JOHNS HOPKINS
UNIVERSITY

Mechanical Engineering
Department

Undergraduate Program Manual 2025-26

for the Bachelor of Science Degrees in Mechanical Engineering and Engineering Mechanics

for the **Class of 2029** only

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Department of Mechanical Engineering

Johns Hopkins University

Accredited Undergraduate Programs in

Mechanical Engineering and Engineering Mechanics

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1 INTRODUCTION

Welcome to the Johns Hopkins University's Department of Mechanical Engineering! In our time, we have seen once-diverse engineering fields merge and new technologies redefine industries. To keep abreast of rapid technological innovation, engineers must be able to continually update and renew their knowledge throughout their careers.

The task of preparing students for this environment is facilitated by our focus on fundamentals and the low student-to-faculty ratio of the Department of Mechanical Engineering. Educating a small, select group of students has permitted the development of a number of distinctive educational features such as a "capstone" design course that closely simulates professional practice, student participation in faculty research, close faculty-student interaction, and effective advising. By means of flexible programs grounded in fundamentals, we enable our graduates to pursue the lifelong education needed to excel in a rapidly changing world.

1.1 Objectives

In fulfilling our mission of preparing our graduates for the future, we start with the recognition that, at the root of the ever-growing variety of technological innovations lie scientific, engineering, and professional principles that form both the foundation for the student's understanding and a compass throughout the student's career.

A primary objective of the Mechanical Engineering curriculum is to emphasize the importance of these fundamental principles and to help students understand them and master their application. Laboratory experience is invaluable for this purpose, and we provide meaningful hands-on experience in instructional and research laboratories, so that students gain the skills of acquiring, analyzing, and interpreting data.

Fundamental principles are as vital today as when they were first discovered. This aspect is illustrated by showing them "in action" in the more advanced courses devoted to contemporary applications.

The demands of advanced technology, economy, and efficiency put an ever-increasing premium on the quantitative aspects of engineering. For this reason, students must also be educated in the application of advanced mathematical and computational techniques in engineering analysis and design.

1.2 Programs

1.2.1 Academic Programs – Two Majors

The Department of Mechanical Engineering offers two distinct programs of study for undergraduates at Johns Hopkins: Mechanical Engineering and Engineering Mechanics.

The **B.S. Mechanical Engineering** program places an emphasis on mechanical and thermal-fluid systems analysis and design. Students develop a wide range of fundamental skills required of the mechanical engineering profession and choose upper-level technical electives for further in-depth study.

The **B.S. Engineering Mechanics** program is designed to provide students with a flexible but rigorous foundation in solid and fluid mechanics. A strong emphasis on mathematics, basic science, and the engineering sciences prepares students for technical careers or for graduate and professional school.

The objectives indicated below are common to the two programs. In addition, they share the following features:

Flexibility. While the Engineering Mechanics curriculum is, by design, very flexible, both curricula offer several technical electives and allow students to pursue special interests in engineering, physics, biology, mathematics, management, and humanities. Double-majors and a 5-year master's degree are also possible.

Interdisciplinary approach. Both programs require courses in the basic sciences and mathematics and other engineering disciplines (including electrical, civil and materials). Each program also offers elective opportunities in diverse areas such as the physical and mathematical sciences, aerospace engineering, biomedical engineering, and environmental engineering. Students have the opportunity to interact with a multidisciplinary faculty both in the classroom and in research laboratories.

Preparation for professional practice. The modern engineer must be well versed in communication and teamwork skills. These are developed in a number of courses that involve laboratory exercises, report writing, and oral presentations. In addition to the freshman introductory and senior capstone design courses, the students' development in solving design problems is cultivated and encouraged through design electives and special design projects assigned in many of the courses.

The requirements described in this guide are intended to ensure an excellent foundation in science, humanities and social sciences, engineering sciences and engineering design methods, as well as preparation in the specializations of Mechanical Engineering and Engineering Mechanics.

The BS in the **Mechanical Engineering** degree program is accredited by the Engineering Accreditation Commission of ABET, under the General Criteria and the Program Criteria for Mechanical and Similarly Named Engineering programs.

The BS in the **Engineering Mechanics** degree program is accredited by the Engineering Accreditation Commission of ABET, under the General Criteria and the Program Criteria for Engineering Mechanics and Similarly Named Engineering programs.

