

Computer Engineering

**Computer Systems and Electrical
Engineering Concentrations**

Ph.D. Graduate Handbook

2018 - 2019

MANUAL OF THE Ph.D. DEGREE IN
COMPUTER ENGINEERING

ARIZONA STATE UNIVERSITY

2018 – 2019

<http://cen.engineering.asu.edu>

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Introduction to the Computer Engineering Program

Computer Engineering (CEN) is a multi-disciplinary program that builds on the fundamentals of Computer Science, Electrical Engineering, Applied Mathematics, and Physical Sciences. Graduates of this program will have the knowledge and skills necessary to advance the design, system integration, testing, evaluation and deployment of the state-of-the-art hardware and software for systems that include computing, communications, and networking (wired and wireless), control functions, sensing, and signal processing and actuation.

The Ph.D. program is intended for students with excellent skills in mathematics and physical science that are interested in gaining an in-depth knowledge of the foundational principles of engineering, as they pursue a career in academia, research or highly technical entrepreneurial innovation. The Ph.D. program provides a broader and more in-depth preparation than the M.S. program, in anticipation of a demonstrated ability to independently pursue more creative and substantive innovation with higher impact.

Objective of the handbook

The purpose of this handbook is to provide guidance and information related to admission, degree requirements, and general policies and procedures. Please note that in some cases you will find differences between the Graduate College's Policies and Procedures and the Computer Engineering (CEN) Program requirements. In these cases, CEN has established higher standards. Students must satisfy both sets of requirements. Please note that policies and procedures are occasionally amended to improve the program. Changes will be communicated to students via email and posting on the paper and CEN online website.

Student responsibility

All students are expected to become familiar with the university and the program policies and procedures and abide by the terms set forth. Information is available online. Most importantly, you should visit the following websites:

- [Graduate College](#)- visit the section on policies and procedures.
- [The Schedule of Classes](#)
- [The Computer Engineering Program](#)
- [The International Student and Scholars Center](#) if applicable.
- [The Ira A. Fulton Schools of Engineering](#)
- Maintain [academic integrity](#) standards per the [ASU Student Code of Conduct](#)

Faculty responsibility

The members of the faculty of Computer Engineering have diverse backgrounds and knowledge. They are available to guide you in your plan of study and your educational and career goals. We encourage you to take the opportunity to make individual appointments with faculty members with whom you have common interests. Please refer to the list of the faculty names, areas of expertise, and research interest on the [Computer Engineering website](#).

Admission and eligibility to the doctoral degree program

The Computer Engineering doctoral degree requires a background in computer engineering, computer systems engineering, electrical engineering, and computer science. However, in some cases, students with non-traditional educational backgrounds will be considered for admission. These students may be required to take fundamental courses to prepare them for the program coursework better. A student is encouraged to contact a graduate advisor in the respective concentration Advising Center to obtain advice on their educational pursuits.

Eligibility

A minimum of a bachelor's degree (*or equivalent*) or a graduate degree from a regionally accredited College or University of recognized standing in STEM fields

Application

All students are required to submit an application with Graduate Admission and pay the required fee to have their application properly processed.

Application deadlines - December 31 for Fall and August 15 for Spring. To receive full consideration, we ask that you have all the required documents submitted by the deadline. Students can apply through the [Graduate Admission application portal](#). To receive full consideration, we ask that you have all the required documents submitted by the deadline.

GRE scores

Students who have obtained a degree where the School/College has an [ABET accredited](#) bachelor's program are not required to take the GRE.

Students, who do not meet these requirements as outlined, will be required to take the GRE. The average GRE scores for students admitted into the PhD program have been 151 on verbal, 165 on quantitative, and 3.5 on analytical. We do not require specific subject GRE scores. The ASU institution code is 4007. If department code is required use 0000.

English Proficiency

The University requires all international applicants from a country whose native language is not English to provide the Test of English as a Foreign Language (TOEFL), the International English Language Testing System (IETLS), or the Pearson scores. This program strongly recommends scores of at least 575 (paper-based) or 90 (internet-based) TOEFL, 7 for IELTS, or Pearson 65 as a minimum expectation for admission.

Note that your application will not be processed until the university receives official scores, which are valid two years from the start date of the degree program. If a student has completed coursework in the US, they can contact Graduate Admission to see if they qualify for a waiver. Please address all TOEFL questions to Graduate Admissions. The ASU institution code is 4007. If department code is required use 0000.

Personal statement

The application must include a personal statement. The statement should: 1) explain professional goals and reasons for desiring to enroll in the doctorate program; 2) describe any research experiences; 3) indicate personal research interests, and 4) identify two or three ASU [CEN faculty](#) with matching research interests.

Letters of recommendation

CEN requires three (3) letters of recommendation, at least one of which must come from former faculty. There is no standard form for letters of recommendation. Our current application process allows students to indicate the names and emails of their recommenders. In turn, Graduate Admission sends an e-mail to the recommender alerting him or her to go online and submit a recommendation. We encourage letters from people who know you well, such as teachers, professional associates, and supervisors. Ask people who can comment on your academic, emotional, intellectual and professional development.

