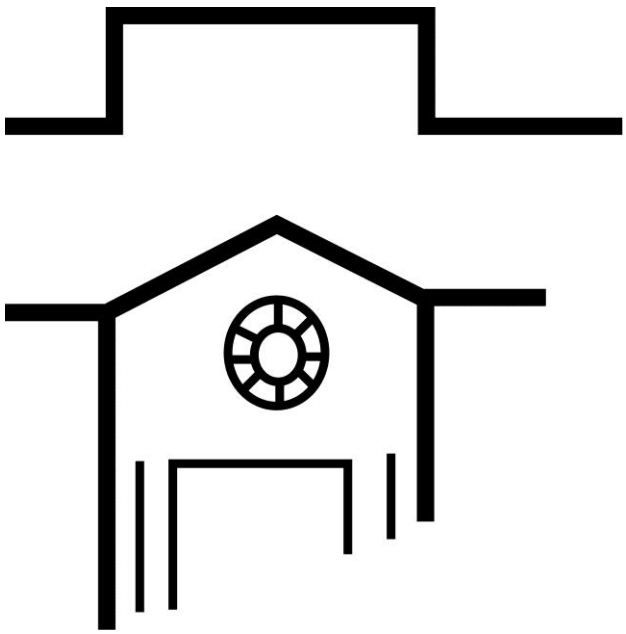
MICHIGAN STATE
UNIVERSITY



College of Engineering

Undergraduate

Student Handbook

2016-2017

MICHIGAN STATE
UNIVERSITY

Oh, the things you will do!

Cornerstone Design

Undergraduate Research

Internships

National Competitions

CAPSTONE DESIGN

Study Abroad

Co-op employment

Student Organizations

Residential Experience

ACADEMICS

On behalf of all of our staff, ***Welcome Spartan Engineer!***

You are embarking on a major journey in life. After 13 years of taking courses mostly in common with all of the other students your age, ***you are now beginning preparation for a profession,*** *and investing time and resources in a college education directed to your specific goals.*

Success in Engineering in the 21st century requires breadth beyond classroom studies and a standard curriculum. To reach your goals, the planning starts now. You need to spend your years as a Spartan Engineer developing the building blocks for a career in engineering or a related field and perhaps additional study in graduate school.

Making your plan starts today at your Academic Orientation Program (AOP) and will continue through your career by interacting with the various units in the office of Engineering Undergraduate Studies (UGS). Our many ways to provide you support and help you broaden your experiences are further described in this handbook. ***Keep this book*** *for your planning and visit our offices to assist you in the many opportunities highlighted above. Our help starts today, in planning your first year of classes*

You are a Spartan Engineer. Welcome and … Go Green!

COLLEGE OF
ENGINEERING
Undergraduate Studies
Michigan State University
1415 Engineering Building
East Lansing, MI
48824-1226
517/355-5128
FAX: 517/432-1356
http://www.egr.msu.edu/ugs

Assistant Dean for Undergraduate Student Affairs

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Campus Resources

Office/Department	Location	Phone #	Website
Academic Advising	1415 Engineering	355-6616 ext. 1	http://www.egr.msu.edu/undergraduate/academic/advisors
Academic Advising First Year Engineering Students	W-8 Wilson Hall	355-6616 ext. 2	http://www.egr.msu.edu/undergraduate/academic/advisors
Admissions	250 Admin Bldg.	355-8332	www.admissions.msu.edu
Campus Living Resources	C 101 Wilson Hall	1-877-9LIVEON	www.liveon.msu.edu
Chemistry Department	185 Chemistry	355-9715	www.chemistry.msu.edu
CoRe	W-8 Wilson Hall	355-6616 Ex t. 2	http://www.egr.msu.edu/core/
Counseling Center	207 Student Services	355-8270	www.counseling.msu.edu
Diversity Programs Office (DPO)	1108 Engineering	355-8310	www.egr.msu.edu/dpo
English Language Center (ELC)	B-204 Wells Hall	353-0800	www.elc.msu.edu
Financial Aid	252 Student Services	353-5940	www.finaid.msu.edu
IAH Department	200 Linton Hall	353-3560	www.cisah.msu.edu
ISS Department	302 Berkey Hall	355-9733	www.cis-ss.msu.edu
Math Department	C212 Wells Hall	353-0844	www.math.msu.edu
Math Learning Center (MLC)	C126 A Wells Hall	884-7414	www.math.msu.edu/mlc
Office Internat'l. Stud. & Scholars (OISS)	105 Internat'l Center	353-1720	www.oiss.msu.edu
Physics Department	1312 BPS Building	355-9200 x3	www.pa.msu.edu
Department of Police & Public Safety (DPPS)	1120 Red Cedar Rd.	355-2221	www.police.msu.edu (sign up for emergency text alerts here)
Registrar	150 Hannah Admin. Bldg.	355-3300	www.reg.msu.edu
Study Abroad	109 Internat'l Center	353-8920	www.studyabroad.msu.edu
The Center (internships, co-ops, career services)	1340 Engineering	355-5163	www.egr.msu.edu/careers
Neighborhood Student Success Collaborative	170 Bessey Hall		http://www.uud.msu.edu/online.html
Women in Engineering (WIE) Student Success	1108A EB	432-1354	www.egr.msu.edu/wie
Women in Engineering (WIE) K-12 Outreach	1410A EB	884-0054	www.egr.msu.edu/wie
Writing Center	300 Bessey Hall	432-3610	www.writing.msu.edu

2016 - 2017 Academic Calendar

For a complete listing of important dates, please visit the registrar's website at https://www.reg.msu.edu/ROInfo/Calendar/academic.asp

Fall 2016

August 27	New Freshmen and Transfer students attending an AUGUST orientation can move into residence halls beginning at 8 am
August 28	New Freshmen and Transfer students who attended JUNE or JULY orientation can move into residence halls beginning at 8 am
August 31	Classes begin, Monday schedule is observed
September 5	Labor Day- University closed
September 7	**End of open add period; 8PM**
September 22	**End of tuition refund period**
October 19	**Middle of Semester, LAST day to drop classes with no grade reported; 8PM**
November 24-25	Thanksgiving holiday- University closed
December 9	End of classes for Fall Semester
December 9	Engineering Design Day
December 12-16	Final exams

Spring 2017

January 9	Classes begin
January 13	**End of open add period; 8PM**
January 16	Martin Luther King, Jr. Day, no classes, university remains open
February 3	**End of tuition refund period**
March 1	**Middle of Semester, LAST day to drop classes with no grade reported; 8PM**
March 6-10	Spring break
April 28	Classes end
April 28	Engineering Design Day
May 1-5	Final exams

Academic Advising

Who are academic advisors?
Academic advisors are professionals with advanced degrees in counseling, education, university administration and related fields. Academic advisors are dedicated to student's academic success and are knowledgeable about university policy. Academic advisors are here to guide you along the way and provide you with valuable information to help you make good academic decisions.

How do I know who my advisor is?
Are you a first year student? If so, please check in at Wilson Hall, Room W8 if you would like to meet with an advisor. Walk in advising is available **Tuesday & Thursday, 10 a.m.-12 p.m. and Monday-Thursday 1:00 p.m.-4:00 p.m.** Questions? Call (517) 355-6616 x2 or schedule an appointment online at https://www.egr.msu.edu/adcalendar/

Wilson Hall Advisors
- Elizabeth Brand
- Titun Maiti
- Lindsay Naylor

Are you a sophomore/junior/senior? Students at these levels are assigned to an advisor by major, and sometimes advising assignments change. For the most updated information check http://www.egr.msu.edu/undergraduate/academic/advisors

Applied Engineering Sciences
- Joyce Samuel

Biosystems Engineering
- Hannah Brodhead

Chemical Engineering, Materials Science Engineering
- TBA

Civil Engineering, Environmental Engineering
- Dan King

Computer Engineering, Electrical Engineering
- Sean Fochtman

Computer Science
- Amber Benton

Mechanical Engineering
- **Sophomores,** Elizabeth Brand
- **Juniors and Seniors,** Gaile Griffore

If you have questions about finding your advisor, stop by W-8 Wilson Hall, 1415 Engineering Building, or call (517) 355-6616 ext. 1. More information is also available at: **http://www.egr.msu.edu/undergraduate/academic/advisors**

How often should I meet with my advisor?
We suggest that you meet with your advisor regularly, **at least once a semester**, to receive assistance with major selection, schedule planning, test-taking, study skills, utilizing resources, career planning, and much more. We encourage you to meet with an advisor in person; while some questions can be handled by email, many issues benefit from a two-way conversation.

How should I prepare for my advising appointment?
Before visiting your advisor, you should:

- Reflect on how you are doing in your classes.
- Review the major/degree requirements for the majors that interest you.
- Review course pre-requisites **http://www.reg.msu.edu/Courses/Search.asp** and schedule of courses **http://schedule.msu.edu/**
- Bring a preliminary schedule of courses you intend to take.
- Think about any questions you might have about your major, the College of Engineering, or the University. Make sure to write them down and bring them to your appointment.

Academic Programs Catalog
Students should consult with their advisors to learn which specific requirements apply to their degree programs. The academic programs catalog can be viewed online at: **http://www.reg.msu.edu/AcademicPrograms/default.asp**

Student Handbook
Spartan Life: Student Handbook and Resource Guide, is a helpful resource guide to campus programs and services and also includes rules, regulations, rights and responsibilities that have been established in the interest of intellectual and personal development while protecting individual freedoms. The most updated version can be found online at **http://splife.studentlife.msu.edu**

How many credits do I need to be a Freshman, Sophomore, Junior, or Senior?

Class	Credits
Freshman	0-27
Sophomore	28-55
Junior	56-87
Senior	88+

Admission to the College of Engineering

In order to enroll in 300 & 400 level engineering courses, students must be admitted to the college. Students in declared engineering majors are reviewed every semester until they reach 56 credits and are admitted once they have:

- completed the required courses
- declared a degree granting Engineering major (*No-Preference is not a degree granting major*)
- attained a specific combination grade point average
- attained a minimum of 2.00 grade-point average in all mathematics courses (other than MTH1825) taken at MSU.

In some cases, an application to the College may be necessary.

- For engineering students with a high amount of AP/Transfer Credits: If core courses are not completed prior to reaching 56 credits, you will have to temporarily change your major out of the Engineering.
- Juniors and seniors who have a declared major outside of Engineering
- An already admitted student who wishes to change to another engineering major

Applications available from the 3rd-15th weeks of each semester at: http://www.egr.msu.edu/undergraduate/academic/admission-engineering

Courses Required for Admission to the College of Engineering

- **MTH 132 – Calculus I**
- **MTH 133 – Calculus II**
- (Students must have a minimum 2.0 grade point average or higher in **all** mathematics courses completed at the time of admission. This does not include MTH 1825.)
- **CEM 141- General Chemistry** or **CEM 151 General and Descriptive Chemistry** for all majors except Computer Science
    - **CEM 151 is required for CHE majors and is ONLY offered in the Fall**
    - **CEM 152 is required for CHE majors and is ONLY offered in the Spring**
- **PHY 183** or **183B – Physics for Scientists and Engineers I**
- **EGR 100- Introduction to Engineering Design**
- **EGR 102- Introduction to Engineering Modeling OR CSE 231- Introduction to Programming I**, (for Computer Engineering, Computer Science and Mechanical Engineers majors **only) OR CSE 220- Programming in C**, (for Electrical Engineering majors **only.**)

As of August, 2016, admission to Engineering majors requires the following **combined (combo)** GPA:

- Mechanical Engineering – 3.1
- Applied Engineering Sciences – 3.0
- Biosystems, Chemical, Civil, Computer Engineering, Computer Science, Electrical, Environmental, Materials Science – 2.9

These admission GPAs are subject to review. Please see an advisor for the most up to date information.

Admission to the College of Engineering is based on your **Combined (Combo)** GPA. Your combined combo grade point average is the average of your cumulative GPA and your technical GPA.

Your Cumulative GPA is an average of the grades you received for **all** courses you have taken for credit at MSU. First, multiply the credits for each MSU course you have taken by grade you received to get your points. Then, divide your total points by your total credits to get your cumulative GPA. Example:

Course	Credits	Multiply	Grade Rec'd.	Equals	Points
ENT 205	3	x	2.5	=	7.5
CEM 141	4	x	3.0	=	12.0
CEM 161	1	x	4.0	=	4.0
ISS 215	4	x	3.0	=	12.0
MTH 132	3	x	3.0	=	9.0
Total	15				44.5

44.5 (total points) ÷ 15 (total credits) = 2.966 cumulative GPA

Your Technical GPA is an average of the grades you have received for all **technical** courses, which include most courses taken in the College of Engineering, Natural Science, Biosystems Engineering courses, and selected courses from Lyman Briggs College. A more complete list of technical courses can be found at
http://www.egr.msu.edu/advising/gpa/gpa-calculations

The technical GPA calculation is the same as the Cumulative GPA, **except** that it only includes your science and engineering related courses. If you have repeated a course, only the most recent grade should be used. In this example, notice that ISS 215 from the list above is not included because it is not technical. Example:

Course	Credits	Multiply	Grade Rec'd.	Equals	Points
ENT 205	3	x	2.5	=	7.5
CEM 141	4	x	3.0	=	12.0
CEM 161	1	x	4.0	=	4.0
MTH 132	3	x	3.0	=	9.0
Total	11				32.5

32.5 (total points) ÷ 11 (total credits) = 2.9545 technical GPA

Your Engineering Degree

Your engineering degree consists of four main parts:

1. *University Requirements (required of every MSU students)*
2. *College Requirements (required of all Engineering students)*
3. *Major Requirements (set of courses just for your major)*
4. *Electives (classes of your choosing to help you reach your total to graduate)*

There are also opportunities to add optional concentrations in most majors, minors in or out of the College of Engineering, and additional majors.

Advisors will help you balance these four areas, as well as any additional minors/concentrations you wish to explore. These four areas are explained in more detail in the next several pages.

1. University Requirements

Writing, Rhetoric, and American Cultures (WRA)

- All MSU students must complete two WRA courses, **one at the Tier I level** and **one at the Tier II level**. The Tier I class is WRA101, and is generally taken during the first year. Tier II classes are always completed through a student's major, usually in the junior or senior year.
- Students needing additional help in writing (as determined by ACT/SAT scores) will be required to enroll in WRA 1004: Preparation for College Writing and WRA 0102: Preparation for College Writing (lab) before completing the Tier I WRA course.
- Strong scores on tests such as Advanced Placement (AP), International Baccalaureate (IB) Diploma Program, College-Level Examination Program (CLEP), Dantes Subject Standardized Tests (DSST), and International A Level may allow for a course waiver or course credit, as well as some dual enrollment credit from high school. Check with an advisor for details.

Integrative Studies in Social Sciences (ISS)

- All MSU students must complete two ISS courses, **one 200-level** course followed by one **300-level** course. These courses can be completed at any time during the undergraduate program.
- Strong scores on tests such as Advanced Placement (AP), International Baccalaureate (IB) Diploma Program, College-Level Examination Program (CLEP), Dantes Subject Standardized Tests (DSST), and International A Level may allow for a course waiver or course credit, as well as some dual enrollment credit from high school. Check with an advisor for details.

Integrative Studies in Arts and Humanities (IAH)

- All MSU students must complete two IAH courses. **Choice A is numbered 201-210** course followed by **Choice B, numbered 211 or higher**. These courses can be completed at any time during the undergraduate program.
- Strong scores on tests such as Advanced Placement (AP), International Baccalaureate (IB) Diploma Program, College-Level Examination Program (CLEP), Dantes Subject Standardized Tests (DSST), and International A Level may allow for a course waiver or course credit, as well as some dual enrollment credit from high school. Check with an advisor for details.

Integrative Studies Diversity Requirement

- IAH and ISS courses are designated as having an emphasis in national diversity (N), international and multicultural diversity (I) or national, international and multicultural diversity (D). As you complete your 4 IAH/ISS courses, you must have at least one "N" and one "I" course. A "D" course designation may meet either an "N" or an "I" requirement, but not both. Students may have any combination of the three designations, but **not** two of the same. For example, **two "D"** designations will **not** fulfill the university diversity requirement.
- **For the most current information, students should check the course descriptions website at: http://www.reg.msu.edu/Courses/Search.asp**

Bioscience

- Engineering students do **not** take ISB or ISP (science courses for non-science majors). Instead, **MOST** majors allow for any of the following: **BS 161, ENT 205, IBIO 150, MMG 141, MMG 201, PLB 105, PSL 250.**
- **Environmental Engineering (ENE) and Chemical Engineering (ChE)** majors must take BS 161 to satisfy both the University requirement **and** their major bioscience requirement.
- **Biosystems Engineering (BE)** majors must take BS 161 to satisfy a **major** requirement **and** must also take BS 162 to satisfy the University requirement. *It is important to keep in mind that BS 161 is a prerequisite for BS 162.*
- The **Computer Science (CpS)** major also has stipulations regarding the bioscience requirement. Please refer to the Computer Science curriculum guide for this information.
- Strong scores on tests such as Advanced Placement (AP), International Baccalaureate (IB) Diploma Program, College-Level Examination Program (CLEP), Dantes Subject Standardized Tests (DSST), and International A Level may allow for a course waiver or course credit, as well as some dual enrollment credit from high school. Check with an advisor for details.

2. College of Engineering Requirements

Design Courses

As part of the CoRe Experience academic program, first year engineering students are introduced to the team design process and analytical tools used in the engineering profession. These courses immerse students in hands-on engineering activities from their first days on campus.