Additional information from the Whiting School of Engineering regarding our ABET Accreditation can be found on the Whiting School ABET Accreditation page**.**

1.2.2 Program Educational Objectives and Student Outcomes

Please see Section 6.3 for the B.S. Mechanical Engineering program and Section 7.3 for the B.S. Engineering Mechanics program for the Program Educational Objectives and Student Outcomes.

1.2.3 Research Programs

The research programs in the Department of Mechanical Engineering are broad and include a variety of areas such as:

- Energy and the Environment
- Fluid Mechanics and Thermal Processes
- Mechanics and Materials
- Micro/Nanoscale Science and Engineering
- Mechanical Engineering in Biology and Medicine
- Robotics, Systems, and Control

A comprehensive list of research topics and the faculty participating in them appear on the Mechanical Engineering website's Research page.

1.2.4 Undergraduate Research Opportunities

The faculty welcomes undergraduate student participation in their research, which greatly enhances the educational experience beyond coursework. Opportunities are available during the academic semesters, intersession, and summer through independent study and research courses or through paid research positions.

Undergraduates at all levels are strongly encouraged to contact faculty members directly to participate in the Department's research programs.

1.2.5 "Laboratory Safety for Undergraduates" Course Required for Lab Courses

All students taking courses with experimental labs must take EN.990.100 Laboratory Safety for Undergraduates before registering for courses. This two-hour online course should be completed 24 hours before the registration period begins so the SIS registration system will acknowledge the course's completion.

If you plan to register for any of these, you must take EN.990.100:

- EN.530.115/116 MechE Freshman Laboratory I/II
- EN.560.211 Statics and Mechanics of Materials Lab
- EN.530.212 Mechanical Engineering Dynamics Lab
- EN.530.216 Mechanics Based Design Lab
- EN.530.232 Thermodynamics Lab
- EN.530.243 Electronics and Instrumentation Lab
- EN.530.254 Manufacturing Engineering
- EN.530.329 Intro to Fluid Mechanics Lab
- EN.530.335 Heat Transfer Lab
- EN.530.344 Design and Analysis of Dynamic Systems Lab
- EN.530.352 Materials Selection
- EN.530.403 (Fall) / EN.530.404 (Spring) Senior Design
- EN.530.418 Aerospace Structures
- EN.530.420 Robot Sensors and Actuators
- EN.530.474 Effective and Economic Design for Biomedical Instrumentation

To take the course:

1. Open the myJH Portal
2. Select the *Education* sidebar tab
3. Select the *MyLearning* option
4. Enter *Laboratory Safety Introductory Course* in the search area
5. Select the course title, then *Add to Dev Plan*
6. Click *Next,* then click *Done* to begin the course.
7. If you need help, contact help@jhmi.edu

Please note that the course EN.990.100 will NOT be visible on your transcript even after you successfully complete it. It is administratively recorded in SIS and will be read by SIS when pre-requisite checking your selected courses.

1.2.6 "Laboratory Safety for Undergraduate Research Assistants" Course Required

Your safety in the lab is paramount, more important than any research or academic benefit you obtain from doing research. The Whiting School has created a lab safety course, which provides a baseline level of safety knowledge—it is not comprehensive. Each laboratory has its own particular hazards and must train you on how to avoid them. The online course gives you a basic understanding of lab hazards and the vocabulary to learn more about safety in your lab.

NOTE: All students physically working in a laboratory where experiments are performed must complete this online course, whether or not the nature of their specific laboratory research is experimental or computational.

Please complete the course online:

- Go to the "myJHU" Portal and sign in with your JHED ID and password.
- Under the Education sidebar tab—select the "myLearning" option.
- Select the "Course Catalog" tab on the left, and enter the text "Laboratory Safety for Undergraduate Research Assistants" in the "search" tab and select the "Add to My Plan" tab. Follow the additional instructions and it will be added to your plan.
- In the plan, select the course title's link, which will take you to its window. Select the "take course" button and you will be able to begin the course.

The course has 6 modules presented in a PDF file, with online exercises and an exam. The total course is about 45 pages and takes about 3 hours to complete.

When you have completed the course, Johns Hopkins will e-mail you a certificate. Your department or principal investigator will require you to present a copy of the certificate before beginning work in the laboratory.

If you have questions about laboratory safety or the course, please contact Perry Cooper at pcooper2@jhmi.edu or 410-516-8798.

1.2.7 "Responsible Conduct of Research Course" May Be Required

Many undergraduate students participating in research will be required to take the "Responsible Conduct of Research" course.

