ELECTRICAL ENGINEERING & COMPUTER SCIENCE
UNIVERSITY OF MICHIGAN

Computer Science Program- Engineering

For students who matriculate into CoE Fall 2012 or later.
Fall 2012 – Summer 2016 Guide

Welcome!

Thank you for your interest in the EECS Department's Computer Science program in the College of Engineering. The fast rate of innovation in computer technology has created many new and exciting opportunities for students with Computer Science undergraduate degrees. Employment opportunities include positions in: software development, game design, medicine, computer graphics, security, business management, consulting, computer systems analysis, data communications administration, robotics, artificial intelligence, knowledge engineering, hardware development, and many others. Major employers of recent graduates include many prominent U.S. corporations and research laboratories, such as Amazon, Apple, AT&T, Boeing, Cisco, Deutsche Bank, Electronic Arts, Facebook, Google, IBM, Intel, Microsoft, NASA, PricewaterhouseCoopers, and many others. In addition, an undergraduate degree in Computer Science provides opportunities for masters, doctoral, and professional studies in various fields.

Computer science is an exceptional field. Computers have been around for only 60 years while most other scientific disciplines have been around for centuries. Progress in computer science has been extraordinarily rapid during this period, and computers have had a profound impact on society. (Can you envision life without text messaging, social networking, and Wifi?) Computer science research has provided much of the intellectual foundation and creative energy that fueled that transformation, and it continues to be an extremely exciting field.

Computer Science - College of Engineering (CS-Eng) Declaration Requirements

To declare a major in CS-Eng, you must be a College of Engineering student and:

(1) Have completed at least one full term at UM Ann Arbor
(2) Have an overall UM GPA of 2.0 or better in courses taken at the UM Ann Arbor campus and be in good standing
(3) Have completed or earned credit by exam or transfer for at least one course in each of these categories:
    a. Calculus (e.g. Math 115, 116, 156)
    b. Calculus-based physics lectures (e.g. Physics 140, 160) or chemistry lectures (e.g. Chem 130)
    c. Required engineering courses (Engr 100, 101, 151)

If you are interested in declaring a CS-Eng major and do not meet these requirements, please schedule an appointment with the CS-Eng Chief Program Advisor (CPA) to discuss your situation.

Getting Advice and Information

If you are a CS-Eng Major or considering becoming one, we recommend that you **see a CS-Eng Faculty Advisor** every semester, even if you know what courses you want to take. There may be options or constraints of which you are unaware. Frequent meetings with an advisor will help ensure that you get the most out of your education here and that there are no surprises when you apply for your diploma. You can schedule an advising appointment online through our website.

Check the EECS Advising web page for information about registration procedures, course offerings, book lists, time schedules, advising hours, and career information. You may also e-mail the CS Undergraduate Program Coordinator or the CS-Eng Chief Program Advisor at **csengadvisor@umich.edu**.

Computer Science Undergraduate Advising Office, 2808 BBB Bldg., ugadmin@eecs.umich.edu, (734) 763-6563.
EECS Undergraduate Program website: **http://www.eecs.umich.edu/eecs/undergraduate**.

This document covers rules and advice for the CS-Eng program for Fall 2012 – Summer 2016. Your program is determined by the rules that were in effect when you entered the College of Engineering. If you entered the College of Engineering before Fall 2012, you are covered by a different set of rules.

THIS DOCUMENT DESCRIBES THE COMPUTER SCIENCE PROGRAM REQUIREMENTS FOR STUDENTS IN **THE COLLEGE OF ENGINEERING**

EECS offers two paths to an undergraduate degree in Computer Science: one for students in the College of LS&A (CS-LSA) and another for students in the College of Engineering (CS-Eng). For more information, please see http://www.eecs.umich.edu/eecs/undergraduate/cs_lsa_vs_engr.html

(Fall'12-Sum'15) Computer Science- Eng
CS-Eng & CoE Program Requirements & Grade Policy

