12
Differential and Integral Calculus	10
General Education <sup>5</sup>	9
Computing @ Carnegie Mellon	3
Introductory Engineering Elective	12
Restricted Technical Elective	10
Integration, Differential Equations, Approximation	10
General Education Course <sup>5</sup>	9

Notes:

1. Each semester every CIT department offers its Introductory Engineering Elective.\* Every first year CIT student must select one such course each semester.
2. Each Introductory Engineering Elective requires a specific Restricted Technical Elective (as a pre- or co-requisite) as given below:

Introductory Engineering Course	Restricted Technical Elective
Biomedical Engineering	03-121
Chemical Engineering	09-105
Civil & Environmental Engineering	33-141
Electrical & Computer Engineering	15-110 or 15-112
Engineering & Public Policy	33-141
Mechanical Engineering	33-141
Materials Science & Engineering	33-141

3. Restricted Technical Electives include the following courses:

		Units
03-121	Modern Biology	9
09-105	Introduction to Modern Chemistry I	10
15-110	Principles of Computing	10
or 15-112	Fundamentals of Programming and Computer Science	
33-141	Physics I for Engineering Students	12

4. All students must complete 33-141 Physics I for Engineering Students by the end of the first year. Therefore, if a student chooses to take Introduction to Chemical Engineering (with 09-105 as a co-requisite) during one semester and Introduction to Electrical and Computer Engineering (with 15-110 as a co-requisite), the student must take 33-141 in place of the General Education requirement in the Spring semester of the first year and take the General Education course in a subsequent semester. Alternatively, a student entering the university with AP credit in a required first year course may substitute 33-141 in its place.
2. Interpretation and Argument, 76-101, should be completed in the first year. Some students for whom English is not a native language, may have to take 76-100 first.

## General Education Programs

### Program in General Education for CIT students for the Classes of 2016 - 2020

The environment in which today's engineering graduates will find themselves working is evolving rapidly. Technical innovation is becoming ever more critical to retaining

a competitive edge. This is true for individuals, for firms and for nations. Start-ups, as well as established companies, have significant international opportunities but also face more competition in a global economy. Seizing these opportunities and dealing with the associated challenges requires an understanding of the global context in which engineers work, as well as understanding multi-disciplinary approaches to technological innovation across cultures.

The College of Engineering has developed General Education Requirements designed to ensure that our students are ready to work effectively in the global economy, and become the innovators and leaders of tomorrow.

Complete the following requirements to graduate (72 units):

- 76-101 Interpretation and Argument (some students may need to take 76-100 first)
- One course from the following list:

73-230	Intermediate Microeconomics	9
84-104	Decision Processes in American Political Institutions	9
85-102	Introduction to Psychology	9
79-104	Global Histories	9

one other PPC or SDM course (defined below) or a 100-level Modern Language course

Students must complete each of the categories (descriptions of categories follow below) **\*\*This is a 9-unit requirement. Any course taken on this list that is below 9 units must be combined with an additional course to total at least 9 units in order to complete this requirement.\*\***

**\*Note that the units from one course cannot be split to count for two General Education categories (eg PPC and General Education Elective)**

- Innovation & Internationalization (I&I)**
  - 9 units from the I&I list of courses (which could be two 4.5 unit courses);
- Peoples, Places, and Cultures (PPC)**<sup>1</sup>
  - 9 units from the PPC list; or a 9-12 unit course in a modern language at the 200+ level (Students can receive exemption through an approved study abroad program. These students would have three General Education Electives to complete instead of two.)
- Social Analysis and Decision Making (SDM)**
  - 9 units from the SDM list of courses (which could be two 4.5 unit courses)
- Writing and Expression (W&E)**
  - 9 units from the W&E list of courses (in addition to 76-101)
- General Education Electives (2 total)**
  - At least 18 units (any combination) from the four categories: I&I, PPC, SDM or W&E, or \*non-technical academic courses from the Dietrich College or the College of Fine Arts excluding those listed on the CIT website under General Education Exclusions (<https://engineering.cmu.edu/education/undergraduate-programs/curriculum/general-education/exclusions.html>).

## Experiential Learning (EL)

- 6 EL points by participating in a variety of approved activities in the following timeframe:
  - 2 points sophomore fall semester (39-210)
  - 2 points sophomore spring semester (39-220)
  - 2 points junior fall semester (39-310)

\* A list of acceptable courses to complete these requirements is available at the CIT website, under General Education Requirements (<https://engineering.cmu.edu/education/undergraduate-programs/curriculum/general-education/non-dietrich-cfa-courses.html#undefined>).

## General Education Category Descriptions

### People, Places and Cultures (PPC)

PPC courses are designed to help you gain better understanding of the diversity of the world in which we live, and the way in which societal factors interact to shape that world.

