

PENNSSTATE



Department of Mechanical & Nuclear Engineering

Undergraduate Curriculum Information
& Planning Manual

Bachelor of Science in Mechanical Engineering
(BSME)

Bachelor of Science in Nuclear Engineering
(BSNE)

2017-2018

Undergraduate Programs Office
Department of Mechanical &
Nuclear Engineering
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<http://www.mne.psu.edu/>

NOTICE TO STUDENT

This manual provides basic information about (a) the Mechanical and Nuclear Engineering Department, (b) the current program Curriculum, and (c) certain important College and University procedures. This Curriculum Planning Manual is an important document that will be a useful guide for the duration of your degree program. You are encouraged to become familiar with its contents and bring it with you when meeting with your advisor. **For curricula and professional advising you should meet with your assigned academic adviser. You can find your adviser's name on LionPATH:**

LionPATH: <http://launch.lionpath.psu.edu/http://mne.psu.edu/students/undergraduate/SemesterAbroad.aspx>

ACADEMIC ADVISER: _____

OFFICE: _____

TELEPHONE: _____

EMAIL ADDRESS: _____

Important Announcements:

Important announcements on advising and curriculum matters are posted on the undergraduate website at <http://www.mne.psu.edu>.

Regulations Subject to Change:

The Curriculum Planning Manual for the Mechanical and Nuclear Engineering Programs is an important document that will be a useful guide to assist in the achievement of your academic goals. Please be aware that degree requirements are specified at the time that you enter the major. Course prerequisites, however, can change at any time. You are required to follow the current course prerequisites. You can find current course prerequisites at the MNE web site at <http://mne.psu.edu/students/undergraduate/curriculum.aspx>.

The educational process necessitates change. This manual must be considered as informational and not binding on the University. Each step of the educational process, from admission through graduation, requires continuous review and appropriate approval by University officials. The University, therefore, reserves the right to change the requirements and regulations contained in this manual and to determine whether a student has satisfactorily met his/her requirements for admission or graduation.

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Preface

Mechanical Engineering Program

EDUCATION MISSION STATEMENT & EDUCATIONAL OBJECTIVES

Education Mission Statement

- **Cognizant of the unique mission of Penn State** in the Commonwealth and the nation, our program endeavors to produce graduates who are capable of becoming productive citizens in modern society. The education provided encompasses the full breadth of the discipline of mechanical engineering and consists of technical content, interactive and participatory learning and consistent reinforcement of the skills and characteristics consistent with a successful professional.
- **The most important asset we bring to this mission is our faculty.** We will leverage the rich background and research accomplishments of our faculty by making appropriate use of research results in the classroom.
- In this endeavor, **the primary focus is on the student.** Through admission standards, professional advising, and consistent and high expectations, we lead the students, through lecture and example, toward our common goal of life as a professional in our society.

Program Educational Objectives

Mechanical Engineering is one of the broadest engineering disciplines and is central in many new technological developments. Mechanical engineers create things that help improve the health, happiness and safety of our everyday lives such as biomedical devices, aircraft propulsion, and ways to store renewable energies. Mechanical engineering is divided into two broad areas: mechanical systems and thermal systems. Mechanical systems include the design of mechanisms and the analysis of the strength and wear of materials. Thermal systems include methods of energy conversions, heat transfer and fluid flow. Three to five years after graduation, Mechanical Engineering graduates will be:

- I. Working in industry and government including computer-aided design, simulation and analysis of products or systems, experimentation and testing, manufacturing, and technical sales.
- II. Assuming increasing levels of responsibility in project, personnel, and budget management.
- III. Working and leading effectively in multi-disciplinary and multi-cultural teams.
- IV. Communicating effectively and recognizing the global, societal, and ethical contexts of their work.
- V. Entering into graduate and professional studies.

Nuclear Engineering Program

EDUCATION MISSION STATEMENT & EDUCATIONAL OBJECTIVES

Education Mission Statement

- Cognizant of the unique mission of Penn State in the Commonwealth and the nation, our program endeavors to produce graduates who are capable of becoming productive citizens in modern society. The education provided encompasses the full breadth of the discipline of nuclear engineering and consists of technical content, interactive and participatory learning and consistent reinforcement of the skills and characteristics consistent with a successful professional.
- The most important asset we bring to this mission is our faculty. We will leverage the rich background and research accomplishments of our faculty by making appropriate use of research results in the classroom.
- In this endeavor, the primary focus is on the student. Through admission standards, professional advising, and consistent and high expectations, we lead the students, through lecture and example, toward our common goal of life as a professional in our society.

Program Educational Objectives

The overall educational objective of the Nuclear Engineering program is to prepare our graduates to function effectively in the marketplace in a wide range of career paths in Nuclear Engineering. The technical part of the curriculum emphasizes power engineering, which refers to complex systems used to generate electricity. Because our emphasis in power engineering is strong, and because a shortage for this expertise exists in the industry, generally the industry values our graduates highly. We recognize that nuclear science is an important growth area. We constantly assess and review the needs of our undergraduate students and their most frequent employers and use this feedback to consider revisions to our curriculum so that it is responsive to the needs of our constituents. Accordingly, we will maintain and provide a curriculum that prepares our graduates such that:

- I. At graduation our graduates will work effectively in multidisciplinary and multicultural teams, communicate effectively and recognize the global, societal and ethical aspects of their work.
- II. Within two to three years of graduation, the majority of our B.S. graduates are expected to:
 - A. Be working in industry, especially power engineering,
 - B. Be working in government agencies or national laboratories,
 - C. Be pursuing advanced degrees.

After five to ten years we expect that many of our graduates will have established strong records of achievement at various technical and managerial levels in industry and government.

Section 1: Introduction

Purpose

This manual provides basic information about (a) the Mechanical and Nuclear Engineering Department, (b) the current program Curriculum, and (c) certain important College and University procedures. This program manual, with additional program information and forms, can be found online at <http://www.mne.psu.edu>. This Curriculum Planning Manual is an important document that will be a useful guide for the duration of your degree program. You should refer to this curriculum planning manual for the requirements that you will need to satisfy.

In addition to this manual, students should be familiar with the rules of the University given in the current Faculty Senate Policies for Students available at the following website: <http://senate.psu.edu/policies-and-rules-for-undergraduate-students/>.

An additional source of information on the academic regulations of the College of Engineering is the University Undergraduate Advising Handbook: <http://handbook.psu.edu/>.

Advising – How it Works

Every student in Mechanical and Nuclear Engineering is assigned an Academic Adviser who is a faculty member in the Department. Advisers assist you in planning your academic curriculum and will help you in other matters associated with your college life. In some cases, advisers may not know the answers, but they will sit down and explore the possibilities and, where appropriate, recommend other avenues for assistance. You can also refer to the following website for online advising information: <http://launch.lionpath.psu.edu/>. Advisers are the most important professional link you have at Penn State. Get to know them as soon as you can.

The Undergraduate Records Assistant in 139/140 Reber Building, is responsible for all student records. Please contact the Undergraduate Records Assistant if you have any questions about your records, petitions, Co-op, or anything related to interpreting statements made in this manual. The MNE Curriculum Adviser in 139/140 Reber Building, is available for routine questions and academic transactions (Drop/Add, etc.) during a regular posted schedule. The Undergraduate Programs Assistant in Room 140A is responsible for undergraduate program issues. The Programs Assistant is available for questions about undergraduate policies and procedures. In emergencies where neither your Academic Adviser nor the Undergraduate Programs Office staff is available, the Professor-In-Charge of Undergraduate Programs for Mechanical & Nuclear Engineering can be consulted in Room 140B Reber Building.

Although the faculty and staff of the MNE Department will help you as much as possible, the student should realize two important facts:

- 1) Faculty members have, in addition to 20-30 student advisees, major responsibilities in

teaching and research, so use your time with them efficiently. When you have questions, you must take the initiative to see your adviser. The best way of doing this is to contact them and make an appointment.

- 2) Your advisor's role is to help guide and provide insight such that you may make informed decisions. Each student is responsible for their program/course choices and the monitoring of their academic progress. Be aware that the student must "assume final responsibility for course scheduling, program planning, and the successful completion of all graduation recommendations." (Academic Policy 32-30)

Undergraduate Student Organizations

The American Society of Mechanical Engineers (ASME) and the American Nuclear Society (ANS) are two student organizations that many undergraduate students belong to. For a complete listing of all the undergraduate student organizations of interest to MNE students, please visit <http://www.engr.psu.edu/students/organizations.aspx>.

Promoting a Vibrant Learning Culture (From Faculty Senate, March 2001)

A vibrant learning culture with teachers and students energetically participating in the learning process requires dedicated interaction between teacher and learner. Whereas the teacher has the responsibility to apply effective teaching methods and learning tools, it is the responsibility of the student to effectively utilize the provided resources. Both quality teaching and quality learning require hard work, diligence, and major time commitment.

The following recommendations address the partnership between the faculty-teacher and student-learner in the personal process of learning with a focus on the maturation of students in the learning process.

The Teacher in the Learning Process: Maintaining a high level of learning requires characteristics in teaching necessary for a strong teacher-learner relationship. The teacher should:

- a) **Maintain an atmosphere of integrity, civility, and respect** within and outside the classroom while promoting the reasoned discussion of a wide range of ideas and the open expression of diverse opinions.
- b) **Exhibit a strong desire for students to learn**, by providing effective tools to help students learn, and by teaching the learning process in the course. Encourage constructive feedback to enhance student-teacher interaction.
- c) **Recognize that effective teaching requires a balance** among teaching, advising, research, and service. It is important that student assignments and tests be designed to encourage and enhance student learning, and that student work be returned to students in a timely manner to encourage continued learning.
- d) **Encourage active student participation in learning.** The classroom structure should include student interaction and time for clarification of the students understanding.
- e) **Employ effective teaching and learning strategies.** For quality learning it is necessary that effective tools and strategies be provided by the instructor that, when used properly, lead to a high level of learning by the student. Teacher expectations (e.g. assignments and course strategy) should

be clear to the student. Sufficient availability for students to seek help must be provided.

- f) **Help students connect learning experiences.** The teacher should relate course material to other courses and applications and demonstrate linkages in knowledge and understanding.
- g) **Develop an effective personal teaching approach.** The teacher should monitor the progress of the students, apply effective teaching strategies, and improve the learning experience where possible. To advance ideas for improving student learning, faculty should take advantage of the many university programs available (e.g. CELT, Royer Center and TLC).

The Student in the Learning Process: Maintaining a high level of learning and scholarly activity requires the following characteristics of the student learner:

- a) **Academic integrity, respect, and civility.** A vibrant learning culture assumes honesty and integrity in one's work, and a willingness to think about and openly discuss a wide range of ideas and opinions. Academic integrity is accepted as a way of life. Respect for teachers and fellow students and civility in voice and word is necessary.
- b) **Strong work ethic.** Quality learning requires self-discipline and a strong desire to learn, to relearn, and to progress. A university education requires intensive work, high quality effort and major time commitment (typically 48-64 hours/week for a 16-credit load).
- c) **Manage time wisely.** Quality learning requires sufficient time to study, analyze, absorb, and synthesize knowledge into understanding. Careful organization and use of time are therefore essential, including beginning and completing assignments in a timely manner and allowing sufficient time to assimilate knowledge during exam preparation to maximize learning.
- d) **Participate actively in class.** Complete class attendance is assumed. An involved strong learner is an active participant in class, mentally and verbally. Students benefit from coming to class prepared to clarify understanding from out-of-class readings, assignments, and previous lectures.
- e) **Recognize importance of out-of-class learning.** The student is ultimately responsible for his/her own personal learning process. The learner should make proper independent use of learning tools and strategies as directed by the teacher (reference material, assignment analysis, follow-up material, etc.). To learn effectively it is necessary that assigned readings are studied before class, and that essential material from previous courses be relearned when needed. It is also useful to interact with colleagues in team meetings or study groups during the assimilation and clarification of knowledge. Students should seek help from the teacher and teaching assistant when necessary and take advantage of university-wide resources to enhance learning. Active participation in community service and other student life activities also enriches learning. (A healthy and balanced lifestyle is important.)
- f) **Reflect on the educational process.** It is essential to recognize that learning is not memorization of facts, but rather development of understanding and the integration of knowledge. The learner therefore needs to assimilate new material with material from previous courses and relearn material as necessary.
- g) **Perform self-assessment.** It is essential to regularly evaluate strengths and weaknesses, effectiveness of study habits, level of responsibility in learning, and progress toward educational goals. Effort should be continually directed to improve upon weaknesses, and to strengthen oral and written communication skills and group interaction skills. Student journals and portfolios to record and track progress are useful for this purpose.

World-Class Engineer

Becoming a **WORLD-CLASS ENGINEER** is an exciting journey that begins with undergraduate study and requires a commitment to lifelong learning and professional development.

Mechanical and Nuclear Engineering students develop World Class Engineer attributes throughout their undergraduate studies. A detailed listing of attributes can be found at <http://www.engr.psu.edu/WorldClass/>



Follow Us



The Path to Becoming a World-Class Engineer ...

... begins with undergraduate study and requires a commitment to lifelong learning and professional development.

World-Class Engineers are:

SOLIDLY GROUNDED

World-Class Engineers are solidly grounded in fundamentals of their discipline and are committed to lifelong learning.

TECHNICALLY BROAD

World-Class Engineers are conversant in multiple technical disciplines. They design solutions that span business functions such as finance, marketing, legal, and manufacturing.

GLOBALLY ENGAGED

World-Class Engineers understand the worldwide nature of their profession and are sensitive to the speed required to keep pace in geographically and culturally diverse environments.

ETHICAL

World-Class Engineers uphold the highest ethical standards. They readily identify, and carefully address, ethical issues that arise in their professional lives.

INNOVATIVE

World-Class Engineers develop precise definitions of complex problems and formulate sustainable solutions by thinking creatively across technical, business, social, and environmental dimensions.

EXCELLENT COLLABORATORS

World-Class Engineers seek optimal outcomes through collaboration and honor intellectual property rights of all partners. They work effectively within co-located and geographically dispersed teams.

VISIONARY LEADERS

World-Class Engineers are courageous, customer-oriented leaders who develop visions that deliver successful results.

Computer Services for Engineering Students

The University and College do not require students to bring their own personal computer to College. However, students will be required to use computers frequently for communications and academic activities. Computer ownership, whether it is a desktop or laptop model, will enable students to benefit from the in-class and out-of-class activities and opportunities to the fullest extent.

The College has gone to great lengths to enhance the computing experience for its students by expanding services; including the deployment of College-wide Secure Wireless networking equipment for College of Engineering students. Additional wireless networking services provided at various on-campus locations and on-campus housing add to the Internet and collaborative computing environment.

College of Engineering students are able to access all College networking and computing service through the College's VPN services.

With the expanding wireless capabilities and increasing dependence on computers for individual and group work at various campus locations, it appears that there are many advantages to having a laptop computer with built-in wireless capability. Since the purchase of a computer may be one of the largest single expenditures made by a student and since portability also increases security risk, students need to closely guard their investment and take steps to secure their computer when not in use.

Mechanical and Nuclear Engineering Computer Resources

E-Knowledge Commons

The E-Knowledge Commons is available to students with computers, and conference rooms containing televisions. These conference rooms can be reserved; otherwise, they are open for general use.

Room 119 & 120 Reber Building

The department of Mechanical and Nuclear Engineering offers numerous resources to assist students with the need for computer and technology resources within their courses. The department maintains the philosophy that access to technology should not be a "limiting factor" to our students' education.

MNE Students have access to several computer laboratories. The department has 2 general use labs; the PC Studio and the Linux Lab. These 2 labs have computers for both general computing use (Word, Excel, Net browsing, E-mail) and advanced course related assignments (MATLAB, Mathematica, Visual C++, SolidWorks). Additionally, the department maintains 8 instructional labs for enhancing the teaching atmosphere by adding a "hands-on" component to the theory taught within the Mechanical & Nuclear curriculum. The Instructional Labs enhance the topics of Automatic Controls, Fluids and Fluid Flow, Heat Transfer, Measurement, Mechatronics, Micro Computer Interfacing, Nuclear data analysis, and Vibrations.

As an added resource, all MNE Students also have access to the Learning Factory. The Learning Factory is a University - Industry partnership through the College of Engineering. This partnership allows students to apply their engineering skillsets to solve real-world industry problems. This partnership makes a significant difference in the undergraduate education at PSU. The Learning Factory has computers with both general and machine specific software for the student use.

We are also dedicated to providing our students with the technology needed to succeed in their courses. Undergraduate and Graduate students can check out laptops, projectors, camcorders, digital cameras, and other equipment from our Instrument Room. The Instrument Room is located in 23 Reber Building and is open M – F, 8:30 am to 4:30 pm. Additionally, students have access to the PC Studio and the Linux Lab.

Faculty Directory: <http://mne.psu.edu/department/faculty-staff-list.aspx>

Section 2:

Mechanical Engineering Degree Requirements

Overview

The faculty of the Mechanical and Nuclear Engineering Department determine the degree requirements for a Bachelor of Science degree in Mechanical Engineering (BSME). The degree requirements incorporate the University's 'General Education Requirements', as well as items required by the College of Engineering here at Penn State. The BSME degree at Penn State is fully accredited by the Accreditation Board for Engineering and Technology (ABET). Please see the inside front cover for our educational objectives.

On pages 2.6 and 2.8 you will find the entire curriculum summarized in a semester-by-semester table. The semester-by-semester plan can be modified; however, the student must be certain that all prerequisite courses have been passed before taking a course.

This chapter will describe the Mechanical Engineering core courses, the technical electives, and the Arts-Humanities-Social Science (AHS) electives, which are all consistent with ABET criteria.

Mechanical Engineering Core (REQUIRED) Courses

All core courses are offered both fall and spring semesters and several are offered during summers, although Summer Session offerings vary. Students must pass prerequisite courses before enrolling in a course.

- | | |
|---------------|---|
| ME 300 | Engineering Thermodynamics I (3 cr.)
Basic thermodynamic concepts, first and second law of thermodynamics, properties of pure substances. Prerequisites: CHEM 110. Prerequisite or Concurrent: MATH 141. |
| ME 320 | Fluid Flow (3 cr.)
Thermodynamic and dynamic principles applied to fluid behavior; ideal, viscous, under internal and external flow conditions. Prerequisites: E MCH 212; MATH 251; ME 201 or ME 300; MATH 230 or MATH 231. |
| ME 340 | Mechanical Engineering Design Methodology (3 cr.)
The design process; problem definition, conceptual design, system design, detail design, evaluation and test, implementation, documentation and communication. Prerequisite: EDSGN 100. Prerequisite or Concurrent: M E 320 or BME 409; ME 360. |

- ME 345 Instrumentation, Measurements, and Statistics (4 cr.)**
 Fundamentals of statistics, sensors, instrumentation, and measurement of mechanical phenomena such as temperature, flow, pressure, force, stress, displacement, and acceleration. Prerequisite or Concurrent: E E 212 or E E 211 or equivalent.
- ME 360 Mechanical Design (3 cr.)**
 Specification of components such as shafts, bearings, and power transformers; optimal designs for operational, environmental and manufacturing requirements. Prerequisite or Concurrent: CMPSC 200 and E MCH 315.
- ME 370 Vibrations of Mechanical Systems (3 cr.)**
 Modeling and analysis of vibration characteristics of mechanical systems with single degree and multiple degrees of freedom. Vibration control by isolation, absorption and balancing, and without damping; vibration isolation, vibration absorbers; classical Laplace transform, matrix digital computer methods. Prerequisite: MATH 220; MATH 251; E MCH 212; CMPSC 200.
- ME 410 Heat Transfer (3 cr.)**
 Thermal energy transfer mechanisms: conduction (steady, transient), convection (internal, external), radiation; lumped parameter method; heat exchangers; introduction to numerical methods. Prerequisites: ME 320; or BME 409; CMPSC 200 or CMPSC 201; MATH 220 or NUC E 309
- ME 440W Mechanical Systems Design Project (3 cr.)**
 Design and analysis of mechanical components and systems. Application of fundamental design and analysis methods to open ended engineering problems. Prerequisites: ME 340. Prerequisite or Concurrent: IE 312; ENGL 202C.
- ME 441W Thermal Systems Design Project (3 cr.)**
 Design of thermal systems through component design and/or selection, system simulation and optimization. Assessment of system economics and energy efficiency. Prerequisites: ME 340; ME 410. Prerequisite or Concurrent: ENGL 202C.
- ME 442W Advanced Vehicle Design I (2 cr.)**
 Part one of a two course sequence; applications of design and analysis methods to open-ended advanced transportation vehicles. Two semester course; satisfies Senior Design or ME Technical Elective requirements (when combined with ME 443W). Prerequisites: ME 340. Prerequisite or Concurrent: ENGL 202C; IE 312; ME 410.