College of Engineering Core Requirements

1. Engineering 100, and [Engineering 101 or Engineering 151]
2. Chemistry 125, Chemistry 126, Chemistry 130 or Chemistry 210, Chemistry 211
3. Physics 140, Physics 141, Physics 240, Physics 241
4. Math
    a. Math 115 or Math 120 (AP)
    b. Math 116 or Math 121 (AP)
    c. Math 214 (can also be satisfied with Math 217, Math 417 or Math 419)
    d. Math 215 or Math 216 (If both Math 215 and Math 216 are taken, Math 216 will be counted as a Flexible Technical Elective.)
5. Intellectual Breadth: 16 credits to include 3 credits of Humanities/"HU" and 3 credits of Upper-level (300+). These two requirements can overlap. The 16 credits cannot include more than 4 credits of PCDC (Professional & Creative Development) courses.
6. General Electives: 15 credits are required.

Computer Science in Engineering Program Requirements

1. **Program Core:** All of the following courses are required:
    a. Computer Science: EECS 203 (or MATH 465/565), EECS 280, EECS 281, EECS 370, EECS 376, EECS 496
    b. Probability and Statistics: STATS 250 or STATS 412 or STATS 426 or EECS 301 or EECS 401 or IOE 265. Note that IOE 265 is generally open only to undeclared or IOE students. *Dual major/dual degree students, see dual majors document (2808 BBB) for possible substitutions.*
    c. Technical Communications: TCHNCLCM 300

2. **Technical Electives:** A minimum of 26 additional credits of technical electives are required (27 credits if the course used for the CS MDE is 3 credits):
    a. At least 16 of these credits must be in approved *Upper Level CS Technical Electives* (a list of approved courses can be found later in this document). Students are encouraged to take more than the minimum of 16 credits.
    b. The remainder of the technical elective credits may be chosen from the approved *Flexible Technical Electives* (a list of approved courses can be found later in this document). These are courses in engineering, mathematics, or science that are approved as appropriate for CS students.

3. **Major Design Experience (MDE):** The MDE is a capstone design project taken during one of your final two semesters. It is comprised of three courses, which must be taken concurrently in the same semester.
    a. A CS MDE design project course: EECS 441 or EECS 467 or EECS 470 or EECS 481 or EECS 494 or EECS 497. If a 3-credit CS MDE course is selected, students need to take a total of 27 credits of Technical Electives. Students who are interested in using a non-CS course for their MDE requirement need to meet with a Faculty Advisor for permission (note: these students will need at least 18 credits of CS coursework among their Technical Electives).
    b. Computer professionalism: EECS 496
    c. Writing and oral presentation: TCHNCLCM 497 (TCHNCLCM 496 will also be accepted.)