All majors take EGR 100 – Introduction to *Engineering Design*
Team-based, interdisciplinary projects will be used to introduce students to the principles of engineering design processes. Teamwork, oral and written communication, career preparation, engineering ethics and other topics will also be discussed.
One technical computing class must be taken, depending on your intended major

- **EGR 102** – Introduction to *Engineering Modeling.* Students will learn how to systematically identify and deconstruct engineering problems using tools such as advanced spreadsheets and engineering software applications such as MATLAB. Students will analyze various engineering systems, through the use of a variety of mathematical models. For students in **Applied Engineering Sciences, Biosystems Engineering, Civil Engineering, Chemical Engineering, Environmental Engineering, and Materials Science.**
- **CSE 231** – Introduction to *Programming I*. CSE 231 is an introduction to programming course. Using the Python language students will learn how to design, implement, and test programs to solve problems such as those in engineering, mathematics and science. For students in **Computer Science, Computer Engineering and Mechanical Engineering.**
- **CSE 220** – Programming in C. CSE 220 is a programming course geared toward electrical engineering. It covers basics of programming in C, including data types, operators, control, functions, arrays, pointers, file processing, testing and debugging. For students in **Electrical Engineering.**

Mathematics

Over the course of your studies, you are expected to display competency in calculus. These mathematics courses are typically completed in the first two or two and half years of a student's academic program.

MTH 132 Calculus I*
MTH 133 Calculus II
MTH 234 Multivariable Calculus
MTH 235 Differential Equations (not required for AES or CPS)

***If you earn a repeatable grade in a math course (1.0 or 1.5), it is HIGHLY RECOMMENDED you repeat that course BEFORE moving on to the next math course.**

Placement in mathematics the first-year is determined by the student's high school math background as evaluated by the MSU Mathematics Placement Test, ACT or SAT Math Score, or Advanced Placement (AP) test. Students who do not place directly into the calculus series must successfully complete one of the sequences below *before* enrolling in MTH 132:

Sequence A: **MTH 116** – College Algebra & Trigonometry
Sequence B: **MTH 103** – College Algebra
and **MTH 114** – Trigonometry
Sequence C: **MTH 1825** – Intermediate Algebra
and **MTH 116** – College Algebra & Trigonometry.

** Important to note that the credits earned in MTH 1825 do **not** count toward graduation

Chemistry

All engineering students (except Computer Science majors) are required to complete at least one introductory course in general chemistry, usually taken during the freshman year.

CEM 141 – General Chemistry (must be in MTH 103 or higher)
- Required for: Applied Engineering Sciences, Biosystems Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, and Mechanical Engineering

CEM 151 – General and Descriptive Chemistry (must be in MTH 116 or higher)
- Required for: Chemical Engineering, Environmental Engineering, and Materials Science and Engineering

****Special Note for Chemical Engineering Majors**

Students intending to major in chemical engineering are strongly advised to take CEM 151, CEM 152, CEM 161, CEM 162, CEM 351, CEM 352, and CEM 355 in order to properly prepare them for the chemical engineering curriculum and profession. Transfer students who have already taken CEM 141/142 or the equivalent or students who have AP credits equivalent to CEM 141/142 are strongly advised to take CEM 351, CEM 352, and CEM 355 in order to have the appropriate background needed for the chemical engineering profession.

Please Note:
- CEM 151 – Fall Only
- CEM 152– Spring Only
- CEM 351– Fall Only
- CEM 352 – Spring Only
- CEM 355 – Spring Only

Physics

All engineering students are expected to develop an understanding of certain fundamental principles of physics as a prerequisite to future engineering coursework. This requirement is met by taking two semesters of calculus-based physics.

- **PHY 183** – Physics for Scientists and Engineers I
- **PHY 184** – Physics for Scientists and Engineers II

Strong scores on tests such as Advanced Placement (AP), International Baccalaureate (IB) Diploma Program, College-Level Examination Program (CLEP), Dantes Subject Standardized Tests (DSST), and International A Level may allow for a course waiver or course credit, as well as some dual enrollment credit from high school. Check with an advisor for details.

PHY 231 and **PHY 232** are not calculus-based, and by themselves do **not** fulfill the College of Engineering Physics requirements. If you have test/dual enrollment credit for these, you will also need the "bridge" courses for the calculus components.
PHY 231 + PHY 233B = PHY 183
PHY 232 + PHY 234B = PHY 184

3. Major Requirements

Major requirements differ across the 10 majors. Specific courses can be found on the curriculum guides in the back half of this handbook, or online. Some courses count in several majors, so if you are undecided, look for courses that count in multiple majors.

4. Electives

Engineering degrees require 120 or 128 credits, depending on which one you choose. Degree requirements for your major will not total 120/128, so you get to fill those credits with ***electives***. These are courses at MSU that you are eligible to take, and allow you to broaden your academic horizons by exploring other subjects. You can "spend" your elective credits any way you wish, but know that they are a part of your degree.

What are some electives you might like to take?

Biomedical Engineering at Michigan State

What do biomedical engineers do?
Biomedical engineers develop devices and procedures that solve medical and health-related problems. Biomedical engineers develop new processes, materials, and devices which can be used in the prevention, detection, and treatment of disease, patient rehabilitation, and overall health.

Where is biomedical engineering at MSU?
Biomedical engineering solutions require knowledge of an underlying engineering discipline. At MSU, students **choose an engineering major first** and then select biomedical electives as part of the major curriculum. The biomedical engineering concentration may be added to the following six engineering disciplines: Biosystems, Chemical, Computer, Electrical, Materials Science, or Mechanical Engineering.

Students interested in biomedical engineering should speak with their academic advisor early in their careers, as the biomedical concentration has specific bioscience requirements.

1. Biomedical Concentration with Biosystems Engineering
Biosystems engineers identify and solve problems at the interface of engineering and biology. In the biomedical area, biosystems engineering students have opportunities for undergraduate research in areas such as microbial modeling and biosensors for rapid detection of pathogens. In this application area, biosystems engineers find employment with pharmaceutical/healthcare companies, medical supply companies, and federal agencies, as well as continuing their studies in medical, veterinary, and graduate school.

2. Biochemical/Biomedical Concentrations with Chemical Engineering
Historically, chemical engineers have designed devices, pharmaceutical processes, and artificial organs (such as the artificial kidney). Chemical engineers are making significant contributions in computational and functional genomics, biosensors, cell and tissue engineering, biomolecular engineering, gene therapy, metabolic engineering, high-throughput drug screening, and drug formulation and delivery.

3. Biomedical Concentration with Electrical and Computer Engineering
Electrical and Computer Engineering students can take courses in the areas of bio-imaging and biomedical applications of signals and systems, and are given opportunities to conduct independent research with faculty in the areas of biomedical engineering. With the departments focus on developing physical systems and data analysis methods for biomedical applications, some of the current research includes: modeling of physiological systems, cardiovascular physiology, biomedical ultrasonics, medical imaging, neural engineering, development of implantable devices and biomedical signal processing.

4. Biomedical Materials Concentration with Materials Science & Engineering
Biomedical materials engineers create new materials and devices that are used to treat diseases and repair damaged tissues by combining their knowledge and skills in engineering materials design with biology and chemistry. They may conduct research in areas such as tissue engineering (creating new tissues like bone and muscle) and implant development (like total knee and hip replacements). It also serves for the design of devices used in various medical procedures, such as screws and plates used in orthopedics. Some will specialize in orthopedics and sports medicine, while others will work in areas such as implant design and manufacturing.

5. Biomedical Concentration with Mechanical Engineering
Mechanical engineers combining biomedical engineering are trained in biomechanical engineering and find employment designing, for example, prosthetics, artificial joints, automotive safety equipment, robotics for telemedicine, heart valves, left ventricle assist devices, and the whole range of medical devices. Research by biomechanical engineers includes studying the strength of bones and soft tissues, the motion of cells, the kinematics of human motion, and the flow of blood.

Environmental Engineering at Michigan State

What are Environmental and Ecosystems Engineers?
Environmental and ecosystems engineers integrate physical, chemical, biological, mathematical, and engineering principles to address environmental problems. They advance fundamental understanding of human impacts on the environment and the environment's response to these impacts.
Examples of engineering for the environment:

- water and wastewater treatment
- treatment and prevention of diffuse source pollution
- industrial pollution control
- groundwater and hazardous waste site remediation
- constructed wetlands and vegetative buffers
- green process engineering
- air pollution monitoring, control, and permitting
- ecosystems restoration and adaptation to climate change impacts
- conversion of waste to resources

Where is Environmental and Ecosystems Engineering at MSU?
Undergraduate programs in environmental and ecosystems engineering are distributed across the Environmental Engineering, Biosystems Engineering (Ecosystems Engineering Concentration), and Chemical Engineering (Environmental Engineering Concentration) majors.

B.S. Environmental Engineering

The environmental engineering major prepares students with a solid background in chemical, biological, and physical processes, allowing them to analyze, design, and manage environmental systems and associated infrastructure, such as water supplies, wastewater treatment facilities, air pollution control systems, surface and groundwater resources, and landfills.

B.S. Biosystems Engineering (Ecosystems Engineering Concentration)

The biosystems engineering major (ecosystems engineering concentration) prepares students to analyze, design, and control systems and processes with critical biological components, with a focus on natural resources, such as ecosystems restoration, treatment wetlands, watershed management, biomass conversions, or other biologically-centered challenges.

B.S. Chemical Engineering (Environmental Engineering Concentration)

The chemical engineering major (environmental engineering concentration) prepares students to design and operate manufacturing facilities that chemical-physically-biologically transform raw materials to finished products, with a focus on environmentally friendly processing that reduces pollution and maximizes benefit.

Additional Minors

MSU has a number of minors available to students. See the Academic Programs Catalog at www.reg.msu.edu for an up to date list. The College of Engineering offers 3 minors:

Minor in Computer Science

The academic minor in Computer Science will provide a basic foundation in Computer Science. Students wanting to complete the minor must apply to the Department of Computer Science at the time of completion of CSE 231 and CSE 260 and have an average of at least 3.0 for those two courses combined. Enrollment may be limited. Permission is required to take more than 18 CSE credits.

Requirements

Complete 18 credits in Computer Science and Engineering as follows:

- CSE 231 (4 credits) Introduction to Programming I
- CSE 232 (4 credits) Introduction to Programming II
- CSE 260 (4 credits) Discrete Structures
- Two courses from CSE 320, 331, 335, 410, 420, 422, 425, 435, 440, 450, 460, 471, 472, 473, 476, 477, 480, or 484

Minor in Materials Science

The Minor in Materials Science and Engineering provides students with a basic foundation in materials science that is applicable to many disciplines. The minor also offers opportunities for students to work in industry, research, or government, as well as to prepare for graduate study in materials science.

Students who plan to complete the requirements for the minor must complete an online application to the Department of Chemical Engineering and Materials Science. To be accepted into the minor, the student must be admitted into the College of Engineering. Enrollment for some MSE courses may be limited.

Requirements

Complete 18 credits from the following

- MSE 250 (3 credits) Materials Science and Engineering
- MSE 360 (3 credits) Fundamentals of Microstructural Design*
- One course from MSE 260, 310, 320, 370
- Three courses from MSE 310, 320, 370, 410, 425, 451, 454, 460, 465, 466, 476, or 477

A course used to fulfill requirement 2 above may not be used to fulfill requirement 3.

* This course has a prerequisite of MSE 310, a course covering thermodynamics. For the minor, ME 201, CHE 321, or PHY 215 is also acceptable, but students will need to do some background study of regular solutions and phase diagrams that are covered in the latter half of MSE 310.

Minor in Energy

The Minor in Energy, administered by the College of Engineering, provides students with a foundation in energy science that focuses on topics of fundamental physical principles guiding energy generation, utilization, conservation, engineering applications and the impact of energy within a societal and geological context. Students gain a perspective in energy science that is applicable to many disciplines and highly interdisciplinary. It offers opportunities for students to prepare to work in industry, research, or government, as well as preparation for graduate studies in energy science.

The minor is available as an elective to students who are enrolled in bachelor's degree programs in the College of Engineering. With the approval of the department and college that administer the student's degree program, the courses that are used to satisfy the minor may also be used to satisfy the requirements for the bachelor's degree. At least 9 credits counted towards the requirements for this minor must be unique. Unique credits must not be used to fulfill another university, college, or major requirement in the student's program.

Students who plan to complete the requirements of the minor should consult their undergraduate adviser in the College of Engineering. Students accepted into the minor must be admitted to the College of Engineering and have completed items 1. and 2. of the requirements stated below. Enrollment for some courses may not be available and may be limited. Application forms are available at www.egr.msu.edu/academics/multi-disciplinary.

Requirements for the Minor in Energy
Complete a minimum of 21 credits from the following.

- One course from BE 230, CHE 201, MSE 250 (3 credits)
- One course from BE 351, CHE 321, ME 201, MSE 310 (3 or 4 credits)
- One course from BE 456, ECE 202, 345 (3 Credits)
- One course from ME 417, MSE 410 (3 credits)
- One course from AESC 310, CSUS 200, EEP 255 (3 credits)
- Two courses from AFRE 829, BE 469, CHE 468, CSS 467, CSUS 200, 491, ECE 305, 320, 423, 425, 476, 821, EEP 320, ENE 481, 489, FOR 414, GLG 201, 301, 471, ISP 221, MC 450, ME 417, 422, 442, 444, MSE 410, 460 (6 to 8 credits)

Notes

Schedule Planning Worksheets

Remember that your math placement will tell us where you will be starting with a number of courses. Listed on the next few pages are *sample* first and second year schedules for the possible starting points in math.

MTH 1825 placement, first year

Fall	Credits		Spring	Credits		Summer	Credits
WRA 101	4		CEM 141	4		MTH 132	3
ISS 2**	4		CEM 161	1			
MTH 1825	3		MTH 116	5			
Bioscience	3-4		IAH 20*	4			
Total	**14-15**		**Total**	**14**		**Total**	**3**

MTH 1825 placement, second year

Fall	Credits		Spring	Credits		Summer	Credits
MTH 133	4		MTH 234	4			
PHY 183	4		PHY 184	4			
EGR 100	2		ISS 3**	4			
Major course	3-4		EGR 102	2			
Total	**13-14**		**Total**	**14**		**Total**	

MTH 103 placement, first year

Fall	Credits		Spring	Credits		Summer	Credits
WRA 101	4		CEM 141	4		MTH 132	3
MTH 103	3		CEM 161	1			
ISS2**	4		MTH 114	3			
Bioscience	3-4		IAH 20*	4			
			EGR 100 or Elective	2-3			
Total	**14-15**		**Total**	**14-15**		**Total**	**3**

MTH 103 placement, second year

Fall	Credits		Spring	Credits		Summer	Credits
MTH 133	4		MTH 234	4			
PHY 183	4		PHY 184	4			
EGR 102	2		ISS 3**	4			
Major course	3-4		Major course	3-4			
Total	**13-14**		**Total**	**15-16**		**Total**	

MTH 116, placement, first year

Fall	Credits		Spring	Credits		Summer	Credits
ISS 2**	4		EGR 100	2		MTH 133	4
CEM 141	4		MTH 132	3		OR	
CEM 161	1		Bioscience	3-4		PHY 183	4
MTH 116	5		WRA 101	4			
Total	**14**		**Total**	**12-13**		**Total**	**4**

MTH 116, placement, second year

Fall	Credits		Spring	Credits		Summer	Credits
MTH 234	4		MTH 235	3			
PHY 183	4		PHY 184	4			
IAH 20*	4		ISS 3**	4			
Major course	3-4		Major course	3-4			
Total	**15-16**		**Total**	**14-15**		**Total**	

MTH 132 or higher placement, first year

Fall	Credits		Spring	Credits		Summer	Credits
EGR 100	2		EGR 102	2			
CEM 141	4		MTH 133	4			
CEM 161	1		PHY 183	4			
MTH 132*	3		WRA 101	4			
ISS 2**	4						
Total	**14**		**Total**	**14**		**Total**	

MTH 132 or higher placement, second year

Fall	Credits		Spring	Credits		Summer	Credits
MTH 234	4		MTH 235	3			
PHY 184	4		Bioscience	3-4			
IAH 20*	4		ISS 3**	4			
Major course	3-4		Major course	3-4			
Total	**15-16**		**Total**	**13-15**		**Total**	

Notes

Academic Resources

Academic Assistance
As a first-year student, you are beginning the transition from high school to the rigors of the college curriculum. As a college student, you will be trained and challenged to think in new and exciting ways. There are many engineering and university resources available (free of cost!) to help you with the transition to an advanced and scholarly way of thinking and writing. Those resources include:

- Your academic advisor
- Chemistry Help Room, Rooms 81 and 83 Chemistry Building
- CoRe tutors and Peer Leaders in the South Neighborhood
- Guided Learning Center (GLC), 1109 EB
- Math Learning Center, Wells Hall and Neighborhood Engagement Centers
- Writing Center, 300 Bessey Hall

Time Management
The key to academic success in college is to develop good time management skills **early** in the semester and to designate time to your studies **every day**. It is okay to ask for help. See your advisor for more information. We are here to help you succeed!

The Center for Spartan Engineering
Experiential Engineering Education is a broad term used to describe co-curricular programs that enhance the classroom educational experience. These opportunities may include traditional cooperative (co-op) education and internship programs, on-campus research or intern positions, study abroad opportunities, service-learning, and other non-traditional approaches to learning.

If you are ready to start exploring experiential education opportunities, or just want to see what positions might be available, sign up on **MySpartanCareer.com** to access Experiential Education's online application and job postings. Depending on the opportunity, you can begin working your freshman year.

For more information, please visit our website: **www.egr.msu.edu/careers,** stop by 1340 Engineering Building, or call us at (517) 355-5163.

The Center Staff-
Garth Motschenbacher, Director of Employer Relations
Bernadette Friedrich, Ph.D., Director of Student Advancement
Kyle Liechty, Co-op / Intern Coordinator
Rachel Mangiavellano, Career Consultant

Diversity Programs Office (DPO) and Guided Learning Center (GLC)
The DPO is proud to support and provide resources for all students, with a particular emphasis on assisting groups underrepresented in Engineering. The DPO offers the following services, free of charge!

- The Guided Learning Center offers academic assistance in any course through one-on-one tutoring sessions
- Professional development
- Resource materials
- Speakers, trips, events, and programs
- Opportunities for students to network with faculty, staff, and career professionals
- A freshman/sophomore course, *Diversity and Engineering*, (EGR 160)
    - Business protocol, resume writing, interviewing, and study skills.
    - Practicing engineers come to class and discuss professional development.

These services are made possible through cooperation with other Engineering and MSU departments, the volunteerism of our alumni and friends, and generous grants and gifts resulting from partnerships with numerous corporations and non-profit organizations. For more information, please visit our website at **www.egr.msu.edu/dpo** or call us at (517) 355-8310.