- Students receiving payment for research or who are conducting research used to help complete degree requirements (such as in an Independent Research or

Independent Study course) must first complete the online training course (AS.360.624) before conducting research and receiving payment or credit.

- Students receiving payment from NIH Training Grants must take the 10-hour online training course (AS.360.625).

Information is available on the Responsible Conduct of Research page. Successful completion of this course must be verified before a student's diploma is issued.

1.3 Advising and Mentoring

Each undergraduate student with a primary major in Mechanical Engineering or in Engineering Mechanics will be assigned one academic advisor from the WSE Advising Office (either a Professional Academic Advisor or a Success Coach Academic Advisor) and one faculty mentor from the Mechanical Engineering Department.

The Department's faculty coordinator for undergraduate mentoring is the Director of Undergraduate Studies, Professor Steven Marra (123 Latrobe, marra@jhu.edu).

1.3.1 Visit Your Academic Advisor and Faculty Mentor Often

You must meet with your academic advisor at least once per semester to plan a course schedule, change courses, and discuss degree requirements. It is important to plan out your four years of courses as early as possible. You can also discuss issues related to academics or academic performance at any time.

You must meet with your faculty mentor at least two times per semester during your freshman year. You must meet with your faculty mentor at least once per semester during your sophomore, junior, and senior years.

You must initiate the above meetings with your academic advisor and faculty mentor.

1.3.2 Advising Alerts on Registration

Two alerts will be placed on your account prior to the start of each semester's course registration period – an Academic Advising Alert and a Faculty Mentor Alert. Students are expected to meet with both their faculty mentor and their academic advisor prior to registering for courses. Students will not be allowed to register for courses until their Academic Advising Alert is lifted.

1.4 University Catalogue

The JHU University Catalogue is a valuable resource for information on academic and administrative procedures, registration, grading, professional opportunities, and student life.

Please refer to it often, as it will answer many questions about policies and procedures.

1.5 Blue Jay Families

The JHU Office of Student Affairs, Family Engagement has created a companion website "Blue Jay Family Connection" Please encourage your parent(s) or guardian(s) to refer to this as it provides helpful information about suggestions to support you in your student experience.

2 GENERAL REGULATIONS

2.1 Course Grading

2.1.1 Letter Grades vs. S/U grades

Students majoring in Mechanical Engineering or Engineering Mechanics may take their required First-Year Seminar course as Satisfactory/Unsatisfactory (S/U). All other courses/credits required for either program must be taken for a letter grade.

2.1.2 Letter Grades Below C-

The Department of Mechanical Engineering requires that grades of C- or better be obtained in all Engineering, Mathematics and Science courses.

Students may not take a Mechanical Engineering course until they have earned a C- or better in all the prerequisites for that course.

Grades of C- or better are also required for all courses used to satisfy the Foundational Abilities requirements.

Grades of D+, D, or F will not be accepted, even though credits will appear in the transcript for D-level grades.

Note: A student who wishes to re-take a completed Hopkins course must do so at Hopkins. For example, a student who performed poorly in our Thermodynamics course cannot "overwrite" it by taking a similar thermodynamics course at another school over the summer.

2.2 Credit minimums at Johns Hopkins

All students matriculating as freshmen must earn a minimum of 100 credits at Johns Hopkins University, even if they are not all used for a student's degree requirements or minors.

Credits earned through AP or IB exams and credits earned during a study abroad semester count as in-residence credits.

All students who transferred to Johns Hopkins from another institution must earn a minimum of 60 credits at Johns Hopkins University, even if they are not all used for a student's degree requirements or minors.

2.3 *WSE Course-Level Guidelines*

In an effort to promote consistent course labeling, the course numbering guidelines found below are used throughout the University:

- 100: introductory/freshman-level coursework
- 200: sophomore-level coursework
- 300: junior-level coursework
- 400: senior-level coursework; typically permitted to apply to graduate degrees (at the discretion of the student's department)
- 500: undergraduate independent study, undergraduate research, and senior thesis coursework
- 600: graduate coursework; typically graded with letter grades
- 700: advanced graduate and topics courses
- 800: graduate seminars, graduate independent study, graduate research and dissertation research coursework

2.4 *Academic Area Designations*

Johns Hopkins uses academic area designations (H, S, N, Q, E) to categorize courses within its curriculum, representing Humanities, Social and behavioral sciences, Natural sciences, Quantitative and mathematical sciences, and Engineering, respectively. (These designations are also referred to as "credit areas", "course areas", and/or "credit distributions".) Courses may include one or more designations, or none.