ME 443W **Advanced Vehicle Design II (1cr.)**
Part two of a two course sequence; applications of design and analysis methods to open-ended advanced transportation vehicles. Two semester course; satisfies Senior Design or ME Technical Elective requirements (when combined with ME 442W). Prerequisites: ME 442W.

ME 450 **Modeling of Dynamic Systems (3 cr.)**
Modeling and analysis of dynamic interactions in engineering systems. Classical and state variable methods; computer simulation; stability and dynamic response. Prerequisites: ME 370, Prerequisite or concurrent: ME 345.

ME Senior Lab Courses

Students will select two of the five laboratory courses below. They may also take ME 445 (4) which serves as both a 3-credit technical elective and a 1-credit laboratory course.

ME 315 **Heat Transfer Laboratory (1 cr.)**
Application of the fundamental concepts associated with conduction, convection, and radiation to the actual measurements of heat transfer. Prerequisite: ME 320. Prerequisite or concurrent: ME 345; ME 410.

ME 325 **Fluids Laboratory (1 cr.)**
Laboratory experience with fluid mechanics measurement techniques: flow visualization, pressure measurement, hot-wire anemometry, laser Doppler anemometry, lift and drag, computational fluid dynamics. Prerequisite: ME 320; ME 345.

ME 355 **Automatic Controls Laboratory (1 cr.)**
Experimental investigation of simple position, velocity, and temperature control systems with analog and digital controllers. Prerequisite: ME 345. Prerequisite or Concurrent: ME 450.

ME 375 **Vibrations Laboratory (1 cr.)**
Experimental measurement and analysis of mechanical system dynamics. Prerequisite or concurrent: ME 345; ME 370.

E MCH 316 **Experimental Determination of Mechanical Response of Materials (1 cr.)**
Experimental techniques for mechanical property measurement and structural testing. Prerequisite or concurrent: E MCH 315.

Curriculum Prerequisites (Senate Policy 34-60)

A course must not be taken before the prerequisite courses have been passed (at least a D in all prerequisite courses). A prerequisite course provides knowledge upon which the subsequent course depends. Under unusual circumstances (transferring degree programs, Universities etc.), in which other courses may possibly substitute for a prerequisite, the student must obtain the permission of the course instructor (or course leader) to waive or substitute prerequisites. Since the relationship between the various prerequisites for the courses in the curriculum can become quite complex, a flow diagram showing the relationship between prerequisites is included (see page 2.6).

Design Project Course Substitution

The capstone design project is culminating experience allowing the students to apply their engineering knowledge to an open ended activity. Most students satisfy the requirement by enrolling in either ME 440W or ME 441W.

Honors Thesis (**494H) may be used to satisfy the requirement by petition that must be approved by the student's advisor and the Associate Department Head of Undergraduate Programs provided the student can demonstrate:

1. The course substitution has similar course objectives as ME 440W, ME 441W; ME 442W & ME 443W:
 - a. To apply academic training and education to provide a professional engineering solution to a real life problem,
 - b. Implement the design process to a professional engineering problem,
 - c. Work effectively in a team that includes co-workers, customers and vendors,
 - d. Communicate well using verbal, written and electronic methods.
2. The student has the necessary background to meet the project technical needs.
3. The student must have the prerequisites common for ME 440W; ME 441W (Prerequisite: ME 340; Concurrent ENGL 202C) prior to enrolling in the substituted course.

Technical Elective Courses

The purpose of technical elective courses is to undertake advanced study in selected areas of Mechanical Engineering in order to prepare for careers in industry or graduate study. Students must take 12 credits of technical electives, divided in three categories as follows:

3 Credits of Mechanical Engineering Technical Elective (METE): 400-level ME course excluding ME 410, ME 440W, ME 441W, ME 442W, ME 443W, ME 450, ME 494, and ME 496.

6 Credits of Engineering Technical Elective (ETE): 400-level courses in the College of Engineering not required for the major. The courses can be in ME or another Engineering program. ME 494H or 496 can be used for the ETE.

3 Credits of General Technical Elective (GTE): Math, science, or engineering courses beyond the level of required courses in the program. Co-op and internship credits are accepted after

completion of a combination of three Co-op rotations or internships (ENGR 195A ENGR 295A, ENGR 395A, and ENGR 495A). An E-Petition must be submitted and approved for all General Technical Electives.

- Students are not permitted to take more than 6 credits of any combination of ME 494H (Senior Thesis) and ME 496 (Independent Study).
- Students completing Basic ROTC may substitute six of these credits for 3 credits of GHA and 3 credits of General Technical Elective.
- You can find an incomplete list of courses appropriate for the GTE on the undergrad web site at <http://www.mne.psu.edu/students/undergraduate/curriculum-electives.aspx>.

Semester Schedule

A copy of the semester schedule is on the page 2.5 & 2.7. This schedule can be modified, but strict attention must be paid to prerequisites as shown on the flow chart on page 2.6 & 2.8.

Courses Requiring at least “C” Grades for Entrance to Major

Effective Spring 2016, the entrance to major requirements (C grade or better) are listed below:

Math 140, Math 141, Chem 110, Physics 211, Physics 212, Math 251

Any entrance to majors occurring prior to Spring 2016 have the following C grade requirements:

Math 140, Math 141, Chem 110, Physics 211

Courses Requiring at least “C” Grades for Mechanical Engineering

In addition to entrance to major requirements, students admitted into Mechanical Engineering are required to earn a minimum of a C grade in each course designated by the major as a C-required course. These are listed below:

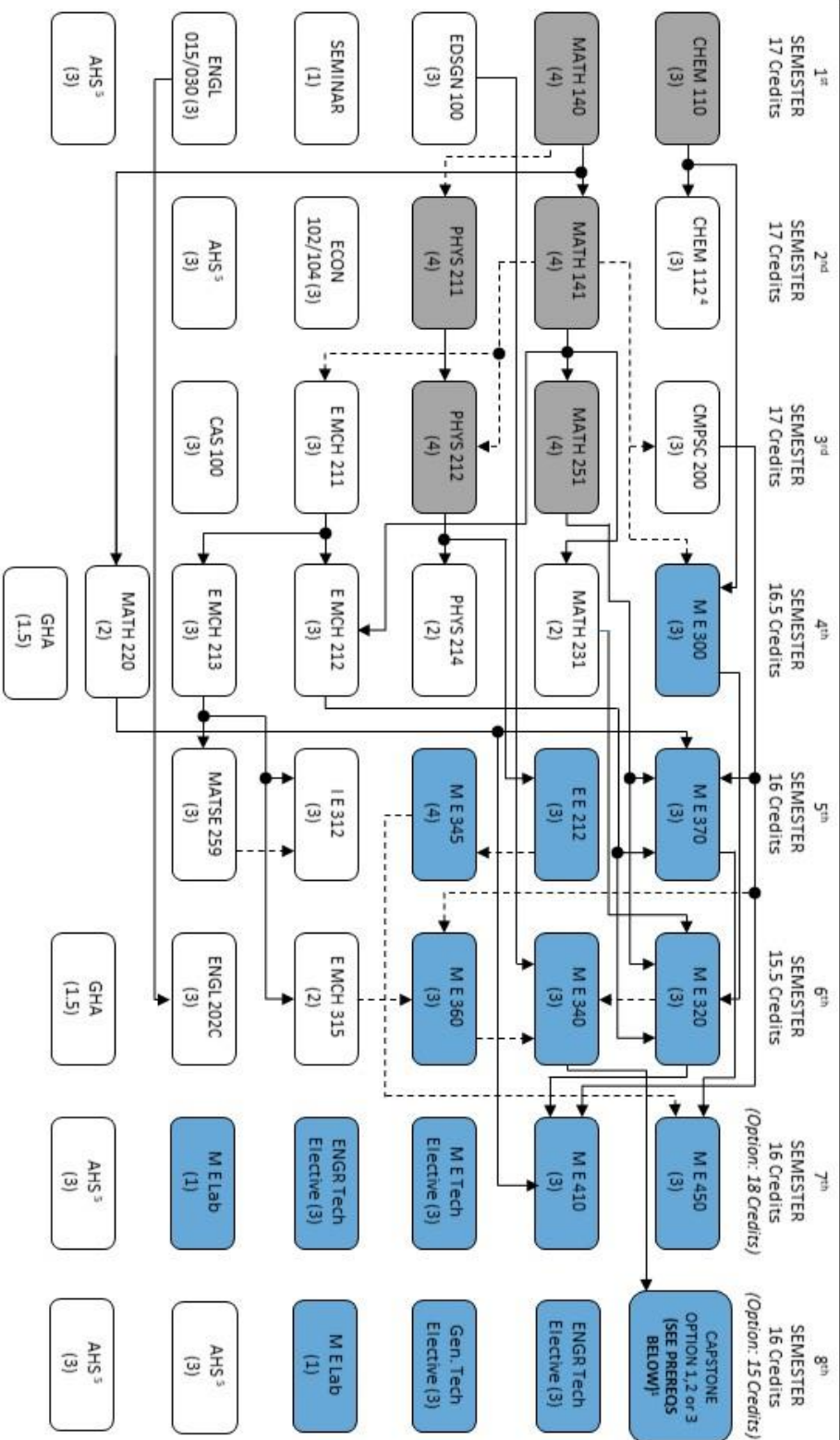
M E 300, E MCH 211, E MCH 212, E MCH 213, M E 370, M E 345, M E 340, M E 360, M E 320, M E410, M E 450

Mechanical Engineering Curriculum (Option A: last Name begins with A-K)

SEMESTER 1			SEMESTER 2		
Course		Credits	Course		Credits
FYS	First Year Seminar	1	(c) CHEM 112	Chemical Principles II	3
ENGL 015	Rhetoric and Composition -or-	3	(j) ECON 102	Microeconomic Analysis & Policy (GS) -or-	3
ENGL 030	Honors Freshman Composition		ECON 104	Macroeconomic Analysis & Policy (GS)	
EDSGN 100	Introduction to Engineering Design	3	(j) AHS course	(GA, GH, or GS)	3
(j) AHS course	(GA, GH, or GS)	3	(a,d) PHYS 211	Mechanics	4
(a,b,d) MATH 140	Calculus with Analytic Geometry I -or-	4	(a,b,d) MATH 141	Calc with Analytic Geometry II -or-	4
MATH 140E	Calc with Engineering Applications I		MATH 141E	Calc with Engineering Applications II	
(a,d) CHEM 110	Chemical Principles	3			
Total Semester Credits		17	Total Semester Credits		17
SEMESTER 3			SEMESTER 4		
Course		Credits	Course		Credits
CMPSC 200	MATLAB	3	(d) E MCH 212	Dynamics	3
CAS 100A/B	Effective Speech	3	(d) E MCH 213	Strength of Materials -or-	3
(d) E MCH 211	Statics	3	EMCH 213D	Strength of Materials with Design	
(a,d) MATH 251	Ordinary and Partial Differential Eq.	4	(i) GHA	Health/Physical Activity	1.5
(a,d) PHYS 212	Electricity and Magnetism	4	(d) M E 300	Engineering Thermodynamics I	3
			MATH 231	Calculus of Several Variables	2
			MATH 220	Matrices	2
			PHYS 214	Wave Motion and Quantum Physics	2
Total Semester Credits		17	Total Semester Credits		16.5
SEMESTER 5			SEMESTER 6		
Course		Credits	Course		Credits
E E 212	Intro to Electronic Measuring Systems	3	ENGL 202C	Technical Writing	3
I E 312	Product Design & Mfg Processes	3	E MCH 315	Mechanical Response of Engr. Mat'l.	2
MATSE 259	Properties & Processing of Engr. Mat'l.	3	(d) M E 340	Mech. Engr. Design Methodology	3
(d) M E 370	Vibrations of Mechanical Systems	3	(d) M E 360	Mechanical Design	3
(d) M E 345	Instrumentation, Measurements, and Statistics	4	(d) M E 320	Fluid Flow	3
			(i) GHA	Health/Physical Activity	1.5
Total Semester Credits		16	Total Semester Credits		15.5
SEMESTER 7			SEMESTER 8		
Course		Credits	Course		Credits
(e) ETE	Engineering Technical Elective	3	(e) ETE	Engineering Technical Elective	3
(j) AHS course	(GA, GH, or GS)	3	(j) AHS course	(GA, GH, or GS)	3
(d) M E 410	Heat Transfer	3	(j) AHS course	(GA, GH, or GS)	3
(d) M E 450	Modeling of Dynamic Systems	3	(h,i) GTE	General Technical Elective	3
(g) METE	M E Technical Elective	3	(f) M E Lab		1
(f) M E Lab		1	M E 440W	Senior Capstone Project -or-	3
			M E 441W	Senior Capstone Project (option II)	
Total Semester Credits		16	Total Semester Credits		16
**OPTIONAL SEQUENCE			** OPTIONAL SEQUENCE		
(k) M E 442W	Senior Capstone Project (option III)	2	(k) M E 443W	Senior Capstone Project (option III)	1
Total Semester Credits with ME 442W + ME 443W sequence		18	Total Semester Credits with ME 442W + ME 443W sequence		14

- a) Courses listed in **boldface italic type** require a C or better for entrance to major.
- b) MATH 140E & 141E are only available at University Park in the semester listed.
- c) Students may substitute BIOL 141 for CHEM 112.
- d) Courses listed in **boldface type** require a C or better for graduation in this major.
- e) An Engineering Technical Elective is any three credit, 400-level engineering course NOT required for the major.
- f) To graduate, one of the following lab courses must be taken: ME 315, 325, 355 or 375. EMCH 316 will satisfy the second lab requirement. 1 credit of ME 445 can also be used as 1 credit of a ME lab course and a Mechanical Engineering Technical Elective (METE)
- g) A Mechanical Engineering Technical Elective (METE) is any three-credit, 400-level ME or NUC E course that is not required for the major. ME 494 or ME 496 may not be used.
- h) Three credits of co-op may also be used for the GTE after completion of three co-op rotations.
- i) Six ROTC credits may be substituted for three credits of GHA plus three GTE credits upon completion of the basic ROTC Program.
- j) An elective course to satisfy General Education AHS requirements: GA - General Arts, GH - Humanities, GS - Social & Behavioral Sciences, selected from the lists published in the University General Education Handbook.
- k) **Both M E 442W and M E 443W must be completed to satisfy the Senior Design Project (Capstone) requirement.**

MECHANICAL ENGINEERING CURRICULUM (Option A: last Name begins with A-K)



¹ CAPSTONE OPTION 1: M E 440 (3 credits) – Prerequisites: M E 340 Concurrent: I E 312, ENGL 202C
² CAPSTONE OPTION 2: M E 441 (3 credits) – Prerequisites: M E 340, M E 410 Concurrent: ENGL 202C.
³ CAPSTONE OPTION 3: M E 442 (Fall, 2 credits) – Prerequisites: M E 340 Concurrent: I E 312, ENGL 202C, M E 410
⁴ BIOL 141 may be substituted for CHEM 112
⁵ US Cultures and IL Cultures requirements are satisfied in conjunction with AHS courses
 • Courses shaded in BLUE used for the In-major GPA calculation.

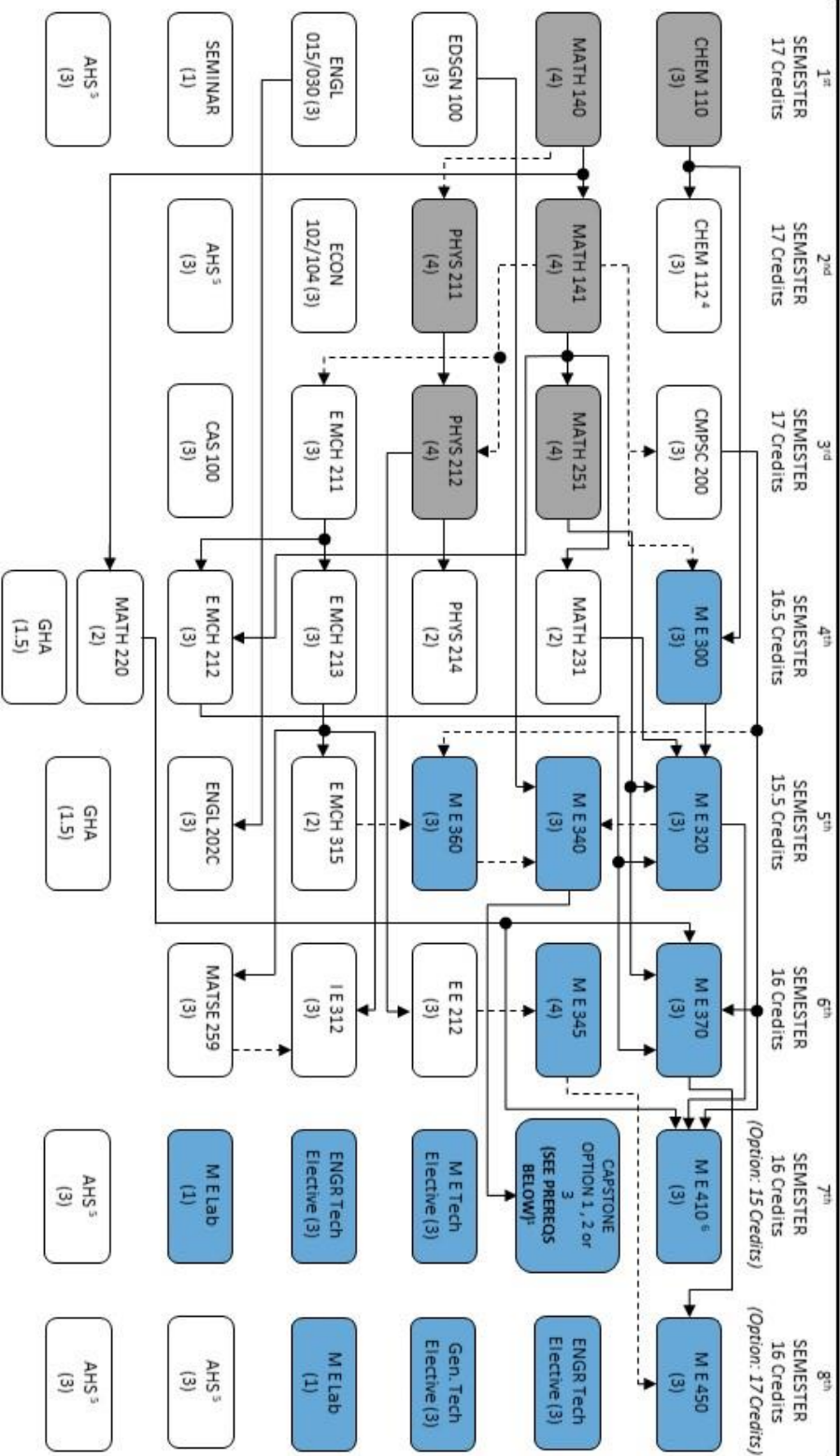
9/26/2017 → = Prerequisite - - - - - → = Prerequisite or Concurrent