The DPO Staff-
Theo Caldwell, Director
Kyle Foster, Assistant Director
Lisa Henry, Student Services Assistant
Bryndan Arnold, Guided Learning Center Coordinator
Robin Smith, Secretary

CoRe Experience
The College of Engineering CoRe Experience is an integrated program designed around the success of early engineering students. The CoRe Experience consists of both academic and co-curricular activities. The mission of the CoRe Experience is to provide early engineering students with unmatched learning opportunities within a supportive community that encourages academic, personal, and professional achievement, foster life-enriching connections between students and their peers, faculty members, advisors, and corporate representatives, cultivate students' skills that encourage lifelong learning, and demonstrate to students the critical roles of engineers in contributing to society. For more information, please visit our website at http://www.egr.msu.edu/core/or call us at (517) 355-6616 Ext. 2

The CoRe Staff-
S. Patrick Walton, Sc.D., Director
Carmellia Davis-King, Co-Curricular Director
Timothy Hinds, CoRe Academic Director
Sandra Christlieb, Project Engineer
Jeanette Robertson, Secretary

Engineering Study Abroad
At MSU, we take pride in being a leader in study abroad. In the College of Engineering, we strive to help our students prepare to compete in this growing global climate. One of the many ways to do this is to study abroad during the course of your studies here at State. Study abroad options include year-long, semester, and summer stay options.

We recommend that students who plan to go abroad begin the planning process with their advisor early on in their academic careers. It is advisable to reserve at least one IAH or ISS requirement for use while abroad if students intend to study abroad.

Besides Engineering-specific programs, you can also choose from other MSU sponsored programs. The University Study Abroad Office is located in 109 International Center, (517) 353-8920.

For more information on Engineering-specific programs, please visit our website at **www.egr.msu.edu/study-abroad**, stop by 1108F Engineering Building, or call us at (517) 432-2012.

The Study Abroad Staff-
Maggie Blair-Ramsey, Study Abroad Coordinator

Scholarship Information
The College of Engineering administers a variety of scholarships from corporate and private donors in addition to the various financial aid programs available through the Office of Financial Aid. These engineering awards are generally based on academic excellence and are available for returning students. Scholarship applications will be available after January 1st of each year and are due in February. For further information visit: **www.egr.msu.edu/undergraduate/resources/scholarships**

Women in Engineering Program (WIE)
The Women in Engineering Program (WIE) encourages students of all backgrounds to pursue careers in Engineering. While our particular emphasis is assisting women students, we collaborate with others in the College and University to provide an environment that is conducive to all students' success, providing opportunities for academic, personal and professional growth. WIE programs include mentoring opportunities, outreach programs, and connection to important resources. WIE also supports the Society of Women Engineers, MSU Women in Computing and Phi Sigma Rho, three very active student organizations in the College of Engineering. For more information about WIE, visit our website at: **www.egr.msu.edu/wie**

The WIE staff-
Judy Cordes, Director of Women in Engineering for Student Success
Teresa VanderSloot, Director of Women in Engineering for Recruiting and Outreach

Student Organizations
MSU has hundreds of student organizations, with many are geared towards international student interests. For information on international-specific student groups, please visit: **http://oiss.isp.msu.edu/students/clubs.htm.** We also encourage international students to become involved and engaged with Engineering student groups.

The College of Engineering has about thirty student groups just for engineers! Find the chapter of your national/international disciplinary organization, or join a group that crosses all majors and interests. Please visit **http://www.egr.msu.edu/student-groups** for more information.

Questions? See…

- Your academic advisor
- The Center for Spartan Engineering (experiential education, jobs)
- The Diversity Programs Office
- The Women in Engineering Office
- The Engineering Study Abroad Office
- Spartan Engineering tweets and LinkedIn groups

Notes

What are the engineering disciplines?

Applied Engineering Sciences (AES) ~ https://www.egr.msu.edu/aes/
Broad foundation across all engineering majors; students choose business law, computer science, packaging, supply chain management, technical sales or media and information concentrations
Work in: EGR consulting, recruiting, sales, marketing, logistics management

Biosystems Engineering (BE) ~ https://www.egr.msu.edu/bae/
Broad biological component, food processing & ecosystems
Work in: food quality & safety, renewable bioenergy, consulting and regulatory agencies

Chemical Engineering (ChE) ~ http://www.chems.msu.edu/
Chemistry & engineering applied to full-scale industrial production
Work in: pharmaceuticals, bioenergy, consumer products

Civil Engineering (CE) ~ http://www.egr.msu.edu/cee/
Transportation, structures, infrastructure design and management
Work with: roads, bridges, water, structures, construction, & infrastructure

Computer Engineering (CpE) ~ http://www.egr.msu.edu/ece/
Hardware & software; make computers smaller & faster
Work as: computer & embedded systems architects, real-time system design

Computer Science (CpS) ~ http://www.cse.msu.edu/
Software design & development; databases, graphics, webpages, & networks
Work in: cyber security, artificial intelligence, information technology, consulting, project management, & marketing

Electrical Engineering (EE) ~ http://www.egr.msu.edu/ece/
Integrated circuits, robotics & control, power, lasers, & materials
Work in: nanotechnology, fiber optic communication systems, automotive & aerospace industries

Environmental Engineering (ENE) ~ http://www.egr.msu.edu/cee
Water and wastewater treatment, air quality, landfills and solid waste, permitting and regulation, hazardous waste cleanup, and protection of the environment
Work in: consulting, government agencies, and industry

Materials Science & Engineering (MSE) ~ http://www.chems.msu.edu/
Develop new materials & the processes to create them
Work with: metals & ceramics, plastics, & polymers (non-metals)

Mechanical Engineering (ME) ~ http://www.egr.msu.edu/me/
Anything with motion or moving parts, design
Work in: aerospace, automotive, manufacturing, & energy systems

Notes

ENGINEERING

DEGREE PROGRAMS

AND

MAJOR

REQUIREMENTS

The information listed here is current as of Fall 2016.
Students are expected to know departmental policies and course prerequisites and **are ultimately responsible** for accurately completing degree requirements.

The most current information on major requirements is available at http://www.egr.msu.edu/undergraduate/academics/programs

Applied Engineering Sciences

1. University Requirements: (23)

Writing, Rhetoric and American Cultures (WRA)	4
Integrative Studies in Humanities (IAH)	8
Integrative Studies in Social Sciences (ISS)	8
Bioscience (one of the following): BS 161, ENT 205, IBIO 150, MMG 141 MMG 201, PLB 105, PSL 250	3-4

2. College Requirements: (27)

CEM 141	General Chemistry	4
EGR 100	Introduction to Engineering Design	2
EGR 102	Introduction to Engineering Modeling	2
MTH 132	Calculus I	3
MTH 133	Calculus II	4
MTH 234	Multivariable Calculus	4
PHY 183	Physics for Scientists & Engineers I	4
PHY 184	Physics for Scientists & Engineers II	4

3. Major Requirements: (64-67)

A. Complete all of the following courses: (46)

ACC 230	Survey of Accounting Concepts	3
CE 221	Statics	3
CEM 161	Chemistry Laboratory I	1
COM 225	Intro to Interpersonal Communication	3
EC 201	Introduction to Microeconomics	3
EC 202	Introduction to Macroeconomics	3
ECE 201	Circuits and Systems I	3
AESC 210	Global Sys: Econ, Engr, Environment	3
AESC 310	Sustainable Systems Analysis	3
AESC 410	Capstone Project in Applied Egr Sci (W)	3
ME 201	Thermodynamics	3
ME 280	Graphic Communications	2
MGT 325	Management Skills and Processes	3
MKT 317	Quantitative Bus Research Methods	3
MSE 250	Materials Science and Engineering	3
PHY 191	Physics Lab for Scientists, I	1
STT 315	Intro to Prob & Statistics for Business	3

B. Select one of the following courses: (3)

BE 230	Engr Analysis of Biological Systems	3
ENE 280	Principles of Environ Engr & Science	3

Total credits Required for Degree 120

The requirements listed above apply to students admitted to the major of Applied Engineering Sciences in the Engineering Undergraduate Studies Office (UGS) beginning Fall, 2015. The Engineering Undergraduate Studies Office constantly reviews requirements and reserves the right to make changes as necessary. Consequently, each student is strongly encouraged to consult with his/her adviser to obtain assistance in planning and appropriate schedule of courses. Students who have questions about Applied Engineering Sciences should contact the Engineering Undergraduate Studies Advising Office, 1415 Engineering Building, phone (517) 355-6616 extension 1.

C. Concentrations (15-18)

In consultation with their academic advisor, students must select one of the following concentrations: business law, computer science, packaging, supply chain management, technical sales, or media and information. For students interested in computer science, the minimum criteria for acceptance is the completion of Computer Science and Engineering 231 and 260 with a combined grade-point average in those two courses of 3.0. The concentration will be noted on the student's academic record.

Business Law (16-17)

1. All of the following courses: (13)

EC 301	Intermediate Microeconomics	3
EC 425	Law and Economics	3
GBL 295	Business Law, Public Policy & Ethics	3
GBL 480	Environmental Law & Sustainability for Business: From Local to Global	3
PHY 192	Physics Laboratory for Scientists, II	1

2. One of the following courses (3 or 4 credits):

PHL 345	Business Ethics	4
PHL 354	Philosophy of Law	3
PLS 320	Judicial Politics	3
PLS 321	Constitutional Law	3
PLS 322	Comparative Legal Systems	3

Computer Science: (18)

1. All of the following courses: (12)

CSE 231	Introduction to Programming I	4
CSE 232	Introduction to Programming II	4
CSE 260	Discrete Structures in Computer Sci	4

2. One of the following courses: (3)

CSE 320	Computer Organization & Architecture	3
CSE 331	Algorithms and Data Structures	3
CSE 335	Object-oriented Software Design	4

3. One of the following courses: (3)

CSE 410	Operating Systems	3
CSE 420	Computer Architecture	3
CSE 440	Intro to Artificial Intelligence	3
CSE 471	Media Processing & Multimedia Computing	3
CSE 472	Computer Graphics	3

Packaging (17)

All of the following courses:

CEM 143	Survey of Organic Chemistry	4
PKG 101	Principles of Packaging	3
PKG 221	Packaging with Glass and Metal	2
PKG 322	Packaging with Paper and Paperboard	4
PKG 323	Packaging with Plastics	4

Supply Chain Management: (15)

FI 320	Introduction to Finance	3
MKT 327	Introduction to Marketing	3
SCM 303	Introduction to Supply Chain Mgt	3
SCM 371	Procurement & Supply Management	3
SCM 372	Manufacturing Planning and Control	3

Technical Sales: (18)

COM 360	Advanced Sales Communication	3
COM 483*	Practicum in Sales Communication	1
FI 320	Introduction to Finance	3
MKT 313	Personal Selling and Buying Processes	3
MKT 327	Introduction to Marketing	3
MKT 383	Sales Management	3
SCM 474	Negotiations	2

*Requires a sales-based internship

Media and Information: (18)

MI 101	Understanding Media and Information	3
MI 201	Media & Information Technologies & Industries	3
MI 301	Bringing Media to Market	3
MI 305	Media & Information Policy	3
MI 361	IT Network Management & Security	3
MI 458	Project Management (W)	3

Other Electives (Variable)

Last revised May 2016

NOTES

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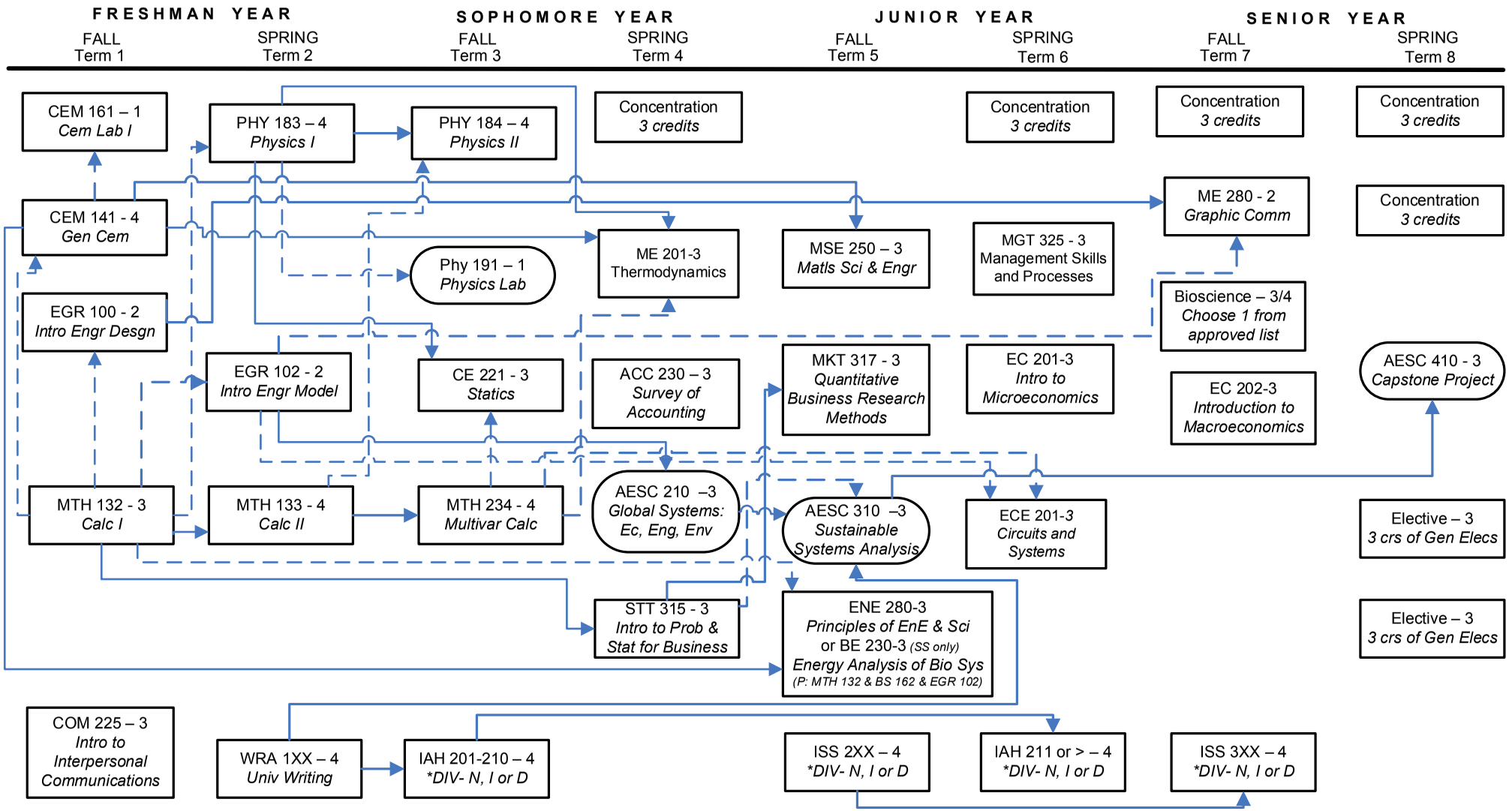
Engineering Building, 428 S. Shaw Lane, Room 1415, East Lansing MI 48824 | (517) 355-6616
http://www.egr.msu.edu/undergraduate/academics/programs

Applied Engineering Sciences

Prerequisite Flowchart

These requirements are effective for students admitted to the Applied Engineering Sciences major beginning Fall 2015.



LEGEND

→ Prerequisite ⇢ Prerequisite or Concurrent

Rounded box: Offered only in the semester listed (excluding summer)

*DIV: Complete courses in at least 2 out of 3 diversity categories- "N", "I" or "D"

Last Revised: 05/24/16

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http://www.egr.msu.edu/undergraduate/academics/programs

Biosystems Engineering

Accredited by the Engineering Accreditation Commission of ABET, www.abet.org

1. University Requirements: (23)

Writing, Rhetoric and American Cultures (WRA)		4
Integrative Studies in Humanities (IAH)		8
Integrative Studies in Social Sciences (ISS)		8
Bioscience: BS 161 Cell and Molecular Biology		3

2. College Requirements: (30)

CEM 141	General Chemistry	4
EGR 100	Introduction to Engineering Design	2
EGR 102	Introduction to Engineering Modeling	2
MTH 132	Calculus I	3
MTH 133	Calculus II	4
MTH 234	Multivariable Calculus	4
MTH 235	Differential Equations	3
PHY 183	Physics for Scientists & Engineers I	4
PHY 184	Physics for Scientists & Engineers II	4

3. Major Requirements: (63-65)

a. Complete all of the following courses: (44)

BE 101	Introduction to Biosystems Engineering	1
BE 230	Engineering Analysis of Biological Systems	3
BE 332	Engineering Properties of Biological Materials	3
BE 334	Biosystems Engineering Laboratory Practice	3
BE 350	Heat and Mass Transfer in Biosystems	3
BE 351	Thermodynamics for Biological Engineering	3
BE 360	Microbial Systems Engineering	3
BE 385	Engineering Design & Optimization for Biological Sys	3
BE 485	Biosystems Design Techniques	3
BE 487	Biosystems Design Project (W)	3
BS 162	Organismal and Population Biology	3
CE 221	Statics	3
CE 274	Graphics for Civil & Environmental Engineers	1
CE 321	Introduction to Fluid Mechanics	4
CEM 143	Survey of Organic Chemistry	4
CEM 161	Chemistry Laboratory I	1

b. Select one of the following courses: (2)

BS 171	Cell and Molecular Biology Laboratory	2
BS 172	Organismal and Population Biology Laboratory	2

c. Select one of the following courses: (3-4)

IBIO 341	Fundamental Genetics	4
IBIO 355	Ecology	3
MMG 301	Introductory Microbiology	3
PLB 301	Introductory Plant Physiology	3
PSL 250	Introductory Physiology	4

d. Select one of the following courses: (3-4)

BLD 450	Eukaryotic Pathogens	3
CSS 442	Agricultural Ecology	3
CSS 451	Biotechnology Apps for Breeding & Genetics	3
FOR 406	Applied Forest Ecology: Silviculture	3
FSC 440	Food Microbiology	3
MMG 425	Microbial Ecology	3
MMG 445	Microbial Biotechnology (W)	3
PLB 402	Biology of Fungi	3
PLB 424	Algal Biology	4
PSL 425	Physiological Biophysics	3

e. Select four of the following courses: (12)

BE 444	Biosensors for Medical Diagnostics	3
BE 449	Human Health Risk Analysis for Eng Controls	3
BE 456	Electric Power and Control	3
BE 469	Sustainable Bioenergy Systems	3
BE 477	Food Engineering: Fluids	3
BE 478	Food Engineering: Solids	3
BE 481	Water Resources Sys Anlys & Modeling	3
BE 482	Diffuse-Source Pollution Engineering	3
CHE 468	Biomass Conversion Engineering	3

Optional Concentrations

The department offers concentrations for students who wish to focus on a specific application area in the discipline. The concentrations are available to, but not required of, any student enrolled in the Bachelor of Science degree program in Biosystems Engineering. Courses completed to satisfy requirement 3. above may also be used to satisfy the requirements of a concentration. The concentration will be noted on the student's transcript.