2.5 *Courses taken at other Universities*

The University allows no more than 12 credits completed prior to matriculation or in summer sessions at other accredited colleges or universities to be counted toward the degree.

Transfer students have a cap of 60 external credits, which includes courses taken both before and after starting at Hopkins. Transfer students must obtain credit for courses they wish to transfer during their first year at Hopkins. University regulations also require a minimum of two years' residence for a Hopkins degree.

Pre-approval is required to take a course at other accredited colleges or universities while enrolled as a Hopkins undergraduate student. Visit the Mechanical Engineering Undergraduate Advising webpage "APPROVAL REQUIRED: Credit Overloads / Taking Classes Outside JHU" for information.

A student who wishes to re-take a completed Hopkins course must do so at Hopkins. For example, a student who performed poorly in our Thermodynamics course cannot "overwrite" it by taking a similar thermodynamics course at another school over the summer.

2.6 Course Waivers – No Credits Earned

As a result of mathematics placement testing or prior course experience in high school, some students may be allowed to begin their course sequences at a higher level than in the initially prescribed curriculum. For example, some students may initiate the math sequence at Calculus II instead of the traditional Calculus I start.

No academic credit is given for waivers. A waiver merely shifts the beginning level of course work. Students must earn the prescribed number of credits for each portion of their degree and work with their advisors to select appropriate classes.

2.7 Advanced Placement

Johns Hopkins University grants credit for many Advanced Placement (AP) and International Baccalaureate (IB) examinations, including calculus, chemistry, physics, computer science, economics, languages, biology, environmental science, and statistics. Visit the Johns Hopkins Catalogue's External Credit Policies page for information.

Many, but not all, AP credits can substitute for courses required for the B.S. degrees in Mechanical Engineering and Engineering Mechanics. A student's academic advisor can help determine which will count.

Official records of advanced placement examinations should be submitted to the Johns Hopkins Office of Undergraduate Admissions. AP scores will be entered on academic records upon receipt.

2.8 AP Physics C and IB Physics Credit

AP PHYSICS C (MECHANICS)

Students who have earned a score of 4 or 5 on the AP Physics C (Mechanics) exam can receive four credits and are not required to take EN.530.123 Introduction to Mechanics I.

Students may not substitute AP credits for EN.530.124 Introduction to Mechanics II. All Mechanical Engineering and Engineering Mechanics majors must take this course, no matter what AP credits have been earned.

If a student takes a course that AP credits normally would replace, the AP credits will be lost. This is important to consider with the physics courses because taking

EN.530.123 Introduction to Mechanics I will eliminate any earned AP Physics C (Mechanics) credits.

ADDITIONAL INTRODUCTORY PHYSICS CREDITS MUST BE TAKEN WITH AP PHYSICS C - MECHANICS CREDIT

Students starting as Mechanical Engineering or Engineering Mechanics majors…

- …in the freshman fall semester must take EN.530.124 Intro to Mechanics II in the freshman spring semester.
- …after the freshman fall semester should consult with their academic advisor as to which course to take, either EN.530.124 Intro to Mechanics II or AS.173.111 General Physics Laboratory I.

AP PHYSICS C (ELECTRICITY and MAGNETISM)

Students who have earned a score of 4 or 5 on the AP Physics C (Electricity and Magnetism) exam can receive four credits and are not required to take AS.171.102/108 General Physics II.

While the University allows waiver of the associated lab, AS.173.112 General Physics II Lab, individual departments can still require the lab. Mechanical Engineering requires AS.173.112 General Physics II Lab for all Mechanical Engineering and Engineering Mechanics majors, even when AP Physics C (Electricity and Magnetism) credits are earned.

IB PHYSICS

The following credit is given for IB Physics:

- A score of 6 will grant 4 credits that will exonerate a student from taking EN.530.123 Introduction to Mechanics I. The courses EN.530.124 Intro to Mechanics II, AS. 171.102 General Physics II, and AS.173.112 General Physics Lab II must be taken.
- A score of 7 will grant 8 credits that will exonerate a student from taking EN.530.123 Introduction to Mechanics I and AS.171.102 General Physics II.
    - The courses EN.530.124 Intro to Mechanics II and AS.173.112 General Physics Lab II must be taken.
    - If a student takes EN.530.123 Introduction to Mechanics I, 4 of the 8 IB credits will be forfeited, but the remaining 4 will still exonerate a student from taking AS.171.102 General Physics II.