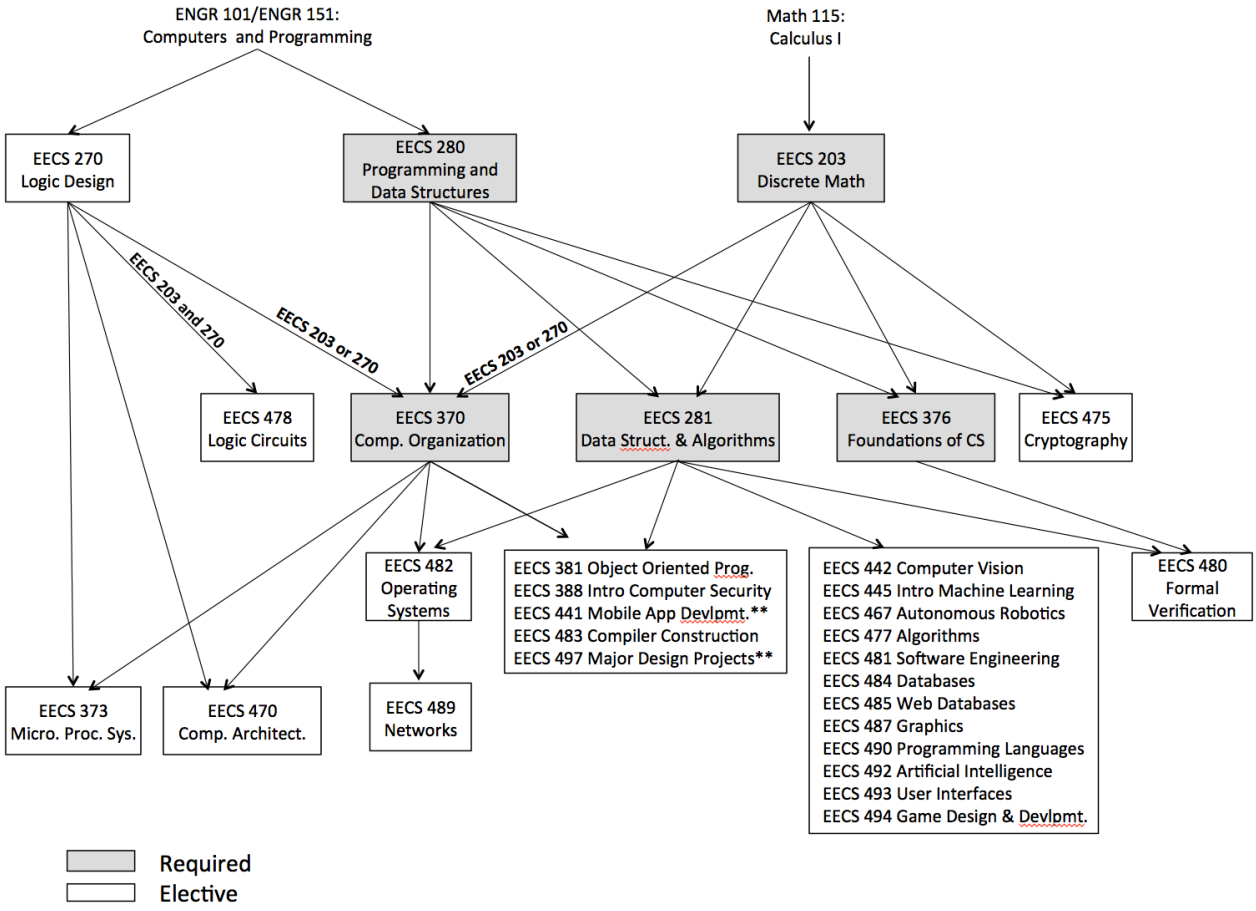
EECS Grading & Repeat Policies

A grade of C- or below in any of the College Core, Program Core, or Technical Electives is considered a failing grade and the course must be repeated or substituted with another. [Note: Grades of C- through D- are acceptable for Intellectual Breadth requirements or for Free Electives.] Students are limited to attempting each of the three 200-level courses (EECS 203, EECS 280, EECS 281) at most twice. An attempt includes, but is not limited to, a notation of any letter grade ("A-F"), withdraw ("W"), Pass/Fail ("P"/"F"), Transfer ("T"), or Incomplete ("I") posted on your U-M transcript. At most one attempt from Summer 2014 and earlier will count against this limit. Exceptions to this rule can be granted by the CS-Engineering Chief Program Advisor *only in extraordinary circumstances.*

Sample Schedule

To view a sample schedule on how to complete the CS-Eng bachelor's degree in 4 years, visit: http://advising.engin.umich.edu/coe-sample-schedules/.

(Fall'12-Sum'15) Computer Science- Eng
Prerequisite Chain and College Policies



***EECS 441 and EECS 497 also require successful completion of at least 4 credits of ULCS prior to electing one of these courses.*

College of Engineering Policies

Intellectual Breadth: The courses that count toward the Intellectual Breadth requirements are complex and not always intuitive. If you have questions, please contact the EECS Undergraduate Advising Office. See the CoE Bulletin for details. http://www.engin.umich.edu/college/academics/bulletin/ug-ed/reqs [Note that **Test Credit for Foreign Languages** (AP credits and credits by exam) at the 100-level count only as free electives.]

Dual degrees: To earn a dual degree within Engineering, you must satisfy the requirements for both programs and take at least 14 additional credit hours of pertinent technical electives beyond either major (142 credits total). You can double count requirements across degrees, but the 142-credit minimum must be maintained.

Pass/Fail is only allowed for Intellectual Breadth requirements and free electives. You may take at most 2 courses pass/fail per term (1 during Spring or Summer half-terms) and at most 14 credits total. This can be a good way to maintain a good GPA during difficult semesters.