Mechanical Engineering Curriculum (Option B: last Name begins with L-Z)

SEMESTER 1			SEMESTER 2		
Course		Credits	Course		Credits
FYS	First Year Seminar	1	(c) CHEM 112	Chemical Principles II	3
ENGL 015	Rhetoric and Composition -or-	3	(j) ECON 102	Microeconomic Analysis & Policy (GS) -or-	3
ENGL 030	Honors Freshman Composition		ECON 104	Macroeconomic Analysis & Policy (GS)	
EDSGN 100	Introduction to Engineering Design	3	(j) AHS course	(GA, GH, or GS)	3
(j) AHS course	(GA, GH, or GS)	3	(a,d) PHYS 211	Mechanics	4
(a,b,d) MATH 140	Calculus with Analytic Geometry I -or-	4	(a,b,d) MATH 141	Calc with Analytic Geometry II -or-	4
MATH 140E	Calc with Engineering Applications I		MATH 141E	Calc with Engineering Applications II	
(a,d) CHEM 110	Chemical Principles	3			
Total Semester Credits			Total Semester Credits		
17			17		
SEMESTER 3			SEMESTER 4		
Course		Credits	Course		Credits
CMPS 200	MATLAB	3	(d) E MCH 212	Dynamics	3
CAS 100A/B	Effective Speech	3	(d) E MCH 213	Strength of Materials -or-	3
(d) E MCH 211	Statics	3	EMCH 213D	Strength of Materials with Design	
(a,d) MATH 251	Ordinary and Partial Differential Eq.	4	(i) GHA	Health/Physical Activity	1.5
(a,d) PHYS 212	Electricity and Magnetism	4	(d) M E 300	Engineering Thermodynamics I	3
			MATH 231	Calculus of Several Variables	2
			MATH 220	Matrices	2
			PHYS 214	Wave Motion and Quantum Physics	2
Total Semester Credits			Total Semester Credits		
17			16.5		
SEMESTER 5			SEMESTER 6		
Course		Credits	Course		Credits
ENGL 202C	Technical Writing	3	E E 212	Intro to Electronic Measuring Systems	3
E MCH 315	Mechanical Response of Engr. Mat'l.	2	I E 312	Product Design & Mfg Processes	3
(d) M E 340	Mech. Engr. Design Methodology	3	MATSE 259	Properties & Processing of Engr. Mat'l.	3
(d) M E 360	Mechanical Design	3	(d) M E 370	Vibrations of Mechanical Systems	3
(d) M E 320	Fluid Flow	3	(d) M E 345	Instrumentation, Measurements, and Statistics	4
(i) GHA	Health/Physical Activity	1.5			
Total Semester Credits			Total Semester Credits		
15.5			16		
SEMESTER 7			SEMESTER 8		
Course		Credits	Course		Credits
(e) ETE	Engineering Technical Elective	3	(d) M E 450	Modeling of Dynamic Systems	3
(d) M E 410	Heat Transfer	3	(e) ETE	Engineering Technical Elective	3
(j) AHS course	(GA, GH, or GS)	3	(j) AHS course	(GA, GH, or GS)	3
(g) METE	M E Technical Elective	3	(j) AHS course	(GA, GH, or GS)	3
(f) M E Lab		1	(h,i) GTE	General Technical Elective	3
M E 440W	Senior Capstone Project -or-	3	(f) M E Lab		1
M E 441W	Senior Capstone Project (option II)				
Total Semester Credits			Total Semester Credits		
16			16		
**OPTIONAL SEQUENCE			**OPTIONAL SEQUENCE		
(k) M E 442W	Senior Capstone Project (option III)	2	(k) M E 443W	Senior Capstone Project (option III)	1
Total Semester Credits with ME 442W + ME 443W sequence			Total Semester Credits with ME 442W + ME 443W sequence		
15			17		

- a) Courses listed in **boldface italic type** require a C or better for entrance to major.
- b) MATH 140E & 141E are only available at University Park in the semester listed.
- c) Students may substitute BIOL 141 for CHEM 112.
- d) Courses listed in **boldface type** require a C or better for graduation in this major.
- e) An Engineering Technical Elective is any three credit, 400-level engineering course NOT required for the major.
- f) To graduate, one of the following lab courses must be taken: ME 315, 325, 355 or 375. EMCH 316 will satisfy the second lab requirement. 1 credit of ME 445 can also be used as 1 credit of a ME lab course and a Mechanical Engineering Technical Elective (METE)
- g) A Mechanical Engineering Technical Elective (METE) is any three-credit, 400-level ME or NUC E course that is not required for the major. ME 494 or ME 496 may not be used.
- h) Three credits of co-op may also be used for the GTE after completion of three co-op rotations.
- i) Six ROTC credits may be substituted for three credits of GHA plus three GTE credits upon completion of the basic ROTC Program.
- j) An elective course to satisfy General Education AHS requirements: GA - General Arts, GH - Humanities, GS - Social & Behavioral Sciences, selected from the lists published in the University General Education Handbook.
- k) Both M E 442W and M E 443W must be completed to satisfy the Senior Design Project (Capstone) requirement.

MECHANICAL ENGINEERING CURRICULUM (Option B: last Name begins with L-Z)



¹ CAPSTONE OPTION 1: M E 440 (3 credits) – Prerequisites: M E 340 Concurrent: I E 312, ENGL 202C
² CAPSTONE OPTION 2: M E 441 (3 credits) – Prerequisites: M E 340, M E 410 Concurrent: ENGL 202C
³ CAPSTONE OPTION 3: M E 442 (Fall, 2 credits) – Prerequisites: M E 340 Concurrent: I E 312, ENGL 202C, M E 410
⁴ BIOL 141 may be substituted for CHEM 112
⁵ US Cultures and IL Cultures requirements are satisfied in conjunction with AHS courses.
 • Courses shaded in BLUE are used for the In-major GPA calculation.

9/27/2017 → = Prerequisite - - - - - → = Prerequisite or Concurrent

Section 3:

Mechanical Engineering Technical Elective Courses

Overview of Mechanical Engineering Technical Electives

Before graduation, all Mechanical Engineering students must enroll in twelve credits of technical electives to prepare themselves for engineering careers. Available courses include reciprocating engines, heat exchangers, turbomachinery, jet engines, rocket engines, pollution control, combustion, automatic controls, refrigeration and air conditioning, compressible fluid dynamics, vibrations, vehicle dynamics, noise control, reliability, wear, microcomputer interfacing, computer-aided design, and advanced study in machine dynamics, fluid mechanics, and machine design. The strength of the major and its long-standing appeal to employers is that students are required to master both mechanical and thermal science subjects. Implicit in all their studies, students are expected to develop personal skills needed to be leaders in their profession.

The twelve credits of technical electives are divided into three different areas:

3 credits of Mechanical Engineering Technical Elective (METE): 400-level ME course excluding ME 410, ME 440W, ME 441W, ME 442W, ME443W, ME 450, ME 494, and ME 496.

6 credits of Engineering Technical Elective (ETE): 400-level Engineering courses not required for the major. The courses can be in ME or another Engineering program. ME 494 or 496 can be used for the ETE. IE 302 cannot be used for the ETE.

3 credits of General Technical Elective (GTE): math, science, or engineering courses beyond the level of required courses in the program. Co-op and internship credits are accepted after completion of a combination of three Co-op rotations or internships (ENGR 195A ENGR 295A, ENGR 395A, and ENGR 495A). An E-Petition must be submitted and approved for all General Technical Electives.

*Student is not permitted to use more than 6 credits of any combination of ME 494H (Senior Thesis) and ME 496 (Independent Study).

*Student completing Basic ROTC may substitute six of these credits for 3 credits of GHA and 3 credits of General Technical Elective.

*A list of many of the courses appropriate for the GTE can be found online at <http://www.mne.psu.edu/students/undergraduate/curriculum-electives.aspx>.

*Some students choose to group their technical electives in a particular specialty area. Examples of specialty areas can be found on pages 3.7 to 3.10 as well as online at <http://www.mne.psu.edu/students/undergraduate/curriculum-meelectivegroupings.aspx>.

Mechanical Engineering Technical Electives:

A listing of the Mechanical Engineering Technical Electives and short course descriptions follows. Detailed course outlines and syllabi can be found in the online ME program guide by clicking on the course title. This listing is subject to change in the future. Contact the instructor of the course for

further information.

The ME courses have been numbered by topical areas using course decades:

- x00 to x09 Thermodynamics
- x10 to x19 Heat Transfer
- x20 to x29 Fluid Mechanics
- x30 to x39 Combustion
- x40 to x49 Mathematics, Instrumentation, and Design
- x50 to x59 System Dynamics and Control
- x60 to x69 Solid Mechanics, Materials, and Manufacturing
- x70 to x79 Vibration and Noise Control
- x80 to x89 Rigid Body Mechanics
- x90 to x99 Thesis, Special Topics, Independent Study

Lab courses end in 5. The fundamental course in an area ends in 0.

ME 400: Thermodynamics of Propulsion and Power Systems (3 cr.) Fall Semester

Analysis and modeling of propulsion and power systems, including combustion, compressible flow through nozzles, chemical equilibrium, and moist air systems. Prerequisites: ME 300; ME 320. Prerequisite or concurrent: ME 410.

ME 402: Power Plants (3 cr.) Spring Semester (odd years)

A study of fossil-fuel steam generation and utility plants, including cogeneration, gas turbine, and combined cycles. Prerequisite or concurrent: ME 410.

ME 403: Polymer Electrolyte Fuel Cell Engines (3 cr.) Fall Semester

Introduction to Fundamentals of Polymer Electrolyte Fuel Cells (PEFCs). Includes fundamentals of electrochemistry, thermodynamics, fluid mechanics, heat transfer materials, and manufacturing issues of PEFCs. Prerequisite ME 300, Prerequisite or concurrent: ME 320, ME 410.

ME 404: Gas Turbines (3 cr.) Fall Semester

Thermodynamic cycles relating to gas turbines; analysis and performance of compressors, combustion chambers, single- and multi- stage turbines; recent developments. Prerequisites: ME 320.

ME 405: Indoor Air Quality Engineering (3 cr.) Fall Semester

Prediction of the motion of contaminants (both gaseous particulate) in gas streams; analysis of ventilation systems and air pollution control systems; comparison of experimental sampling techniques. Prerequisite: ME 320.

ME 406 (NUC E 406): Introduction to Statistical Thermodynamics (3 cr.) Spring Semester (odd years)

Statistical description of systems composed of large numbers of particles in the context of classical and quantum mechanics; basic concepts of probability theory and thermodynamics as they relate to statistical mechanics. Prerequisites: ME 300 or ME 201, or ME 302 or CHE 303; MATH 230 or MATH 231.

ME 411: Heat-Exchanger Design (3 cr.) Spring Semester (even years)

Thermal design and application of different heat-exchanger types, including surface selection and design optimization. Prerequisite: ME 410.

ME 420: Compressible Flow I (3 cr.) Spring Semester

Introductory compressible flow (gas dynamics), mathematical background, and physical concepts of isentropic flow, shock waves, expansion waves, and applications. Prerequisite: ME 320.

ME 422: Principles of Turbomachinery (3 cr.) Spring Semester

Application of Newton's laws of motion and basic laws of thermodynamics to analysis of fluid flow in turbomachinery. Prerequisite: ME 320.

ME 430 (EGEE 430): Introduction to Combustion (3 cr.) Fall & Spring Semesters

Concepts related to laminar and turbulent premixed and non-premixed combustion with applications to propulsion and stationary systems. Prerequisites: ME 201 or ME 300 or EME 301.

ME 431: Internal Combustion Engines (3 cr.) Spring Semester

Thermodynamic aspects of internal combustion engine design and performance; two- and four-stroke cycle, supercharged and non-supercharged, diesel and spark-ignition types. Prerequisites: ME 300.

ME 433: Fundamentals of Air Pollution (3 cr.) Spring Semester

Natural and man-made sources of pollution; atmospheric dispersion; biological and health effects; control systems; legislation and regulations. Prerequisite: ME 201 or ME 300.

ME 444: Engineering Optimization (3 cr.) Spring Semester

Problem formulation, algorithms and computer solution of various engineering optimization problems. Prerequisites: MATH 220; MATH 230 or MATH 231; CMPSC 200, or CMPSC 201 or CMPSC 202.

ME 445: Micro Computer Interfacing (4 cr.) Fall & Spring Semesters

Interfacing of electro-mechanical systems to microcomputers for data acquisition, data analysis and digital control. Prerequisites: ME 345 and 7th Semester standing. The 4th credit of this course can be used as an ME Lab. Prerequisite M E 345

ME 452: Vehicle Dynamics (3 cr.) Spring Semester

Investigations of three-dimensional dynamics and design into the study of vehicle dynamics including tire forces, suspension, and stability. Prerequisite: ME 370. Prerequisite or concurrent: ME 450

ME 455: Automatic Control Systems (3 cr.) Spring Semester

Dynamic analysis of systems involving automatic control of position, speed, power, flow, pressure, temperature, and other physical quantities. Prerequisites: ME 320; ME 450.

ME 456 (IE 456): Industrial Robot Applications (3 cr.) Fall Semester

Introduction to robotics, with emphasis on robot selection, programming, and economic justification for manufacturing applications. Prerequisites: MATH 220; MATH 250 or MATH 251; I E 305 or ME 360; CMPSC 200 or CMPSC 201.

ME 460: Advanced Machine Design Problems (3 cr.) Spring Semester

Special machine design problems in unusual type springs; gear problems and involutometry; cam design and application; multiple diameter shaft deflections and ball bearings. Prerequisite: ME 360; ME 370.

ME 461: Finite Elements in Engineering (3 cr.) Fall, Spring & Summer Semesters

Computer modeling and fundamental analysis of solid, fluid, and heat flow problems using existing computer codes. Prerequisites: CMPSC 200, CMPSC 201 or CMPSC 202; E MCH 213, E MCH 210 or E

MCH 210H.

ME 462: Lubrication in Machine Design (3 cr.) Fall Semester

Lubricants and lubrication with applications to design aspects of machines and mechanisms including bearings, gears, cams, and automotive engines. Prerequisites: MATH 251; ME 360.

ME 470: Analysis and Design in Vibration Engineering (3 cr.) Spring Semester

Application of Lagrange's equations to mechanical system modeling, multiple-degree-of-freedom systems, experimental and computer methods; some emphasis on design applications.

Prerequisite: E MCH 212 or E MCH 212H; M E 370 or E SC 407H.

ME 480: Mechanism Design and Analysis (3 cr.) Fall Semester

Design and analysis of mechanical linkages including kinematic synthesis and dynamic analysis. Linkages for a variety of applications are considered. Prerequisite: E MCH 212. Prerequisite or Concurrent: CMPSC 200.

ME 481: Introduction to Computer-Aided Analysis of Machine Dynamics (3 cr.) Spring Semester Techniques and formulations for computer based kinematic and dynamic analyses of machines. Prerequisite: E MCH 212. Prerequisite or Concurrent: CMPSC 200.

ME 494H: Senior Honors Thesis (6 cr. Max.)

The Senior (Honors) Thesis is a requirement for students participating in the Schreyer Honors Program in Mechanical Engineering. It is a valuable component of the entire honors program for the student participating in this program --using, extending, and integrating what he/she has learned, developing a sense of mastery of information and knowledge, and providing an achievement worth noting. Up to six credits of honors course work may be devoted to thesis preparation. Though department policy or a thesis supervisor may approve fewer than six credits in no case may more than six honors credits be earned for a thesis. For students in the Schreyer Honors Program, six credits of senior thesis may be substituted for:

- 3 credits of Capstone Design Project, if the effort meets the criterion stated in "Design Project Course Substitutions" on page 2.3 is satisfied, and
- 3 credits of Engineering Technical Elective (ETE) or General Technical Elective (GTE).

- OR -

- 3 credits of Engineering Technical Elective (ETE) and 3 credits of General Technical Elective (GTE).

The Honor's Thesis capstone experience approval form can be found at:

<http://assets.engr.psu.edu/MNE/docs/Academic%20Plans/ME494HThesisSubRegistrationForm2016.pdf>

ME 496: Independent Studies (1-6 cr.)

Students engaged in independent study under the supervision of an ME faculty member may use up to 6 credits of ME 496 for the Engineering Technical Elective requirement (ETE) or General Technical Elective (GTE). Students cannot register for ME 496 without having made arrangements with a faculty member and receiving the permission of the student's advisor. In addition to registering for ME 496, a Project Registration form must be submitted in 139/140 Reber Building. The Department requires that students have an overall GPA not less than a 3.0 to enroll in ME 496.

ME 497: Special Topics

New or experimental courses will be offered from time-to-time as an ME 497X course.

Suggested Technical Specialization Course Tracks (Technical Elective Groupings):

Students select their technical electives in many different ways. Some students select technical electives in a variety of topic areas to determine their interests or prepare for Graduate School enrollment. Other students cluster their courses in one topic area to gain a specialty within Mechanical Engineering. The following groupings are possible specialty areas that you can study within the Mechanical Engineering program. Courses outside of ME can be used as Engineering Technical Elective (ETE) or General Technical Elective (GTE) as noted. A Mechanical Engineering Technical Elective (METE) can also be used for ETE or GTE. A course noted as ETE can also be used for GTE. For information on possible minors see <http://bulletins.psu.edu/undergrad/programs/minors/>.

Mechanical Engineering in Aerospace Applications

The track provides a specialization in the application of mechanical engineering in the aerospace field. Track courses focus on advanced mechanical engineering topics needed in aerospace applications such as fluid dynamics, gas turbines, mechatronics and automatic control systems. Applications and professional opportunities exist in jet engines, rotorcraft, aircraft and spacecraft design and development.

ME 400 – Thermodynamics
ME 404 – Gas Turbines
ME 420 – Compressible Flow
ME 445* – Application of Microcomputers
ME 455 – Automatic Control Systems
ME 461 – Finite Elements in Engineering
AERSP 306 – Aeronautics (GTE)
AERSP 309 – Astronautics (GTE)

Vehicle Engineering for the 21st Century

This track includes traditional automotive engineering topics and advanced topics needed to meet today's needs for efficient and environmentally friendly transportation vehicles. Track courses include internal combustion engines, vehicle dynamics, fuel cells, hybrid vehicles and advanced engineering tools such as mechatronics, finite element analysis and control systems. Applications and professional opportunities exist in the traditional automotive and heavy transportation industries, earthmoving and construction equipment, and agricultural equipment. Emerging opportunities are developing as a result of the world's needs for low carbon emission, high efficiency transportation systems.

ME 400 – Thermodynamics
ME 455 – Automatic Control Systems
ME 431 – Internal Combustion Engines
ME 460 – Adv. Machine Design Problems
ME 445* – Applications of Microcomputers
ME 461 – Finite Elements in Engineering
ME 452 – Vehicle Dynamics
ME 481 – Computer Aided Analysis Mech. Sys.

An Off-Road Equipment Minor can be pursued with BSME:

ME 431 – Internal Combustion Engines
BE 461 – Design of Fluid Power Systems (ETE)
ASM 420 – Principles of Off-Road Machines (Can be petitioned for ETE)
ASM 424 – Selection and Management of Agricultural Machinery (Can be petitioned for ETE)

Biomedical Device Engineering

The track provides a specialization in the application of mechanical engineering to devices and instruments used in the medical field. Track courses include finite element analysis, automatic control systems, medical imaging and prosthesis design. Applications and professional opportunities exist throughout rapidly growing medical instrument and patient rehabilitation fields. (A BMEngineering minor can be pursued with BSME.)