Bioenergy and Bioproduct Engineering Concentration

To earn a Bachelor of Science degree in Biosystems Engineering with a bioenergy and bioproduct engineering concentration, students must complete requirements 1., 2., and 3. above and the following:

1. All of the following courses: (9)

BE 469	Sustainable Bioenergy Systems	3
CHE 468	Biomass Conversion Engineering	3
CSS 467	Bioenergy Feedstock Production	3

2. Two of the following courses: (6-8):

BE 457	Bioenergy Feedstock Systems Analysis	
CHE 481	Biochemical Engineering	3
CHE 882	Advanced Biochemical Engineering	3
CHE 883	Multidisciplinary Bioprocessing Laboratory	3
CSS 451	Biotechnology Applications for Plant Breeding & Genetics	3
FOR 406	Applied Forest Ecology: Silviculture	3
GLG 471	Applied Geophysics	4
MC 450	International Environmental Law & Policy	3
ME 417	Design of Alternative Energy Systems	3
ME 422	Introduction to Combustion	3
MMG 445	Microbial Biotechnology (W)	3
PLB 402	Biology of Fungi	4
PLB 424	Algal Biology	4

Biomedical Engineering Concentration

To earn a Bachelor of Science degree in Biosystems Engineering with a biomedical engineering concentration, students must complete requirements 1., 2., and 3. above and the following:

1. All of the following courses: (6)

BE 444	Biosensors for Medical Diagnostics	3
BE 449	Human Health Risk Analysis for Eng Controls	3

2.. One of the following courses: (3)

BLD 450	Eukaryotic Pathogens	3
PSL 425	Physiological Biophysics	3

3. Two of the following: (5-6)

BLD 204	Mechanisms of Disease	3
BLD 430	Molecular Laboratory Diagnostics	2
BLD 434	Clinical Immunology	3
BLD 450	Eukaryotic Pathogens	3
ECE 445	Biomedical Instrumentation	3
ME 494	Biofluid Mechanics and Heat Transfer	3
MSE 425	Biomaterials and Biocompatibility	3
PLB 400	Introduction to Bioinformatics	3
PSL 425	Physiological Biophysics	3

Courses used to fulfill requirement 2. in this concentration may not be used to fulfill this requirement.

Ecosystems Engineering Concentration

To earn a Bachelor of Science degree in Biosystems Engineering with an ecosystems engineering concentration, students must complete requirements 1., 2., and 3. above and the following:

1. All of the following courses: (9)

BE 481	Water Resources Systems Analysis and Modeling	3
BE 482	Diffuse-Source Pollution Engineering	3
MMG 425	Microbial Ecology	3

2. Two of the following courses: (5-6)

CE 422	Applied Hydraulics	3
CSS 210	Fundamentals of Soil Science	3
CSS 330	Soil Chemistry	2
CSS 360	Soil Biology	3
CSS 442	Agricultural Ecology	3
CSS 455	Pollutants in the Soil Environment	3
FOR 404	Forest Ecology	3
FW 417	Wetland Ecology and Management	3
FW 420	Stream Ecology	3
FW 443	Restoration Ecology	3

Food Engineering Concentration

To earn a Bachelor of Science degree in Biosystems Engineering with a food engineering concentration, students must complete requirements 1., 2., and 3. above and the following:

All of the following courses: (9)

BE 477	Food Engineering: Fluids	3
BE 478	Food Engineering: Solids	3
FSC 440	Food Microbiology	3

Two of the following courses, one of which must be at the 400-level: (6-7)

BMB 200	Introduction to Biochemistry	4
FSC 211	Principles of Food Science	3
FSC 401	Food Chemistry	3
FSC 430	Food Processing: Fruits & Vegetables	3
FSC 431	Food Processing: Cereals	3
FSC 432	Food Processing: Dairy Foods	3
FSC 433	Food Processing: Muscle Foods	3

Other Electives (Variable)

Total Credits Required for Degree 128

These requirements are effective for students admitted to the Biosystems Engineering major beginning Fall 2016. The Department of Biosystems and Agricultural Engineering (BAE) constantly reviews program requirements and reserves the right to make changes as necessary. Consequently, each student is strongly encouraged to consult with his/her adviser to obtain assistance in planning an appropriate schedule of courses. Students who have questions about Biosystems Engineering should contact the Biosystems Engineering Advising Office, 103 B Farrall Hall, phone (517) 355-3274. For scheduling academic advising appointments visit: https://www.egr.msu.edu/adcalendar/

Last revised April 2016

NOTES

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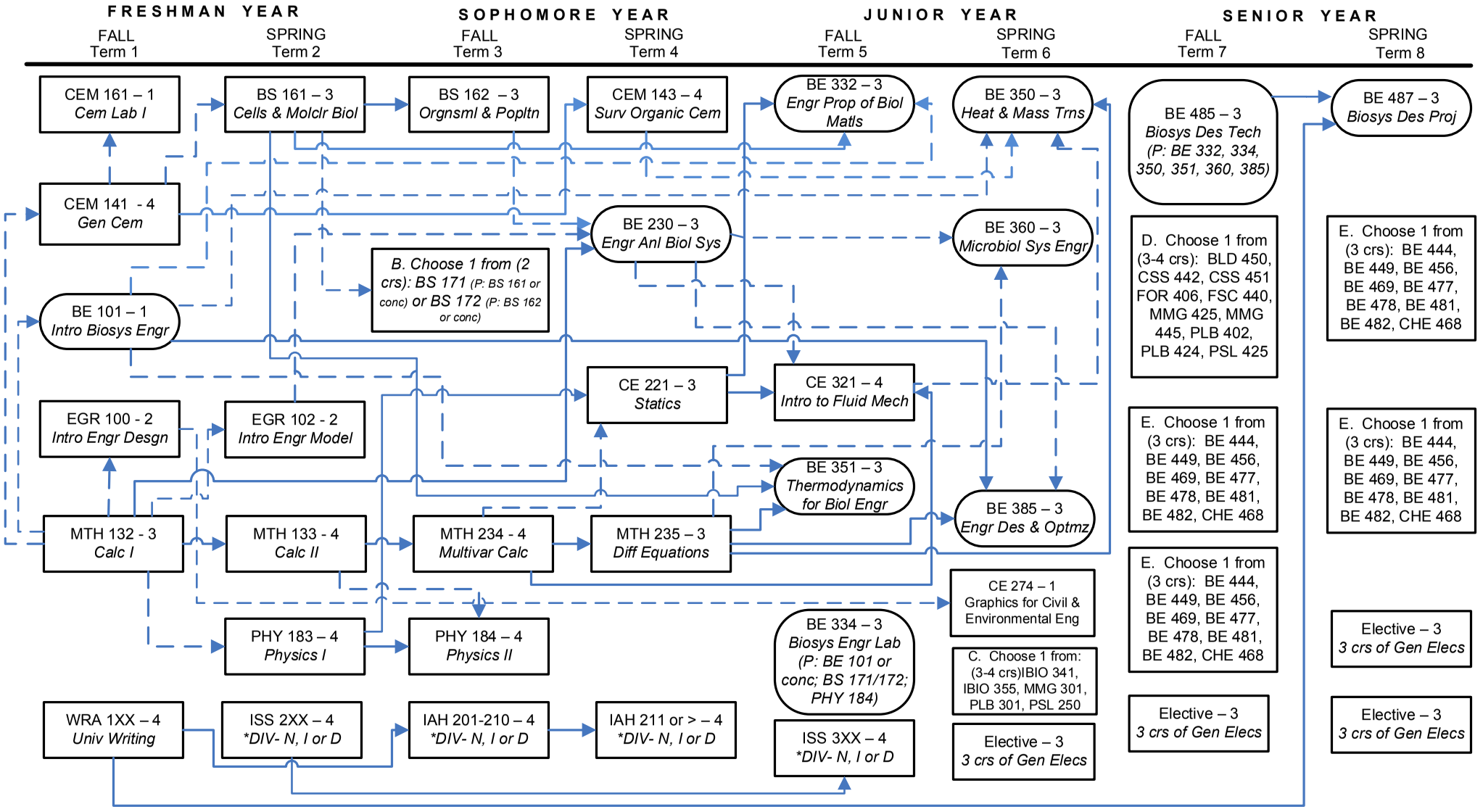
Biosystems Engineering

Prerequisite Flowchart

These requirements are effective for students admitted to the Biosystems Engineering major beginning Fall 2016.



Last Revised: May 2016

MSU COLLEGE OF ENGINEERING

Michigan State University I College of Engineering I Engineering Undergraduate Studies
Engineering Building, 428 S. Shaw Lane, Room 1415, East Lansing MI 48824 I (517) 355-6616 ext. 1
http://www.egr.msu.edu/undergraduate/academics/programs

Chemical Engineering

Accredited by the Engineering Accreditation Commission of ABET, www.abet.org

1. University Requirements: (23)

Writing, Rhetoric and American Cultures (WRA)	4
Integrative Studies in Humanities (IAH)	8
Integrative Studies in Social Sciences (ISS)	8
Bioscience: BS 161 Cell and Molecular Biology	3

2. College Requirements: (30)

CEM 151	General and Descriptive Chemistry	4
EGR 100	Introduction to Engineering Design	2
EGR 102	Introduction to Engineering Modeling	2
MTH 132	Calculus I	3
MTH 133	Calculus II	4
MTH 234	Multivariable Calculus	4
MTH 235	Differential Equations	3
PHY 183	Physics for Scientists & Engineers I	4
PHY 184	Physics for Scientists & Engineers II	4

3. Major Requirements: (67-69)

A. Complete all of the following courses: (51)

CEM 152	Principles of Chemistry	3
CEM 161	Chemistry Laboratory I	1
CEM 162	Chemistry Laboratory II	1
CEM 351	Organic Chemistry I	3
CEM 352	Organic Chemistry II	3
CEM 355	Organic Laboratory I	2
CHE 201	Material and Energy Balances	3
CHE 210	Modeling and Analysis of Transport Phenomena	3
CHE 301	Chemical Engineering as a Profession	1
CHE 311	Fluid Flow and Heat Transfer	3
CHE 312	Mass Transfer and Separations	4
CHE 316	Lab Practice and Statistical Analysis (W)	4
CHE 321	Thermodynamics for Chemical Engineering	4
CHE 431	Chemical Reaction Engineering	4
CHE 432	Process Analysis and Control	3
CHE 433	Process Design and Optimization I (W)	4
CHE 434	Process Design and Optimization II	2
CHE 473	Chemical Engr Princ in Polymers & Mats Sys	3

B. One of the following groups: (4-6)

Group 1

BMB 401	Basic Biochemistry	4

Group 2

BMB 461	Biochemistry I	3
BMB 462	Biochemistry II	3

C. Select one of the following courses: (3)

CHE 472	Composite Materials Processing	3
CHE 481	Biochemical Engineering	3

D. Select one of the following courses: (3)

CEM 483	Quantum Chemistry	3
CEM 484	Molecular Thermodynamics	3

E. Technical Electives: (6)

Students must complete at least 6 credits of technically oriented subject-related courses approved by the student's advisor. Acceptable subjects include, but are not limited to, composites processing or biochemical engineering (in addition to that required in 3. c. above), electronic materials, environment, advanced mathematics, transport phenomena, advanced chemistry, foods, legal and regulatory issues, advanced materials, advanced biology, statistics, biomedical engineering, bioenergy, and polymers.

Note: Elective courses in item 3. e. must include at least 3 credits of engineering topics, which includes courses taught in the College of Engineering as well as courses taught in advanced mathematics, advanced chemistry, advanced biology, advanced statistics, and advanced physics. If Biochemistry and Molecular Biology 462 is taken to fulfill requirement 3.b. it will count as technical elective credit in item 3.e.

Concentrations in Chemical Engineering

In response to increasing interest in the application of chemical engineering principles to related fields, the Department of Chemical Engineering and Materials Science offers concentrations in biochemical engineering, bioenergy, biomedical engineering, environmental engineering, food science, and polymer science and engineering to students wishing an area of concentration in the degree. Concentrations are available to, but not required of, any student enrolled in the Bachelor of Science degree program in chemical engineering. The concentration will be noted on the student's transcript.

NOTE: Completing the Bachelor of Science degree in chemical engineering with a concentration may require more than 128 credits.

Biochemical Engineering Concentration: (11-15)

To earn a Bachelor of Science degree in Chemical Engineering with a biochemical engineering concentration, students must complete requirements 1., 2., 3.a., 3.d., above and the following:

All of the following courses: (6)

CHE 481	Biochemical Engineering	3
MMG 301	Introductory Microbiology	3

One of the following (4 or 6 credits)

BMB 401	Comprehensive Biochemistry	4
BMB 461	Advanced Biochemistry I	3
BMB 462	Advanced Biochemistry II	3

Two or three of the following courses. Students who chose BMB 401 in 3.B. must complete three courses. Students who chose BMB 461 and 462 must complete two courses: (5-9)

BMB 829	Methods Of Macromolecular Anlys & Synthesis	2
CHE 882	Advanced Biochemical Engineering	3
CHE 883	Multidisciplinary Bioprocessing Laboratory	3
MMG 409	Eukaryotic Cell Biology	3
MMG 421	Prokaryotic Cell Physiology	3
MMG 431	Microbial Genetics	3
MMG 445	Microbial Biotechnology (W)	3

Bioenergy Concentration: (15-16)

To earn a Bachelor of Science degree in Chemical Engineering with a bioenergy engineering concentration, students must complete requirements 1., 2., 3.a., 3.b., 3.d.,above and the following:

All of the following courses: (12)

BE 469	Sustainable Bioenergy Systems	3
CHE 468	Biomass Conversion in Engineering	3
CHE 481	Biochemical Engineering	3
CSS 467	Bioenergy Feedstock Production	3

One of the following courses (3-4 credits):

AEC 829	Economics of Environ Resources	3
CHE 882	Advanced Biochemical Engineering	3
CHE 883	Multidisciplinary Bioprocessing Laboratory	3
GLG 471	Applied Geophysics	4
MC 450	International Environmental Law and Policy	3
MMG 445	Microbial Biotechnology (W)	3

Biomedical Engineering Concentration: (15-16)

To earn a Bachelor of Science degree in Chemical Engineering with a biomedical engineering concentration, students must complete requirements 1., 2., 3.a., 3.b., 3.d., above and the following:

All of the following courses: (9)

CHE 481	Biochemical Engineering	3
MMG 409	Eukaryotic Cell Biology	3
PSL 431	Human Physiology I	3

Two of the following courses: (6-7)

BMB 471	Advanced Biochemistry Laboratory (W)	3
CHE 883	Multidisciplinary Bioprocessing Laboratory	3
ME 494	Biofluid Mechanics and Heat Transfer	3
IBIO 341	Fundamental Genetics	4

Environmental Concentration: (15)

To earn a Bachelor of Science degree in Chemical Engineering with an environmental concentration, the student must complete requirements 1., 2., and 3. a., 3.b., 3.d., above and the following:

All of the following courses: (6)

CHE 481	Biochemical Engineering	3
ENE 280	Principles of Environmental Engr and Science	3

Three of the following courses: (9)

EEP 255	Ecological Economics	3
EEP 320	Environmental Economics	3
EEP 405	Corporate Environmental Management	3
ENE 481	Environ Chemistry: Equilibrium Concepts	3
ENE 483	Water and Wastewater Engineering	3
ENE 489	Air Pollution: Science and Engineering	3
CE 485	Landfill Design	3
CSUS 200	Introduction to Sustainability	3
CSUS 465	Environmental Law and Policy	3
IBIO 446	Environmental Issues and Public Policy	3

Food Science Concentration: (12-13)

To earn a Bachelor of Science degree in Chemical Engineering with a food science concentration, students must complete requirements 1., 2., 3. a., 3. b., 3.c., 3.d., above and all of the following:

All of the following courses: (9)

FSC 401	Food Chemistry	3
FSC 440	Food Microbiology	3
MMG 301	Introductory Microbiology	3

One of the following courses: (3-4)

BE 477	Food Engineering: Fluids	3
BE 478	Food Engineering: Solids	3
FSC 325	Food Processing: Unit Operations	3
FSC 455	Food and Nutrition Laboratory	3
FSC 470	Integrated Approaches to Food Product Dev	3

Polymer Science and Engineering Concentration: (16-17)

To earn a Bachelor of Science degree in Chemical Engineering with a polymer science and engineering concentration, students must complete requirements 1., 2., 3. a., 3. b., 3.d., above and all of the following:

All of the following courses: (10)

CE 221	Statics	3
CHE 472	Composite Materials Processing	3
ME 222	Mechanics of Deformable Solids	3

Two of the following courses: (6-7)

CHE 871	Materials Surfaces and Interfaces	3
CHE 872	Polymers & Cmposites: Mfg, Strc & Prfrmnce	3
MSE 370	Synthesis and Processing of Materials	3
MSE 426	Introduction to Composite Materials	3
PKG 323	Packaging with Plastics	4

Other Electives (Variable)

Total Credits Required for Degree **128**

These requirements are effective for students admitted to the Chemical Engineering major beginning Fall 2014. The Department of Chemical Engineering and Materials Science constantly reviews program requirements and reserves the right to make changes as necessary. Consequently, each student is strongly encouraged to consult with his/her adviser to obtain assistance in planning an appropriate schedule of courses. Students who have questions about Chemical Engineering should contact the Chemical Engineering and Materials Science Department Advising Office, 3508 Engineering Building, phone (517) 432-1352. For scheduling academic advising appointments visit: https://www.egr.msu.edu/adcalendar/

Some courses may have prerequisites, which are not otherwise required in the program. Students should check course descriptions to ensure they are aware of prerequisites.

