

**Computer Engineering**

**Computer Systems and Electrical  
Engineering Concentrations**

**MS Graduate Handbook**

**2018 - 2019**

MANUAL OF THE MS 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 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 in order to have their application properly processed.

### Application Deadlines

December 31 for Fall and August 15 for Spring. Students can submit the application 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 (IETLS), or the Pearson scores. This program requires a score of at least 575 (paper-based) or 90 (internet-based) TOEFL, 7 for IETLS, 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 have knowledge in the following topics prior to 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 credits with grades of "B" or better from the original program to the new program. However, petitions to the pre-admission policy will be considered on a case-by-case basis.

## 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 advisor and committee chair.

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

Students can apply to participate in the 4+1 Accelerated Bachelor's/Master's 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 are able to 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 guaranteed admission to the program.

## Summary of Degree Requirements

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

### Area courses that fulfill the concentration requirement

12 credits of graduate-level CEN area courses that fill 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

12 credits of electives for Non-Thesis Option and 6 credits of electives plus 6-credit thesis for Thesis Option with electives selected from approved list of elective courses or from CEN Area Courses

- 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 [handbooks 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

MS Non-Thesis Students need to complete a Comprehensive Examination for their culminating experience.

**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 over all iPOS courses, and completed the 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.

A student who fails the comprehensive examination must petition for re-examination and receive approval from the CEN Graduate Program Committee (GPC), CEN Program Chair, and the Vice Provost for Graduate College before the date of the examination. If the petition is approved, a student is allowed to retake the examination one time only in the test period 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

MS Thesis Students need to complete a master's thesis for their culminating experience.

MS students writing a thesis require 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.

For MS Thesis students, the thesis and a successful oral defense constitute their final examination. A majority pass vote by the student's committee is required.

## Steps to Preparing for Your MS 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. Schedule a date and time with your committee for the oral defense.
3. Important: Ensure that a minimum of 50% of the official committee be 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 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.
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 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 properly.

### *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. If you have revisions, you must submit a copy of the Thesis Defense Report Form (Pass/Fail form) to Graduate College within 10 working days of the defense. A copy of the Pass/Fail form should be submitted to the advising office as well.
3. 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.
4. After you have passed the defense and/or completed all required revisions, your committee chair should sign part D on your Pass/Fail form.
5. 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 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 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., CEN595 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

All work toward a 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 thesis, this includes maintain 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 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 a number of 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 30 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).

In order to be eligible for 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) participate in an out of state or in state internship as full time or part time interns in the summer semester if their GPA is at least 3.0 and they meet the requirements in the preceding paragraph. Students with a 3.25 GPA may participate in an out of state or in state internship as part time or full time interns in the fall and spring semesters. Students with a GPA between 3.0-3.24 may participate in an in state internship as a part time intern 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.

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

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 from the Graduate Program Chair before registering for CEN 584. In order to register for CEN 584, a student must have a CUM GPA of 3.00 or higher.

### Reneges

Reneges: (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 withdraw from all employment seeking activities. Students who accept an offer from an organization and later renege/decline 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 590 Reading and Conference

A maximum of 3 credit hours of CEN 590 are 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 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 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 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 are having 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 provide 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 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 have knowledge in 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. 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)