GPA requirement

A minimum of a 3.00 cumulative GPA (scale is 4.0=A) in the last 60 hours of a student's first bachelor's degree program. A minimum GPA of 3.0 is required in the MS/MSE work for acceptance into the Ph.D. program.

Application evaluation

Several factors are taken into consideration when evaluating a student's application including but not limited to the student's cumulative GPA, major, institution, personal statement, letters of recommendation, standardized test scores, performance in individual courses, skills, and research experience.

Recommended Academic Preparation

Computer Engineering graduate students should know the following topics before applying for the program at Arizona State University: Computer Architecture & Organization, Algorithms & Data Structures, Digital Signal Processing, Digital VLSI, Discrete Math, and Random Signal Analysis. Additional prerequisites may be required these recommended courses,

ASU Recommended Courses

- CSE 230 – Computer Organization and Assembly Language Programming
- CSE 310 – Data Structures and Algorithms
- EEE 203 – Signals and Systems I
- EEE 350 – Random Signal Analysis
- MAT 243 – Discrete Math Structures

Notice of Admission

Computer Engineering submits its recommendation of admission to Graduate Admission. The final notice of admission decision is posted by Graduate Admission on [MyASU](#).

Pre-admission Credits

Please refer to Graduate College's policies and procedures.

Transfer Credit

Only approved graduate-level CEN area courses taken at ASU can be applied towards the CEN Mandatory Concentration Degree Requirement. Up to 30 credits can be applied towards electives for students who already obtained a graduate MS degree from a regionally accredited College or University of recognized standing in a related field, such as Computer Engineering, Computer Systems Engineering, Electrical Engineering, and Computer Science. Degrees obtained in fields other than mentioned here, will have to be evaluated and approved by the Program Chair and the Office of the Graduate College. Please consult with your area academic advisor to get the process started **after** matriculating in the CEN program.

Doctoral degree requirements

Degree requirements for the Ph.D. include a minimum of 84 semester hours beyond the bachelor's degree and deficiency courses. Students are allowed up to 30 credit hours from a previously awarded master's degree to count towards the degree requirements for the doctoral program, if approved by the student's supervisory committee and the Program Chair.

The Ph.D. is comprised of four major milestones, which all students are required to pass successfully before graduation.

- Filing an approved Plan of Study
- Completion of the core, area, and elective coursework along with research and dissertation credits.
- Passing the Comprehensive Examination and obtain approval of the dissertation prospectus to advance to candidacy.
- Successful oral defense of an approved written dissertation.

Core courses

There are 6 credit hours required core courses for the MS in Computer Engineering

- CSE 551 – Foundations of Algorithms (3)
- EEE 554 – Random Signal Theory (3)

All students are required to take the core courses, CSE 551 Foundations of Algorithms and EEE 554 Random Signal Theory in their first two semesters. Students in the Computer Systems Concentration (CEN-CS) are required to take CSE 551 in their first semester. Students in the Electrical Engineering Concentration (CEN-EE) are required to take EEE 554 in their first semester. These courses have a pre-requisite of CSE 310 for CSE 551 and EEE 350 for EEE 554. If students are deficient in CSE 310 or EEE 350, they may choose to take these concurrently with the core courses. CSE 310 and EEE 350 will not count towards degree requirements.

CEN Area courses

Total credits hours for program area courses:

- For PhD students with previously awarded MS degree, minimum of 12 credit hours.
- For PhD students with no master's degree, minimum of 24 credit hours.

The five (5) area courses in the graduate Computer Engineering program are listed in the table located on the [CEN handbooks website](#). These courses will be referred to as Computer Engineering Area (CEN-Area) courses.

- At least 6 credit hours of graduate-level CEN area courses covering two (2) of the five (5) areas must be taken.

The five (5) areas of study are:

- 1) Autonomous Systems and Robotics (ASR)
 - 2) Communication and Networks (CN)
 - 3) Distributed, Dependable and Secure Systems (DDSS)
 - 4) Multimedia and Signal Processing (MSP)
 - 5) VLSI, Architecture, and Embedded Systems (VAES)
- **Concentration requirement is met by taking the correct prefix courses from the CEN Area course list for your degree concentration.**
 - CEN-CS Concentration: 9 credits CSE or CEN and 3 credits EEE or CEN
 - CEN-EE Concentration: 9 credits EEE or CEN and 3 credits CSE or CEN

Elective Courses

6-24 credits of electives selected from an approved list of elective courses or CEN Area Courses. The combined set of area courses and elective courses should be selected to ensure the student has adequate preparation to pursue research in the selected area of the thesis.

- No more than 6 hours of 400-level coursework can be included on the graduate student program of study.
- No more than 12 hours of combined courses (4XX/5XX) can be included on the graduate student program of study.
- No more than a total of 12 hours of a combination of 400-level and combined courses (4XX/5XX) can be included on the graduate student program of study.
- If a 400-level course is combined with a 500-level course, CEN students will be required to enroll in the 500-level course.
- All 400-level and combined (4XX/5XX) courses count towards elective credits.