ME 445* – Applications of Microcomputers
BME 402 – Biomedical Instrumentation & Meas.
ME 455 – Automatic Control Systems
BME 406 – Medical Imaging (ETE)
ME 461 – Finite Elements in Engineering
BME 410 – Biomedical Microfluidics (ETE)
BME 201 – Fundamentals of Cells & Molecules (GTE)
BME 419 – Artificial Organs & Prosthetic Devices (ETE)
BME 301 – Analysis of Physiological Systems (GTE)

Combustion Based Energy Conversions

The track provides a specialization in conversion of energy from combustion of fuels. Track courses include combustion processes, internal combustion engines and rocket propulsion. Applications and professional opportunities exist and are wide ranging from power generation, transportation systems and aerospace fields.

ME 400 – Thermodynamics
ME 404 – Gas Turbines
ME 430 – Introduction to Combustion
ME 431 – Internal Combustion Engines

Machinery Dynamics & Design

This track provides a specialization in some of the most traditional and enduring mechanical engineering topics of design, motion, and dynamics of mechanical machinery. Track courses focus on the analysis of forces and motions in moving components, and the control of noise and vibration resulting from the equipment operation. The most current engineering tools are used to design and analyze mechanical devices for safe, functional and efficient operation. Applications and professional opportunities exist in almost all fields requiring mechanical engineering expertise, including, agricultural equipment, steam turbines, solar power, marine propulsion, micro-machines, etc.

ME 460 – Advanced Machine Design
ME 461 – Finite Elements in Engineering
ME 462 – Lubrication in Machine Design
ME 470 – Analysis & Design in Vibration Engr.
ME 480 – Machine Dynamics

ME 481 – Computer Aided Analysis Mech. Sys.
E MCH 400 – Adv. Strength of Material & Design (ETE)
E MCH 402 – Applied & Exper. Stress Analysis (ETE)
E MCH 403 – Strength Design in Mat. Structure (ETE)
E MCH 440 – Nondestructive Evaluation of Flaws (ETE)
E MCH 471 – Engr. Composite Materials (ETE)
E MCH 473 – Composites Processing (ETE)

Control of Mechanical Systems

This track provides a specialization in the control mechanical systems for a specific goal such as maintaining a prescribed motion profile, efficient energy utilization or force application. Courses include control system design and analysis, mechatronics and robotics. Applications and professional opportunities exist in many engineering fields including process and equipment automation, aircraft flight systems, medication dispensing, emission control of combustion processes, etc.

ME 445* – Applications of Microcomputers
ME 455 – Automatic Control Systems
ME 461 – Finite Elements in Engineering
ME 481 – Computer Aided Analysis Mech. Sys.

Turbomachinery Based Energy Conversions

This track provides a specialization in the efficiency transfer of thermal to mechanical energy. The track courses focus on advanced fluid dynamics, heat transfer and turbine design and operation. Applications and professional opportunities exist in many areas as the global demand for energy grows exponentially.

ME 404 – Gas Turbines
ME 411 – Heat-Exchanger Design
ME 420 – Compressible Fluid Flow I
ME 422 – Principles of Turbomachinery
AERSP 412 – Turbulent Flow (ETE)
AERSP 423 – Num. Methods in Fluids (ETE)

Mechatronics and Robotics Engineering

This track provides a specialization in the merging of electronics and mechanical devices to optimize operational efficiency. Topics include computer-mechanical device interfacing, control of mechanical actuators, automatic control systems, and operation of industrial robots. Applications and professional opportunities exist in fields such as computer control of mechanical mechanisms, process automation, pharmaceutical production, etc.

ME 445* – Applications of Microcomputers
ME 455 – Automatic Control Systems
ME 456 – Industrial Robotic Applications

Power Engineering

This track provides a specialization in the transfer of energy from one form to another, often as electricity in the end. The track is subdivided into nuclear engineering and power plant groupings. Courses in the nuclear engineering sub track provide the mechanical engineer with a fundamental knowledge of the field. The power plant sub track focuses on the conversion thermal energy to mechanical motion necessary to create electrical power, with courses in turbomachinery, heat exchangers and automatic control systems. Applications and professional opportunities exist in electrical utilities and its support vendors.

ME 402 – Power Plants

ME 404 – Gas Turbines

ME 411 – Heat-Exchanger Design

ME 420 – Compressible Fluid Flow I

ME 422 – Principles of Turbomachinery

ME 433 – Fundamentals of Air Pollution

ME 445* – Applications of Microcomputers

ME 455 – Automatic Control Systems

NUC E 301 – Fundamentals of Reactor Physics (GTE)

NUC E 310W – Issues in Nuclear Engineering (GTE)

Global Engineering via Study Abroad

This track provides experience to working in the global economy via a Study Abroad. Penn State has numerous engineering exchange programs (<http://www.engr.psu.edu/global/>) throughout the world. By overseas study you will gain the critical experience to cultural sensitivities and the work environment. As each of the international partner institutions has different opportunities available, you can tailor your technical course of study. The experience prepares you to work for multi-national companies in a variety of industries.

New Product Design and Manufacturing

This track provides a specialization in developing a product starting with a customer need through to a manufactured device. Courses focus on the design process, mechanical component design, design optimization and manufacturing processes. Applications and professional opportunities range from consumer products to commercial aircraft.

Product Design and Development: (A Product Realization Minor can be pursued with BSME)

ME 240 – Product Dissection (GTE)

ME 445* – Applications of Microcomputers

ME 455 – Automatic Control Systems

ME 456 – Industrial Robotic Applications

ME 460 – Advanced Machine Design

ME 461 – Finite Elements in Engineering

ME 480 – Machine Dynamics

ME 481 – Computer Aided Analysis Mech. Sys.

* ME 445 is a four credit course. Three credits are used as ME Technical Elective. One credit can be used as an ME Lab (Fill out pink DAR form)

Suggested Technical Elective Groupings for Graduate School Preparation

Mechanical Sciences

ME 455 – Automatic Control Systems

ME 470 – Analysis & Design in Vibration Engr.

ME 480 – Machine Dynamics

E MCH 400 - Advanced Strength of Material & Design

Thermal Sciences

ME 400 – Thermodynamics

ME 420 – Compressible Fluid Flow I

ME 421 – Viscous Flow Analysis & Computation

ME 430 – Introduction to Combustion

Scheduling Pattern for 400-Level M E Technical Elective Courses

This is the anticipated scheduling pattern. Please consult Schedule of Classes for further information.

Fall Semester	Spring Semester	Summer Session
ME 400	ME 401 (odd years)	ME 410
ME 403	ME 402 (odd years)	ME 422
ME 404	ME 406 (odd years)	ME 461
ME 405	ME 411 (even years)	ME 494
ME 430	ME 420	ME 496
ME 445	ME 422	
ME 456	ME 430	
ME 461	ME 431	
ME 462	ME 433	
ME 480	ME 444	
ME 494	ME 445	
ME 496	ME 452	
ME 497	ME 455	
	ME 460	
	ME 461	
	ME 463	
	ME 470	
	ME 481 (odd years)	
	ME 494	
	ME 496	
	ME 497	

Section 4:

Nuclear Engineering Degree Requirements

Overview

The faculty of the Mechanical and Nuclear Engineering Department determine the degree requirements for a Bachelor of Science degree in Nuclear Engineering. The degree requirements incorporate the University's 'General Education Requirements', as well as items required by the College of Engineering here at Penn State. The Nuclear Engineering BS degree at Penn State is fully accredited by the Accreditation Board for Engineering and Technology (ABET). Please see the inside front cover for our educational objectives.

On page 4.4, you will find the entire curriculum summarized in a semester-by-semester table. This chapter will describe the Nuclear Engineering core courses, the technical electives, and the Arts-Humanities-Social Science (AHS) electives, which are all consistent with ABET criteria.

Nuclear Engineering Core (Required) Courses

All NUC E core courses are offered once a year. Nuclear Engineering students are also required to take the Electrical Engineering, Engineering Mechanics and Mechanical Engineering courses listed below. It is important to carefully plan your course schedules for the remaining semesters in your undergraduate degree so that you will complete your degree in the anticipated semester. Students must pass prerequisite courses before enrolling in a course.

NUC E 301 Fundamentals of Reactor Physics (4 CR.) Fall Semester

Nuclear reactions and interactions relevant to the nuclear engineering including fission, cross-sections, reaction rate calculations, energy depositions rates, and radioactive decay. Prerequisites: MATH 251, Prerequisite or Concurrent: MATH 230 or MATH 232; PHYS 214.

NUC E 302 Introduction to Reactor Design (4 CR.) Spring Semester

Static and dynamic reactor theory applied to basic reactor design problems. Prerequisite: NUC E 301; NUC E 309.

NUC E 309 Analytical Techniques for Nuclear Concept (3 CR.) Fall Semester

This course is an introduction to many of the analytical techniques used in the nuclear engineering discipline. Prerequisites: MATH 251. Prerequisite or Concurrent: MATH 230 or MATH 232

NUC E 310W Issues in Nuclear Engineering (2 CR.) Fall Semester

Societal and technical issues facing nuclear engineers, including safety, operations, waste, regulation, public acceptance, economics, ethics, and radiation. Prerequisite: fifth- semester standing.

NUC E 403 Advanced Reactor Design (3 CR.) Fall Semester

Physical principles and computational methods for reactor analysis and design. Multigroup diffusion theory; determination of fast and thermal group constants;

cell calculations for heterogeneous core lattices. Prerequisite: NUC E 302.

- NUC E 430 Design Principles of Reactor Systems (3 CR.) Fall Semester**
Nuclear power cycles; heat removal problems; kinetic behavior of nuclear systems; material and structural design problems. Prerequisites: NUC E 302; Prerequisite or Concurrent: M E 410.
- NUC E 431W Nuclear Reactor Core Design Synthesis (4 CR.) Spring Semester**
Technical and economic optimization of nuclear systems. Prerequisites: NUC E 403; NUC E 430. Prerequisite or Concurrent: ENGL 202C
- NUC E 450 Radiation Detection and Measurement (3 CR.) Spring Semester**
Theory and laboratory applications of radiation detectors, including proton, neutron, charged particle detectors. NIM devices, and pulse-height analysis. Prerequisite: NUC E 301 or NUC E/CHEM 405; NUC E 309.
- NUC E 451 Experiments in Reactor Physics (3 CR.) Fall Semester**
Acquisition and processing nuclear and atomic data; application to nucleonic phenomena of importance in nuclear engineering. Prerequisites: NUC E 450; E E 212.
- ME 300 Engineering Thermodynamics I (3 CR.) Fall & Spring Semester**
Basic thermodynamic concepts, first and second law of thermodynamics, properties of pure substances. Prerequisites: CHEM 110. Prerequisite or Concurrent: MATH 141.
- ME 320 Fluid Flow (3 CR.) Fall & Spring Semester**
Thermodynamic and dynamic principles applied to fluid behavior; ideal, viscous, under internal and external flow conditions. Prerequisites: Prerequisites: E MCH 212; MATH 251; ME 201 or ME 300; MATH 230 or MATH 231.
- ME 410 Heat Transfer (3 CR.) Fall & Spring Semester**
Transient heat conduction; convection in laminar and turbulent flow; heat exchanger devices; boiling and condensation; radiation. Prerequisites: ME 320; or BME 409; CMPSC 200 or CMPSC 201; MATH 220 or NUC E 309

Laboratory Facilities

The Radiation Science & Engineering Center (RSEC) is one of the most complete and modern university reactor facilities in the country. The laboratory complex contains the Breazeale Nuclear Reactor, a TRIGA Mark III reactor, the Cobalt-60 Radiation Facility, two hot cells, a radio-chemistry laboratory, a radio- nuclear applications laboratory, a natural uranium graphite subcritical reactor, a neutron radiography laboratory, an electronics shop, a machine shop, an extensive array of radiation sources and counting equipment, and student classrooms.

TRIGA Reactor - The Breazeale Nuclear Reactor at the RSEC is a versatile and useful university research reactor. It can operate in the steady-state mode at a power level of 1 megawatt with a maximum thermal neutron flux of 2.7×10^{13} neutrons/cm²-sec and can be pulsed to a peak power of 2000 megawatts with a maximum integrated output of 6×10^{16} neutrons/cm²-sec. The reactor core, suspended from a movable bridge, can be positioned in the "swimming pool" to provide the most effective experimental setup. Special equipment directly associated with the reactor includes a D2O thermal column, pneumatic "rabbit" tubes, several beam ports, and a traversing

experimental bridge. The reactor normally operates one shift per day, five days a week.

Neutron Radiography Laboratory - Located in the RSEC Neutron Beam Laboratory, this facility passes a well-collimated beam of neutrons from the reactor, thermalized by a D2O thermal column, through the shielding wall for use in nondestructive testing and evaluation. The major work now being done is utilizing a neutron image intensifier for neutron imaging in real-time. The beam is also being used for static neutron radiography and neutron attenuation studies. Equipment is available to digitize the real time radiography images for image processing.

Cobalt-60 - In 1966, the University placed into operation a laboratory extension to its reactor facility. This two-level, gamma-ray laboratory cobalt-60 in a large pool of water. The radioactive cobalt-60, can be arranged in various configurations to meet the needs of the experimenter. Exposure rates up to 5 x 10⁵ roentgens per hour are available and irradiation conditions such as controlled temperature, and instrumentation for experiments are possible.

Nuclear Materials Laboratory - Located at the RSEC, this laboratory includes a positron annihilation lifetime spectrometer which is being used to monitor damage to pressure vessel steels. Facilities for sample preparation for electron microscopy are available, including electro polishing and arc melting. The laboratory also includes a Charpy impact tester and full hot cell facilities.

Hot Cells - To aid materials research and provide safe handling of many highly radioactive sources, the University has constructed two well-equipped hot cells at the RSEC. Each of these cells is capable of handling the equivalent of 100 curies of cobalt-60. Special shielding arrangements make possible experiments at an even higher level. Direct viewing of experiments through lead glass windows, remote manipulators, air cleaning equipment, utilities, and special control of waste materials all add to the capabilities of these hot cells.

Subcritical Reactor - A graphite, natural uranium subcritical reactor is used for student instruction. Several lattice spacings can be set up with this subcritical reactor, allowing studies of heterogeneous arrays. Its unique construction permits experiments associated with thermal reactor physics. Replacement of the fuel with graphite stringers provides a 6x6x9 foot graphite region for instructional use.

Radionuclear Applications Lab - Located at the RSEC, this laboratory is equipped with the latest in radiation detection equipment, including multichannel analyzers (including one with 4096 channels), and Ge(Ge), Si(Li) and NaI(Tl) radiation detectors. Personnel of this laboratory conduct research and offer other services to the University research community in the areas of activation analysis, gamma-ray spectroscopy, tracer techniques, radiography, isotope gauging, and other applications of radiation and radioisotope technology.

Intelligent Distributed Control Research Laboratory (IDCRL) - The Penn State IDCRL was established in 1989. The original funding supplied the initial Bailey Control System. Equipment added later includes seven UNIX workstations, simulation and controls software, additional Bailey controller equipment and a modern state-of-the-art UNIX network compatible microprocessor-based control system. The equipment is used for advanced intelligent control research for fossil and nuclear power plants. This research includes validation using distributed real-time simulation of plant-wide power plant systems including boiler, feed water turbine and generator subsystems and validation using the Penn State TRIGA research reactor. This laboratory is jointly used by faculty and students from the Mechanical and Nuclear Engineering Department and the Electrical Engineering Department that are conducting applied controls research involving implementation in a Bailey microprocessor-based distributed control system. The main part of the equipment is housed in 104 Electrical Engineering East Building. A portion of the equipment is also maintained

at the Penn State Breazeale Reactor for those students conducting tests of advanced concepts on the reactor.

Low Pressure Integral Test Facility (LPITF) - The Penn State Nuclear Engineering Low Pressure Integral Test Facility (LPITF) is a unique, multipurpose, thermal hydraulic test loop. This test facility is made of two separate components with two separate objectives. These two components are the test loop and the boiling regime pipe. The test loop is designed to be an integral effects test facility, while the boiling regime pipe is a separate effects facility.

The study of natural circulation in a reactor system is a primary facility objective. This includes system behavior during startup, normal operation, and during accident scenarios. The test loop also provides an opportunity to benchmark and develop thermal hydraulic codes such as TRAC, RELAP, and RETRAN. The system also presents an opportunity to interface digital signal gathering and digital control with a model operating system. The test loop instrumentation can be coupled with a computer and related software to allow for digital signal acquisition and control of various valves, heaters, and pumps.

Curriculum Prerequisites (Policy 34-60)

A course must not be taken before the prerequisite courses have been passed. A prerequisite course provides knowledge upon which the subsequent course depends. Under unusual circumstances (transferring degree programs, Universities etc.), in which other courses may possibly substitute for a prerequisite, the student must obtain the permission of the course instructor (or course leader) to waive or substitute prerequisites. Since the relationship between the various prerequisites for the courses in the curriculum can become quite complex, a flow diagram showing the relationship between prerequisites is included (see page 4.5).

Technical Elective Courses

The purpose of technical elective courses is to undertake advanced study in Nuclear Engineering in order to prepare for careers in industry or graduate study. Nine credits of technical electives are required: six credits of technical electives in Nuclear Engineering and three credits of general technical elective.

Additional restrictions concerning the selection of "technical electives" are as follows:

6 Credits Nuclear Engineering Technical Electives (NETE): Six credits of Nuclear Engineering technical electives are required. Select from NUC E 405, 406, 408, 409, 420, 446, 470, 490, or Bio E 406. NUC E 496 can be used as a General Technical Elective, GTE. NUC E 401 is for non-majors and cannot be used as an NETE.

3 Credits General Technical Elective (GTE): Three credits of general technical electives are required. General Technical Electives include: Nuclear Engineering courses which are not required, except NUC E 401; other 400-level Engineering courses; some science or math courses outside of the College of Engineering. Co-op and internship credits are accepted after completion of a combination of three Co-op rotations or internships (ENGR 195A ENGR 295A, ENGR 395A, and ENGR 495A). An E-Petition must be submitted and approved for all General Technical Electives. Before registering for a course, see your Adviser to verify acceptability.

- Students are not permitted to take more than 6 credits of any combination of NUC E 494H (Senior
- Thesis) and NUC E 496 (Independent Study).

- Students completing Basic ROTC may substitute six of these credits for 3 credits of GHA requirement and 3 credits of General Technical Elective.
- You can find an incomplete list of courses appropriate for the GTE on the undergrad web site at <http://www.mne.psu.edu/students/undergraduate/curriculum-electives.aspx>.

Semester Schedule

A copy of the semester schedule is on page 4.5. This schedule can be modified, but strict attention must be paid to prerequisites as shown on the flow chart on page 4.5.