Transfer credit: The College of Engineering maintains a list of approved transfer courses from many other institutions at **http://www.engin.umich.edu/transferdatabase**. Courses that do not appear on this list may still transfer but will need to be reviewed. *You must take 50 credits hours (including 30 hours of 300-level or above of technical credits) on the Ann Arbor campus.*

(Fall'12-Sum'15) Computer Science- Eng
General Advice

Mental Health: If you're feeling stressed, depressed or just need someone to talk to, there are many places to find support on campus: www.rackham.umich.edu/student_life/health_and_wellness/resources/mental_health/

Information from Friends: Your friends can be a very good source of information on certain topics, like the workload in courses they have taken. However, they can be a very unreliable source of information when it comes to details of program and college requirements. For specific questions about program requirements, always check with the advising office rather than relying on word of mouth.

Directed / Independent Study and Research: Only 4 hours of directed/independent study or research courses (total across all depts., i.e. EECS, IOE, Civil, etc.) can count toward Flexible Technical Electives. EECS 499 is only open to seniors; sophomores & juniors should consider EECS 399 (counts as general elective credit if taken prior to Fall 2014; counts as Flexible Technical Electives if taken Fall 2014 or later, up to 4 credits).

Course Sequencing and Workload: How many EECS classes should I take simultaneously? We periodically ask students about the workload associated with CS classes, and the survey results are available at http://www.eecs.umich.edu/eecs/undergraduate/survey/. Survey results are summarized below. However, note there is considerable variance for courses because different students are challenged by different aspects of courses (writing complicated programs, understanding mathematical concepts, etc.).

Extremely heavy (average workload > 3 on 4 point scale): 373, 381, 467, 470, 482, 494
Heavy (2.5-3 on 4 point scale): 281, 442, 445, 477, 483
Moderate (1.75-2.5 on 4 point scale): 203, 280, 370, 376, 388, 441, 475, 478, 481, 484, 485, 487, 489, 492, 493, 497
Light (1-1.75 on 4 point scale): 183, 285, 496

CS courses can be very demanding relative to many courses at the University, so we advise students to avoid overloading themselves. For most, a load of 2 CS courses in the same semester is normal, but that can vary based on the combination of CS courses chosen (e.g., a CS course with an extremely heavy load should only be paired with one of moderate load or less), and what non-CS courses are being taken at the same time. Students with questions should talk with peer and faculty advisors about the course load they are considering.

EECS 203 & EECS 280: Taking EECS 203 (Discrete Structures) and EECS 280 (Programming) simultaneously often works well, and these are the prereqs for the "gateway" course, EECS 281 (Data Structures & Algorithms).

EECS 281: Take EECS 281 as soon as you can. This is the "gateway" course to all Upper Level CS Courses.

EECS 270 & 370: Many students say that EECS 270 (which counts as a CS Flexible Tech Elective), makes EECS 370 easier. Others say that the 203 prerequisite is good enough and don't want to use a flexible technical elective on 270. You will probably get more out of 370 by taking 270 first, but this is not required.

TCHNCLCM 300 is a prerequisite for TCHNCLCM 497. The TechComm Dept. handles TCHNCLCM courses. Please visit http://techcom.engin.umich.edu/ for more information.

Majoring in Computer Science at UM provides many exciting opportunities…

Research: A great deal of leading-edge academic research is carried out at UM. If you show that you can do the work, you can get involved in this research as an undergraduate, which will provide you with extraordinarily valuable training for future work in the field. http://www.eecs.umich.edu/eecs/undergraduate/research/undergrad-research.html

Teaching—Become an Instructional Aid: The discussion sections for EECS 183, EECS 280, and ENGR 100 (CSE-based) are led primarily by undergraduates. As a section leader, you will have the chance to teach the next generation of CSE majors and get them excited about computing.

Mentoring—Become a Peer Advisor: Share your experiences with other undergraduates. If you are interested, check in with the CSE Undergraduate Advising Office. Opportunities are available at the department and college level, as well as with numerous student groups on campus.