Reading and Conference (CEN 790)

Up to 6 credits of Reading and Conference (CEN 790) can be taken with a limit of 3 credit hours of CEN 790 per semester.

Research credits (CEN 792)

12 to 18 credit hours of Research (CEN 792)

Dissertation credits (CEN 799)

12 credit hours of Dissertation (CEN 799)

Internship courses do not count toward the degree 84-credit requirement.

Masters in Passing

The CEN program awards a master in passing (MIP). The master's in passing will be the MS in Computer Engineering (appropriate concentration). Students are eligible for a master in passing who are actively pursuing the Ph.D. who do not have a master's degree or are not bringing in any of their prior master degree into the PhD program. A student must take and pass the PhD Comprehensive Exams (written and oral) for the MIP culminating experience.

To obtain the MIP degree, the student must file the "master's in passing form" with the academic advisor, complete the MS iPOS, and file for graduation. The application form is available on the website: <https://graduate.asu.edu/forms>.

Formulation of Plan of Study

During their first semester of study, each student must formulate and submit an official plan of study (iPOS) which will be reviewed for approval by the CEN Program Chair. The plan of study should satisfy the degree requirement as described in this handbook. Coursework completed that is not listed in the approved course list or has not had a prior approval may not count toward a student's degree requirements if the coursework does not satisfy the degree requirements as described in this handbook.

The plan of study may be amended as the student progresses through the program with the approval of the student's faculty advisor and the CEN Program Chair.

Courses with grades of "D," "E," "W," and "I" cannot be included on an iPOS and should be replaced with another course or complete the course with the grade is "I" within one year from the date the grade is posted.

A check sheet can be found on the CEN website as a guide when creating the iPOS. The check sheet must be submitted to the advising office for approval along with the electronic submission of the iPOS. Students should consult this handbook for detailed information about degree requirements and their submitted iPOS must satisfy the degree requirements as described in this handbook.

Supervisory Committee

During the first semester in the Ph.D. program, the student must select a faculty advisor who has the right to chair from the Computer Engineering Program Graduate Faculty. The list of faculty members is available at [CEN Website](#) and Graduate College.

At least one semester before taking the Comprehensive Examination, the student must form a graduate supervisory committee. The chair of the committee will be the Ph.D. faculty advisor who directs the student's research program. The role of the supervisory committee is to provide guidance and direction for the student's educational and research plan. As such, the committee must have the necessary expertise to guide and evaluate research in the proposed dissertation area. A minimum of four committee members is required, including the committee chair or two co-chairs. The committee chair or one of the co-chairs must be a Computer Engineering Graduate Faculty member with the right to chair. At least two members must be CEN Graduate Faculty members. The fourth member can be a CEN Graduate Faculty member or a member outside the CEN Graduate Faculty. The supervisory committee must be approved by the CEN Program Chair and by Graduate College before taking the Comprehensive Examination.

Comprehensive Exam and Dissertation Prospectus

A student must pass a comprehensive examination and the prospectus defense before being formally admitted to candidacy for the Ph.D. The examination is administered by the student's graduate supervisory committee after the student has essentially completed coursework. The student must have an approved formal plan of study before taking the exam. The exam is typically completed in the 3rd year or the 6th semester of study at ASU for Ph.D. students with a previously awarded MS degree, and by the 4th year or the 9th semester of study at ASU for Direct Ph.D. students.

The comprehensive examination will be given by the four members of the supervisory committee. The comprehensive examination will consist of a written part and an oral part. Once the written part is approved by the chair or co-chairs of the supervisory committee, the student must schedule the oral presentation and must submit the written part to the supervisory committee 10 working days in advance of the oral presentation. The written part will be composed of a background paper on the area of research, and includes the current status of this area, a summary of work the student has already done, and a thesis proposal (dissertation prospectus). The oral part will be an examination on the contents of the paper in general and thesis proposal in particular. The oral portion consists of a presentation which is open to the public and a closed session with the committee members.

The student is required to bring a Doctoral Comprehensive Examination form available on the Computer Engineering website to the oral examination. Following completion of the exam, the completed Doctoral Comprehensive Examination form must be returned to the student's assigned advising staff to be given to the CEN Program Chair.

Should a student fail the examination, the advisory committee will decide if and when a retake of the examination is possible. A reexamination may be administered as early as three months and no later than one year from the date of the original examination. Only one retake is allowed.

The student will be granted doctoral candidacy by Graduate College immediately after passing the comprehensive exam and successfully defending the dissertation prospectus.

The final committee-approved version of the dissertation prospectus (thesis proposal) that is included in the written part, is a binding agreement between the student and the supervisory committee and will be enforced by the CEN Program. Satisfactory completion of the research as outlined in the prospectus will result in an approved dissertation. Following approval of the written dissertation by the supervisory committee chair, the student must schedule and pass a final oral defense.