Last revised May 2016

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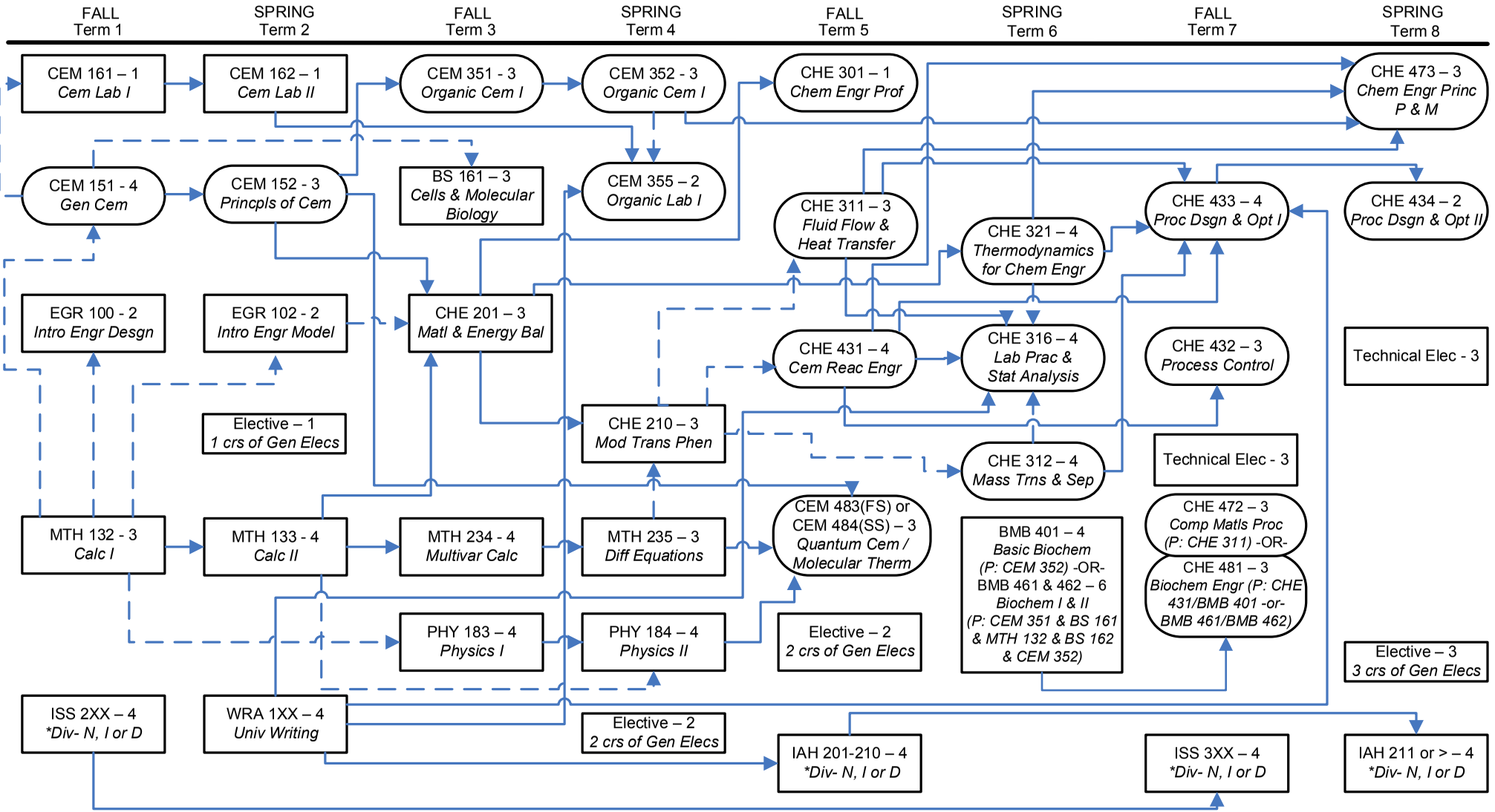
Chemical Engineering

Prerequisite Flowchart

These requirements are effective for students admitted to the Chemical Engineering major beginning Fall 2014.



LEGEND

→ Prerequisite ⇢ Prerequisite or Concurrent "P:" Prerequisite

Rounded box: Offered only in the semester listed (excluding summer) * Div: Complete courses in at least 2 out of 3 diversity categories - "N", "I" or "D"

Last Revised: May 2016

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Civil Engineering

Accredited by the Engineering Accreditation Commission of ABET, www.abet.org

1. University Requirements: (23-24)

Writing, Rhetoric and American Cultures (WRA)	4
Integrative Studies in Humanities (IAH)	8
Integrative Studies in Social Sciences (ISS)	8
Bioscience (one of the following): BS 161, ENT 205, IBIO 150, MMG 141, MMG 201, PLB 105, PSL 250	3-4

2. College Requirements: (30)

CEM 141	General Chemistry	4
OR		
CEM 151	General and Descriptive Chemistry	4
EGR 100	Introduction to Engineering Design	2
EGR 102	Introduction to Engineering Modeling	2
MTH 132	Calculus I	3
MTH 133	Calculus II	4
MTH 234	Multivariable Calculus	4
MTH 235	Differential Equations	3
PHY 183	Physics for Scientists & Engineers I	4
PHY 184	Physics for Scientists & Engineers II	4

3. Major Requirements: (67)

A. Complete all of the following courses: (43)

CE 221	Statics	3
CE 273	Civil & Environmental Engineering Measurements	2
CE 274	Graphics for Civil & Environmental Engineers	1
CE 305	Introduction to Structural Analysis	3
CE 312	Soil Mechanics	4
CE 321	Introduction to Fluid Mechanics (W)	4
CE 337	Civil Engineering Materials I	4
CE 341	Transportation Engineering (W)	3
CE 371	Sustainable Civil & Environmental Egr Systems	3
CE 372	Risk Analysis in Civil & Environmental Engineering	2
CE 495	Senior Design in Civil & Environmental Engineering	4
CEM 161	Chemistry Laboratory I	1
ENE 280	Principles of Environmental Engineering & Science	3
GLG 301	Geology of Continents and Oceans	3
ME 222	Mechanics of Deformable Solids	3

B. Complete one of the following courses: (3)

CE 461	Computational Methods in Civil Engineering	3
ME 361	Dynamics	3

C. Complete one of the following courses: (3)

BE 351	Thermodynamics for Biological Engineering	3
ECE 345	Electronic Instrumentation and Systems	3
ME 201	Thermodynamics	3
MSE 250	Materials Science and Engineering	3

D. Technical Electives: (18)

Technical electives. Complete 18 credits of electives from the list below. At least four courses, totaling a minimum of 12 credits, must be from at least four different areas (environmental, geotechnical, pavements, structures, transportation, and water resources). Additional credits to meet the 18 credit requirement may be taken from the list of courses below, which includes courses in construction management.

Environmental

ENE 481	Environmental Chem: Equilibrium Concepts	3
ENE 483	Water & Wastewater Engineering	3
ENE 487	Microbiology for Environ Science & Egr	3
ENE 489	Air Pollution: Science & Engineering	3

Geotechnical

CE 418	Geotechnical Engineering	3

Pavements

CE 431	Pavement Design and Analysis I	3
CE 831	Adv Concrete Pavement Analysis & Design	3
CE 832	Adv Asphalt Pavement Analysis & Design	3

Structures

CE 405	Design of Steel Structures	3
CE 406	Design of Concrete Structures	3
CE 805	Advanced Design of Steel Structures	3
CE 806	Advanced Structural Concrete Design	3

Transportation

CE 444	Principles of Traffic Engineering	3
CE 448	Transportation Planning	3
CE 449	Highway Design	3

Water Resources

ENE 421	Engineering Hydrology	3
ENE 422	Applied Hydraulics	3
ENE 822	Groundwater Modeling	3

The additional six credits may include courses from the construction management program and/or the above list.

CE 471	Construction Egr-Eqpt, Methods & Planning	3
CMP 311	Construction Project Scheduling	3
CMP 415	Cost Estimating and Analysis	3
CMP 423	Construction Project Management	3

Other Electives (Variable)

Total Credits Required for Degree **128**

The requirements listed above apply to students admitted to the Department of Civil & Environmental Engineering (CEE) beginning Fall 2016. The Department of Civil & Environmental Engineering (CEE) constantly reviews program requirements and reserves the right to make changes as necessary. Consequently, each student is strongly encouraged to consult with his/her adviser to obtain assistance in planning an appropriate schedule of courses. Students who have questions about Civil Engineering should contact the Civil & Environmental Engineering Department Advising Office, 3579 Engineering Building, phone (517) 355-3274. For scheduling academic advising appointments https://www.egr.msu.edu/adcalendar/

Last Revised April 2016

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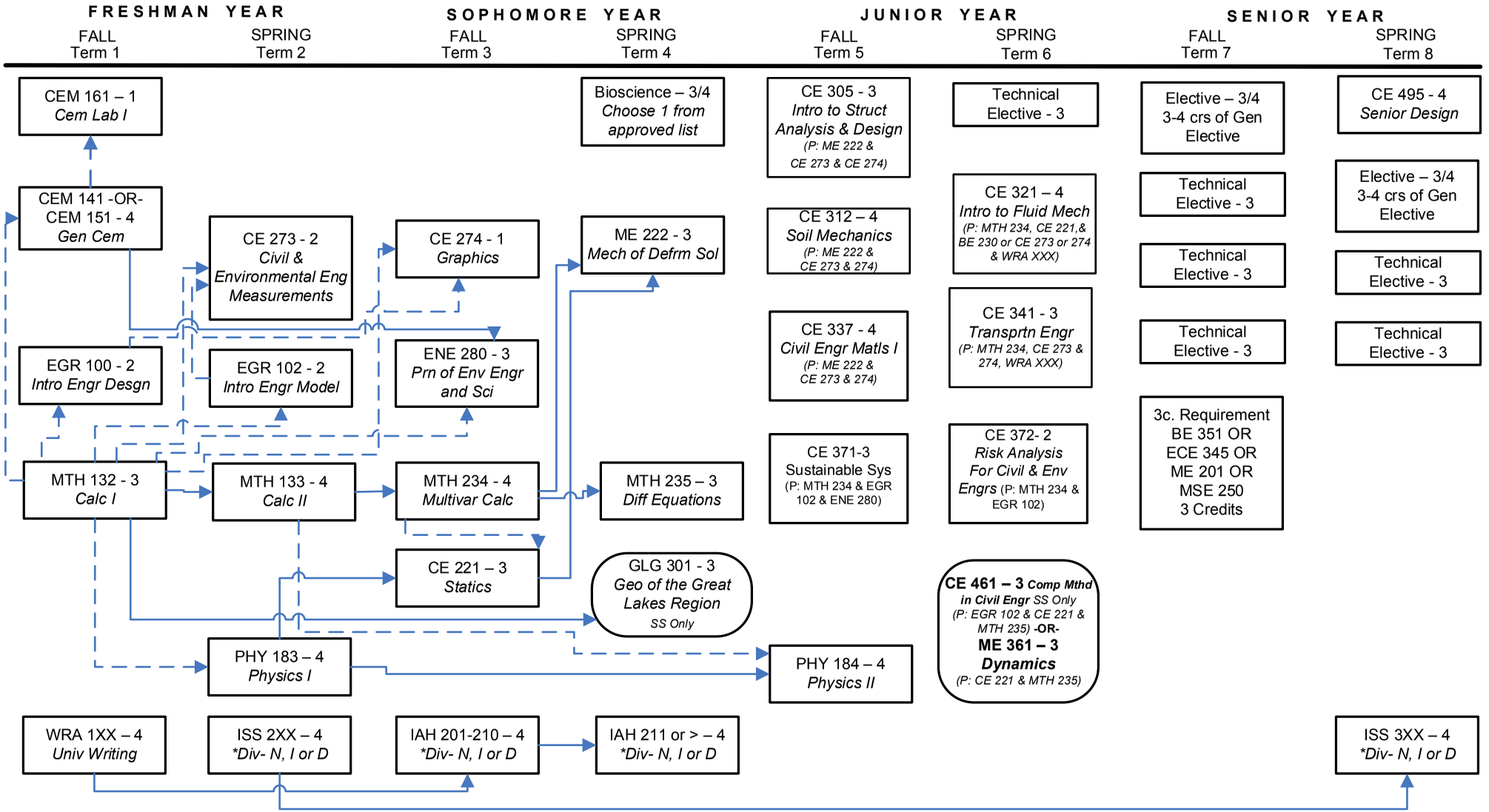
Civil Engineering

Prerequisite Flowchart

These requirements are effective for students admitted to the Civil Engineering major beginning Fall 2016.



LEGEND

→ Prerequisite ⇢ Prerequisite or Concurrent

Rounded box: Offered only in the semester listed (excluding summer)

*Div- Complete courses in at least 2 out of 3 diversity categories: "N", "I" or "D"

Last Revised: May 2016

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Computer Engineering

Accredited by the Engineering Accreditation Commission of ABET, www.abet.org

1. University Requirements (23-24)

Writing, Rhetoric and American Cultures (WRA)	4
Integrative Studies in Humanities (IAH)	8
Integrative Studies in Social Sciences (ISS)	8
Bioscience (one of the following):	
BS 161, ENT 205, IBIO 150, MMG 141, MMG 201, PLB 105, PSL 250	3-4

2. College Requirements: (28)

CEM 141	General Chemistry	4
EGR 100	Introduction to Engineering Design	2
MTH 132	Calculus I	3
MTH 133	Calculus II	4
MTH 234	Multivariable Calculus	4
MTH 235	Differential Equations	3
PHY 183	Physics for Scientists & Engineers I	4
PHY 184	Physics for Scientists & Engineers II	4

3. Major Requirements: (69)

A. Complete one of the following courses: (1)

CEM 161	Chemistry Laboratory I	1
PHY 191	Physics Laboratory for Scientists I	1

B. All of the following courses: (44)

CSE 231	Introduction to Programming I	4
CSE 232	Introduction to Programming II	4
CSE 260	Discrete Structures in Computer Sci	4
CSE 331	Algorithms and Data Structures	3
CSE 410	Operating Systems	3
ECE 201	Circuits and Systems I	3
ECE 202	Circuits and Systems II	3
ECE 203	Electronic Circuits and Systems Lab	1
ECE 230	Digital Logic Fundamentals	3
ECE 280	Electrical Engineering Analysis	3
ECE 302	Electronic Circuits	3
ECE 303	Electronics Laboratory	1
ECE 331	Microprocessors & Digital Systems	4
ECE 390	Ethics, Professnlsm and Cont. Issues	1
ECE 480	Senior Design (W)	4

The requirements listed above apply to students admitted to the major of Computer Engineering beginning Fall, 2013. The Department of Electrical and Computer Engineering (ECE) constantly reviews program requirements and reserves the right to make changes as necessary. Students are encouraged to consult with their advisor to obtain assistance in planning an appropriate schedule. Students who have questions about Computer Engineering should contact the Electrical and Computer Engineering Department Advising Office, 2212 Engineering Building, phone (517) 355-5242.

C. Major Electives: (24)

Complete 24 credits of electives as specified below. At least 18 credits must be from core and focus track electives combined, with at least one course with a laboratory. Additional credits to meet the 24 credit requirement may be taken from other courses listed below, any 400-level Computer Science and Engineering (CSE) or Electrical and Computer Engineering (ECE) courses, or by completing an approved 3 or 4 credit experiential, out-of-classroom education experience obtained through engineering cooperative education or independent study.

Core Electives: (6)

At least 6 credits from the following:

CSE 420	Computer Architecture	3
ECE 410	VLSI Design (L)	4
CSE 422*	Computer Networks	3
or		
ECE 442*	Introduction to Communication Networks	3

**CSE 422 or ECE 442 can count towards you total Core Electives*

Focus Track Electives: (12)

At least 12 credits from the following:

Hardware

ECE 402	Appl of Analog Integrated Circuits (L)	4
ECE 411	Electronic Design Automation (L)	4
ECE 412	Intro to Mixed-Signal Circuits Design (L)	4
ECE 445	Biomedical Instrumentation	3

Software

CSE 335	Object-oriented Software Design	4
CSE 450	Translation of Programming Languages	3
CSE 471	Media Processing & Multimedia Computing	3
ECE 366	Introduction to Signal Processing	3

Recommended Electives:

ECE 305	Electromagnetic Fields & Waves I	4
ECE 313	Control Systems	3
ECE 404	Radio Frequency Electronic Circuits	4
ECE 415	Computer Aided Manufacturing	3
ECE 416	Digital Control	3
ECE 457	Communication Systems	3
ECE 458	Communication Systems Laboratory	1
ECE 466	Digital Signal Processing & Filter Design	3
ECE 474	Principles of Electronics Devices	3

Other Electives (Variable)

Total Credits Required for Degree 128

Last revised May 2016

Computer Engineering Biomedical Engineering Concentration

The department offers a concentration for students who plan to pursue graduate work in biomedical areas or seek employment in selected medical-related areas. The concentration is available to, but not required of, any student enrolled in the Bachelor of Science degree program in Computer Engineering. Courses completed to satisfy requirement 3. above may also be used to satisfy the requirements of the concentration. The concentration will be noted on the student's transcript.

