

Computer Engineering

**Computer Systems and Electrical
Engineering Concentrations**

MS Graduate Handbook

2019 - 2020

**MANUAL OF THE MS DEGREE IN
COMPUTER ENGINEERING
ARIZONA STATE UNIVERSITY**

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

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Introduction to the Computer Engineering Program

Computer Engineering 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 state-of-the-art hardware and software for systems that include computing, communications, and networking (wired and wireless), control functions, sensing, signal processing, and actuation.

The MS degree program is intended for students that want to gain deeper knowledge beyond the bachelor's degree level and obtain sufficient knowledge for designing and implementing state-of-the-art systems in research and development positions. The program is also appropriate for students contemplating future PhD study and desiring to gain experience in research. MS graduates may work under the direction of scientists and engineers in high tech lab settings, assisting in developing innovative products and systems that require strong foundational knowledge in the underlying sciences and the ability to synthesize and analyze engineering principles as they relate to the development of new computer engineering technology.

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.

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 both online and by hardcopy upon request. 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 MS Degree Programs

The Computer Engineering MS degree requires a background in engineering, sciences or closely related fields. However, in some cases, students with non-traditional educational backgrounds will be considered for admission. These students may be required to take foundational courses to better prepare for the graduate coursework. 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 a related field such as Computer Engineering, Computer Systems Engineering, Electrical Engineering, and Computer Science.

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. 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 M.S. program have been 153 or 63 percentile on verbal, 163 or 88 percentile on quantitative, and 4.0 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 (IELTS), or the Pearson scores. This program requires a score of at least 575 (paper-based) or 90 (internet-based) TOEFL, 7 for IELTS, or Pearson 65 as minimum expectations 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

Applicants must submit a personal statement that indicates professional goals and reasons for desiring to enroll in the MS program.

Letters of Recommendation – (Optional)

If you choose to submit letters of recommendation. The following guidelines are recommended. 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

To be considered for the MS program, we require a minimum of a 3.00 cumulative GPA (scale is 4.0) in the last 60 hours of a student's first bachelor's degree program.

Application Evaluation

Several factors are taken into consideration when evaluating a student's application: the student's cumulative GPA, major, institution, personal statement, letters of recommendation, standardized test scores, and performance in individual courses.

Recommended Academic Preparation

Computer Engineering graduate students should know about the following topics before applying for the program at Arizona State University: Computer Architecture & Organization, Algorithms & Data Structures, Digital Signal Processing, Digital VLSI, and Discrete Math. Additional details on these courses can be found at the end of this handbook in Appendix 1.

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
- MATH 243 – Discrete Math Structures

Notice of Admission

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

Pre-admission Credits and Transfer Credit

Please refer to [Graduate College's policies and procedures](#).

Transferring Between Programs

Students wanting to change between concentrations or change from a Master's to a Ph.D. in Computer Engineering must submit a new application with Graduate Admission. If admitted, Graduate College's pre-admission policy states that a student is allowed to use only twelve graduate-level credits with grades of "B" or better that were not used towards a previous degree. Pre-admission credits must have been taken within three years of admission to the ASU degree to be accepted. Pre-admission credits are evaluated and are subject to approval by the Program Chair and the Graduate College.

4+1 Accelerated Bachelor's/Master's program

Students interested in the 4+1 Accelerated Bachelor's/Master's program can apply with their respective unit and program. Students in the BSE in Computer Systems Engineering program would apply for admission into the MS in Computer Engineering (Computer Systems Concentration) program, and students in BSE in Electrical Engineering program would apply for admission into the Computer Engineering (Electrical Engineering Concentration). Students must have a GPA of at least 3.0 to qualify.

This program requires approval from both the undergraduate and the graduate program to apply to the graduate program. Visit your undergraduate advisor for more information about the application process. Students can share up 9 credit hours between the two programs with an additional 3 credits of pre-admission coursework that can be completed while in the undergraduate side which will later count towards the MS degree. Note: Admission is competitive and meeting the minimum requirements does not guarantee admission to the program.

MS Degree Requirements

A minimum of 30 credit hours of coursework beyond the bachelor's degree and deficiency courses are required to complete the MS degree. All Master's students are required to develop and submit an Interactive Plan of Study (iPOS) through your MyASU page during the first semester at ASU. The iPOS should be developed with the aid of the student's faculty advisor. The CEN Graduate Academic Advisor, acting on behalf of the Graduate Program Chair, will initially advise the student. Students pursuing the non-thesis option will list the Program Chair as their faculty advisor. Students pursuing the thesis option should seek out a faculty member in his or her area of study to serve as an advisor and committee chair.

Summary of Degree Requirements

Six hours of Core courses

- 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, or they can petition to take these in their first semester before taking the core courses.