Dissertation and Oral Defense

A student is expected to become an active participant in a research program during the first semester of study in the PhD program. Research leading to a dissertation is performed under the direction of the supervisory committee. The candidate must register for a total of at least 12 - 18 credits of Research (CEN792) and 12 credits of Dissertation (CEN799). Credits for Research (CEN792) will be graded with options of, E, Z, or Y. A grade of Y indicates satisfactory progress and is at the discretion of the dissertation advisor. Such a grade may later be changed to a letter grade or left on the permanent record. The Y is the usual grade for Research. The Z grade is typically used for Dissertation (CEN799) credits until you complete your dissertation defense. When the dissertation is satisfactorily completed, a grade of Y is given for successful completion of the dissertation and for passing the oral dissertation defense. If a student does not complete the dissertation, the dissertation advisor may assign a failing grade of E for CEN799.

Students are required to submit at least one paper based on the dissertation research to a CEN-related refereed journal before the final examination. They are strongly encouraged to present a conference paper(s) on their work during the course of the research. These publications are normally jointly written with the advisor and other appropriate faculty.

Upon completion of the dissertation, the student must successfully defend it by passing the oral defense. The defense can be scheduled as early as receiving the candidacy. In addition, once the dissertation is approved by the chair or co-chairs of the supervisory committee, the student must submit the dissertation to Graduate College for format review at least 10 calendar days before the oral defense date. No exceptions to this rule will be made. In addition, the dissertation must be delivered to all committee members at least 10calendar days before the oral defense. The oral defense must be scheduled through Graduate College **10 working days in advance**. The PhD Dissertation Chair and the committee will receive an electronic copy of the pass/fail form from Graduate College.

The student is required to bring a list of archival publication form available on the Computer Engineering website to the oral examination. The publication form must be signed by the PhD committee and returned to the student's advising staff to be given to the CEN Program Chair. The pass/fail form should be submitted to Graduate College following the instructions they provided.

Successful dissertation defense of the dissertation fulfills the CEN 799 grading requirement.

Steps to Preparing for Your Defense

Detailed instructions can be found on the [Graduate College](#) website.

Prior to defense

1. Obtain a consensus of approval from the committee chair and the committee members to proceed with the oral defense.
2. The chair or one co-chair must be physically present at the defense. If this is not possible, the defense must be rescheduled. The student cannot submit a committee change after the defense is scheduled.
3. A minimum of 50% of the student's official committee must be physically present with the student at the defense. If at least 50% of the committee cannot be physically present, the defense must be rescheduled.
4. Schedule a date and time with your committee for the oral defense.
5. Visit the Graduate College website to familiarize yourself with the dates and deadlines on format approval.

10 calendar days prior to the defense

Submit a draft of the dissertation to Graduate College following the instructions on the [Graduate College](#) website.

10 working days prior to the defense

These steps are required to be completed prior to 10 working days from the date of oral defense.

1. Reserve a room for your defense. Contact your respective concentration advising center for help with room reservation. CS Concentration students please contact Monica Dugan on the CIDSE 5th floor. EE Concentration students please contact ECEE graduate advisor.
2. Submit an electronic version of your abstract with title, full names of your committee members, defense date/time/place, and your name as you want it to appear on the defense announcement to your respective concentration to the individual scheduling the room reservation.
3. Schedule your defense through your MyASU (my.asu.edu) defense tab.

On the day of the defense

Set-up all your equipment at least one half-hour prior to your presentation to make sure they work.

After the defense

1. Your committee will have comments and a discussion with you. At the end, the committee makes a recommendation: Pass, Pass with minor revisions, Pass with major revisions, or Fail.
2. You must be registered for at least one credit hour of graduate level coursework each semester until the final submission of your thesis. Revisions must be completed within one year from the date of the defense.
3. After you have passed the defense and/or completed all required revisions, your committee chair should sign part D on your Pass/Fail e-form.
4. Upload your thesis online through ProQuest.

General Information

Research standards for publication of the dissertation

Graduate research is the study of an issue that is of sufficient breadth and depth to be publishable in a CEN-related journal. The effort should reflect a minimum of 1,500 hours of thoughtful work for a dissertation (Ph.D.). The research should follow the 'scientific method' and thus be both objective and reproducible. The dissertation should demonstrate independent, original, and creative inquiry. There should be predefined hypotheses or developmental goals and objectives that are measurable and can be tested. The document should demonstrate proficiency in written English and should conform to Graduate College format guidelines. For more information on format guidelines, please visit the [Graduate College website](#).

Financial assistance and fellowships

The Computer Engineering Program's goal is to provide support to all incoming Ph.D. students. According to the student's academic performance and past academic research, funding offers will be extended to individual students with the highest academic achievements. We encourage students to highlight their past academic achievements in their statement and their resume.

Continuous Enrollment and Leave of Absence Policies

Once admitted to a graduate degree program, graduate students must be registered for a minimum of one credit hour of graduate-level coursework (not audit) during all phases of their graduate education. This includes periods when they are engaged in research, working on or

defending a thesis, taking comprehensive exams, or in any other way using university facilities or faculty time including the term in which they graduate. This credit must appear on the iPOS or must be an appropriate graduate-level course (e.g., CEN795 Continuing Registration). Courses with grades of “W” and “X” and Incomplete (changes to permanent incomplete grade after one year) are not considered valid registration for continuous enrollment purposes.