Biomedical Engineering

To earn a Bachelor of Science degree in Computer Engineering with a biomedical engineering concentration, students must complete requirements 1., 2., and 3. above and the following:

1. Complete 6 credits from the following courses:

ANTR 350	Human Gross Anatomy for Pre-Health Professionals	3
BS 161	Cell and Molecular Biology	3
PSL 250	Introductory Physiology	4
PSL 310	Physiology for Pre-Health Professionals	4

2. Complete 6 credits from the following courses:

ECE 445	Biomedical Instrumentation	3
ECE 446	Biomedical Signal Processing	3
ECE 447	Introduction to Biomedical Imaging	3
ECE 448	Modeling and Analysis of Bioelectrical Systems	3

3. Complete 3 credits from the following courses:

BE 444	Biosensors for Medical Diagnostics	3
ME 494	Biofluid Mechanics and Heat Transfer	3
ME 495	Tissue Mechanics	3
MSE 425	Biomaterials and Biocompatibility	3

A 400-level listed above or other approved Electrical and Computer Engineering (ECE) courses with biomedical engineering content as approved by the student's advisor. The course used to fulfill this requirement may not be used to fulfill concentration requirement 1. or 2.

NOTES

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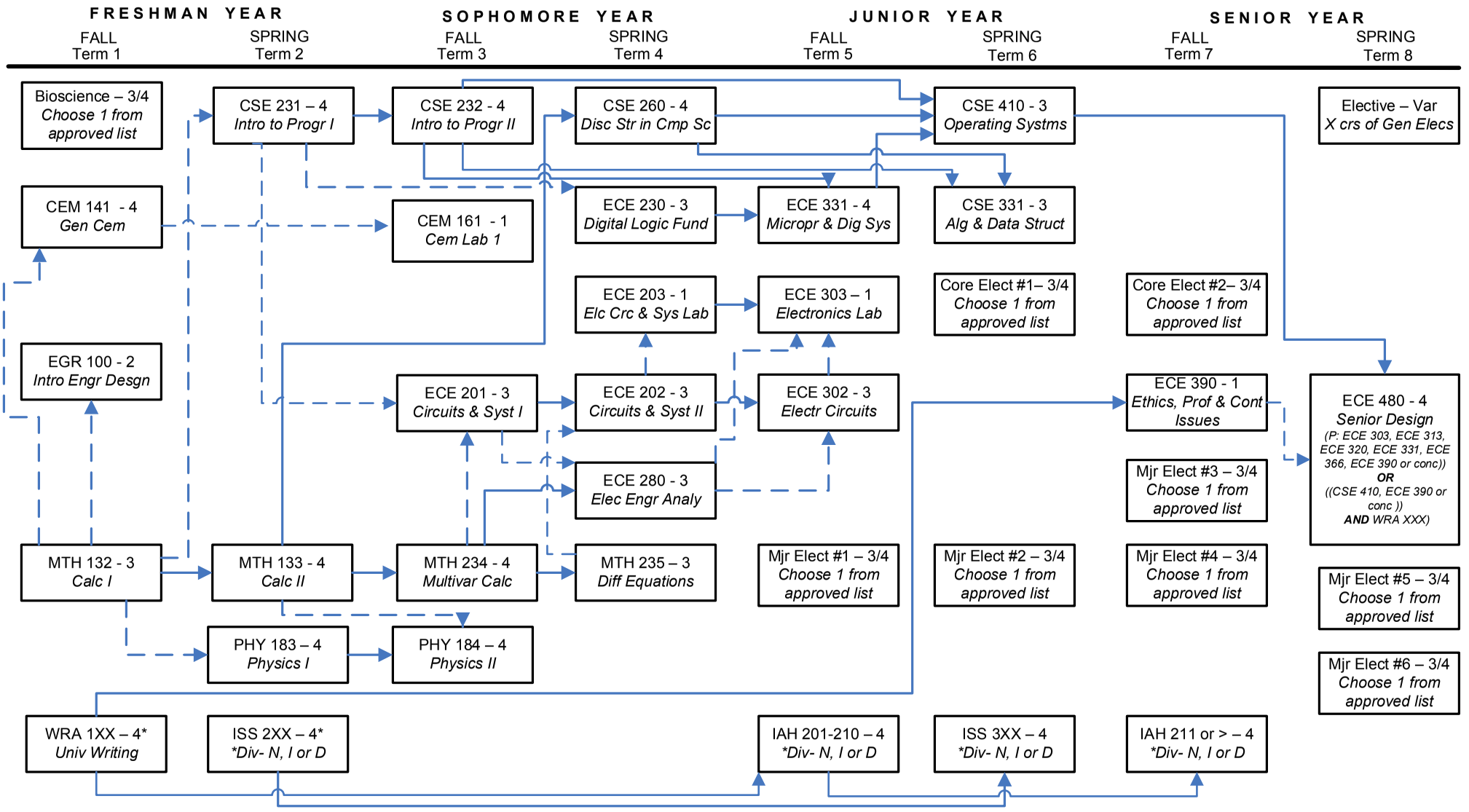
Computer Engineering

Prerequisite Flowchart

These requirements are effective for students admitted to the Computer Engineering major beginning Fall 2013.



LEGEND

Prerequisite ---------- Prerequisite or Concurrent * May be interchanged

Rounded box: Offered only in the semester listed (excluding summer) *Div: Complete courses in at least 2 out of 3 diversity categories- "N", "I" or "D"

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Computer Science

Accredited by the Computing Accreditation Commission of ABET, www.abet.org

1. University Requirements: (20)

Writing, Rhetoric and American Cultures (WRA)	4
Integrative Studies in Humanities (IAH)	8
Integrative Studies in Social Sciences (ISS)	8
Bioscience (See 3A Below)	

2. College Requirements (25)

CSE 231	Introduction to Programming I	4
EGR 100	Introduction to Engineering Design	2
MTH 132	Calculus I	3
MTH 133	Calculus II	4
MTH 234	Multivariable Calculus	4
PHY 183	Physics for Scientists & Engineers I	4
PHY 184	Physics for Scientists & Engineers II	4

3. Major Requirements (67-69)

A. Bioscience: (4-6)

Select one course from Group 1 and one course from Group 2.

Group 1

*BS 161	Cell and Molecular Biology	3
ENT 205	Pests, Society & Environment	3
IBIO 150	Integrating Biology: From DNA to Populations	3
MMG 141	Introductory Human Genetics	3
MMG 201	Fundamentals of Microbiology	3
PLB 105	Plant Biology	3
PSL 250	Introductory Physiology	4

Group 2

BS 171	Cell and Molecular Biology Laboratory	2
*CEM 161	Chemistry Laboratory I	1
CEM 162	Chemistry Laboratory II	1
PHY 191	Physics Laboratory for Scientists I	1
PHY 192	Physics Laboratory for Scientists II	1
PLB 106	Plant Biology Laboratory	1

B. Complete all of the following: (33)

CSE 100	Computer Science as a Profession	1
CSE 231	Introduction to Programming I	4
CSE 232	Introduction to Programming II	4
CSE 260	Discrete Structures in Computer Science	4
CSE 320	Computer Organization and Architecture	3
CSE 331	Algorithms and Data Structures	3
CSE 335	Object-Oriented Software Design	4
CSE 410	Operating Systems	3
CSE 498	Collaborative Design (W)	4
STT 351	Probability and Statistics for Engineering	3

*These courses may have prerequisites, which are not otherwise required in the program. Students should check course descriptions to ensure they are aware of prerequisites.

C. Select five of the following courses: (15)

An additional five courses selected from the following (15 credits):

CSE 420	Computer Architecture	3
CSE 422	Computer Networks	3
CSE 425	Introduction to Computer Security	3
CSE 435	Software Engineering	3
CSE 440	Introduction to Artificial Intelligence	3
CSE 450	Translation of Programming Languages	3
CSE 460	Computability & Formal Language Theory	3
CSE 471	Media Processing & Multimedia Computing	3
CSE 472	Computer Graphics	3
CSE 473	Fundamentals of 3D Game Development	3
CSE 476	Mobile Application Development	3
CSE 477	Web Application Architecture & Development	3
CSE 480	Database Systems	3
CSE 484	Information Retrieval	3
CSE 491	Selected Topics in Computer Science	1-4
MTH 451	Numerical Analysis I	3

Required Cognate: (15)

Cognates in the following areas are available to students in Computer Science: business, communication arts and sciences, foreign language, mathematics, the natural sciences, philosophy, psychology, the social sciences, and telecommunication. Students may complete cognates in other areas with the approval of the Department of Computer Science and Engineering academic adviser. The cognate should enhance the student's ability to apply analytical procedures in a specific subject area

The cognate is selected from (1), (2) or (3) below. The academic adviser of the Department of Computer Science and Engineering must pre-approve both the cognate and the cognate courses.

Cognate 1

A minimum of four courses totaling 15 or more credits outside the College of Engineering. At least 6 of the 15 credits must be in courses at the 300-400 level.

Cognate 2

Cognate in The Eli Broad College of Business consisting of this specific set of courses: ACC 230, (EC 201 or EC 202), FI 320, GBL 323 and MKT 327.

Cognate 3

A sequence of at least four courses in a foreign language.

Other Electives (Variable)

Total Credits Required for Degree **120**

The requirements listed above apply to students admitted to the major of Computer Science in the Department of Computer Science and Engineering beginning Spring 2015. The Department of Computer Science and Engineering (CSE) constantly reviews program requirements and reserves the right to make changes as necessary. Consequently, each student is strongly encouraged to consult with his/her advisor to obtain assistance in planning an appropriate schedule of courses. Students who have questions about Computer Science should contact the Computer Science and Engineering Department Advising Office, 3201 Engineering Building, phone (517) 353-5455.

Last revised May 2016

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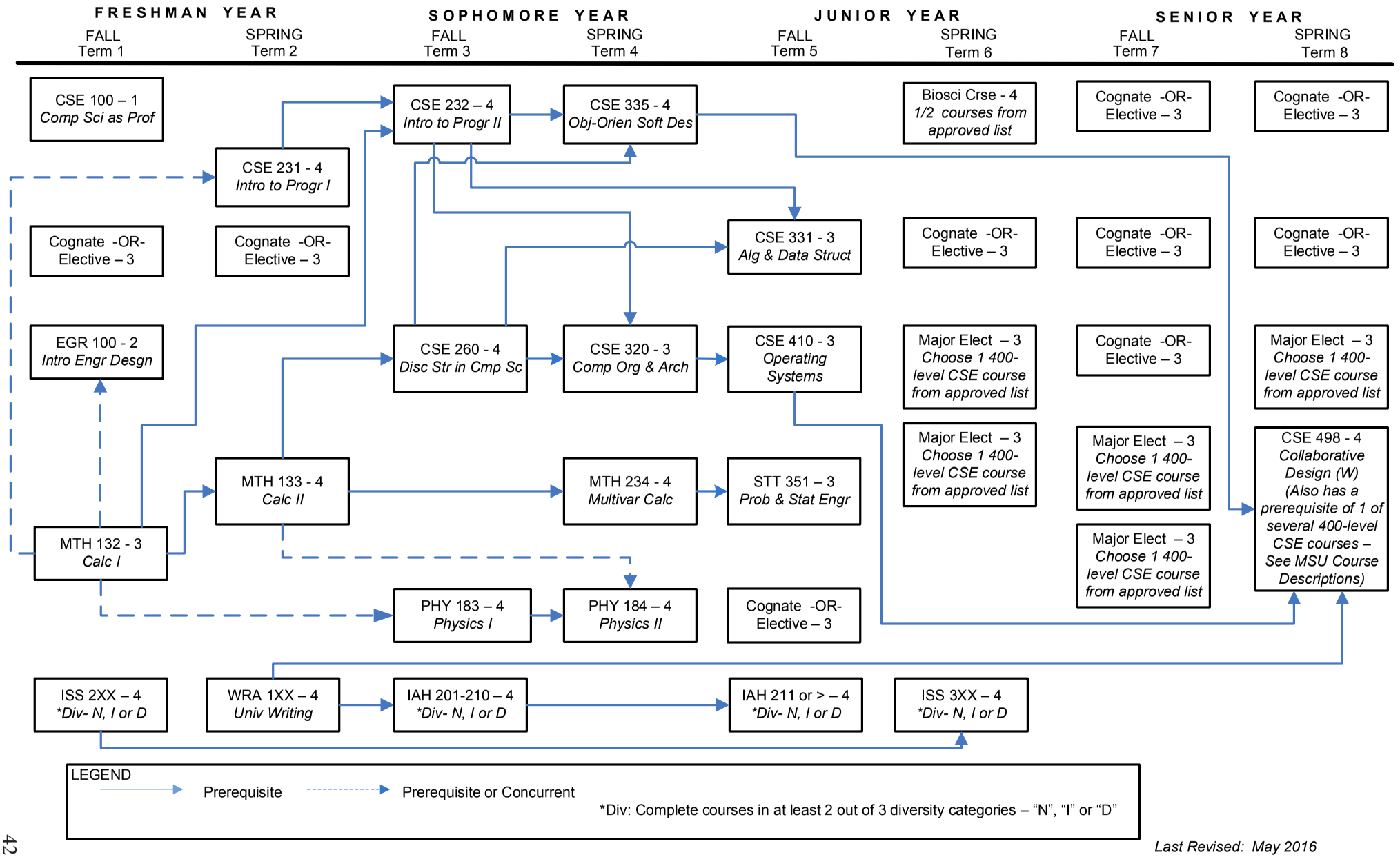
Computer Science

Requirements and Program Flow

These requirements are effective for students admitted to the Computer Science major beginning Spring 2015.



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Electrical Engineering

Accredited by the Engineering Accreditation Commission of ABET, www.abet.org

1. University Requirements: (23-24)

Writing, Rhetoric and American Cultures (WRA)	4
Integrative Studies in Humanities (IAH)	8
Integrative Studies in Social Sciences (ISS)	8
Bioscience (one of the following):	
BS 161, ENT 205, IBIO 150, MMG 141, MMG 201, PLB 105, PSL 250	3-4

2. College Requirements: (31)

CEM 141	General Chemistry	4
EGR 100	Introduction to Engineering Design	2
CSE 220	Programming in C	3
MTH 132	Calculus I	3
MTH 133	Calculus II	4
MTH 234	Multivariable Calculus	4
MTH 235	Differential Equations	3
PHY 183	Physics for Scientists & Engineers I	4
PHY 184	Physics for Scientists & Engineers II	4

3. Major Requirements: (61)

A. Complete one of the following courses: (1)

CEM 161	Chemistry Laboratory I	1
PHY 191	Physics Laboratory for Scientists I	1

B. Complete all of the following courses: (39)

ECE 201	Circuits and Systems I	3
ECE 202	Circuits and Systems II	3
ECE 203	Electronic Circuits and Systems Lab	1
ECE 230	Digital Logic Fundamentals	3
ECE 280	Electrical Engineering Analysis	3
ECE 302	Electronic Circuits	3
ECE 303	Electronics Laboratory	1
ECE 305	Electromagnetic Fields & Waves I	4
ECE 313	Control Systems	3
ECE 320	Energy Conversion & Pwr Electronics	3
ECE 331	Microprocessors & Digital Systems	4
ECE 366	Introduction to Signal Processing	3
ECE 390	Ethics, Professionalism and Contemporary Issues	1
ECE 480	Senior Design (W)	4

C. Select one of the following courses: (3)

CE 221	Statics	3
ME 201	Thermodynamics	3

D. Major Electives (18)

A minimum of six courses totaling a minimum of 18 credits, of 3- or 4-credits each, selected from at least four different areas. A laboratory course ("L") must be included. Students may substitute, for one of the six required courses, a 3- or 4-credit experiential education experience obtained in a minimum of three out-of-classroom experiences through engineering cooperative education or independent study. Students interested in the experiential education experience must contact the department for approval.

Electromagnetics

ECE 405	Electromagnetic Fields and Waves II (L)	4
ECE 407	Electromagnetic Compatibility (L)	4

Power

ECE 420	Machines and Power Laboratory	1
ECE 423	Power System Analysis	3
ECE 425	Solid State Power Conversion	3

Integrated Circuits / VLSI

ECE 402	Applications of Analog Integrated Circuits (L)	4
ECE 404	Radio Frequency Electronic Circuits (L)	4
ECE 410	VLSI Design (L)	4
ECE 411	Electronic Design Automation (L)	4
ECE 412	Intro to Mixed-Signal Integrated Circuits (L)	4

Solid-State Electronics / Electro-optics

ECE 474	Principles of Electronic Devices	3
ECE 476	Electro-Optics (L)	4
ECE 477	Microelectronic Fabrication (L)	3

Communications / Signal Processing

ECE 442	Introduction to Communication Networks	3
ECE 457	Communication Systems	3
ECE 458	Communication Systems Laboratory	1
ECE 466	Digital Signal Processing and Filter Design	3

Control / Robotics

ECE 415	Computer Aided Manufacturing (L)	3
ECE 416	Digital Control (L)	3

Biomedical Engineering

ECE 445	Biomedical Instrumentation (L)	3
ECE 446	Biomedical Signal Processing	3
ECE 447	Intro to Biomedical Imaging	3
ECE 448	Modeling & Analys of Bioelectrical Systems	3

Other Electives (Variable)

Total Credits Required for Degree **128**

The requirements listed above apply to students admitted to the major of Electrical Engineering beginning Fall 2013. The Department of Electrical and Computer Engineering (ECE) constantly reviews program requirements and reserves the right to make changes as necessary. Students are encouraged to consult with their advisor to obtain assistance in planning an appropriate schedule. Students who have questions about Computer Engineering should contact the Electrical and Computer Engineering Department Advising Office, 2212 Engineering Building, phone (517) 355-5242.

Last revised May 2016

Biomedical Engineering Concentration: (15)
The department offers a concentration for students who plan to pursue graduate work in biomedical areas or seek employment in selected medical-related areas. The concentration is available to, but not required of, any student enrolled in the Bachelor of Science degree program in Electrical Engineering. Courses completed to satisfy requirement 3. above may also be used to satisfy the requirements of the concentration. The concentration will be noted on the student's transcript.

To earn a Bachelor of Science degree in Electrical Engineering with a biomedical engineering concentration, students must complete requirements 1., 2., and 3. above and the following.