Courses Requiring at least “C” Grades for Entrance to Major

Effective Spring 2016, the entrance to major requirements (C grade or better) are listed below:

Math 140, Math 141, Chem 110, Physics 211, Physics 212, Math 251

Any entrance to majors occurring prior to Spring 2016 have the following C grade requirements:

Math 140, Math 141, Chem 110, Physics 211

Courses Requiring at least “C” Grades for Nuclear Engineering

In addition to entrance to major requirements, students admitted into Mechanical Engineering are required to earn a minimum of a C grade in each course designated by the major as a C-required course. These are listed below:

NUC E 301, NUC E 302, NUC E 309, NUC E 430, NUC E 450

NUCLEAR ENGINEERING CURRICULUM

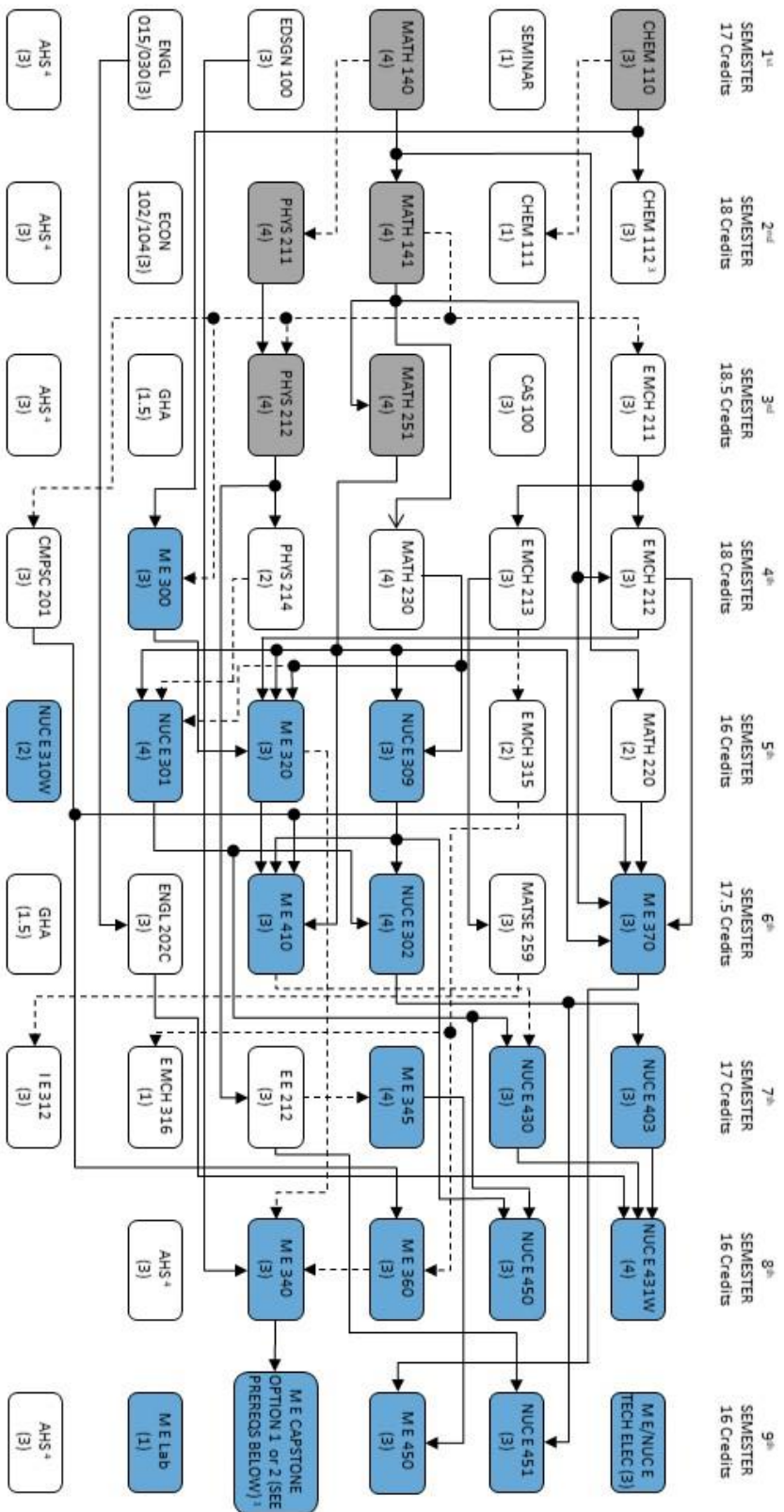
SEMESTER 1			SEMESTER 2		
Course		Credits	Course		Credits
(a,c) CHEM 110	Chemical Principles	3	FYS	First Year Seminar	1
CHEM 111	Experimental Chemistry	1	(g) AHS course	(GA, GH, or GS)	3
ENGL 015	Rhetoric and Composition -or-	3	(g) ECON 102	Microeconomic Analysis & Policy (GS) -or-	3
ENGL 030	Honors Freshman Composition		ECON 104	Macroeconomic Analysis & Policy (GS)	
EDSGN 100	Introduction to Engineering Design	3	(a,c) PHYS 211	Mechanics	4
(a,b,c) MATH 140	Calculus with Analytic Geometry I -or-	4	(a,b,c) MATH 141	Calc with Analytic Geometry II -or-	4
MATH 140E	Calc with Engineering Applications I		MATH 141E	Calc with Engineering Applications II	
(g) AHS course	(GA, GH, or GS)	3	(f) GHA	Health/Physical Activity	1.5
Total Semester Credits		17	Total Semester Credits		17
SEMESTER 3			SEMESTER 4		
Course		Credits	Course		Credits
CMPSC 201	C++ for Engineers (Preferred) -or-	3	E MCH 212	Dynamics	3
CMPSC 200	Programming with MATLAB		E MCH 213	Strength of Materials -or-	3
E MCH 211	Statics	3	EMCH 213D	Strength of Materials with Design	
(a,c) MATH 251	Ordinary and Partial Differential Eq.	4	(f) GHA	Health/Physical Activity	1.5
(a,c) PHYS 212	Electricity and Magnetism	4	M E 300	Engineering Thermodynamics I	3
(g) AHS course	(GA, GH, or GS)	3	MATH 230	Calculus of Several Variables	4
Total Semester Credits		17	PHYS 214	Wave Motion and Quantum Physics	2
Total Semester Credits		17	Total Semester Credits		16.5
SEMESTER 5			SEMESTER 6		
Course		Credits	Course		Credits
CAS 100A/B	Effective Speech	3	EE 212	Intro to Electronic Measuring Systems	3
M E 320	Fluid Flow	3	M E 410	Heat Transfer	3
(c,*) NUCE 301	Fundamentals of Reactor Physics	4	E MCH 315	Mechanical Response of Engr. Mat'l.	2
(c,*) NUCE 309	Analytical Techniques for Nuclear Concepts	3	E MCH 316	Experimental Determination of Mechanical Response of Materials	1
(*) NUCE 310W	Issues in Nuclear Engineering	2	(c,**) NUCE 302	Intro to Reactor Design	4
Total Semester Credits		15	(c,**) NUCE 450	Radiation Detection and Measurement	3
Total Semester Credits		15	Total Semester Credits		16
SEMESTER 7			SEMESTER 8		
Course		Credits	Course		Credits
(*) ENGL 202C	Technical Writing	3	(g) AHS course	(GA, GH, or GS)	3
(*) NUCE 403	Advanced Reactor Design	3	(g) AHS course	(GA, GH, or GS)	3
(c,*) NUC E 430	Design Principles of Reactor Systems	3	(e,f) GTE	General Technical Elective	3
(*) NUCE 451	Experiments in Reactor Physics	3	(**) NUCE 431W	Nuclear Reactor Core Design Synthesis	4
(d) NUCE TE	NUCE Technical Elective	3	(d) NUCE TE	NUCE Technical Elective	3
Total Semester Credits		15	Total Semester Credits		16

- a) Courses listed in **boldface italic type** require a C or better for entrance to major.
- b) MATH 140E & 141E are only available at University Park in the semester listed.
- c) Courses listed in **boldface type** require a C or better for graduation in this major.
- d) Select from Nuclear Engineering Programs List (NUC E 405, 406, 408, 409, 420, 446, 470, 490, 497, or BIOE 406).
- e) Nuclear Engineering courses not required for the major are also permitted, except Nuc E 401 (See department list). Three credits of co-op may also be used for the GTE after completion of three co-op rotations.
- f) Six ROTC credits may be substituted for three credits of GHA plus three GTE credits upon completion of the basic ROTC Program.
- g) An elective course to satisfy General Education AHS requirements: GA - General Arts, GH - Humanities, GS - Social & Behavioral Sciences, selected from the lists published in the University General Education Handbook.

* These Nuc E courses are **ONLY** offered in the **Fall** semester *

** These Nuc E courses are **ONLY** offered in the **Spring** semester *

CONCURRENT MAJOR IN MECHANICAL & NUCLEAR ENGINEERING (9 SEMESTERS)



¹ M E CAPSTONE OPTION 1: M E 440 (3 credits) – Prerequisites: M E 340 Concurrent: I E 312, ENGL 202C
² M E CAPSTONE OPTION 2: M E 441 (3 credits) – Prerequisites: M E 340, M E 410 Concurrent: ENGL 202C
³ BIOL 141 may be substituted for CHEM 112
⁴ US Cultures and IL Cultures requirements are satisfied in conjunction with AHS courses
 * Only one M E CAPSTONE OPTION is required for completion of the M E Degree.
 * All courses in BLUE are used to calculate the in-major GPA.

→ = Prerequisite - - - - - → = Prerequisite or Concurrent

9/26/2017

Section 5:

Nuclear Engineering Technical Elective Courses

Overview of Nuclear Engineering Technical Electives

Before graduation, all students must enroll in two Nuclear Engineering technical electives to prepare themselves for engineering careers. NUC E Technical electives are 400-level NUC E courses, except NUC E 401, that are not required in the BS NUC E curriculum.

The twelve credits of technical electives are divided into three different areas:

6 Credits Nuclear Engineering Technical Electives (NETE): Six credits of Nuclear Engineering technical electives are required. Select from NUC E 405, 406, 408, 409, 420, 446, 470, 490, or Bio E 406. NUC E 496 can be used as a General Technical Elective, GTE. NUC E 401 is for non-majors and cannot be used as an NETE.

3 Credits General Technical Elective (GTE): Three credits of general technical electives are required. General Technical Electives include: Nuclear Engineering courses which are not required, except NUC E 401; other 400-level Engineering courses; some science or math courses outside of the College of Engineering. Co-op and internship credits are accepted after completion of a combination of three Co-op rotations or internships (ENGR 195A ENGR 295A, ENGR 395A, and ENGR 495A). An E-Petition must be submitted and approved for all General Technical Electives. Before registering for a course, see your Adviser to verify acceptability.

*Student completing Basic ROTC may substitute six of these credits for 3 credits of GHA and 3 credits of General Technical Elective.

*A list of many of the courses appropriate for the GTE can be found online at <http://www.mne.psu.edu/students/undergraduate/curriculum-electives.aspx>.

Nuclear Engineering Technical Electives

NUC E 406 (ME 406): Introduction to Statistical Thermodynamics (3 cr.) Fall Semester (odd years)

Statistical description of systems composed of large numbers of particles in the context of classical and quantum mechanics; basic concepts of probability theory and thermodynamics as they relate to statistical mechanics. Prerequisites: ME 201, ME 300, ME 202 or CH E 303; MATH 230 or MATH 231.

NUC E 409 (MATSE 409): Nuclear Materials (3 cr.) Spring Semester

Nuclear reactor materials; relationship between changes in material properties and microstructural evolution of nuclear cladding and fuel under irradiation. Prerequisite: PHYS 214.

NUC E 420: Radiological Safety (3 CR.) Fall Semester

Ionizing radiation, biological effects, radiation measurement, dose computational techniques, local and federal regulations, exposure control. Prerequisites: NUC E 301 or NUC E/CHEM 406.

NUC E 428: Radioactive Waste Control (3 CR.) Spring Semester (even years)

Nature, sources and control of radioactive wastes; theory and practice of disposal processes. Prerequisites: NUC E 301 or NUC E 405.

NUC E 470: Power Plant Simulation (3 CR.) Fall Semester

Basic knowledge necessary for intelligent simulation and interpretation of simulations of transients in nuclear power plants. Prerequisite: M E 320; MATH 251; NUC E 302.

NUC E 496: Independent Studies (1-18 CR.)

Students engaged in independent study under the supervision of a NUC E faculty member may use up to 3 credits of NUC E 496 for the General Technical Elective requirement (GTE). Students cannot register for NUC E 496 without having made arrangements with a faculty member and receiving the permission of the student's Adviser. In addition to registering for NUC E 496, a Project Registration form must be submitted in 139 Reber Building. The Department requires that students have an overall GPA not less than a 3.0 to enroll in NUC E 496. NUC E 496 can be used as a General Technical Elective (GTE) but not a Nuclear Engineering Technical Elective (NETE). **REVISED 9/12/2014**

BME 406: Medical Imaging (3 CR.) Fall Semester

Physical principles and clinical applications of medical imaging methods. Prerequisite: PHYS 212.

Section 6: Special Programs in Mechanical and Nuclear Engineering

Co-op Program

The Co-op Program is a rotational work-study program where students work with a company or organization for three semesters. This program enables students to graduate with industrial experience, and as a result, graduation is usually extended to accommodate the work experience. At the end of the 4th semester of study, students can attend alternating periods of work and study for a semester at a time.

The College of Engineering Co-op office is located in 205 Hammond Building. Interested students can obtain information about the program by using the College Co-op web site: <https://www.engr.psu.edu/career/Students/coopintern.aspx>. There you will discover how to enroll in offered co-op courses for degree credit, how to apply for co-op positions, how to find an employer, and other key answers.

Guidelines

To complete the Co-op Program, students can choose to complete a rotation during the fall, spring or summer semester. Co-ops are available to students in their sophomore, junior, and senior year. Students must complete their entrance-to-major requirements prior to participating in the Co-op program.

Each student will enroll in a 1 credit co-op course of ENGR 295A, ENGR 395A, or ENGR 495A for the first, second, or third co-op rotation (NOTE: some minors accept Co-op credits toward fulfillment of the minor. In such cases, a student may wish to register for more than one credit.). By enrolling in one of these 1 credit co-op courses, students will maintain their “full time” student status at the university. This allows students to continue through the semester as if they were enrolled as a full time student. In addition to maintaining a full time student status, if a student completes all three co-op courses of ENGR 295A, ENGR 395A, and ENGR 495A, 3 credits will be counted towards the General Technical Elective requirement for both M E and NUC E degrees.

A report concerning the work experience is submitted in fulfillment of the course registration. Letter grades will be given for the Co-op report, but the Co-op course will appear as pass/fail on the student’s transcript.

Please note that all co-op reports and evaluations are submitted electronically to the Co-op Office in 205 Hammond Building. The reports are then routed to the Undergraduate Records Assistant in 139/140 Reber Building, who forwards them to your adviser for grading.

Minors (Senate Policy 59-00)

A minor consists of at least 18 credits that supplement a major. For the ME degree, required courses and technical electives can often be used to satisfy some requirements for a minor within Engineering. If carefully planned, some of these minors can be completed with only a few additional credits. See details at <http://www.engr.psu.edu/students/undergrad-prospective/majors-minors-certificates.aspx#minor> to see what required courses in the BSME or BSNE program can be used to fulfill requirements for a minor.

Minors can be obtained in the following programs in Engineering:

- [Biological Engineering](#)
- [Biomedical Engineering](#)
- [Engineering Entrepreneurship](#)
- [Engineering Leadership Development](#)
- [Engineering Mechanics](#)
- [Environmental Engineering](#)
- [Information Sciences and Technology](#)
- [Nanotechnology](#)
- [Six Sigma](#)

Minors can also be obtained in other programs in other colleges. See the online Undergraduate Degree Programs Bulletin, <http://bulletins.psu.edu/bulletins/bluebook/> in the section describing programs within colleges which gives the content, standards of admission and graduation, and other details about specific minors in specific departments.

Reserve Officer Training Corps (ROTC)

Some students choose to join one of the four ROTC programs and receive an officer commission upon graduation. As a consequence, they will take more than the number of credits required for the major. University rules allow students to substitute 6 credits of ROTC for credits in the major, provided they successfully complete the ROTC Program. In the case of Mechanical and Nuclear Engineering students, the last six ROTC credits may be substituted for three credits of GHA requirement and three credits of General Technical Elective (GTE). ROTC students are normally faced with demanding schedules if they wish to graduate in four years. Also, the addition of the ROTC courses each semester creates unique scheduling problems. These students should see their adviser as soon as possible.

Mechanical Engineering Semester Abroad Program

Have you considered making study abroad part of your mechanical engineering education? It's easier than you think! The Mechanical Engineering Semester Abroad program offers specialized experiences abroad where you can take fully transferrable mechanical engineering courses in English.

Program features:

- **Take classes in English.** Classes and tests will be conducted in English, so your learning will not be impacted by lack of fluency in a foreign language. English is also widely spoken in the many of the metropolitan areas where partner universities are located.
- **Graduate on time.** Pre-approved course plans are directly applicable and transferable to your

- Penn State requirements.
- **Take classes in your major.** You'll take mechanical engineering classes that fit into your current degree plan.
- **No additional tuition.** Even though you'll be taking courses at another university, you'll only pay tuition to Penn State. Living expenses like room and board will be comparable to what you'd spend for a semester in Happy Valley.
- **Travel scholarships are available.** Scholarships will be available to outstanding students to help offset travel costs.
- **Take advantage of special opportunities.** Some experiences offer paid internships or research opportunities, and others have committed to support your cultural travel over the course of your stay.

For information, including a listing of Mechanical Engineering Semester Abroad Partners, please visit <http://mne.psu.edu/students/undergraduate/SemesterAbroad.aspx>

For additional information, visit the University Office of Global Programs, 410 Boucke Building, 865-7681. Students considering Study Abroad should seek approval of courses from the MNE Undergraduate Office before going abroad. You can also visit at the following website: <http://www.engr.psu.edu/global/>.

Concurrent Majors (Senate Policy 60-10)

A student who receives approval from the respective colleges may gain entrance to more than one major. The student successfully completing the requirements for multiple majors shall receive a separate diploma for each major for which requirements have been completed. The final academic record will indicate the completion of the requirements for each major. Please see the following website for additional information: <https://handbook.psu.edu/content/concurrent-majors-program>.

Discussed below are several common concurrent majors. Program Requirements and Flow Charts for each of these Concurrent Majors are also included at the end of the section.

Concurrent Majors in Mechanical and Nuclear Engineering

With department permission, a student may pursue concurrent majors in both Mechanical Engineering and Nuclear Engineering. Twenty-three credits beyond the Mechanical Engineering degree requirements are needed to complete both degrees. A concurrent majors graduate receives a BS degree and diploma in both disciplines and is expected to have enhanced employment opportunities in the nuclear-power industry.

Mechanical Engineering is a controlled major that can only be entered during the Sophomore Major Selection Process. Students interested in the MNE concurrent majors must therefore, first enter ME and then add NUC E as the second major. Further information about the concurrent majors program in ME and NUC E, can be found at: <http://www.mne.psu.edu/students/undergraduate/curriculum.aspx>.

An Application for Concurrent Majors in Mechanical and Nuclear Engineering can be found at: <http://www.psu.edu/dept/oue/aappm/concurrent.pdf>

Concurrent Majors in Biomedical Engineering and Mechanical Engineering

With department permission, a student may pursue concurrent majors in both Biomedical Engineering and Mechanical Engineering. Students receiving a concurrent major in BME and ME will receive a BS degree and diploma in both disciplines and is expected to have enhanced employment opportunities in the Biomedical Engineering and Mechanical Engineering industry, where there is overlap between the two disciplines. Students interested in the BME/ME concurrent majors must first be admitted into BME, and then add ME as a second major. Prospective students are encouraged to plan their entry to Biomedical Engineering in their first year since the second-year life science courses are not part of the common engineering curriculum. Further information about the concurrent majors program in BME and ME, can be found at <http://www.mne.psu.edu/students/undergraduate/curriculum.aspx>.

An Application for Approval of Concurrent Majors in Biomedical Engineering and Mechanical Engineering can be found at: <http://www.psu.edu/dept/oue/aappm/concurrent.pdf>.

Concurrent Degrees Program in Liberal Arts and Engineering

The Concurrent Degrees Program in Liberal Arts and Engineering requires 10 semesters of study. During the first six (6) semesters 70 credits of General Education and Bachelor of Arts degree requirements are completed in addition to 30-34 credits of basic Engineering requirements. During the final 4 semesters, 12 Liberal Arts credits are completed as well as the remaining requirements for the selected College of Engineering major.

Upon completion of the program, the degree of Bachelor of Arts in General Arts and Sciences will be awarded by the College of the Liberal Arts and the Bachelor of Science by the College of Engineering. To be eligible, the student must file an application for entrance with the Assistant Dean for Student Services, College of Engineering, by the published deadline during the student's 3rd semester and with the Associate Dean for Undergraduate Studies, the College of the Liberal Arts. Consult your adviser or the Assistant Dean for Student Services (208 Hammond Building) for additional information.