Students planning to discontinue enrollment for a semester or more must request approval for a leave of absence. Students may petition Graduate College for a leave of absence for a maximum of two semesters during their entire program. A petition for a leave of absence must be endorsed by the CEN Program Chair, the committee chair for MS Thesis students, and must be approved by Graduate College. This request must be filed and approved before the anticipated absence.

An approved leave of absence will enable students to re-enter their program without re-applying to the university. Students who do not enroll for a fall or spring semester without an approved leave of absence by Graduate College are considered withdrawn from the university under the assumption that they have decided to discontinue their program. A student removed for this reason may reapply for admission to resume his/her degree program; the application will be considered along with all other new applications to the degree program. Any previously earned credits are subject to Graduate College’s pre-admission credit policy, and it is not guaranteed that you will be able to use them towards your new admission.

A student on leave is not required to pay fees, but in turn, is not permitted to place any demands on university faculty or use any university resources.

Maximum Time Limit

Doctoral students must complete all program requirements within a ten-year period. The ten-year period starts with the semester and year of admission to the doctoral program. Graduate courses taken before admission that are included on the iPOS must have been completed within three years of the semester and year of admission to the program.

Registration requirements for research assistants (RA) and teaching assistants (TA)

Students awarded an assistantship within the Ira A. Fulton Schools of Engineering are required to be registered for 12 credit hours (no more, no less). Audit credit hours do not count towards the 12 credit hours.

Students who obtain an assistantship outside the Ira A. Fulton Schools of Engineering are required to follow the policy of the unit that hires them.

TAs and RAs are treated as residents for tuition purposes. To be eligible for tuition remission, TAs and RAs must be employed a minimum of 10 hours per week (25 percent Full Time Equivalency {FTE}). TAs/RAs working 10-19 hours per week (25-49 percent FTE) receive a 50 percent remission of tuition for the semester or summer session of their

employment. TAs/RAs working 20 hours per week (50 percent FTE) do not pay tuition during the semester or summer session of their employment. In addition, the university pays the individual's health insurance premium for those TAs and RAs working 20 hours per week (50 percent FTE). The student is responsible for fees other than tuition.

Satisfactory Progress, Academic Probation, Progress probation, and Withdrawal from the CEN Program

Each semester, the Computer Engineering Program reviews students' files for satisfactory progress towards completion of the degree. All students are placed on one of the four categories:

Satisfactory progress

Satisfactory Progress means that the student does not have any academic and progress probationary issues. In addition to the probationary rules, satisfactory progress includes communication each semester with the student's faculty advisor regarding his or her progress.

Academic Probation

Academic Probation pertains to grades that might affect Program and University policies including graduation. The following are notices/letters you will receive if one of these pertains to your academics:

- GPA below 3.0 in approved iPOS courses.
- Overall post-baccalaureate (cumulative) GPA below 3.0.
- Overall graduate (500 level or above) GPA below 3.0.

Progress Probation

Progress Probation pertains to issues dealing with making progress towards a degree. The following are notices/letters, to name a few, a student may receive if one of these pertains to the student's academics:

- Failure to complete core courses within the first year of study
- Failure to pass the Comprehensive Examination or the dissertation prospectus
- Failure to make satisfactory progress towards completing the dissertation, this includes maintaining regular contact with your dissertation committee chair.
- Failure to maintain regular contact with your Dissertation Chair on your research.

Removal from the Program

A student is recommended for removal from the CEN Program if he/she fails to meet the probationary standards placed upon him/her in the semester mentioned in the probationary letter. The student will receive a letter from the Computer Engineering Program explaining the reasons for the removal. The student will have 5 calendar days from the date of the letter to appeal the decision. The Computer Engineering Graduate Programs Committee (GPC) will review the case and will make the necessary recommendation. The Graduate Program Chair, on behalf of the GPC, will provide a written explanation of the outcome. If the outcome is favorable, the student will have to meet all the outlined requirements at the end of the specified period. The student will be required to sign an agreement acknowledging the recommendations and the consequences if the requirements are not met. If the GPC recommends that the appeal is not granted in favor of the student, the Graduate Program Chair, on behalf of the GPC, will recommend to the Dean of Academic Affairs to remove the student from the CEN Program. The Ira A. Fulton Schools Standards Committee reviews the student's case and makes the final ruling to the Associate Dean of Graduate College and the CEN Program. If the appeal is not granted in favor of the student, the Dean of Academic and Student Affairs will recommend to Graduate College to remove the student from the CEN PhD Program. Graduate College makes the final decision to dismiss the student from the program. If the appeal is granted in favor of the student, the Dean of Academic and Student Affairs will recommend to the unit to continue in the program whereby the student will have to meet all the outlined requirements at the end of the specified period.

Academic Integrity

The highest standards of academic integrity are expected of all graduate students, both in the academic coursework and in their related research activities. The failure of any graduate student to meet these standards may result in serious consequences including suspension or expulsion from the university and/or other sanctions as specified in the academic integrity policies of individual colleges as well as the university.