Twelve Credits of graduate-level CEN Area courses that fulfill the concentration requirement

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

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)

- 6 of the 12 credit hours should be courses covering two (2) of the five (5) CEN areas (CEN areas listed below).
- Concentration requirement
 - 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 from an approved list of elective courses, CEN Area Courses, or any 500 level CSE/CEN/EEE course.

12 credits of electives for Non-Thesis Option

6 credits of electives plus 6-credit CEN 599 - Thesis for Thesis Option.

- Up to 12 credits of approved combined courses (5xx/4xx) and 400 level courses can be taken and these count as electives. Of these 12 credits, 6 of them are allowed to be CSE 4XX. Please refer to the list of approved 5xx/4xx electives that can be found on the [handbook's website](#).
- If a 400-level course is combined with a 500-level course, CEN students will be required to enroll in the 500-level course.
- Up to 3 credits of Reading & Conference (CEN 590)
- All graduate-level CSE, EEE, or CEN courses can be taken as electives

- Other graduate-level Math, Science, and Engineering courses can count as electives if they are on the approved list of electives. Please speak to your advisor if you would like to enroll in a course outside of the CSE or EEE departments.
- Internship courses do not count toward the degree 30-credit requirement

Culminating Experience for MS Non-Thesis Students – Comprehensive Examination

Comprehensive Examination: A comprehensive examination is held once in fall and once in spring. A student must be in good academic standing and have a cumulative graduate grade-point-average (CUM GPA) 3.0 or higher, graduate grade-point-average (500 level courses GPA) 3.0 or higher, 3.0 overall iPOS courses, and completed at least 18 credit hours including the 2 core courses to take the Comprehensive Examination. The Comprehensive exam entails questions on the core courses and might include questions from the pre-requisites of these courses. Details of the comprehensive examination will be communicated to the students in the semester the exam is being administered.

Failing the comprehensive examination is considered final unless the supervisory committee and the head of the academic unit recommend, and the Dean of the Graduate College approves a re-examination. Only one re-examination is permitted. A petition with substantial justification for re-examination, endorsed by the head of the academic unit must be approved by the Dean for the Graduate College before students can take the examination a second time. If the petition is approved, a student is allowed to retake the examination immediately following the period in which the examination was failed. If the student's petition for re-examination is not approved or the student fails the re-examination, the CEN program will recommend to Graduate College to remove the student from the MS program.

Culminating Experience for MS Thesis Students – Written and Oral Defense

A thesis requires a research advisory committee comprised of at least three faculty members including the committee chair. The committee chair must be a CEN faculty member approved to chair a committee. The two additional members are chosen jointly by the committee chair and the student to facilitate the student's research. A least one additional member should be from the CEN faculty. Please refer to the Computer Engineering website for a list of CEN faculty and their research and to the Graduate College website for a list of faculty with the right to chair in Computer Engineering.

The written thesis and a successful oral defense constitute their final examination. A majority pass vote by the student's committee is required to graduate.

Steps to Preparing for Your MS Defense

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

Before defense:

1. Obtain a consensus of approval from the committee chair and the committee members to proceed with the oral defense.
2. Schedule a date and time with your committee for the oral defense.

3. Important: Ensure that a minimum of 50% of the official committee is physically present at the defense. The Chair must be physically present at the defense. If at least 50% of the committee cannot be physically present, the defense must be rescheduled.
4. Visit the Graduate College website to familiarize yourself with the dates and deadlines on format approval.

10 calendar days prior to the defense

Submit the thesis draft 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 before 10 working days from the date of the oral defense.

1. Reserve a room for your defense. Contact your respective concentration advising center for help with a room reservation.
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 advising center.
3. Schedule your defense through your iPOS.

On the day of the defense

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

After the defense

1. Your committee will have comments and a discussion with you. In 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 form.
4. Upload your thesis online through ProQuest.

General Information

Research Standards for Publication of Thesis

Graduate research is the study of an issue that is of sufficient breadth and depth to be publishable in CEN-related journal. The effort should reflect a minimum of 750 hours of thoughtful work for an MS thesis. The research should follow the ‘scientific method’ and thus be both objective and reproducible.

The thesis 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 with 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/or Fellowships

Students interested in funding should contact faculty members to inquire about their funded projects for potential hourly or assistantship positions. We also encourage our students to explore assistantships available outside CEN as well as explore the [Graduate College website](#).

Continuous Enrollment

Once admitted to a graduate degree program or graduate certificate program, students must be registered for a minimum of one credit hour during all phases of their graduate education, including the terms in which they are admitted and graduate. This includes periods when students are engaged in research, conducting a doctoral prospectus, working on or defending theses or dissertations, taking comprehensive examinations, or in any other way utilizing university resources, facilities or faculty time.

Registration for every fall semester and spring semester is required. Summer registration is required for students taking examinations, completing culminating experiences, conducting a doctoral prospectus, defending theses or dissertations or graduating from the degree program.