Sequential Degree (Senate Policy 60-20)

A PSU student who has graduated from Mechanical or Nuclear engineering desiring a second BS degree must request enrollment. Students must complete their first BS degree before applying for a second BS degree. Due to restrictions in engineering enrollments, preference is granted to students pursuing their first engineering degree and there is a low probability of being able to pursue a second BS degree in engineering. Restrictions may apply to admission to a major that is under enrollment control. (See Policy 60-20 for more details <http://senate.psu.edu/policies-and-rules-for-undergraduate-students/60-00-completing-more-than-one-undergraduate-program/#60-20>)

Fundamentals of Engineering (FE)

Fundamentals of Engineering (FE--formerly known as EIT or Engineer-In-Training) exams are offered twice a year. The Department of MNE recommends that students wishing to take the FE exam do so after having successfully completed all junior level courses and ME 410. The FE examination is developed with problems that require a variety of approaches and methodologies including design, analysis, application and operations. Some problems require knowledge of engineering economics, covered in IE 302. This closed-book examination contains both essay and multiple-choice problems. An equation book is distributed at the exam for reference. To prepare for the exam, you can purchase a copy of the

equation book from NCEES. Several student organizations, including Tau Beta Pi, sell study manuals and the equation book. See the following websites for more information about this exam: www.ncees.org and http://www.engr.psu.edu/cde/FE_PE/fe_pe.html.

The electronic application may be accessed at <https://www.pcshq.com/>

CONCURRENT MAJOR IN MECHANICAL & NUCLEAR ENGINEERING (9 SEMESTERS)

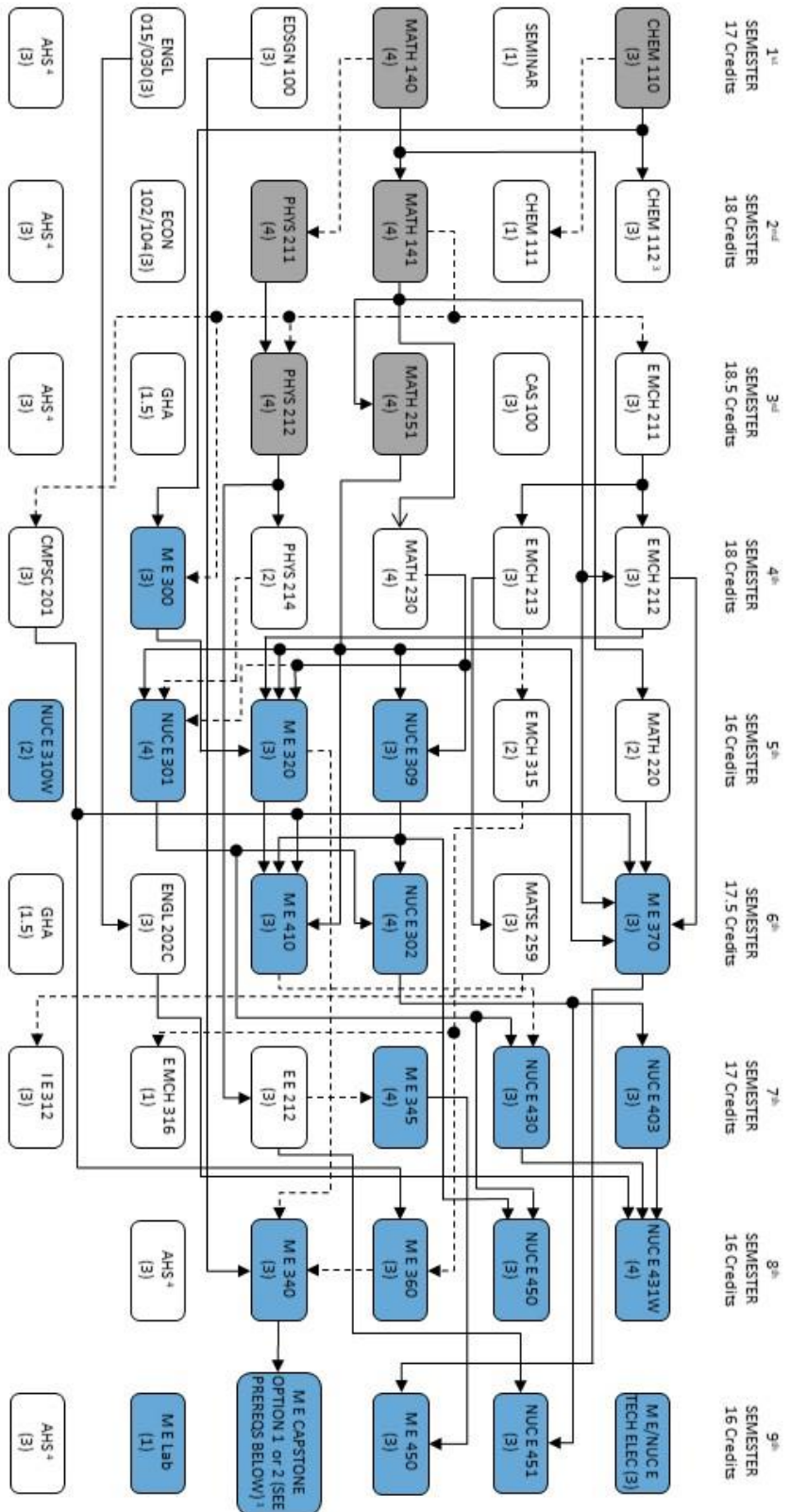
SEMESTER 1				SEMESTER 2			
Course		Credits		Course		Credits	
	FYS	First Year Seminar	1	(c)	CHEM 112	Chemical Principles II	3
(a, d)	CHEM 110	Chemical Principles	3		CHEM 11	Experimental Chemistry I	1
	ENGL 015	Rhetoric and Composition -or-	3	(m)	ECON 102	Microeconomic Analysis & Policy (GS) -or-	3
	ENGL 030	Honors Freshman Composition	3		ECON 104	Macroeconomic Analysis & Policy (GS)	3
	EDSGN 100	Introduction to Engineering Design	3	(a)	PHYS 211	Mechanics	4
(a,b,d)	MATH 140	Calculus with Analytic Geometry I -or-	4	(a,b,d)	MATH 141	Calc. with Analytic Geometry II -or-	4
	MATH 140E	Calc. with Engineering Applications I	4		MATH 141E	Calc. with Engineering Applications II	4
(m)	AHS course	(GA, GH, or GS)	3	(m)	AHS course	(GA, GH, or GS)	3
Total Semester Credits			17	Total Semester Credits			18
SEMESTER 3				SEMESTER 4			
Course		Credits		Course		Credits	
	CAS 100A/B	Effective Speech	3	(d)	E MCH 212	Dynamics	3
(d)	EMCH 211	Statics	3	(d)	E MCH 213	Strength of Materials -or-	3
	PHYS 212	Electricity and Magnetism	4		EMCH 213D	Strength of Materials with Design	3
(a,d)	MATH 251	Ordinary and Partial Differential Eq.	4	(d)	M E 300	Engineering Thermodynamics I	3
(m)	AHS course	(GA, GH, or GS)	3	(e)	MATH 230	Calculus of Several Variables	4
(k)	GHA	Health/Physical Activity	1.5		PHYS 214	Wave Motion and Quantum Physics	2
					CMPSC 201	C++ (Preferred) -or-	3
					CMPSC 200	MATLAB	3
Total Semester Credits			18.5	Total Semester Credits			18
SEMESTER 5				SEMESTER 6			
Course		Credits		Course		Credits	
	MATH 220	Matrices	2		ENGL 202C	Technical Writing	3
(d)	M E 320	Fluid Flow	3		MATSE 259	Properties and Processing of Engr. Matls.	3
(d,*)	NUC E 301	Fundamentals of Reactor Physics	4	(d,j,**)	NUC E 302	Intro. To Reactor Design	4
(d,j,*)	NUC E 309	Analytical Techniques for Nuclear Concepts	3	(d)	M E 410	Heat Transfer	3
(*)	NUC E 310W	Issues in Nuclear Engineering	2	(d,f)	M E 370	Vibration of Mechanical Systems	3
	E MCH 315	Mechanical Response of Engr. Matl.	2	(k)	GHA	Health/Physical Activity	1.5
Total Semester Credits			16	Total Semester Credits			17.5
SEMESTER 7				SEMESTER 8			
Course		Credits		Course		Credits	
(g)	EMCH 316	Exp. Determination of Mech. Response of Materials	3	(d)	M E 340	Mechanical Engr. Design Methodology	3
(d)	M E 345	Instrumentation, Measurement & Statistics	3	(d,f)	M E 360	Mechanical Design	3
(d,*)	NUC E 430	Design Principles of Reactor Systems	3	(d,**)	NUC E 450	Radiation Detection and Measurement	3
(*)	NUC E 403	Advanced Reactor Design	3	(**)	NUC E 431W	Nuclear Reactor Core Design Synthesis	4
(l)	I E 312	Product Design and Mfg. Processes	3	(m)	AHS course	(GA, GH, or GS)	3
	E E 212	Intro to Elec. Measuring Systems	3				
Total Semester Credits			17	Total Semester Credits			16
SEMESTER 9				SEMESTER 10			
Course		Credits		Course		Credits	
(h)	NUCE/ME	Technical Elective	3				
	M E 440W	Senior Capstone Project (option I) -or-	3				
	M E 441W	Senior Capstone Project (option II)	3				
(*)	NUC E 451	Experiments in Reactor Physics	3				
(d,f)	M E 450	Modeling of Dynamic Systems	3				
(g)	M E Lab		1				
(m)	AHS	(GA, GH, or GS)	3				
Total Semester Credits			16	Total Semester Credits			16

- a) Courses listed in **boldface italic type** require a C or better for entrance to major
- b) MATH 140E & 141E are only available at U. Park in the semester listed.
- c) Students may substitute BIOL 141 for CHEM 112.
- d) Courses listed in **boldface type** require a C or better for entrance to major
- e) MATH 231 and MATH 232=MATH 230; ME students who have taken MATH 231 should enroll in MATH 232 in the fall semester of Junior year. The course content is used in the Spring Junior year NUCE courses
- f) ME 360, 370, or 450 can be used as an Engineering Technical Elective (ETE), or General Technical Elective (GTE), in the NUCE degree for concurrent majors
- g) To graduate, one of the following lab courses must be taken: ME 315, 325, 355 or 375. EMCH 316 will satisfy the second lab requirement. 1 credit of ME 445 can also be used as 1 credit of a ME lab course
- h) A Mechanical Engineering Technical Elective (METE), and Nuclear Engineering Technical Elective (NETE), is any three-credit, 400-level ME or NUC E course that is not required for the major. ME/NUC E 494 or ME/NUC E 496 may not be used. Students may substitute BIOL 141 for CHEM 112.
- i) NUC ER 403, 430, or 451 can be used as an Engineering Technical Elective (ETE), in the ME degree for concurrent majors.
- j) NUCE 301, 302, or any three-credit 400-level NUCE course can be used as a General Technical Elective (GTE) in the ME audit for concurrent Majors.
- k) Six ROTC credits may be substituted for three credits of GHA plus three GTE credits upon completion of the basic ROTC Program.
- l) IE 312 cannot be taken in the same semester as NUCE 450 or 451 due to scheduling conflicts.
- m) An elective course to satisfy General Education AHS requirements: GA-General Artsm GH-Humanities, GS-Social and Behavioral Sciences, selected from the lists published in the University General Education handbook

* These Nuc E courses are **ONLY** offered in the **Fall** semester *

** These Nuc E courses are **ONLY** offered in the **Spring** semester ** 5/14/2015

CONCURRENT MAJOR IN MECHANICAL & NUCLEAR ENGINEERING (9 SEMESTERS)



1 M E CAPSTONE OPTION 1: M E 440 (3 credits) – Prerequisites: M E 340 Concurrent: IE 312, ENGL 202C
 2 M E CAPSTONE OPTION 2: M E 441 (3 credits) – Prerequisites: M E 340, M E 410 Concurrent: ENGL 202C
 3 BIOL 141 may be substituted for CHEM 112
 4 US Cultures and IL Cultures requirements are satisfied in conjunction with AHS courses
 * Only one M E CAPSTONE OPTION is required for completion of the M E degree.
 • All courses in BLUE are used to calculate their in-major GPA.

—————> = Prerequisite
 - - - - -> = Prerequisite or Concurrent

9/26/2017

Concurrent Majors in Biomedical (BME) and Mechanical Engineering (M E)

Only for students admitted first to BME with the Biomechanics Option

9 Semesters: Total Credits = 148

PROGRAM REQUIREMENTS											
First Semester			CR	Second Semester			CR				
(a,b,d)	[MATH 140	Calculus with Analytic Geometry I -or-	4	(a,b,d)	[MATH 141	Calculus with Analytic Geometry II - or-	4		
		MATH 140E	Calculus with Engineering Applications I				MATH 141E	Calculus with Engineering Applications II			
(a,d)		CHEM 110	Chemical Principles I	3	(a,d)		PHYS 211	General Physics: Mechanics	4		
		CHEM 111	Experimental Chemistry I	1			CHEM 112	Chemical Principles II	3		
		EDSGN 100	Introduction to Engineering Design	3			CHEM 113	Experimental Chemistry III	1		
		ENGL 015	Rhetoric and Composition - or -	3	(d)		BIOL 141	Physiology (or BIOL 240W)	3		
		ENGL 030	Honors Freshman Composition		(d)		BIOL 142	Physiology Lab (240W has a lab)	1		
		FYS	First Year Seminar	1			GHA	Health & Physical Activity	1.5		
		ECON 102	Microeconomic Analysis and Policy (GS), - or-	3							
		ECON 104	Macroeconomic Analysis and Policy (GS),								
				Total	18					Total	17.5
Third Semester			CR	Fourth Semester			CR				
(a, d)		MATH 251	Ordinary and Partial Differential Equations	4	(e)	MATH 230	Calculus and Vector Analysis	4			
(c, d)		E MCH 210	Statics and Strength of Materials	5		MATH 220	Matrices	2			
		CMPSOC 200	Programming for Engineers with MATLAB	3	(d)	E MCH 212	Dynamics	3			
(a,d)		PHYS 212	General Physics: Electricity and Magnetism	4	(d,*)	BME 201	Fundamentals of Cells and Molecules	3			
				Total	16	E MCH 315	Mechanical Response of Engineering Materials	2			
						E MCH 316	Experimental Determination of Mechanical Response of Materials	1			
				Total	16					Total	15
Fifth Semester			CR	Sixth Semester			CR				
(d)		M E 300	Engineering Thermodynamics I	3	(d,*)	MATSE 259	Properties and Processing of Eng. Materials	3			
		PHYS 214	Wave Motion and Quantum Physics	2	(d,*)	BME 409	Biofluid Mechanics	3			
(d)		M E 360	Mechanical Design	3	(d,*)	BME 401	Numerical Simulations in BME	3			
(d,*)		BME 303	Bio-Continuum Mechanics	3	(d,*)	BME 402	Biomedical Instrumentation and Measurements	3			
(d,*)		BME 301	Analysis of Physiological Systems	4	(d,*)	BME 403	Biomedical Instrumentation Laboratory	1			
		GHA	Health & Physical Activity	1.5	(i)	GA, GH, or GS Course		3			
				Total	16.5					Total	16
Seventh Semester			CR	Eighth Semester			CR				
		IE 312	Product Design and Manufacturing Processes	3		BME Related & ME ET Elective (Must complete BME&ME req)		3			
(d)		M E 370	Vibration of Mechanical Systems	3	(*)	BME 450W	Senior Design (CAPSTONE)	3			
(*)		BME 440	BME Professional Seminar	1	(d)	M E 410	Heat Transfer	3			
(d)		M E 340	Mechanical Engineering Design Methodology	3	(f)	M E Lab		1			
		ENGL 202C	Technical Writing	3	(i)	GA, GH, or GS Course		3			
(*)		BME 429	Biomechanics and Techniques Lab	2	(i)	GA, GH, or GS Course		3			
				Total	15					Total	16
Ninth Semester			CR								
(h)		Related Elective (See BME guidelines)		3							
(d)		M E 450	Modeling of Dynamic Systems	3							
(g)		METE	M E Technical Elective	3							
		CAS 100A/B	Effective Speech	3							
(i)		GA, GH, or GS Course		3							
(i)		GA, GH, or GS Course		3							
				Total	18						

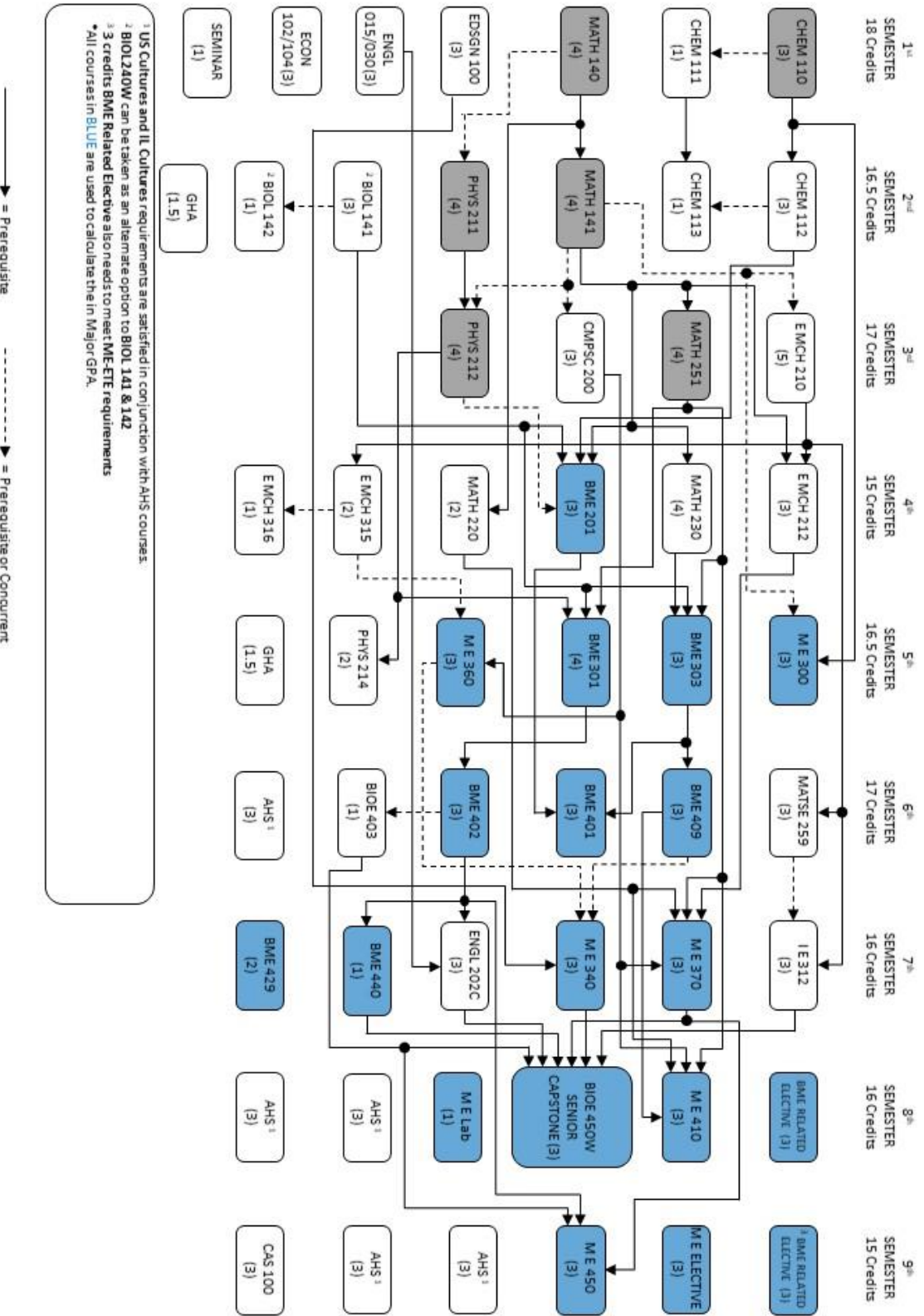
[Choose one from the courses enclosed within the brackets.