Violations of academic integrity include, but are not limited to: cheating, fabrication, tampering, plagiarism, or aiding and/or facilitating such activities. At the graduate level, it is expected that students are familiar with these issues and each student must take personal responsibility in their work. In addition, graduate students are expected to follow university guidelines related to the Student Code of Conduct. University policies related to academic integrity and code of conduct are available in the [Office of Student Life](#).

CEN 584 Internship (Curricular Practical Training)

Internship (CPT) is an academic experience usually obtained at off-campus work settings, allowing the student to apply knowledge and skills gained in various classes. It is intended as a unique, hands-on learning experience to provide students with some valuable skills that they can use upon graduation from their graduate degree programs. Accordingly, it is not available to full-time or part-time workers regularly employed by the company where the internship is proposed.

The internship (CPT) is available to both domestic and international students. However, international students must work with the International Students and Scholars Center (ISSC) and submit additional documentation to obtain work authorization. Furthermore, international students must include the CPT course(s) CEN 584 (1 credit hour) as an integral part of their Program of Study, reflected in their approved iPOS.

The internship (CPT) experience (up to three 1-credit CEN 584) should occur prior to the students completing the required 84 hours. It is highly recommended that the internship (CPT) course(s) be listed at the initial submission of the student's iPOS during the first semester of study. Each student is required to file an iPOS by the end of his/her first semester of study. An internship course cannot be added to an approved iPOS once all coursework has been completed. Internship (CPT) cannot be the only course remaining in the last semester of study. Later additions of internship (CPT) courses must be requested and approved at least one full semester (fall, spring or summer) prior to the proposed start date of the first internship course. For example, a student planning to do an internship during the summer semester should have an approved iPOS with the internship courses before the beginning of classes in the preceding Spring semester. Exceptions may be made if the internship is relevant to thesis research. The Graduate Program Chair will determine the need for a CPT internship in such cases in consultation with the Graduate Academic Advisor.

International students need to be aware of immigration policies and regulations, which may jeopardize their academic status. Hence, it is strongly recommended for international students to consult with the International Students and Scholars Center (ISSC).

To be eligible for an internship, a student must be in good academic standing and not have an academic integrity violation in a course for two full semesters (summer semesters not included) from the initial reporting of the incident. For example, a sanctioned academic integrity violation initially reported on April 15, 2017, will make the student ineligible for this approval until the end of the Spring 18 semester.

All students (domestic and international) can participate in an out of state or in state internship as full time or part time interns in the summer semester if **ALL**¹ their GPAs are at least 3.0 and they meet the requirements in the preceding paragraph.

Fall and Spring internships are available in-state as part-time. Full-time out-of-state internships are available for students who meet **ALL** the GPA requirements of 3.25.

During the regular Fall and Spring semesters, international graduate students in F-1 status must register for a minimum of nine (9) credit hours to maintain full-time status and be enrolled in a minimum six (6) credit hours of in-person, on-campus coursework at an ASU campus. A maximum of three (3) credit hours of online courses are permitted.

Required documents and forms for the internship proposal must be submitted to the respective CEN concentration advising office two to three weeks before the beginning of the

¹ ALL GPA includes: Plan of study GPA (courses listed in the iPOS), Graduate (500-level) GPA, and CUM GPA (all courses taken after starting post-baccalaureate).

semester in which the internship is planned. Students will not be able to request late-add registration of the CEN 584 Internship credit to their class schedule after the drop/add deadline of each semester.

An approved registration request form and employer letter are required before commencing the internship. The employer letter will include a statement from the employer that indicates they understand that the work is to satisfy a degree requirement. A sample letter and other required forms are available from the respective concentration advising center and are posted on the Computer Engineering website. Students must receive approval from their faculty advisor and the Graduate Program Chair before registering for CEN 584. To register for CEN 584, a student must have a CUM GPA of 3.00 or higher.

[Renege: \(verb\) to fail to carry out a promise or commitment](#)

It is unethical for students to continue to seek or consider other employment opportunities once an offer has been accepted. Never accept a job with the intention of turning it down if “something better” comes along. Not only is it inconsiderate and unprofessional, it also reflects badly on Arizona State University and might negatively impact another ASU student’s opportunities with that employer. Also, employers communicate with each other and you don’t want to get a bad reputation.

After you have given your decision careful consideration and accepted an offer, stop looking. Inform other employers who have extended offers that you have accepted another position. Don’t accept further interview invitations or search further. Please refer to NACE’s [“Playing Fair...Your Rights and Responsibilities as a Job Seeker”](#) to become familiar with Principles for Professional Practice.

CEN Program expects students to honor an acceptance and withdraw from all employment seeking activities. Reneging is grounds for exclusion from CPT and requests for switching employers will not be considered or processed. Students who accept an offer from an organization and later renege the offer will be prohibited from further requesting future CPT pending a meeting with the Assistant Director.

[Required report](#)

A two-page typed minimum final report is required before a grade and credit is given. The final report must be submitted to the internship supervisor for comments and then submitted for evaluation following the instructions on the CEN Forms website.