1. Complete 6 credits from the following: (6)

ANTR 350	Human Gross Anatomy for Pre-Health Professionals	3
BS 161	Cells and Molecular Biology	3
PSL 250	Introductory Physiology	4
PSL 310	Physiology for Pre-Health Professionals	4

2. Complete 6 credits from the following: (6)

ECE 445	Biomedical Instrumentation	3
ECE 446	Biomedical Signal Processing	3
ECE 447	Intro to Biomedical Imaging	3
ECE 448	Modeling & Anlys of Bioelectrical Systems	3

3. Complete at least 3 credits from 1) the list below or 2) any 400-level course listed above but not otherwise counted toward the concentration, or 3) other approved course such as ECE 490 or ECE 491 with biomedical engineering content. (3)

BE 444	Biosensors for Medical Diagnostics	3
ME 494	Biofluid Mechanics and Heat Transfer	3
ME 495	Tissue Mechanics	3
MSE 425	Biomaterials and Biocompatibility	3

NOTES

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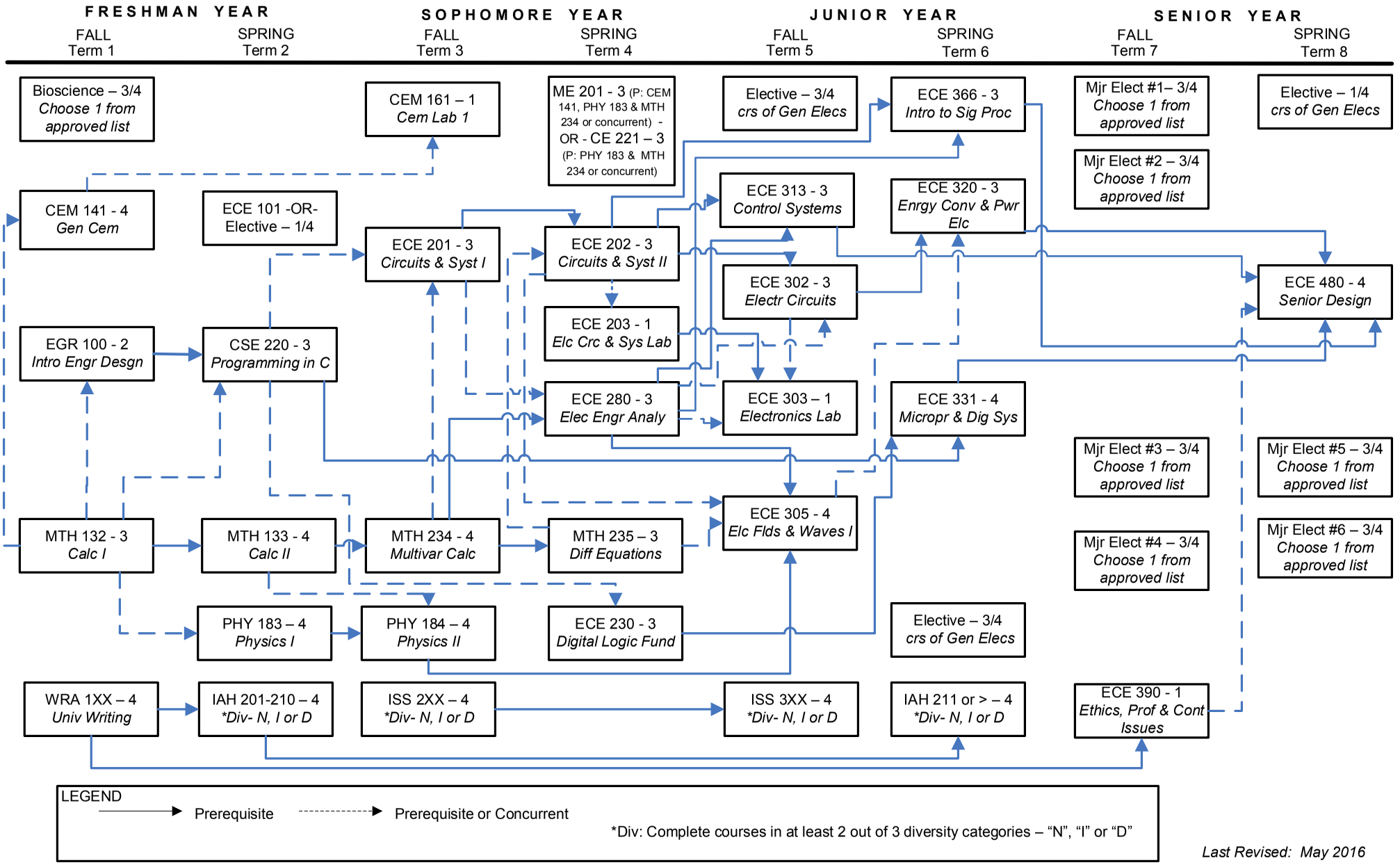
Electrical Engineering

Prerequisite Flowchart

These requirements are effective for students admitted to the Electrical Engineering major beginning Fall 2013.



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Environmental Engineering

Accredited by the Engineering Accreditation Commission of ABET, www.abet.org

1. University Requirements: (23)

Writing, Rhetoric and American Cultures (WRA)		4
Integrative Studies in Humanities (IAH)		8
Integrative Studies in Social Sciences (ISS)		8
Bioscience: BS161 Cell and Molecular Biology		3

2. College Requirements: (30)

CEM 141	General Chemistry	4
OR		
CEM 151	General and Description Chemistry	4
EGR 100	Introduction to Engineering Design	2
EGR 102	Introduction to Engineering Modeling	2
MTH 132	Calculus I	3
MTH 133	Calculus II	4
MTH 234	Multivariable Calculus	4
MTH 235	Differential Equations	3
PHY 183	Physics for Scientists & Engineers I	4
PHY 184	Physics for Scientists & Engineers II	4

3. Major Requirements: (65-73)

A. Complete all of the following courses: (44)

BS 162	Organismal and Population Biology	3
CE 221	Statics	3
CE 273	Civil & Environmental Engineering Measurements	2
CE 274	Graphics for Civil & Environmental Engineers	1
CE 321	Introduction to Fluid Mechanics	4
CE 371	Sustainable Civil & Environmental Egr Systems	3
CE 372	Risk Analysis in Civil & Environmental Engineering	2
CE 495	Senior Design in Civil & Environmental Engineering	4
CEM 161	Chemistry Laboratory I	1
CHE 201	Materials and Energy Balances	3
ENE 280	Principles of Environ Engineering and Science	3
ENE 421	Engineering Hydrology	3
ENE 422	Applied Hydraulics	3
ENE 480	Environmental Measurements Laboratory	1
ENE 481	Environmental Chemistry: Equilibrium Concepts	3
ENE 483	Water & Wastewater Engineering	3
ENE 487	Microbiology for Environmental Science & Egr	3
ENE 489	Air Pollution: Science and Engineering	3

B. Complete one of the following courses: (3)

CEM 142	General & Inorganic Chemistry	3
CEM 152	Principles of Chemistry	3

C. Complete one of the following courses: (3-4)

CHE 321	Thermodynamics for Chemical Engineering	4
ME 201	Thermodynamics	3

D. Complete one of the following courses: (3-4)

GLG 201	The Dynamic Earth	4
GLG 301	Geology of Continents and Oceans	3

e. Technical Electives. Complete at least three courses for a minimum of 9 credits of electives from the list below or by approval of the department. Students may substitute a 3-credit experiential education experience for one of the three courses. The experience is obtained in a minimum of three out-of-classroom experiences through engineering cooperative education. Students must contact the department for approval.

ANS 427	Environmental Toxicology and Society	3
BE 469	Sustainable Bioenergy Systems	3
BE 482	Diffuse-Source Pollution Engineering	3
CSS 455	Environmental Pollutants in Soil and Water	3
CSUS 320	Environmental Planning and Management	3
CSUS 425	Environmental Impact Assessment	3
FW 414	Aquatic Ecosystem Management	3
FW 417	Wetland Ecology and Management	3
FW 420	Stream Ecology	3
FW 443	Restoration Ecology	3
FW 472	Limnology	3
GLG 411	Hydrogeology	3
GLG 412	Glacial GLG & the Record of Climate Change	3
GLG 421	Environmental Geochemistry	4
IBIO 303	Oceanography	4
IBIO 353	Marine Biology (W)	4
IBIO 355	Ecology	3
IBIO 446	Environmental Issues and Public Policy	3
ISS 310	People and Environment (I)	4

Other Electives (Variable)

The requirements listed above apply to students admitted to the Department of Civil & Environmental Engineering (CEE) beginning Fall 2016. The Department of Civil & Environmental Engineering (CEE) constantly reviews program requirements and reserves the right to make changes as necessary. Consequently, each student is strongly encouraged to consult with his/her adviser to obtain assistance in planning an appropriate schedule of courses. Students who have questions about Environmental Engineering should contact the Civil & Environmental Engineering Department Advising Office, 3579 Engineering Building, phone (517) 355-3274. For scheduling academic advising appointments visit: https://www.egr.msu.edu/adcalendar/

Total Credits Required for Degree **128**

Last revised May 2016

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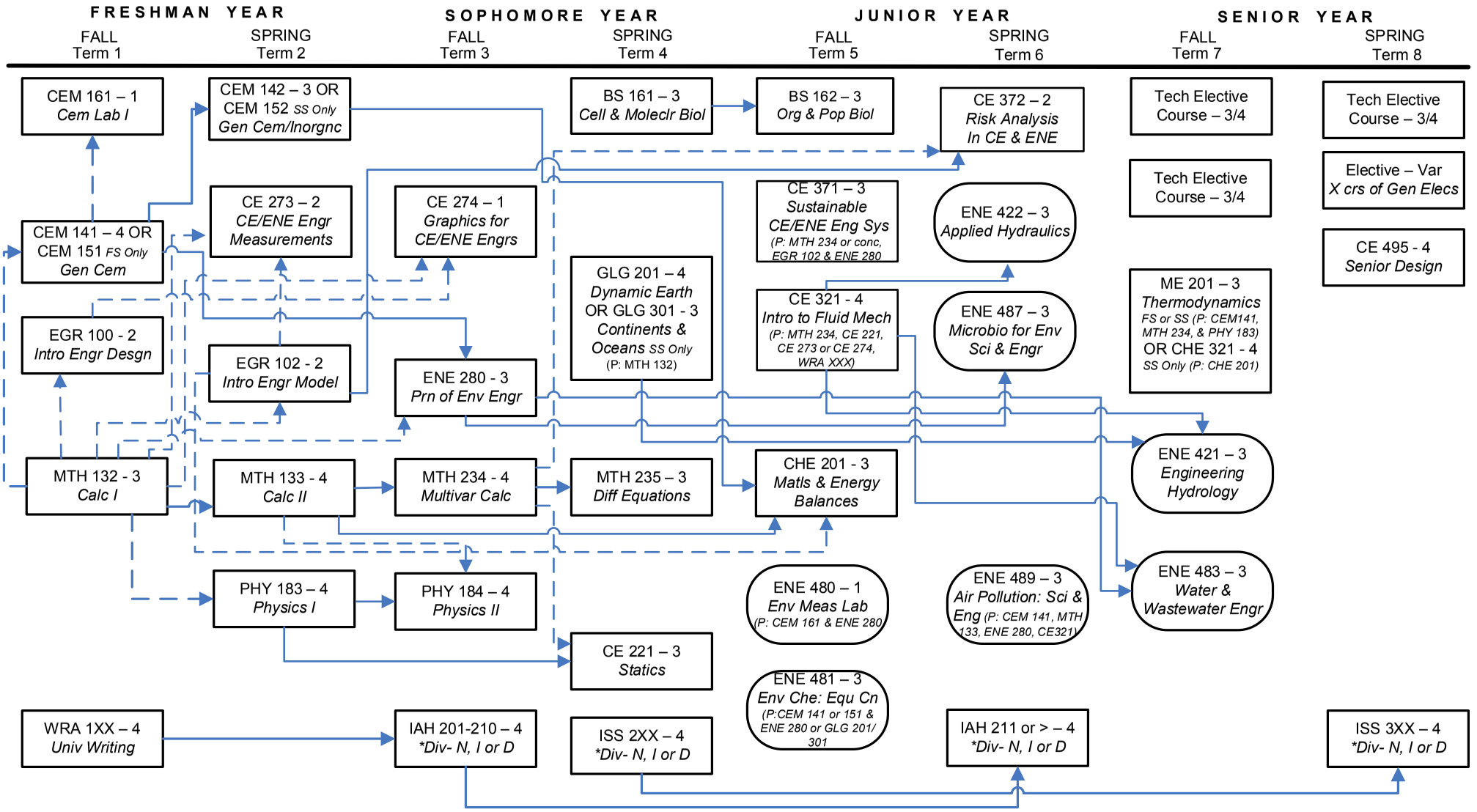
Environmental Engineering

Prerequisite Flowchart

These requirements are effective for students admitted to the Environmental Engineering major beginning Fall 2016.



LEGEND

→ Prerequisite ⇢ Prerequisite or Concurrent

Rounded box: Offered only in the semester listed (excluding summer)

*Div- Complete courses in at least 2 out of 3 diversity categories: "N", "I" or "D"

Last Revised: 5/23/16

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Materials Science and Engineering

Accredited by the Engineering Accreditation Commission of ABET, www.abet.org

1. University Requirements: (23-24)

Writing, Rhetoric and American Cultures (WRA)	4
Integrative Studies in Humanities (IAH)	8
Integrative Studies in Social Sciences (ISS)	8
Bioscience (one of the following):	
BS 161, ENT 205, IBIO 150, MMG 141, MMG 201,PLB 105, PSL 250	3-4

2. College Requirements: (30)

CEM 151	General and Descriptive Chemistry	4
EGR 100	Introduction to Engineering Design	2
EGR 102	Introduction to Engineering Modeling	2
MTH 132	Calculus I	3
MTH 133	Calculus II	4
MTH 234	Multivariable Calculus	4
MTH 235	Differential Equations	3
PHY 183	Physics for Scientists & Engineers I	4
PHY 184	Physics for Scientists & Engineers II	4

3. Major Requirements: (62)

A. Complete all of the following: (41)

CE 221	Statics	3
CEM 152	Principles of Chemistry	3
CEM 161	Chemistry Laboratory I	1
*ECE 345	Electronic Instrumentation and Systems	3
ME 222	Mechanics of Deformable Solids	3
MSE 250	Materials Science and Engineering	3
MSE 260	Electronic, Magnetic, Thermal & Optical Properties of Materials	3
MSE 310	Phase Equilibria in Materials	3
MSE 320	Mechanical Properties of Materials	3
MSE 331	Materials Characterization Methods I	2
MSE 360	Fundamentals of Microstructural Design	3
MSE 370	Synthesis & Processing of Materials	3
MSE 381	Materials Characterization Methods II	2
MSE 466	Design and Failure Analysis (W)	3
STT 351	Probability and Statistics for Engineering	3

B. Select four of the following courses: (12)

MSE 425	Biomaterial & Biocompatibility	
MSE 460	Electronic Struct, Bonding in Materials & Devices	3
MSE 465	Design & Application of Engr Materials	3
MSE 474	Ceramic and Refractory Materials	3
MSE 476	Phys Metallurgy of Ferrous & Alumn Alloys	3
MSE 477	Manufacturing Processes	3

C. Complete at least 6 credits from 400-level courses within the College of Engineering: (6)

D. Technical Electives: (3)

Complete at least 3 credits in courses selected from a list of approved technical electives available from the Department of Chemical Engineering and Materials Science.

**To enroll MSE 426 & MSE 477, enroll in ME 426 & ME 477*
**ECE 302 and ECE 303 may be substituted for ECE 345*

Concentrations

Students may elect to complete a more focused set of courses to enhance their ability to function at the interface with another scientific, engineering, or business discipline. Concentrations are available to, but not required of, any student enrolled in the Bachelor of Science degree in Materials Science and Engineering. Completing the Bachelor of Science degree in Materials Science and Engineering with a concentration may require more than 128 credits. The concentration will be noted on the student's transcript.

Biomedical Materials Engineering Concentration: (28)

To gain interdisciplinary skills in human biology and earn a Bachelor of Science degree in Materials Science and Engineering with a biomedical materials engineering concentration, students must complete requirement 3. a. above and the following:

1. Complete all of the following: (16)

ANTR 350	Human Gross Anatomy for Pre Health Prof	3
CEM 351	Organic Chemistry I	3
ME 495	Tissue Mechanics	3
MSE 425	Biomaterials and Biocompatibility	3
IBIO 341	Fundamental Genetics	4

2. Complete two of the following courses: (6)

MSE 460	Electronic Struct, Bonding in Materials & Devices	3
MSE 465	Design and Application of Egr. Materials	3
MSE 474	Ceramics and Refractory Materials	3
MSE 476	Phys Metallurgy of Ferrous & Alumn Alloys	3
ME 477	Manufacturing Processes	3

3. Technical Electives: (6)

An approved list of Technical Electives is available from the adviser.

Manufacturing Engineering Concentration (21):

To gain interdisciplinary skills with business and design engineers for manufacturing projects and earn a Bachelor of Science degree in Materials Science and Engineering with a manufacturing engineering concentration, students must complete requirement 3. a. above and the following:

1. Complete all of the following: (12)

ECE 415	Computer Aided Manufacturing	3
ME 477	Manufacturing Processes	3
ME 478	Product Development	3
MSE 465	Design and Application of Egr. Materials	3

2. Complete three of the following courses (9):

GBL 323	Introduction to Business Law	3
MSE 426	Introduction to Composite Materials	3
MSE 474	Ceramic and Refractory Materials	3
MSE 476	Phys Metallurgy of Ferrous and Alum Alloys	3

Metallurgical Engineering Concentration: (21)
To enhance the student's ability to characterize, process, and design with metals in association with mechanical engineers and earn a Bachelor of Science degree in Materials Science and Engineering with a metallurgical engineering concentration, students must complete requirement 3.a. above and the following:

1. Complete all of the following: (18)

ME 423	Intermed Mechanics of Deformable Solids	3
ME 475	Computer Aided Design of Structures	3
ME 477	Manufacturing Processes	3
MSE 465	Design and Application of Egr. Materials	3
MSE 476	Phys Metallurgy of Ferrous and Alum Alloys	3
MSE 481	Spectroscopic and Diffraction Analysis of Materials	3

2. Complete one of the following courses (3):

ME 425	Experimental Mechanics	3
MSE 426	Introduction to Composite Materials	3

Polymeric Engineering Concentration (21):
To gain interdisciplinary skills to facilitate interactions with chemical engineers and earn a Bachelor of Science degree in Materials Science and Engineering with a polymeric engineering concentration, students must complete requirement 3. a. above and the following:

Complete all of the following: (18)

CEM 351	Organic Chemistry I	3
CHE 311	Fluid Flow and Heat Transfer	3
CHE 472	Composite Materials Processing	3
CHE 473	Chem Engr Prncpls in Polymrs & Matls Sys	3
MSE 426	Introduction to Composite Materials	3
MSE 460	Electronic Structure & Bonding in Materials & Devices	3

Complete the following: (3)
At least 3 credits in courses from a list of approved technical electives available from the Department of Chemical Engineering and Materials Science.