(*) BME courses are offered only in the semester shown: Fall = odd-numbered semesters, Spring = even-numbered semesters.

- (a) Courses listed in **boldface italic type** require a grade of C or better for entrance to this major.
- (b) MATH 140E and MATH 141E are only available at University Park in the semester shown.
- (c) E MCH 211 and E MCH 213 = E MCH 210
- (d) Courses listed in **bold face type** require a grade of C or better for graduation in this concurrent majors program.
- (e) MATH 231 and MATH 232 = MATH 230
- (f) To graduate, a student must take at least one of the following M E lab courses: M E 315, M E 325, M E 355, or M E 375. E MCH 316 is a required course and will satisfy the second M E Lab requirement. Note: If M E 445 is taken as a technical elective, one credit can be used as an M E Lab Course.

- (g) A Mechanical Engineering Technical Elective (METE) is any three-credit, 400-level mechanical engineering course, not required for the major. M E 494 or M E 496 may not be used.
- (h) A BME Related Elective is any Option (Biochemical, Device and Imaging, Biomechanical, Biomaterial) Elective, any BME 400 level or BIOE 500 level course not otherwise required (may not double count), CHEM 210, CHEM 212, ENGR 295, ENGR 395, ENGR 495 (3 credits max for ENGR x95), and courses for an approved minor (E L D, ESHIP, ENTI, NANO)
- (i) An elective course to satisfy General Education AHS requirements: GA - General Arts, GH - Humanities, GS - Social & Behavioral Sciences, selected from the lists published in the University General Education Handbook.

CONCURRENT MAJOR IN BIOMEDICAL ENGINEERING & MECHANICAL ENGINEERING (9 SEMESTERS)



¹ US Cultures and IL Cultures requirements are satisfied in conjunction with AHS courses.

² BIOL 240W can be taken as an alternate option to BIOL 141 & 142

³ 3 credits BME Related Elective also needs to meet M.E.TE requirements

* All courses in BLUE are used to calculate the Major GPA.

Section 7:

University Requirements

Arts/Humanities/Social Sciences (AHS) Electives

For those institutions preparing baccalaureate graduates for entry into the engineering profession at the basic level, the Accreditation Board for Engineering and Technology (ABET) requires the curricula to include courses in mathematics, science, communication skills, humanities, social sciences, analysis, and design. ABET's criteria is intended to broaden the student's liberal education through the development of understanding in depth. It cannot be overemphasized that an integral part of the engineering educational program is intended to make engineers fully aware of their social responsibilities and better able to consider related factors in the decision-making process.

Studies in the Arts (courses denoted by "GA") are expected to help students understand and appreciate some of the more important creative works, traditions, literature, and history of the arts and architecture. General Education Arts courses aim to teach students to recognize the comprehensive role of arts and architecture as an expression of the cultural values of a society and the need to preserve these expressions for the benefit of future generations.

Studies in the Humanities (courses denoted by "GH") are characterized by their relationship to the common experience of human beings, and should, therefore, develop competency and skill in interpretive understanding of the human condition and of the values inherent in it. Humanistic studies are divided into the following: (1) literature, (2) history and culture, (3) language, and (4) philosophy.

Studies in the Social and Behavioral Sciences (courses denoted by "GS") in General Education are designed to help students understand the diverse personal, interpersonal, and social forces which shape people's lives; and to approach these subjects through the concepts, principles and methods of inquiry.

The Arts/Humanities/Social Science requirements for students in the College of Engineering are identical to those for the rest of the university except that all Engineering students must take ECON 102 or 104 as one of the GS courses. Mechanical and Nuclear Engineering also allows students to take ENNEC 100 to satisfy this requirement. The following website has a succinct summary of these requirements: <http://bulletins.psu.edu/undergrad/generaleducation/generalEd1>

Students may select courses from a broad list to fulfill these requirements. To see a complete listing of all General Education courses, refer to the following website: http://bulletins.psu.edu/bulletins/bluebook/general_education.cfm.

Certain high school advance placement courses (see CLEP, University Bulletin) may be used to satisfy AHS requirements. The student's own judgment, interest, and curiosity will determine the courses to select.

Students need to take 3 credits of US (US Cultures) and 3 credits of IL (International Cultures). Students in the Education Abroad Program satisfy the IL requirement and do not need to take an IL course.

Note: Three credits of a language taken at the 12th credit level (level III at Penn State), or higher, may be used as a course in the Arts, Humanities, or Social Science category, but cannot be the only course in that category. The student must submit a petition and indicate the category in which the language is to be used.

Following are the two methods students can utilize to fulfill the 18-credit requirement for AHS courses. You may choose 1 of the following 2 plans:

Plan I (6-6-6)

Two courses in the **Arts category**,
Two courses in the **Humanities category**,
Two courses in the **Social and Behavioral Sciences category**

Note: At least one of the courses above must fulfill the Intercultural and International Competence **(GI)** requirement.

Plan II (9-6-3)

Three courses in one category,
Two courses in the second category,
One course in the third category

Note: At least one of the courses above must fulfill the Intercultural and International Competence **(GI)** requirement.

Students wishing to pursue a 9-6-3 sequence **must submit a Degree Audit Reconciliation Form**. This form does not require an adviser's signature and, when completed, will be kept in your student file.

Note: A 3-credit economics course is required for the engineering majors. ME will accept ECON 102, 104, or ENNEC 100. The economics course is a GS course for the AHS requirement.

First-Year Seminars

Incoming students are required to take a first-year seminar sometime during their first 3 semesters at Penn State. Offerings will vary from year-to-year. Information about FYS can be found at: <http://www.engr.psu.edu/fys/>.

Other General Education Courses

Health & Physical Activity (3 credits) – All Penn State students are required to take three credits of Health and Physical Activity. (GHA)

Minimum Grade Point Average (GPA)

To graduate (see Senate Policy 82-40, 82-44) students must:

- a) Pass all courses required in the major.
- b) Earn at least a cumulative GPA of 2.00 in all the courses taken at Penn State; and
- c) Earn at least a grade of "C" in courses designated "C-Required for the Major" in the University Bulletin. GPA in the major is computed from all courses required for the major.

Degree Audit Report

You can obtain a current copy of your Degree Audit Report directly from the Internet. To do so, visit the following website: <http://launch.lionpath.psu.edu/> and follow the directions to your audit. The audit is prepared by the Registrar and lists the courses you have completed, the grades you have received, your overall (cumulative) GPA, your GPA in the requirements for the major, and the courses remaining to be taken. **Please see the important information regarding your Degree Audit Report on page 7.4.**

Academic Progress

The University policy (54-00) defines the conditions under which automatic actions are taken if a student fails to achieve satisfactory academic progress. The department does not wish our students to risk these actions being taken and takes steps to advise students before these actions take effect. Each semester, the Department reviews the grades and GPA's of all our students and informs them of consequences that may occur if they do not take corrective action. Corrective actions by the student may require changing study habits, or reducing the number of enrolled credits. If the student's performance does not improve, the student may be dis-enrolled from the Department until the overall GPA is improved.

As a general rule, students are advised to repeat any course listed as a requirement for the major for which they receive a grade of D. See page 2.4 in this curriculum manual for the list of "C-required" courses in Mechanical Engineering and page 4.3 for the list of "C-required" courses in Nuclear Engineering; students must repeat the course if they receive a D. Courses for which they receive a grade of F must be repeated. Students are asked to meet with their academic adviser each semester to discuss courses to be taken in the following semester.

How to Read the DEGREE AUDIT

The general purpose of the Degree Audit Report is to list all required classes for an ME or NUC E degree. This enables the student and his/her adviser to assess the student's academic progress and makes note of all unfulfilled requirements. Completed requirements show a green arrow to the right and the section is closed, as seen in the image below. Notice that the Writing Across the Curriculum Requirement is fulfilled. Degree requirements that are unfulfilled will show a green arrow pointed downwards and the section will remain open, as seen below. Notice that ENG 202c is a degree requirement and according to the degree audit, the requirement is unfulfilled.

▶ World Language Admission Requirement

▶ Writing Across the Curriculum

▶ United States and International Cultures (US/IL)

▶ Minimum 2.00 Cumulative Grade Point Average Required for Graduation

▶ Residency Requirements

▼ General Education- Mechanical Engineering Major (ME_BS)

45 units required

Writing/Speaking (GWS)

Complete 9 units with 3 units in each area: Composition, Speech and Effective Writing.
 Units also apply to major requirements.

▶ ENGL 15 (or equivalent)

▶ CAS 100A or CAS 100B

▼ ENGL 202C

Not Satisfied: Complete 3 units

- Units: 3.00 required, 0.00 taken, 3.00 needed

The following courses may be used to satisfy this requirement:

Course	Description	Units	When	Grade	Notes	Status	Course Type
ENGL 202C	Technical Writing *** view multiple offerings	3.00					

View All | First 1 of 1 Last

Please note that the Degree Audit is a tool to aid you in your progress toward a degree; therefore, it is your responsibility to ensure that you have met all the requirements for your degree. Information about degree requirements may be found in this manual, and you can access a current copy of your Degree Audit Report directly from the Internet by visiting the following website: <http://launch.lionpath.psu.edu/>.

Understanding a degree audit is important because departments use the major degree audit to ensure graduating seniors have met all degree requirements. The degree audit contains crucial information such as:

- the student's current schedule and semester standing;
- a list of all courses the student has previously taken and grades for those courses;
- the student's cumulative GPA and the GPA of the most recently completed semester;
- any transfer credits (through AP or courses taken at other colleges) that Penn State has counted;
- the student's total credits and an indication of the first day on which the student can register by phone for the next semester (Fall or Spring).

At the very bottom of the audit there is a section ("Other Courses") which lists all of the classes on your transcript that do not apply toward graduation. This section may include transfer credits, band credits, ROTC credits, etc. **If you feel one of the classes listed in this section should count for a required class, you can stop in 139/140 Reber, or call 863-1503 to find out whether a petition will be required.**

A degree audit always follows this sequence:

- A box listing the courses from the most recently-completed semester, along with other general information such as GPA, semester standing (classification), date of first registration, late drop credits remaining, etc.;
- A listing of all courses required in the major which the student has taken, transferred, or is currently taking. Each course has next to it either a letter grade, or one of the following:
 - “WP” – late dropped the course while passing;
 - “WN” – late dropped the course with no grade;
 - “WF” – late dropped the course while failing;
 - “W” – withdrew from the semester; or
 - “RG” – currently registered for the class;
 - “SH” – scheduled but have an issue with Registrar.
- A listing of all General Education categories a student needs to fulfill.
- A listing of how the student's past or current courses fulfill these requirements (see Other Courses).

Penn State University's Policies & Rules

A good source of information for General University Policies & Rules; Academic Policies, Rules & Procedures for Students; and the Discipline System for All Students is available in the "Student Guide to General University Policies And Rules" at <http://studentaffairs.psu.edu/conduct/>. Another reference for students is the University Faculty Senate Policies for Students at <http://senate.psu.edu/policies-and-rules-for-undergraduate-students/>. Information regarding academic regulations is available in the University Undergraduate Advising Handbook at <http://handbook.psu.edu> provides much information for students.

Attendance (Senate Policy 42-27)

Class attendance is required in Mechanical and Nuclear Engineering courses. Instructors may include class attendance in calculating final grades.

Professionalism & Academic Integrity (Senate Policy 49-20)

The College of Engineering considers academic dishonesty, including cheating and plagiarism, to be a serious offense. If you are unsure what conditions constitute dishonesty, (i.e., if you can collaborate with other students on homework, etc.), ask your instructor. Dishonest incidents should be reported to the course instructor, the Professor-In-Charge of the Mechanical and Nuclear Engineering Programs, or to the Department Head who, in turn, will refer it to the College Committee on Academic Integrity. The committee consists of faculty, students, and academic administrators with faculty being the majority from the department. The College of Engineering Academic Integrity Policy and Procedures can be found at <http://handbook.psu.edu/content/academic-integrity>.

Tolerance (Diversity Support) & Sexual Harassment


The Pennsylvania State University is committed to the policy that all persons shall have equal access to programs, facilities, admission and employment without regard to personal characteristics not related to ability, performance, or qualifications as determined by University policy or by state or federal authorities. The Pennsylvania State University does not discriminate against any person because of age, ancestry, color, disability or handicap, national origin, race, religious creed, sex, sexual orientation, or veteran status. Please see the following website for more information on tolerance and sexual harassment:

<http://www.engr.psu.edu/AboutCOE/Climate/>

Penn State University's Computer Usage Procedures

Penn State has a detailed and well-publicized policy regarding appropriate use of computers and network services by students. Students are referred to the Center for Academic Computing Web site <http://www.ecs.psu.edu/computersupport/policy.html> to review these regulations. Students found in violation of this policy will be prosecuted through academic judicial channels.

Section 8: Procedures

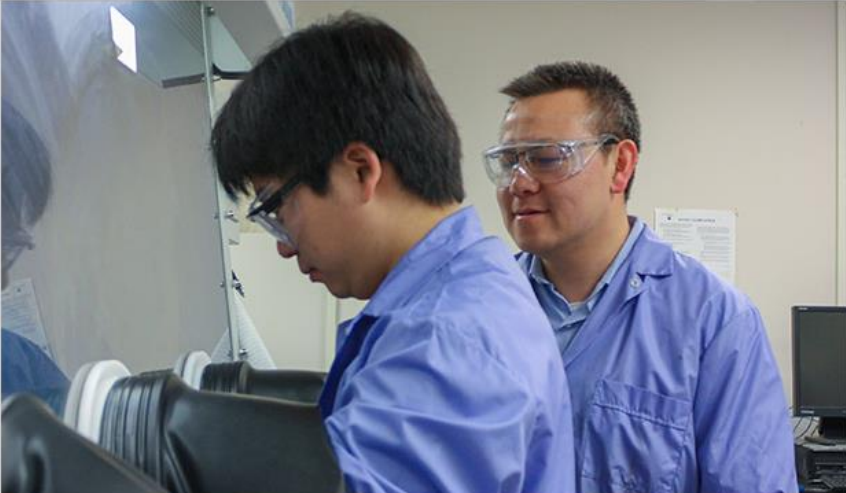
PENNSYLVANIA STATE UNIVERSITY
 Department of Mechanical and Nuclear Engineering

College of Engineering This Site

[Home](#) [About Us](#) [News & Events](#) [Directory](#) [Undergraduate](#) [Graduate](#) [Research](#) [Alumni](#) [Corporate Relations](#)

Wang Promoted to Associate Professor

Congratulations to Dr. Donghai Wang, who was just promoted to Associate Professor with tenure in mechanical engineering. Dr. Wang is the director of the Energy Nanostructure Laboratory, which focuses on nanomaterial development for clean energy technologies.



FEATURE STORY



MSME Degree Now Offered Online

Same MS degree, now available online

July 10, 2013

As the U.S. economy continues to improve, demand for mechanical engineers is up 9 percent, according to the U.S. Bureau of Labor Statistics. Advancing in this career, which involves designing, developing, building and testing mechanical devices, will be more convenient with Penn State's master of science in mechanical engineering (MSME), which will be delivered online starting this fall.

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2014 THON Executive Director Gets National Recognition

June 30, 2014

**Mechanical & Nuclear Engineering
Undergraduate Programs Office
139/140 Reber Building, University Park, PA 16802-1412
Phone: 814/863-1503**

Undergraduate Programs Assistance Contact Information:

For curricula and professional advising, you should meet with your assigned academic adviser.

You can find your adviser's name by signing in to LionPATH at:

<http://launch.lionpath.psu.edu/> – Your adviser is listed on your degree audit.

If you need additional help after meeting with your adviser, you can visit the MNE Undergraduate Programs Office in 139/140 Reber Building.

Dr. Eric Marsh – Associate Head of Undergraduate Programs in Mechanical and Nuclear Engineering and Professor of Mechanical Engineering

Dr. Arthur Motta - Program Chair of Nuclear Engineering and Professor of Nuclear and Mechanical Engineering

138A Reber Building (814) 863-6383

advising@mne.psu.edu

Please contact for the following:

- Career advisement in the nuclear engineering profession

Undergraduate Programs Assistant

139 Reber Building (814) 863-5628

undergrad@mne.psu.edu

Please contact for the following:

- Scheduling classrooms for departmental student organizations
- Monitor student eligibility of scholarship and post awards to student's account
- Assistance with problematic advising and curricular matters

Lori Yarger - Undergraduate Records Assistant

139 Reber Building (814) 863-1503

lyarger@engr.psu.edu

Please contact for the following:

- Processing of petitions for degree audit exceptions, registration transactions (drop/add, etc.)
- Coordinates submission of Co-Op program reports
- Coordinating High School visits
- Assigns advisors, provides access to and maintains the undergraduate files
- Certifies degree candidates for graduation by ensuring they have fulfilled all requirements

Corey Breznak and Katie Kirsch - Curriculum Adviser

140 Reber Building (814) 863-1993

advising@mne.psu.edu

Please contact for the following:

- Academic advising issues
- Processing registration transactions (drop/add, etc.).
- Coordinating the MNE Envoys

(Available on a drop-in basis throughout the semester and keeps about 20 office hours/week.)

Petitions and Course Substitutions

The standard curriculum for each major is given in the online Baccalaureate Degree Programs Bulletin. Substitutions for the required courses may be permitted when the subject matter is equivalent in content, level, and credits. The evaluation of work done at other institutions or in other programs is made by the Department when the student enters Mechanical Engineering or Nuclear Engineering and substitutions are evaluated at that time. Students enrolled in the program must request substitutions on a standard petition form BEFORE the substitute courses are taken. The petition must be approved by the Adviser, the Professor-In-Charge of Undergraduate Programs, and the Associate Dean. Petitions from students wishing to graduate must be submitted prior to their graduating semester. College petitions will not be considered from students wishing to graduate, once their graduating semester begins. Petition forms can be obtained in 139/140 Reber or from the MNE undergraduate website.

<http://www.engr.psu.edu/e-petition/>

If students wish to take courses at another university (for example, during the summer) as substitutes for required Penn State courses, they must receive approval from Penn State Admissions and possibly the Professor-In-Charge of Undergraduate Programs before the course is taken. Students can access the Admissions web site <http://admissions.psu.edu/academics/credit/transfer/>, choose "transfer credits tool". If the course in question appears here, it may transfer with a PSU course number or may transfer as general credits. If the course transfers as general credits, an online e-petition can be filed through the college of engineering. This petition will request to use general credits towards degree requirements. If the course does not appear in the transfer course list, the student must print a "Transfer Course Evaluation Form" and submit it along with the course description to the University Admissions Office, 201 Shields. Admissions will evaluate the course, returning the evaluation to the student, who in turn should take a copy to the department undergraduate programs office. If the course in question is to fulfill a major requirement it will also need to be approved by the Professor-in-Charge of MNE Undergraduate Programs. Do not assume that any course will be accepted until these forms have been completed and approved.

There are two types of petitions students may wish to use:

- **Department Petitions:** If a student seeks permission to waive any Department or College requirement described in this manual, i.e.,
 - a) substitution of required courses with other courses or transfer courses; or
 - b) use a course for AHS or US/IL requirement; or
 - c) use of Technical Electives other than any 400-level engineering course; they must apply formally on a petition application that can be obtained in Room 139/140 Reber Bldg. The purpose of the petition is to document the issue for the student's records:

- **Senate Petitions:** Requests to waive any of the University procedures described in the "Policies and Rules for Students" require students to petition the University Senate for approval. The most common circumstances are:
 - a) dropping or adding a course retroactively;
 - b) withdrawing from the University retroactively;
 - c) late registration

The Senate petition requires the student to submit a petition in the form of a personal letter and supporting documents addressed to the Senate Committee on Undergraduate Education. For specific

information on submitting this type of petition, a student should see directions on the web at: <http://www.engr.psu.edu/forms/SenatePetitionsInstructions.pdf>.