[Optional Practical Training \(OPT\)](#)

Please visit the International Students and Scholars Center website for details regarding OPT and Pre-OPT. Students must be in good academic standing and have an approved iPOS. A student does (Pre-) OPT at their own risk since if the student doesn’t graduate in the semester

indicated on the iPOS, no letter will be issued by advising to support a later graduation date unless the delay is for reasons beyond the control of the student.

CEN 790 Reading and Conference (Independent Study)

A maximum of 6 credit hours of independent study coursework are available for Ph.D. students. The student must get written approval from the supervising faculty outlining the coverage of the content. The Independent Study form must be approved by the Program Chair and will be placed in the student's file. After completion of the independent study, the student needs to submit a written report to the faculty supervising the independent study. Once the report is approved by the supervising faculty, the report and the independent study grade form need to be submitted to the student's assigned advising staff to be given to the CEN Program Chair for review and approval.

Engineering Student Organizations

Student organizations are excellent opportunities to learn about career possibilities as many of the student groups operate in conjunction with industry professional societies ... get involved today! Please visit the [Engineering Student Organizations](#) website for a list of student organizations you can join.

Instructional Concerns and Course-Related Complaints

Being part of a large university creates opportunities to learn from a diverse instructor population with different teaching styles and modalities for delivering course content. Courses are offered by a diverse set of faculty including those who are research intensive, those whose primary responsibility is teaching, and part-time faculty who are working in the field. Based on enrollment or modality of the offering, faculty may also be supported by graduate student teaching assistants and graders. This diverse higher education delivery platform may differ significantly from the high-school experience, and while it provides an opportunity to expand the student's ability to learn and develop problem-solving skills, concerns and conflicts with requirements and instructors may occasionally arise. CEN students with instructional concerns should review and adhere to the following guidelines for attempting to resolve their issues. First and foremost, keep in mind that the faculty and advising staff are experienced, dedicated educators that are here to help you achieve your educational goals but at the same time they have a responsibility to ensure standards are maintained and student outcomes are achieved before graduation. The university culture recognizes the value of diversity in multiple dimensions as well as the presumption of expertise and academic freedom of the faculty.

Communicate with your Instructor

If you have a difference of opinion with your instructor or teaching assistant (TA) or have concerns about technical or administrative aspects of the course, visit the instructor or TA during office hours or contact them via email (if you cannot visit them during the office hours). Express your concerns clearly and respectfully and ask for help. Be sure to provide succinct information about what you have trouble understanding in the course or your concern. Instructors and TAs are here to help. Please remember that you are responsible for pre-requisite knowledge/skills required for a course and regularly studying the material taught in the course. The teaching staff may not be able to help you with your problem if you lack in the pre-requisite knowledge/skills or have not been keeping up with the course material. As a guideline, you should be spending three hours studying every week for each hour of course credit. Thus, you should schedule 8-10 hours of time each week to devote to each 3-credit course. In addition, make sure to resolve the issues as soon as they occur and maintain all documentation. For example, if the assignment instructions are not clear, get the clarification on the day the assignment is assigned and do not wait until the deadline of the assignment.

If, after communicating with your instructor or TA, you are still having problems in the course, connect with your academic advisor to understand your options moving forward.

Connect with your Graduate Program Chair

If you are unable to resolve the concern after initial contact with the instructor or the TA, and you have met with your academic advisor, you should then connect with the Computer Engineering Program Chair (or the department offering the course). The Graduate Program Chair will confer with the instructor and/or TA to better understand the concern and try to resolve the problem. Please note that before meeting with the Graduate Program Chair you should have made a reasonable effort to meet with the course instructor (not just the TA) and get the issue resolved. When contacting the Graduate Program Chair provides all the relevant details such as the course syllabus, assignment handout, email exchange with the instructor, etc. so that the Graduate Program Chair can promptly act on your concerns. Please be brief and precise in the description of your concerns. In some cases, the Graduate Program Chair would like to meet you. When coming for the meeting, please bring along all the relevant documents.

If the instructional concern is not resolved with the Graduate Program Chair or the department offering the course, contact the Associate Dean of Academic Affairs office for the college offering the course for assistance.

Remain Focused

When faced with instructional concerns, it is important to remain focused on the rest of the course while addressing specific areas that are under review. Be sure to stay connected with your academic advisor if there are any changes in your situation.

NOTE:

- Misrepresentation of facts or disrespectful behavior when confronting your instructor or teaching assistant is considered an academic integrity violation.

- Maintain all documentation.
- Act proactively and promptly.

In Summary, Guidelines for Avoiding Problems

- Be sure you have the necessary prerequisite knowledge before starting a course;
- Attend class and on-line exercises regularly;
- Devote time each week to studying to avoid getting behind;
- Contact the TA (if assigned) or instructor during office hours at first sign of trouble and come prepared to ask precise questions and to explain your difficulty;
- Accept the fact that you grow intellectually and professionally by being challenged and learning to deal with diverse expectations and environments.

Process for Resolving Conflicts in Grading, Course Expectations, etc.