To maintain continuous enrollment, the credit hour(s) must:

- Appear on the student's Interactive Plan of Study, OR
- Be research (592, 792), thesis (599), dissertation (799), or continuing registration (595, 695, 795), OR
- Be a graduate-level course.

Grades of "W" and/or "X" are not considered valid registration for continuous enrollment purposes. "W" grades are received when students officially withdraw from a course after the drop/add period. "X" grades are received for audit courses. Additionally, students completing work for a course in which they received a grade of "I" must maintain continuous enrollment as defined previously. Graduate students have one year to complete work for an incomplete grade; if the work is not complete and the grade changed within one year, the "I" grade becomes permanent and will remain on the students' transcripts. Additional information regarding incomplete grades can be found at su.edu/aad/manuals/ssm/ssm203-09.html.

Leave of Absence

Graduate students planning to discontinue registration for a semester or more must submit a *Leave of Absence* request via their Interactive Plan of Student (iPOS). This request must be submitted and approved before the anticipated semester of non-registration. Students may request a maximum of two semesters of leave during their entire program. Having an approved

Leave of Absence by the Graduate College will enable students to reenter their program without re-applying to the university.

Students who do not register for a fall or spring semester without an approved Leave of Absence are considered withdrawn from the university under the assumption that they have decided to discontinue their program. Students removed for this reason may reapply for admission to resume their degree program; the application will be considered along with all other new applications to the degree program.

Students with a Graduate College approved *Leave of Absence* are not required to pay tuition and/or fees, but in turn are not permitted to place any demands on university faculty or use any university resources. These resources include university libraries, laboratories, recreation facilities or faculty and staff time.

Maximum Time Limit

All work toward an MS degree must be completed within six consecutive years. The six years begin with the semester and year of admission to the program. Graduate courses taken prior to 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. Non-Thesis CEN students need to register for 3-credits of practicum (CEN 580) research hours during the semester in which they are hired as RA.

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 Removal from the 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 you will receive if one of these pertains to your academics:

- Failure to complete core courses within the first year of study
- Failure to pass the Comprehensive Examination
- Failure to make satisfactory progress towards completing the thesis, this includes maintaining regular contact with your thesis committee chair.

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 MS Program. Graduate College makes the final decision to dismiss the

student from the program. Please refer to the Graduate College website for policies and procedures or contact the graduate advisor in your respective concentration advising center.

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 severe 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. Also, 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 several 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. International students need to be aware of immigration policies and regulations, which may jeopardize their academic status. It is strongly recommended for international students to consult with the International Students and Scholars Center (ISSC). Students will be required to submit the required documentation to obtain work authorization from ISSC.

The internship (CPT) experience (up to three 1-credit CEN 584) must be included as part of the student's Program of Study. 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.

Internship (CPT) should occur prior to the student completing the required 30 hours. CPT cannot be the only course remaining in the last semester of study. An internship course cannot be added to an approved iPOS once all coursework has been completed. 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.

To be eligible for internship all students must be in good academic standing. Please refer to your department's specific policies and procedures for CPT processing.

All students (domestic and international) can participate in an out of state or an in-state internship, full time or part-time in the summer semester if **ALL**¹ their GPA's are at least 3.0.

Students with all GPA's between 3.0-3.24 may participate in an in-state internship part time only in the fall and spring semesters.

Students with all GPA's 3.25 or higher may participate in an out of state or in-state internship, part time or full time in the fall and spring semesters.

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 is permitted.

Internships cannot start before the semester or session students enroll in the CPT credit (CEN 584). For example, if you are interested in doing an internship in the summer semester, you cannot start working until the summer semester officially starts (1st day of classes). Exceptions are given to students who provide proper justification from the company supporting this request.

Internship end dates can be the last day of classes or continue until the day before classes start in the following semester (unless it is the student's final semester - contact your academic advisor). Refer to the [Academic Calendar](#) for semester start and end dates.

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 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.

Renegé: (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. CIDSE and ECEE expect students to honor an acceptance and immediately stop all employment seeking activities.

Never accept a job turns it down if "something better" comes along. Not only is it inconsiderate and unprofessional, but 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

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).

[“Playing Fair...Your Rights and Responsibilities as a Job Seeker”](#) to become familiar with Principles for Professional Practice.

Students who accept an offer from an organization and later renege the offer will be prohibited from requesting future internship opportunities 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 590 Reading and Conference

A maximum of 3 credit hours of CEN 590 is allowed on the iPOS. The student must complete the Reading and Conference form with the help of the supervising faculty and get written approval from the supervising faculty outlining the coverage of the content. The Program Chair must approve the Independent Study form 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 supervising faculty approves the report, 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 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 prior to 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 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 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 documentations.
- 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 an 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 prospective student information and study guide

Computer Engineering graduate students should know about 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 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; 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)