Total Credits Required for Degree **128**

The requirements listed above apply to students admitted to the major of Materials Science and Engineering in the Department of Chemical Engineering and Materials Science (CHEMS) beginning Fall, 2015. The Department of Chemical Engineering and Materials Science constantly reviews program requirements and reserves the right to make changes as necessary. Consequently, each student is strongly encouraged to consult with his/her adviser to obtain assistance in planning an appropriate schedule of courses. Students who have questions about Materials Science and Engineering should contact Chemical Engineering and Materials Science Department Advising Office, 3508 Engineering Building, phone (517) 432-1352. For scheduling academic appointments visit: https://www.egr.msu.edu/adcalendar/

Some courses may have prerequisites, which are not otherwise required in the program. Students should check course descriptions to ensure they are aware of prerequisites.

Last Revised May 2016

NOTES

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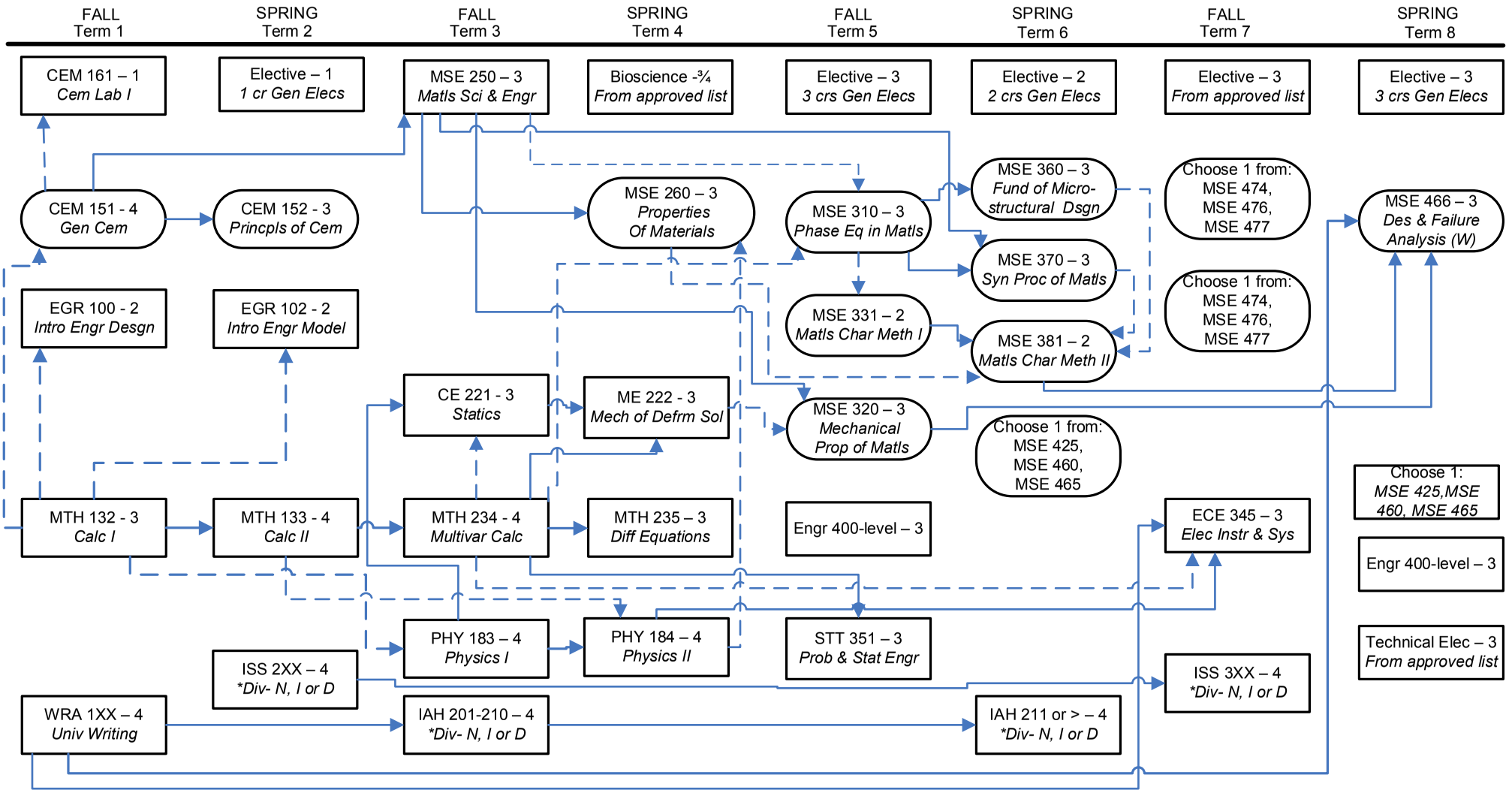
Materials Science and Engineering

Prerequisite Flowchart

These requirements are effective for students admitted to the Materials Science and Engineering major beginning Fall 2015.



LEGEND
——▶ Prerequisite ----------▶ Prerequisite or Concurrent "P:" Prerequisite
Rounded box: Offered only in the semester listed (excluding summer) *Div: Complete courses in at least 2 out of 3 diversity categories- "N", "I" or "D"

Last Revised: May 2016

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Mechanical Engineering

Accredited by the Engineering Accreditation Commission of ABET, www.abet.org

1. University Requirements: (23-24)

Writing, Rhetoric and American Cultures (WRA)		4
Integrative Studies in Humanities (IAH)		8
Integrative Studies in Social Sciences (ISS)		8
Bioscience (one of the following):		
BS 161, ENT 205, IBIO 150, MMG 141, MMG 201, PLB 105, PSL 250		3-4

2. College Requirements: (28)

CEM 141	General Chemistry	4
EGR 100	Introduction to Engineering Design	2
MTH 132	Calculus I	3
MTH 133	Calculus II	4
MTH 234	Multivariable Calculus	4
MTH 235	Differential Equations	3
PHY 183	Physics for Scientists & Engineers I	4
PHY 184	Physics for Scientists & Engineers II	4

3. Major Requirements: (69)

A. Complete all of the following courses: (17)

CE 221	Statics	3
CEM 161	Chemistry Laboratory I	1
CSE 231	Introduction to Programming I	4
ECE 345	Electronic Instrumentation and Systems	3
MSE 250	Materials Science and Engineering	3
STT 351	Probability and Statistics for Engineering	3

B. Complete all of the following courses: (40)

ME 201	Thermodynamics	3
ME 222	Mechanics of Deformable Solids	3
ME 280	Graphic Communications	2
ME 300	Professional Issues in Mechanical Eng	1
ME 332	Fluid Mechanics (W)	4
ME 361	Dynamics	3
ME 371	Mechanical Design I	3
ME 391	Mechanical Engineering Analysis	3
ME 410	Heat Transfer	3
ME 412	Heat Transfer Laboratory (W)	2
ME 451	Control Systems (W)	4
ME 461	Mechanical Vibrations	3
ME 471	Mechanical Design II	3
ME 481	Mechanical Engr Design Projects (W)	3

C. Senior Electives: (9)

Complete a minimum of nine credits from the following:

ME 416	Computer Asstd Design of Thermal Sys	3
ME 417	Design of Alternative Energy Systems	3
ME 422	Introduction to Combustion	3
ME 423	Intermed Mech of Deformable Solids	3
ME 425	Experimental Mechanics	3
ME 426	Introduction to Composite Materials	3
ME 433	Intro to Computational Fluid Dynamics	3
ME 440	Aerospace Engineering Fundamentals	3
ME 442	Turbomachinery	3
ME 444	Automotive Engines	3
ME 445	Automotive Powertrain Design	3
ME 456	Mechatronic System Design	3
ME 464	Intermediate Dynamics	3
ME 465	Computer Aided Optimal Design	3
ME 475	Computer Aided Design of Structures	3
ME 477	Manufacturing Processes	3
ME 478	Product Development	3
ME 490	Independent Study in Mechanical Engr	1-4
ME 491	Selected Topics in Mechanical Engr	1-4
ME 494	Biofluid Mechanics and Heat Transfer	3
ME 495	Tissue Mechanics	3
ME 497	Biomechanical Design in Product Dev	3

D. Design-Intensive courses. Complete a minimum of three *additional* credits from: (3)

ME 416	Computer Ast Design of Thermal Sys	3
ME 417	Design of Alternative Energy Systems	3
ME 442	Turbomachinery	3
ME 445	Automotive Powertrain Design	3
ME 456	Mechatronic System Design	3
ME 465	Computer Aided Optimal Design	3
ME 475	Computer Aided Design of Structures	3
ME 497	Biomechanical Design in Product Dev	3

Courses used to fulfill item 3.c. may not be used to fulfill 3.d.

Concentrations:

The Department offers concentrations in automotive powertrain, biomedical engineering, computational design, energy, engineering mechanics, global engineering, and manufacturing engineering to students wishing an area of specialization in their degree. The concentrations are available to, but not required of, any student enrolled in the Bachelor of Science degree program in mechanical engineering. NOTE: Completing the Bachelor of Science degree in mechanical engineering with a concentration may require more than 128 credits. Upon completion of the required courses for one of these concentrations, certification will appear on the student's official transcript.

Automotive Powertrain Concentration (12)

To earn a Bachelor of Science degree in Mechanical Engineering with an automotive powertrain concentration, students must complete requirements 1., 2., 3.a., 3.b., and 3.d. above and the following:

All of the following (9)

ME 422	Intro to Combustion	3
ME 444	Automotive Engines	3
ME 445	Automotive Powertrain Design	3

One of the following (3)

ME 433	Intro to Computational Fluid Dynamic	3
ME 442	Turbomachinery	3

Biomedical Engineering Concentration (16)

To earn a Bachelor of Science degree in Mechanical Engineering with a biomedical engineering concentration, students must complete requirements 1., 2., 3.a., 3.b., and 3.d. above and the following:

Both of the following courses (7):

BS 161	Cells and Molecular Biology	3
PSL 250	Introductory Physiology	4

Select nine credits from the following courses (9):

BE 444	Biosensors for Medical Diagnostics	3
ECE 445	Biomedical Instrumentation	3
ME 494	Biofluid Mechanics and Heat Transfer	3
ME 495	Tissue Mechanics	3
ME 497	Biomechanical Design in Product Dev	3
MSE 425	Biomaterials and Biocompatibility	3

Computational Design Concentration (12)

To earn an Bachelor of Science degree in Mechanical Engineering with a computational design concentration, students must complete requirements 1.,2., 3.a.,3.b.,and 3.d. and the following:

All of the following (12)

ME 416	Computer Assisted Design of Thermal Systems	3
ME 433	Intr to Computational Fluid Dynamics	3
ME 465	Computer Aided Optimal Design	3
ME 475	Computer Aided Design of Structures	3

Energy Concentration (12)

To earn a Bachelor of Science degree in Mechanical Engineering with an energy concentration, students must complete requirements 1.,2.,3.a.,3.b.,and 3.d. and the following:

All of the following courses (9)

ME 416	Computer Assisted Design of Thermal Systems	3
ME 417	Design of Alternative Energy Systems	3
ME 422	Intro to Combustion	3

One of the following courses (3)

ME 440	Aerospace Engineering Fundamentals	3
ME 442	Turbomachinery	3
ME 444	Automotive Engines	3

Engineering Mechanics Concentration (12)

To earn a Bachelor of Science degree in Mechanical Engineering with a engineering mechanics concentration, students must complete requirements 1., 2., and 3.a., and 3.b. above and the following:

All of the following (12)

ME 423	Intermed Mechanics of Deform Solids	3
ME 425	Experimental Mechanics	3
ME 464	Intermediate Dynamics	3
ME 475	Computer Aided Design of Structures	3

Global Engineering (12)

To earn a Bachelor of Science degree in Mechanical Engineering with a global engineering concentration, students must complete requirements 1., 2., 3.a., and 3.b. above and 12 credits of approved mechanical engineering courses from a MSU co-sponsored Study Abroad institution. At least 3 credits must include a team design project.

Manufacturing Engineering Concentration (13)

To earn a Bachelor of Science degree in Mechanical Engineering with a manufacturing engineering concentration, students must complete requirements 1., 2., 3.a., 3.b., and 3.d. above and the following:

All of the following courses (10):

EC 210	Economics Principles Using Calculus	3
ME 372	Machine Tool Laboratory	1
ME 477	Manufacturing Processes	3
ME 478	Product Development	3

Select one of the following courses (3):

CHE 472	Composite Materials Processing	3
ECE 415	Computer Aided Manufacturing	3
ME 426	Introduction to Composite Materials	3

Other Electives (Variable)

Total Credits Required for Degree 128

The requirements listed apply to students admitted to the major of Mechanical Engineering in the Department of Mechanical Engineering beginning Fall 2016. The Department of Mechanical Engineering (ME) constantly reviews program requirements and reserves the right to make changes as necessary. Consequently, each student is strongly encouraged to consult with his/her advisor to obtain assistance in planning an appropriate schedule of courses. Students who have questions about Mechanical Engineering should contact the Mechanical Engineering Department Advising Office, 2560 Engineering Building, phone (517) 355-3338.

Some courses may have prerequisites, which are not otherwise required in the program. Students should check course descriptions to ensure they are aware of prerequisites.

Last Revised May 2016

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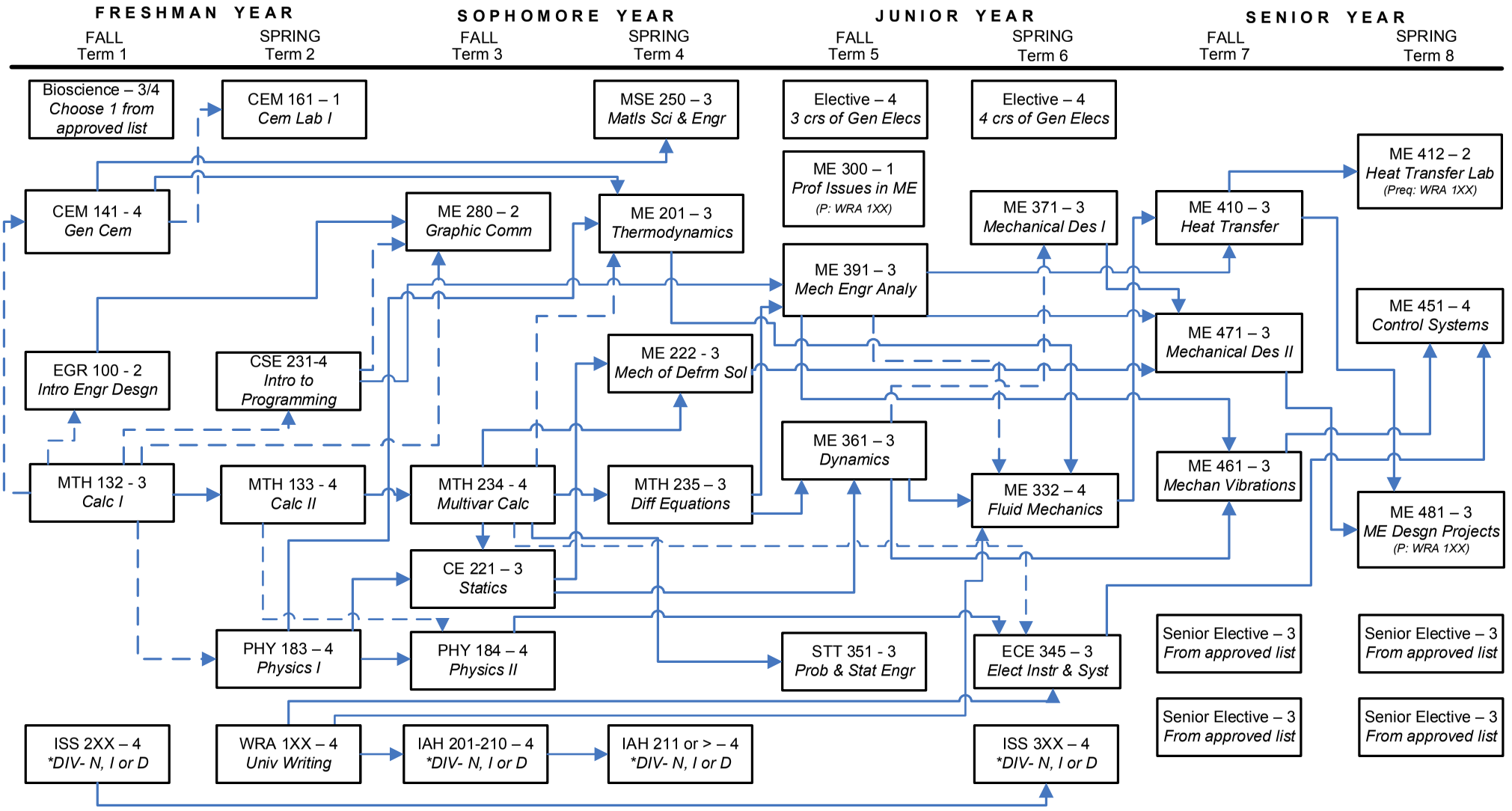
Mechanical Engineering

Prerequisite Flowchart

These requirements are effective for students admitted to the Mechanical Engineering major beginning Fall 2016.



LEGEND
Prerequisite ---------- Prerequisite or Concurrent *Div: Complete courses in at least 2 out of 3 diversity categories - "N", "I" or "D"

Last Revised: May 2016

Notes

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219 Wilson Rd, Room W8
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