NOTE REGARDING THE SUBMISSION OF SENATE PETITIONS: Students submitting petitions for late drops/late adds will not be required to pay the \$6.00 charge before their petition is reviewed. The \$6.00 fee will be charged to their Penn State account if the petition is granted. Thus, the fee receipt will not be part of the petition.

Use of Mechanical & Nuclear Computer Labs

Individuals are expected to exercise responsible, ethical behavior when using the Universities computers, information, networks, and other resources. Upon admission to the University, all students are notified of the University's policies, including those related to computer usage (AD20 & AD23 and ADG01 & ADG02). The Mechanical & Nuclear Engineering Department rigorously enforces these policies.

Students accepted to the Mechanical or Nuclear Engineering major or students taking MNE courses are granted access to the MNE Computer labs. These labs contain "general use" Windows machines in room 119 & 120 Reber and "general use" Linux machines in room 317 Reber. Additionally the Department maintains "course specific" computers in several other rooms. Access to these computers is contingent on specific course enrollment.

For more information including installed software, printing & storage policies, and instructions for obtaining an account, please visit <http://www.mne.psu.edu/mnelabs/> or contact our Computer Administrators, Matthew at MLindenberg@psu.edu or Chris at cdh5049@psu.edu.

Schedule Change – Drop or Add a Course (Rules 34-87; 34-89)

Regular Add/Drop Deadline:

Students can add or drop courses either: 1) during the first ten calendar days of the semester using LionPATH or 2) an equal percentage of time for courses offered on a different timetable (see LionPATH link named "Course Drop Dates"). Adding and dropping is free for the first ten calendar days of the Fall and Spring semesters.

Late Add:

Students wishing to late add courses must contact the department whom offers the course. There is no guarantee that the department will add students after the regular add deadline.

Late Drop:

Courses dropped after the regular Add/Drop deadline are considered to be late-drops. **There is no restriction on the number of credits you can drop during your Penn State baccalaureate career. However, you may only schedule a course three times. After this approval from the Assistant Dean will be required.** No courses may be dropped after the twelfth week of classes for a regular semester. See the Registrar's Calendar for exact late-drop deadline. Students are billed \$6.00 by the Bursar's Office for late dropping a course.

All late drop requests should be made in consultation with your academic adviser. There are consequences involved when a course is dropped, consequences which may adversely affect financial aid, health insurance, meeting course prerequisites, eligibility for a major, and more! Your academic adviser can make you aware of these consequences and minimize the chance for any problems arising later. (Although the late drop action can be completed by the student using LionPATH, consultation with your academic adviser is highly encouraged.) Please note: Students who drop courses and carry less than 12 credits are defined as "part-time" and may jeopardize their eligibility for loans, or scholarships. Late dropping a course because of academic difficulties is a prerogative available to Penn State students. However, "copping-out when the going gets rough" is a practice not tolerated by U.S. industry, nor condoned by the MNE faculty. Students wishing to late-drop a course should discuss the matter with the course instructor before taking action. If you wish to drop a course after the Late-Drop deadline you **MUST** petition the Faculty Senate.

If a student is taking a course concurrently with a prerequisite or concurrent course, the prerequisite or concurrent course may not be dropped without also dropping the course for which it is a prerequisite.

Schedules: Maximum/Minimum Credit Load

Students enrolled in the College of Engineering are expected to take the prescribed courses in the major. The student's adviser may recommend irregular schedules which are necessary due to a student's transfer from another institution with advanced standing, change of major, failure in one or more courses, or extenuating circumstances beyond the student's control.

Standard Schedule

Students enrolled in Mechanical and Nuclear Engineering are expected to follow the assigned course plan. This plan requires students to take between 16-18 credits per semester to progress satisfactorily. This is considered a standard schedule. With respect to summer session, in general, one credit per week of instruction is considered to be a reasonable load (6 or 7 credits in the six-week session).

World Campus

Students often satisfy degree requirements by taking World Campus courses. Students may take World Campus courses in any semester in which they are registered. To begin the process, the student should visit the World Campus website at http://www.worldcampus.psu.edu/StudentServices_Forms.shtml. A World Campus registration form is required for all Penn State students wishing to register for World Campus courses. Undergraduate degree, non-degree conditional and provisional students do not need permission to enroll into one World Campus course. Students at other campus locations need permission from their college to enroll into two or more World Campus courses. This permission may be e-mailed to psuwd@psu.edu by the appropriate college official. World Campus offers two types of courses, Continuous Enrollment and Cohort based. Continuous Enrollment courses have no specific beginning or ending date; students have 8 months to complete these courses. Cohort based courses have specific beginning and ending dates. Students may never register for more than one Continuous Enrollment course at a time, but may register for one Continuous Enrollment and one Cohort based course at the same time. World Campus course credits count toward the maximum credit load for the semester. Registration materials are available through the World Campus Office, located in room 128 Outreach Building, 865-5403 or refer to website: <http://www.outreach.psu.edu/de>.

Change of Major

TO ANOTHER COLLEGE OR TO THE DIVISION OF UNDERGRADUATE STUDIES: Students will be permitted to change from a major in the College of Engineering to one in another college only with the approval of the Dean of the new college. If students do not meet the transfer requirements of the new college, the Dean of Engineering may require them to transfer to the Division of Undergraduate Studies until they meet these transfer requirements. A student desiring to change majors may obtain a Change of Major form and necessary assistance at the Office of the Assistant Dean for Academic Support and Global Programs (208 Hammond Building).

FROM ONE MAJOR TO ANOTHER WITHIN ENGINEERING: Transfers between majors will be permitted when space is available provided the student is accepted to the major. To change from one major to another within the College, the student should go to the Office of the Assistant Dean for Academic Support and Global Programs (208 Hammond Building) for assistance.

FROM BACCALAUREATE DEGREE TO ASSOCIATE DEGREE: Students are permitted to change from the baccalaureate degree program to the associate degree program. For assistance, students should go to the Office of the Assistant Dean for Academic Support and Global Programs (208 Hammond Building).

Final Exams (Rule 44-20) and Conflict Exams (Senate Policy 44-25)

All courses conclude with a final exam or an alternative end-of-semester evaluation method. Students scheduled for two finals at the same time must file for a conflict examination with the University Registrar. Students with an overload conflict of three or more final examinations scheduled on any one calendar day or in three consecutive examination periods may file for a conflict examination.

Withdrawal from the University and Leave of Absence (Senate Policy 56-00)

A student may withdraw from the University any time up to and including the last day of classes before the final exam period begins. Such a withdrawal applies to all courses being taken. If the student wishes to enroll in classes at a later time, an application for re-enrollment as a degree candidate must be made (see Rule 58-00) and must satisfy the degree requirements that exist at the time of re-enrollment even if these requirements are different from those in effect when the student was admitted to the University. **WE STRONGLY RECOMMEND THAT A STUDENT MEET WITH THEIR ACADEMIC ADVISER, THE MNE PROFESSOR-IN-CHARGE, OR THE ASSISTANT DEAN OF ADVISING BEFORE TAKING THIS ACTION.**

Unsatisfactory Scholarship

UNIVERSITY ACTIONS

- a) At the end of each semester, a student's academic record is reviewed for a grade point deficiency. A grade point deficiency exists whenever the total grade-points are less than the total accumulated credits multiplied by two (2).
- b) A student with any grade-point deficiency shall receive an academic warning unless drop action is taken under other rules. Academic warning is an official notification to students that they are currently failing to meet the minimum grade point requirements toward graduation.
- c) A student shall be dropped from the University for unsatisfactory scholarship at the end of the indicated semester in accordance with the following grade-point deficiencies.

<u>Total Credits Scheduled (cum. cr.)</u>	<u>Grade Point Deficiency</u>
24 to 39	21 or more
40 to 69	18 or more
70 to 99	15 or more
100 or more	12 or more

These actions shall not apply to:

- i. Students transferring from another institution at the end of their first semester of enrollment.
 - ii. Students who have earned a 2.00 average or better in their most recent semester.
- d) The actions listed above are taken automatically by the Office of the Director of Academic Services in cases of unsatisfactory scholarship and that Office will notify students and their parents or guardian of such action.
 - e) The Dean of the College, subject to the review of the faculty of the College, may at any time, recommend to the President that a candidate enrolled in that College be dropped as a degree candidate at the University if the candidate is, in the opinion of the faculty, not adaptive to the work of the college.

Satisfactory/Unsatisfactory Grading System (Senate Policy 49-60)

Students may not use the Satisfactory/Unsatisfactory grading system to fulfill the degree requirements in Mechanical and Nuclear Engineering.

Financial Aid & Scholarships/Resumes/Employment Opportunities/Career Services:

There are numerous sources of financial aid available to undergraduate degree candidates of the University. A booklet describing these sources, and outlining the procedures to follow in applying for aid can be obtained from the Office of Student Aid: <http://www.psu.edu/studentaid/>, 314 Shields Building at University Park. Students should complete the "Free Application for Federal Student Aid" (FAFSA) as soon after January 1st as possible for maximum consideration of available student aid programs. <http://www.fafsa.ed.gov/> **First-Year Undergraduate Student Awarding** typically begins the first week of March and continues throughout the year. **Upper-class Awarding** occurs in June and continues throughout the year. Or, you can apply on-line at <http://studentaid.psu.edu/apply>.

In addition, the College of Engineering and the Mechanical and Nuclear Engineering Program administer several endowed scholarships and awards. You can visit the Mechanical and Nuclear Engineering scholarship website at <http://mne.psu.edu/students/undergraduate/Awards.aspx>. The MNE Scholarship website lists a variety of private organizations and Penn State units that fund scholarships for students whom excel in their studies. You can search their eligibility requirements and process to apply. Students are usually chosen based on their academic record, and/or financial need, although other factors, such as extracurricular activities, leadership potential, and chosen interest can have a role in the selection for some scholarships. Individuals who would like to be considered for these awards (usually only awarded to those students with a 3.5 GPA or better) should complete a financial need form.

Employment

<https://psu.jobs/>

Career Services

The Career Services Department offers a multitude of options to assist students with their plans for the future. <http://studentaffairs.psu.edu/career/>

Section 9: Frequently-Asked Questions

Who's in charge here?

Dr. Karen Thole, the Department Head, is the person ultimately responsible for all activities within the Department of Mechanical and Nuclear Engineering. Assisting Dr. Thole are three "Professors-in-Charge" who have administrative responsibilities in specific areas:

Dr. Eric Marsh is the Associate Head of Undergraduate Programs for Mechanical and Nuclear Engineering. He is responsible for all activities in the Undergraduate Programs Office.

Dr. Mary Frecker is the Associate Head of Graduate Programs for Mechanical and Nuclear Engineering.

Dr. Arthur Motta is the Chairman of the Nuclear Engineering Program and the Professor-in-Charge of Administration and Planning.

In general, complaints and comments about activities in the department should be addressed to the appropriate "Professor-in-Charge". If you feel you have not received an adequate hearing, you can schedule an appointment to see Dr. Thole directly.

Where do I go to get advice?

The first place you should seek advice would be from your adviser, who is listed on your degree audit through LionPATH. In the event your adviser is unreachable or cannot answer your questions, you should contact the undergraduate Programs Office, Room 139/140 Reber Building.

Phone: 814-863-1503.

Who is my advisor?

An adviser is assigned to you when you enter the Mechanical and Nuclear Engineering Department. Your adviser's name appears near the top of your degree audit, available on LionPATH.

How do I add or drop a class?

After registering, a student may add and/or drop courses through the tenth calendar day of the semester (the drop/add period) using LionPATH. After this point in the semester, a student can only add a course with permission from the instructor by submitting a drop/add form (available from 139/140 Reber Building or on-line) signed by the instructor, submitted to 139/140 Reber Building. Students can late-drop a course using LionPATH anytime up to the late drop deadline for any particular semester. A \$6.00 fee is charged for each late add and/or late drop after the tenth day of the semester.

Can I change sections in a class?

Yes, as long as there is enough room in the class you want to get into. If there is room in the class, a section switch can be easily performed in 139/140 Reber Building. Enrollment into a full technical elective course will only be allowed with permission from the instructor. Enrollment into a full MNE required lecture course will only be allowed with permission from the Professor-In-Charge of MNE Undergraduate Programs. No students will be added to a laboratory course that is full. For courses in other departments, you should contact their undergraduate programs office.

Is there a way to find out when seats open up in a class that is full?

Yes, you can add a course section to your watchlist account on LionPATH. The e-lion system will then send an email to your Penn State email account notifying you there are seats open. To add a course to your watch list, click the advising tab on the upper left portion of the home site, and select "Registration Watch List" and follow the steps given to add a section. To log onto e-lion, go to <http://launch.lionpath.psu.edu/>

How do I choose Technical Electives?

Descriptions of all the Mechanical and Nuclear Engineering technical electives are in the Mechanical and Nuclear Engineering Undergraduate Curriculum Planning Manual found at the following website: <http://mne.psu.edu/students/undergraduate/curriculum.aspx> for advice on grouping your technical electives according to your interests. You may also take any 400-level engineering course as a technical elective. However, be sure you have satisfied the requirements for the technical electives described in Section 3 for Mechanical Engineering, and Section 5 for Nuclear Engineering.

Why do I have to take Arts/Humanities/Social Science courses?

The Faculty Senate of the Pennsylvania State University has established "General Education Requirements" http://bulletins.psu.edu/bulletins/bluebook/general_education.cfm is a website which gives the AHS requirements for Mechanical and Nuclear Engineers. These requirements include 6 credits in each area of Arts, Humanities, and Social and Behavioral Sciences. In addition, the Accreditation Board for Engineering and Technology (ABET) <http://www.abet.org/> requires that all engineering programs include a broad-based educational experience.

Requirements aside, the faculty of the Department of Mechanical and Nuclear Engineering feel that it is important for students to gain an appreciation for the larger societal context of technology, in addition to the technical aspects of their education. Exposure to new ideas in such diverse areas as theater, philosophy, and psychology are essential for well-rounded and rewarding careers.

Students are encouraged to look upon the General Education Requirements as an opportunity to broaden their horizons, interact with colleagues with different points of view, and enhance their technical education with different ways of looking at the world.

How do I choose my AHS electives?

There are websites that have listings of GA, GH, and GS courses:

http://bulletins.psu.edu/bulletins/bluebook/general_education.cfm?section=knowledge3 (GA)

http://bulletins.psu.edu/bulletins/bluebook/general_education.cfm?section=knowledge4 (GH)

http://bulletins.psu.edu/bulletins/bluebook/general_education.cfm?section=knowledge5 (GS)

How do I know if I've met the AHS requirements?

You can check your degree audit to see if you have fulfilled your AHS requirement, or meet with your adviser to confirm that you have. If you have any further concerns, you may come to 139/140 Reber Building, for assistance.

What is the "9-6-3" option?

The usual sequence for the AHS courses is a 6-6-6 sequence – 6 credits (two courses) in each of the following areas: Arts, Humanities, and Social Sciences. The 9-6-3 option allows students to take 9 credits of courses in one AHS area, 6 credits in a second area, and 3 credits in the third area. Students can elect to do a 9-6-3 sequence by submitting a Degree Audit Reconciliation Form.

Where do I get my Degree Audit?

You can obtain a current copy of your Degree Audit Report directly from the Internet. To do so, visit the following website <http://launch.lionpath.psu.edu/> and follow the directions to your audit. See Section 2 for help reading your degree audit.

My Degree Audit seems to be in error. What can I do about it?

If your degree audit shows a deficiency which you believe has been met, there may be a simple explanation. If your adviser cannot sort out the problem, stop by the Undergraduate Programs Office in 139/140 Reber Building and discuss the issue with the Undergraduate Records Assistant. Chances are the degree audit hasn't recognized a course you have taken. You may be asked to fill out a "Degree Audit Reconciliation Form" to help us fix the problem, or you may need to file a petition to ask for special consideration of courses already taken.

I wish to get credit for a course taken outside the curriculum, how do I get credit?

You can complete a petition form as outlined below.

What is a petition?

A petition is an online form you need to fill out and submit when you are requesting substitutions or academic exceptions that vary from the usual degree requirements. To file an online e-petition, please visit the website at <http://www.engr.psu.edu/e-petition/>.

What happens to a petition once I Submit it?

If the petition is only department related, it will be forwarded to the appropriate Professor-In-Charge in the Mechanical and Nuclear Engineering Department for review. If the petition deals with General Education credits, it will be forwarded to the Dean's office for review. If the petition is denied, you will be notified via email to your psu email address. If the petition is approved, the substitution or exception will be entered onto your degree audit and you should see it reflected there when you print your degree audit. You can expect the changes to be made within a two-three week time period.

My advisor didn't help me, what do I do now?

In many instances, you may be able to find your answer on the web using the following website: <http://mne.psu.edu/students/undergraduate/curriculum.aspx>, in the Curriculum Manual, or the Penn State Bulletin (the Blue Book). If you have no success with any of these choices, you may come to the

Undergraduate Programs Office in 139/140 Reber Building for advice or you may find your answers on the following website: <http://launch.lionpath.psu.edu/> and <http://www.psu.edu/advising>.

How do I find out more about the Co-op Program?

You can contact Engineering Career Resources & Employer Relations either by calling 863-1032 or stopping by 205 Hammond Building. The following website is also a good source of information about Co-op www.engr.psu.edu/career.

How do I find information about summer internships?

You can contact Engineering Career Resources & Employer Relations at 863-1032 or stop by 205 Hammond Building. Fall Career Days in September is an excellent place to find summer and full-time employment, as is Engineering Career Week in February. The following website is also a good source of information about Internships www.engr.psu.edu/career.

Where will I likely find employment?

Engineering Career Resources & Employer Relations offers an online job search system (eCareer) that can connect you with full-time as well as short-term engineering jobs. You can also find a lot of information on career development and job placement by visiting Career Services: <http://studentaffairs.psu.edu/career/>. You can find permanent and summer position announcements that companies have posted at the COE eCareer website: <https://eng-psu-csm.symplicity.com/students/>.

What is the Learning Factory and how can I use it?

The Learning Factory is both a new kind of curriculum, and an integrated manufacturing facility. It integrates a practice-based curriculum that emphasizes manufacturing, design, and business realities; with physical facilities for product realization, in an industrial-like setting. To learn more about the Learning Factory, visit the following website: <http://www.lf.psu.edu/>

What is the Leonard Center?

The mission of The Leonard Center states that, "it strives to improve the quality of undergraduate engineering education by emphasizing design as an integrating force in the engineering curricula, promoting active learning, and developing communication and leadership as essential engineering skills". To learn more about The Leonard Center, visit the following website: <http://www.engr.psu.edu/leonhardcenter/>.

Can I participate in the "Study Abroad" program in Mechanical and Nuclear Engineering?

Yes, please see page 3.9 of this manual for information about the Study Abroad Program. To learn more about the Study Abroad Program at Penn State, visit the following websites: <https://www.engr.psu.edu/global/students/SemStudyAbroad.htm>.

If you plan to take technical courses during study abroad, you must meet with the Professor-In-Charge before your study abroad semester, to have courses approved as substitutions for degree requirements.

I thought this was a 4-year program. Why will it take me more than that?

The Mechanical Engineering and Nuclear Engineering degrees take 4 years to complete, as outlined by our Curriculum Manual (see section 2 and section 4). In many cases, this time limit is exceeded due to other factors such as Co-op, or when pursuing a minor, for example.