### Social Analysis and Decision Making (SDM)

SDM courses are focused on helping you to gain an understanding of different ways in which individuals and societies approach and make decisions.

### Innovation and Internationalization (I&I)

I&I courses are intended to provide a broad perspective regarding the creation of pioneering ideas and their outcomes in a global context.

### Experiential Learning (EL)

Being curious and constantly looking for inspiration are critical parts of lifelong learning. To be successful as an engineer and as a citizen, your education must not stop when you graduate from Carnegie Mellon. The EL requirement aims to encourage a habit of lifelong learning about innovation and the growing internationalization in engineering and, indeed of many other aspects of the modern world. The goal of this requirement is to help inspire the habits of being open to new ideas as successful, innovative engineers.

To do that, during both semesters of your sophomore year, and the first semester of your junior year, we require you to choose a few related activities that are not part of your formal course work. Examples could include:

- Attending approved seminars and then submitting a one page write up of your thoughts on what you heard;
- Participating in one of the "country courses" or other weekend courses that the University runs; or
- Holding an official leadership position (eg President, Vice President, Secretary, Treasurer) in a Carnegie Mellon sponsored organization

## Program in General Education for CIT students for the Classes of 2021-later

**All requirements remain the same as above except for the following changes:**

76-101 Interpretation and Argument (some students may need to take 76-100 first)

\* Another possibility is 76-102, which is an advanced Special Topics in Writing course that is by invitation only for select students.

### General Education Electives (3 total)

At least 27 units from any non-technical academic courses from the Dietrich College or the College of Fine Arts excluding those listed on the General Education Exclusions page (<https://engineering.cmu.edu/education/undergraduate-programs/curriculum/general-education/exclusions.html>). Courses from this list of non-technical courses outside of the Dietrich College or the College of Fine Arts (<https://engineering.cmu.edu/education/undergraduate-programs/curriculum/general-education/non-dietrich-cfa-courses.html#undefined>) may also be counted. **A maximum of 18 units of these units may be fulfilled via AP/IB/Cambridge exam credit.**

For category course lists reference the CIT General Education website (<https://engineering.cmu.edu/education/undergraduate-programs/curriculum/general-education>).

## Additional Majors and Dual Degrees in CIT

A major is defined as a program that must be completed for the granting of a degree.

Additional majors comprise a single degree with majors in two separate areas; for example, the degree of Bachelor of Science in Chemical Engineering and an additional major in English. Although the additional major requires the completion of two designated programs, they may have overlapping requirements that can be met simultaneously. The general principle used to measure eligibility for a Carnegie Institute of Technology additional major is that the major (core) requirements of both departments must be completed. Finally, although the student is formally enrolled as an undergraduate in one of the departments (the parent department, which is responsible for scheduling and other administrative actions for the student), the student should apply for the additional major through the second department and coordinate requirements with both departments.

The additional major is to be distinguished from a dual degree program, which results in two separate bachelor's degrees; for example, Bachelor of Science in Chemical Engineering and a Bachelor of Arts in English. The dual degree, though, requires a minimum of 90 units of work in addition to the units required for the first degree. The second degree may be earned in Bachelor of Science or Bachelor of Arts degree programs.

### Requirements for students wishing to complete Additional Majors in CIT

Note: This applies to all students.

The student must satisfactorily pass all requirements of the regular and complete program (with the permissible exceptions) leading to a degree in CIT. The minimum number of units required for the additional major is the number required by the parent department or major.

The student takes and satisfactorily completes the courses specified by a second department, usually using elective space available in the first program.

The second department, on the basis of the specified number of courses plus the courses comprising the parent department's regular degree requirements, then certifies that the student has completed the requirements for a major in the second department.

Equivalent technical electives may be substituted at the discretion of the departments/colleges.

Non-technical courses in the curricula can be used to meet the requirements of the second major. But if the second major is not an H&SS department, the program must include a minimum of 72 units of General Education courses to meet CIT requirements for graduation.

## Designated Minors Offered by CIT

### (for engineering students)

Undergraduate students in the Carnegie Institute of Technology (CIT) can elect to complete an interdisciplinary Designated Minor in addition to their primary major. Designated minors have been added to the curriculum to provide the student with technical elective content in areas related to the research expertise of our faculty. Students may select a designated minor from the following list:

- Additive Manufacturing
- Audio Engineering
- Automation and Control
- Biomedical Engineering\*
- Colloids, Polymers and Surfaces
- Electronic Materials
- Environmental Engineering and Sustainability
- Global Engineering
- Manufacturing Engineering
- Material Science and Engineering
- Mechanical Behavior of Materials
- Robotics\*

\* Also available for non-CIT students

Complete descriptions of the designated minors can be found at Undergraduate Designated Minors in CIT (<http://coursecatalog.web.cmu.edu/carnegieinstituteoftechnology/undergraduatedesignatedminors>).