Getting Involved—Join an EECS Student Group: Enhance your undergraduate experience and resume by joining a student group: http://www.eecs.umich.edu/eecs/students/Student_Organizations.html

Getting Experience—Internships, Co-ops, and Job Opportunities: Many companies hire students for internships upon completion of EECS 281 (for some, even after EECS 280!). You can view current CS intern & job opportunities on our UG website, http://www.eecs.umich.edu/eecs/undergraduate/index.html, through the Engineering Career Resource Center (ECRC), http://career.engin.umich.edu, or through the **September and January Career Fairs,** http://career.engin.umich.edu/studalums/career-fairs/.

(Fall'12-Sum'15) Computer Science- Eng
CS Technical Electives

Discuss your elective choices with an EECS faculty in your area of interest or a CS advisor. Courses that have been approved as a CS MDE design project courses are highlighted in **bold** in the lists below. Note: An EECS course may only count towards one requirement- either ULCS or MDE, not both.

Upper-Level CS (ULCS) Electives
You must take at least 16 credits of Upper-Level CS (ULCS) Electives from the list below. All technical elective credits can be CS Technical Electives, and we encourage students to take more than the minimum. Any credits you earn in ULCS courses beyond the minimum 16 will count toward your Flexible Technical Electives requirement.

373	Design of Microprocessor Based Systems
381	Object-Oriented and Advanced Programming
388	Introduction to Computer Security
427	VLSI Design I
442	Computer Vision
445	Introduction to Machine Learning
467	**Autonomous Robotics**
470	**Computer Architecture**
475	Introduction to Cryptography
477	Introduction to Algorithms
478	Logic Circuit Synthesis and Optimization
480	Logic and Formal Verification
481	**Software Engineering**
482	Introduction to Operating Systems
483	Compiler Construction
484	Database Management Systems
485	Web Database and Information Systems
487	Interactive Computer Graphics
489	Computer Networks
490	Programming Languages
492	Introduction to Artificial Intelligence
493	User Interface Development
494	**Computer Game Design and Development**

Flexible CS Technical Electives
The following courses are approved as Flexible CS Technical Electives (flexible technical electives in other fields are on the next page). This list includes many courses at the graduate level (numbered 500 and above). Students with interests in research, graduate school, or specific areas should discuss graduate course options with the Chief Program Advisor, who may approve graduate courses on a per-student basis for use as ULCS (approval must be obtained prior to registering for the course).

270	Introduction to Logic Design
285	A Programming Language or Computer System
382	Internet-Scale Computing
441	**Mobile App Development for Entrepreneurs**
473	**Advanced Embedded Systems**
497	**EECS Major Design Projects**
527	Layout Synthesis and Optimization
543	Knowledge-Based Systems
545	Machine Learning
547	Electronic Commerce
567	Introduction to Robotics
570	Parallel Computer Architecture
571	Principles of Real Time Computing
573	Microarchitecture
574	Computational Complexity
575	Advanced Cryptography
578	CAD Verification of Digital Systems
579	Digital System Testing
580	Advanced Computer Graphics
581	Software Engineering Tools
582	Advanced Operating Systems
583	Advanced Compilers
584	Advanced Database Systems
586	Design and Analysis of Algorithms
587	Parallel Computing
588	Computer and Network Security
589	Advanced Computer Networks
590	Advanced Programming Languages
591	Distributed Systems
592	Advanced Artificial Intelligence
594	Introduction to Adaptive Systems
595	Natural Language Processing

Note: EECS 398, 498, and 598 are the generic numbers for "Special Topics" courses. Individual sections may be approved for Upper Level CS elective credit or Flexible Technical elective credit. Whether the course is approved for ULCS and/or Flex Tech credit is normally part of the course announcement. See the Undergraduate Advising Office with questions about particular offerings.

Elective Groups
The CS program has no official specializations, but we often advise students to consider the following groups of electives depending on their career interests. Some courses appear in more than one group; these are good choices if you aren't yet certain what area of computing you are most interested in.

Computer hardware: 270, 373, 470, 478
Computing infrastructure: 482, 483, 484, 489
Intelligent systems: 442, 445, 467, 492
Software development: 381, 481, 482, 484, 493, 494
Theory of computation: 475, 477, 480
Web technology & applications: 285, 388, 475, 484, 485

(Fall'12-Sum'15) Computer Science- Eng
Flexible Technical Electives

Listed below are some courses that meet the Flexible Technical Elective requirement for CS-Eng, CS-LSA, and CE. Other courses (including special topics courses, such as EECS 398 and 498) may be approved by the Curriculum Committees on a term-by-term basis. See the Undergraduate Advising Office with questions.