- Contact the TA (if available) or instructor to explain your concern and seek resolution;
- If the TA/instructor has attempted to assist you, but you are still having the academic difficulty that is causing personal stress or hindering your academic success, see your Academic Advisor;
- If the TA/instructor is not responsive or does not provide a legitimate response/accommodation, then contact your Graduate Program Chair;
- If you still feel there is a legal, ethical or procedural violation that is victimizing you, contact the Office of the Associate Dean of Engineering for Academic Affairs;
- Circumventing this process will be considered a violation of professional ethics and protocol.

Appendix I

Computer Engineering graduate program study guide

Computer Engineering graduate students should know the following topics prior to applying for the program at Arizona State University: Discrete Math, Digital Signal Processing, Computer Architecture & Organization, Algorithms & Data Structures, and Random Signal Analysis. For each of the topics, there is a suggested book and list of topics along with suggested Chapters from the book in some cases. Note that a student is free to study from any other relevant book on the subject.

Random Signal Analysis (ASU Course: EEE 350)

Textbook: Yates and Goodman, Probability and Stochastic Processes, second edition, Wiley, 2005.

1. Axiomatic probability
2. Random variables, distribution functions, and density functions
3. Special distributions: Gaussian, exponential, etc.
4. Expectation and variance
5. Multiple random variables
6. Central limit theorem and law of large numbers
7. Maximum-likelihood estimation and confidence intervals
8. Random processes
9. Statistical analysis using sample statistics, histograms, and linear regression

Discrete Mathematics (ASU Course: MAT 243)

Textbook: Discrete Mathematics and Its Applications, Kenneth H. Rosen; Publisher: McGraw-Hill; 7th Ed.

1. Foundations: Logic and Proofs: understand the mathematical reasoning and ability to construct mathematical proofs; mathematical induction. (Chapter 1 & 5)
2. Combinatorial Analysis: ability to solve counting problems. (Chapter 6 & 8)
3. Elementary Number Theory: (Chapter 4)
4. Discrete Probability: fundamentals of probability theory, conditional probability, random variables. (Chapter 7)
5. Graph Theory: basics of graph theory including properties of trees. (Chapter 10-11)
6. Boolean Algebra: basics of Boolean algebra, Boolean functions and their representation, minimization of Boolean circuits. (Chapter 12).

Digital Signal Processing (ASU Course: EEE 203)

Textbook: Signals and Systems by Oppenheim, Willsky, and Nawab. Prentice Hall 2nd edition.

1. Signals: continuous-time and discrete-time; unit step; unit impulse; sinusoids; transformations of the time variable. (Chapter 1)
2. Systems: LTI systems -- linearity, time-invariance, causality, stability; impulse response; convolution (graphical as well as analytical); block diagrams, input-output equations. (Chapter 1, 2)

3. Fourier Transform (FT): calculation of forward and inverse transform of simple signals; use FT properties to determine the FT of a transformed signal; frequency response. (Chapter 4)
4. Discrete-Time Fourier Transform (DTFT): calculation of forward and inverse transform of simple signals; use DTFT properties to determine the DTFT of a transformed signal; frequency response. (Chapter 5)
5. Sampling: converting a continuous-time signal to a discrete-time signal; sampling theorem. (Chapter 7)
6. z-Transform: calculation of forward and inverse transform of simple signals; the region of convergence; properties. (Chapter 10)

Computer Architecture & Organization (ASU Course: CSE 230)

Textbook: “Computer Organization and Design” The hardware-software Interface, by David A. Patterson, and John L. Hennessey, 4th edition.

1. Assembly Language Programming: Understand assembly language, and write assembly language programs for simple problems.
2. Procedure Calling Convention: Know about register conventions, including caller saved, callee saved, argument and return value registers. The student should be able to write procedures and recursive functions in assembly language.
3. Data Representation: Understand the data representation (unsigned, 2’s complement, and floating point) inside the processor, and perform arithmetic operations on them. An understanding of hardware structures to perform these operations will be a plus.
4. Pipelined Processor Design: Understand the working of a single-cycle and pipelined processor. Pipeline hazards, and basic techniques on how to avoid them.
5. Memory Hierarchy: Understand the rationale behind the memory organization, and know how caches operate.
6. I/O: Have a basic understanding of storage and I/O.
7. Advanced Computer Architecture: Be aware of the trends in computer organization and design, including superscalar, multi-threading, and multi-core architectures.

Algorithms and Data Structures (ASU Course: CSE 310)

Textbook: Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 3rd Ed.

1. Basics of algorithm design and analysis (Chapter 1 to 3).
2. Divide and Conquer (Chapter 4)
3. Elementary Data Structure, hash tables (Chapter 10,11)
4. Sorting: Heapsort (Chapter 6), Quicksort (Chapter 7), Radix Sort and Bucket Sort (Chapter 8)
5. Searching: Binary Search Trees. (Chapter 12), red-black trees (Chapter 13.1-4)
6. Dynamic Programming (Chapter 15)
7. Greedy Algorithms. (Chapter 16)
8. Minimum Spanning Tree (Chapter 23)
9. Shortest-Path Problems (Chapter 24-25)
10. Elementary Graph Theory (Chapter 22)
11. String Matching (Chapter 32)
12. NP-completeness (Chapter 34)