To declare a CIT Designated Minor, please contact the director listed for each minor.

## Minors for Non-Engineering Students

Students in a non-engineering discipline can also declare certain CIT minors:

- Biomedical Engineering
- Engineering Studies
- Technology and Policy
- Robotics

A full listing of curriculum for these minors when taken by non-engineering students can be found at CIT Minors for Non-Engineering Students (<http://coursecatalog.web.cmu.edu/carnegieinstituteoftechnology/minorsfornonengineeringstudents>).

## Academic Standards

### Grading Practices

For undergraduate grading regulations, please see Undergraduate Academic Regulations (<http://coursecatalog.web.cmu.edu/servicesandoptions/undergraduateacademicregulations>).

### CIT Dean's Honor List

Each semester, Carnegie Institute of Technology recognizes students who have earned outstanding academic records by naming them on the dean's honor list. The criterion for such recognition is a semester quality point average of at least 3.75 while completing at least 36 factorable units and earning no incomplete grades.

### Transfer into CIT Departments

Undergraduate students admitted to colleges other than CIT who wish to transfer into a CIT department during their first year should consult with an advisor in the Office of Undergraduate Studies in the CIT Dean's Office. Students admitted to CIT but

excluded from certain departments must also consult with the CIT Dean's Office if they wish to transfer into a restricted CIT department.

First-year students can apply for transfer after mid-semester grades for the spring semester have been posted. At that time, a decision will be based on availability of space and the student's academic performance.

CIT undergraduate students beyond the first year wishing to transfer into another CIT department may apply if they are in good academic standing and if there is room in the department of their choice. If the demand for any department exceeds the space available, then the department will admit students based on a comparative evaluation of all applicants at the end of each semester, up to the limit of available space.

Undergraduate students not in CIT who wish to transfer into a CIT department beyond the first year will be considered for transfer on a rolling space available/academic performance basis.

Criteria for all applicants include space in the department, good academic standing, and successful completion of or being currently enrolled in at least one introductory to engineering course (minimally the one of the target major), the appropriate science corequisite, math (21-120, 21-122) and Physics 1 (33-141, 33-111, or 33-131).

Procedure for transfer of students from another university into CIT departments: A student first applies through the Office of Admission. If the Office of Admission believes the applicant is acceptable, the student's record is sent to the appropriate department for evaluation and a decision on acceptance. The CIT department head has the right to refuse to accept the student if there are space restrictions and/or if the student's chance for success in the CIT department is determined to be questionable based on past academic performance.

### Academic Actions

In order to maintain good academic standing, CIT students must attain at least minimum quality point averages for each semester (as well as cumulatively) and also maintain adequate progress toward completing graduation requirements. Minimum quality point averages for good academic standing are 1.75 each semester in the freshman year and 2.00 thereafter. "Adequate academic progress towards graduation" generally means that students are successfully completing approximately 45-55 units per semester so that at the end of eight semesters they will have accumulated the minimum units required for graduation, have a cumulative QPA of at least 2.00, and have completed all degree requirements.

When a student fails to meet minimum performance criteria, it normally results in an academic action. Depending on the circumstances, one of the following actions is taken: academic probation, continued probation, suspension, or drop. These academic actions are recommended by the college's departments, based on the guidelines described below, and adjudicated by the CIT Undergraduate Studies Office. However, the sequence of the academic actions is not automatic in all cases. Decisions may be based on unique individual student performance and circumstances, and are not determined solely on the basis of grades and quality point averages.

#### Probation

A student is on academic probation when performance either for the semester or cumulatively fails to meet the minimum standard. The term of academic probation is one semester, and signifies to the student the college's insistence that academic performance return to at least the minimum acceptable level. A student is removed from academic probation and returned to good academic standing when both the semester and cumulative quality point averages meet at least the stated minimum, and when adequate academic progress\* toward completing graduation requirements is being made.

A first-year student who earns fewer than 27 units per semester, or who has a semester grade point average below 1.75 for either the first or second semester will be placed on academic probation\*.

A student in the third or subsequent semester, who earns fewer than 27 units per semester or fewer than 108 units over three consecutive semesters (excluding summers) or who has a semester grade point average below 2.00 will be placed on academic probation\*.

#### Probation Continued

A student who is currently on probation but whose record indicates that the standards are likely to be met by the end of the next semester may be continued on probation at the discretion of the associate dean.

#### Suspension

A first year student on probation, who earns a semester grade point average below 1.75 or completes less than 27 units for that probationary semester will be suspended\*.

A student on probation in the third or subsequent semester, who earns a semester grade point average below 2.00, fewer than 27 units per semester for that probationary semester or fewer than 108 units over the last three consecutive semesters (excluding summers) will be suspended\*.