Directed/Independent Study Rule: At most 4 credits count toward the Technical Electives requirement. This applies to all independent/directed study or research courses (including those from other departments). Any additional credits count toward free electives.

Aerospace Engineering

215 Introduction to Solid Mechanics and Aerospace Structures
225 Introduction to Gas Dynamics
245 Performance of Aircraft and Spacecraft

Any AEROSP course at the 300-level or higher [AEROSP 390 & 490: see Directed Study Rule above.]

Atmospheric, Oceanic and Space Sciences

Any AOSS course at the 300-level or higher [AOSS 499: see Directed Study Rule above.]

Biology

305 Genetics

Any BIOLOGY course at the 400-level or higher

Biomedical Engineering

221 Biophysical Chemistry and Thermodynamics
231 Introduction to Biomechanics

Any BIOMEDE course at the 300-level or higher [BIOMEDE 490: see Directed Study Rule above.]

Chemical Engineering

230 Material and Energy Balances

Any CHE course at the 300-level or higher [except CHE 405. CHE 490: see Directed Study Rule above.]

Chemistry

210 Structure and Reactivity I
211 Investigations in Chemistry
215 Structure and Reactivity II
216 Synthesis and Characterization of Organic Compounds
230 Physical Chemical Principles and Applications
241 Introduction to Chemical Analysis
242 Introduction to Chemical Analysis Laboratory
260 Chemical Principles

Any CHEM course at the 300-level or higher [CHEM 398, 399, 498, & 499: see Directed Study Rule above.]

Civil and Environmental Engineering

211 Statics and Dynamics
212 Solid and Structural Mechanics
230 Energy and Environment
265 Sustainable Engineering Principles

Any CEE course at the 300-level or higher (except 303) [CEE 490: see Directed Study Rule above.]

Complex Systems

270 Agent Based Modeling

Economics

409 Game Theory
452 Introduction to Econometrics (formerly ECON 406)

Electrical Engineering and Computer Science

215 Introduction to Electronic Circuits
216 Introduction to Signals and Systems
230 Electromagnetics I
250 Electronic Sensing Systems
270 Introduction to Logic Design
285 A Programming Language or Computer System

Any EECS course at the 300-level or higher (*except* 398*, 402, 406, 410, and 498*) [EECS 399 (FA'14 or later)/499: see Directed Study Rule above.] Departmental credit (301X, 401X, etc.) not approved for use as FTE credit. **Special Topics courses are reviewed for possible FTE/ULCS credit each term; see Advising Office for details.*

Engineering

350 Internat.'l Lab. Experience for Engineers
355 Multidisciplinary Design I [See Directed Study Rule above.]
403 Scientific Visualization
450 Multidisciplinary Design [See Directed Study Rule above.]
455 Multidisciplinary Design II [See Directed Study Rule above.]
480 Global Synthesis Project (Tauber Institute)

Industrial and Operations Engineering

202 Operations Modeling

Any IOE course at the 300-level or higher (*except* 373 & 422) [IOE 490: see Directed Study Rule above.]

Linguistics

442 Computational Linguistics II

Materials Science and Engineering

220 Introduction to Materials and Manufacturing
242 Physics of Materials
250 Principles of Engineering Materials

Any MATSCIE course at the 300-level or higher [MATSCIE 490: see Directed Study Rule above.]

Mathematics

215 Calculus III (if not used for CoE Math core)
216 Introduction to Differential Equations (if not used for CoE Math core)

Any MATH course at the 300-level or higher (*except* 310, 327, 333, 385, 389, 399, 417, 419, 422, 429, 431, 485, 486, 489, 497)

Mechanical Engineering

211 Introduction to Solid Mechanics
235 Thermodynamics
240 Introduction to Dynamics and Vibrations
250 Design and Manufacturing I

Any MECHENG course at the 300-level or higher [MECHENG 490 & 491: see Directed Study Rule above.]