The typical period of academic suspension is two semesters, during which a student on academic suspension is expected to reflect on the circumstances leading up to the suspension, identify the issues that prevented achieving academic success, take

actions that address these issues, demonstrate sufficient readiness to return to the university and successfully resume his or her studies. These actions could include a work or internship experience and/or a limited amount of approved academic course work at another college or university.

Two months prior to the end of that suspension period, a student may petition to return to school (on probation) by completing the following steps:

- Writing a formal petition, requesting to return and receiving permission in writing from the CIT associate dean for undergraduate studies.
- Completing a Return from Leave of Absence form from Enrollment Services; and
- Providing transcripts and clearance forms if the student has been in a program at another college or university even though academic credit earned may not transfer back to Carnegie Mellon unless prior approval from the Associate/Assistant Dean is given.

### Drop

The most severe academic action occurs when a student is dropped from the college, and is not permitted to re-enroll. This normally results when a student, already on final academic probation, continues to perform at levels below the minimum set by the college for good academic standing, and does not show indication of being able to reach an acceptable level of performance or maintain adequate academic progress toward completing graduation requirements. It is also an option when, in unusual cases, a student has performed poorly, and has been unresponsive to outreach efforts by college and/or university offices seeking to offer help and support.

\*Note: students with accommodations approved by the Disability Services Office, the Counseling and Psychological Services Center or the Dean of Student Affairs may petition for an exception to adequate academic progress rules.

Students who are suspended, dropped, take a leave of absence or withdraw are required to vacate the campus (including residence halls and Greek houses) within a maximum of two days after the action and to remain off the campus for the duration of the time specified. This action includes debarment from part-time or summer courses at the university for the duration of the period of the action.

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### Graduation Requirements

To be eligible to graduate, undergraduate students must complete all course requirements for their department with a cumulative Quality Point Average of at least 2.0 for all courses taken. For undergraduate students who enrolled at Carnegie Mellon as freshman and whose freshman grades cause the cumulative QPA to fall below 2.0, this requirement is modified to be a cumulative QPA of at least 2.0 for all courses taken after the freshman year. Note, however, the cumulative QPA that appears on the student's final transcript will be calculated based on all grades in all courses taken, including freshman year. Some departments may have additional QPA requirements in order to graduate. Students are encouraged to confirm all graduation requirements with their academic advisor.

1. All mathematics (21-xxx) courses **required\*** for the engineering degree taken at Carnegie Mellon must have a minimum grade of C in order to be counted toward the graduation requirement for the BS engineering degree.
2. A minimum grade of C must be achieved in any required mathematics (21-xxx) course that is a pre-requisite for the next higher level required mathematics (21-xxx) course.

#### **\*Elective mathematics courses are not included in this policy**

Students must be recommended for a degree by the faculty of CIT.

A candidate must meet the residence requirement of having completed at least 180 units at Carnegie Mellon University.

Students must meet all financial obligations to the university before being awarded a degree.

Modification of Graduation Requirements: A student may seek permission to modify graduation requirements by petition to the CIT College Council.

### Other Regulations Affecting Student Status

#### Schedule Changes

Add/drop procedure information and grading procedures for dropped courses can be found under Undergraduate Academic Regulations (<http://coursecatalog.web.cmu.edu/servicesandoptions/undergraduateacademicregulations>).

#### Course Add Deadline

The last date to ADD courses is stipulated for each semester on the university calendar - about two weeks after the beginning of a term. This applies to all courses with the following exception: the final date to add half-semester mini-courses is the last class day of the first week of the course.

#### Course Drop/Withdraw Deadline

CIT undergraduate students may **drop** a course on-line on or before the deadline published in the official university calendar. This deadline is two weeks after mid-semester grades are due in The HUB. The deadline to drop a half-semester mini course is the last day of the fourth week of the mini course. When a course is dropped by the deadlines, the course is removed entirely and disappears from a student's academic record. After the official university deadline to drop, undergraduate students may **withdraw** from a course on-line on or before the last day of classes, excluding final examinations. The deadline to withdraw from a half-semester mini course is the last class day of the mini course. When a student withdraws from a course between the official university deadline to drop a course and the last day of classes, a "W" (Withdrawal) is assigned as a grade, which appears on the student's academic record. This "W" grade does not affect a student's QPA.

CIT undergraduates who are registered as full time students as of the tenth class day are expected to remain full time for the duration of a semester. Full time is defined by being registered for a minimum of 36 factorable units. Students may not drop or withdraw from courses that will reduce their factorable units below 36 unless there are extenuating circumstances for which they obtain approval from the CIT College Council. Undergraduates who are registered as part time (those carrying fewer than 36 factorable units) as of the 10th class day are also subject to the above deadlines to drop or withdraw from a course.

Exceptions to the regulations above will be granted only upon approval of a petition to the College Council.