Molecular, Cellular, and Developmental Biology (MCBD)

306 Introductory Genetics Laboratory
310 Introductory Biochemistry

Naval Architecture and Marine Engineering

260 Marine Systems Manufacturing
270 Marine Design

Any NAVARCH course at the 300-level or higher [NAVARCH 490: see Directed Study Rule above.]

Nuclear Engineering and Radiological Sciences

250 Fundamentals of Nuclear Engineering and Radiological Sciences

Any NERS course at the 300-level or higher [NERS 499: see Directed Study Rule above.]

Operations & Management Science

605 Manufacturing and Supply Operations

Performing Arts Technology

452 Interactive Music Design II
462 Digital Sound Synthesis

Philosophy

414 Mathematical Logic

Physics

Any PHYSICS course at the 300-level or higher (*except* 333, 334, 365, 420, and 481). [PHYS 496, 497 498, 499: see Directed Study Rule above.]

School of Information

301 Models of Social Information Processing
364 Building Interactive Applications
422 Evaluation of Systems and Services

Statistics

401 Applied Statistical Methods II
403 Introduction to Quantitative Research Methods
406 Introduction to Statistical Computing
415 Data Mining and Statistical Learning
425 Introduction to Probability (cross-listed with MATH 425, cannot be double-counted with CE Program Core)
426 Introduction to Theoretical Statistics
430 Applied Probability
470 Introduction to the Design of Experiments
500 Applied Statistics I
531 Analysis of Time Series

Technology & Operations (Ross School of Business)

414 Advanced Analytics

Unofficial CoE Student Advising Form - CS Engin

For advising only; NOT official audit. Students -- consult with your advisor to confirm course selections satisfy degree requirements.

Last Name: _____ First Name: _____ UMID: _____ UniqNm: _____ ElecHrs: __ CTP: __ GPA: __ MSH: __
Req Term: FA15 Dual: _ _____ As of: 2015-07-06

Common Requirements (CoE)

Units Required: 36-39 Units (In Progress and Earned): __

☐ Math115 ☐ Engr100 ☐ Chem 130 or 210 ☐ Physics140
☐ Math116 ☐ Engr101 ☐ Chem 125/126 or 211 ☐ Physics141
☐ Math214 ☐ Physics240
☐ Math215/216 Math Tot: __ Chem Earned: _ ☐ Physics241

☐ 50 units minimum residency taken at UM-AA campus Phys Tot: __
☐ 30 units 300 or higher tech courses taken at UM-AA while enrolled in CoE

Category	Subject	Nbr	Sctn	Units	Term	Grade	Note

Intellectual Breadth

☐ Units Req: 16 Units Earned: __ ☐ 3 Units 300-Level (UpLvl)
☐ 3 Units HU PCDC Units Earned: 0 PCDC Units Earned:

Category	Subject	Nbr	Sctn	Units	Term	Grade	Note

General Electives (General)

Units Required: 15 Units Earned: _ ☐ 128 Units Toward Prog Req

Category	Subject	Nbr	Sctn	Units	Term	Grade	Note

Program Subjects (Prog)

Units Required: 28 Units Earned: _ Dept GPA: _

☐ EECS203 ☐ EECS370 ☐ STATS250/412
☐ EECS280 ☐ EECS376 ☐ TCom300
☐ EECS281 ☐ EECS 496 ☐ TCom 497

Category	Subject	Nbr	Sctn	Units	Term	Grade	Note

Major Design Experience (MDE)

☐ EECS 441*,470,481,494,or 497 *If 441 taken, need 11 flex tech

Category	Subject	Nbr	Sctn	Units	Term	Grade	Note

Upper Level CS Technical Electives(ULCS)

☐ Units Required: 16 Units Earned: _

Category	Subject	Nbr	Sctn	Units	Term	Grade	Note

Flexible Technical Electives (FlxTch)

☐ Units Required: 10-11 Units Earned: _

Category	Subject	Nbr	Sctn	Units	Term	Grade	Note

Total Earned MDE + ULCS TE + Flex Tech

☐ Units Required: 30 Units Earned: _

Courses not eligible or not used for credit (NFC)

Category	Subject	Nbr	Sctn	Units	Term	Grade	Note