2.9 AP Computer Science Credit

Students with no AP Computer Science credit or score lower than a "5" on the AP Computer Science exam must take one version of the 3-credit Gateway Computing course.

EN.500.113 Gateway Computing – Python is preferred. EN.500.112 Gateway Computing – JAVA is also acceptable, however, all students will be expected to know Python for their later mechanical engineering courses.

Students who scored a "5" on the AP Computer Science exam have the option to take either…

- One of the Gateway Computing courses, in which case their AP CS credits will be forfeited, or…
- EN.601.220 Intermediate Programming, EN.601.226 Data Structures, or another programming course of at least three credits pre-approved by the student's academic advisor, in which case the AP Computer Science credits will count toward the student's core computing requirement (replacing Gateway Computing). Note that students may count either EN.601.220 or EN.601.226 as a Technical Elective (but not both).

2.10 Customized Academic Learning (CAL)

Students may wish to explore topics beyond coursework or expand learning on a course topic, and credits may be earned for such Customized Academic Learning (CAL).

Independent Research is a course under the direct supervision of a faculty sponsor, in which a student identifies and proposes research work. The Mechanical Engineering course numbers are:

- EN.530.501 Undergraduate Research
- EN.530.511 Group Undergraduate Research, for groups of 5 or more students working on the same research or project
- EN.530.597 Research - Summer

Independent Study is the result of creating a course of study focused on topics beyond coursework or expanding on a topic in which further study is desired. The Mechanical Engineering course numbers are:

- EN.530.526 Independent Study - Spring
- EN.530.527 Independent Study - Fall
- EN.530.599 Independent Study - Summer

Students planning to earn credit for independent work should register for the appropriate course and section corresponding to their faculty supervisor/research advisor.

Other Whiting School departments also offer independent research and study courses, but have different course numbers.

Up to three credits of CAL work can be earned in any one semester, summer, or intersession.

2.10.1 Options to Count CAL Work

A maximum of six credits of letter-graded Customized Academic Learning (CAL) work may be applied toward the B.S. Mechanical Engineering and Engineering Mechanics degrees as electives in this manner:

- Up to three credits of undergraduate research (EN.530.501, EN.530.511, or EN.530.597, or equivalent course numbers from other departments)
- Up to three credits of independent study (EN.530.526, EN.530.527, or EN.530.599, or equivalent course numbers from other departments)

Students cannot count six credits of undergraduate research nor six credits of independent study toward their degree requirements.

Mechanical Engineering majors conducting CAL work under a Mechanical Engineering faculty sponsor may count the credits toward their Mechanical Engineering electives or Technical Electives.

Mechanical Engineering majors conducting CAL work under a faculty sponsor from outside Mechanical Engineering may count the credits earned toward their Technical Electives. If students wish to count the credits earned as a Mechanical Engineering elective, they must obtain approval from the Mechanical Engineering Director of Undergraduate Studies before beginning the work.

Engineering Mechanics majors may not use CAL work to satisfy any of the four Engineering Sciences electives.

2.10.2 More Information About CAL Work

Each credit should reflect 40 hours of work.

- CAL work done for academic credit may be paid or unpaid.
- No academic area designations are attached to independent work, though your academic advisor can designate an area through a Substitution/Exception/Waiver (SEW) form. This is necessary to count the course towards an elective.

- To count CAL work toward an elective section of the BS Mechanical Engineering or BS Engineering Mechanics degrees, the work must be at the rigor and vigor of upper-undergraduate (junior or senior) work or higher.
- Students must register in the first six weeks of the semester to earn independent research or study credit that semester. The University prohibits retroactive registration.
- Students taking three or more credits of undergraduate research are encouraged to present a research poster at the Johns Hopkins University's DREAMS Undergraduate Research Day each spring. Announcements will be sent in advance to arrange to submit the poster.

The Mechanical Engineering department strongly recommends that a student have a cumulative GPA of at least 3.0 to request approval to conduct independent research or independent study.

2.10.3 Pre-Approval is Required

Before embarking on research for credit, students must obtain pre-approval from their faculty sponsor by presenting a completed "Independent Academic Work" form in SIS.

- Sign in to SIS at sis.jhu.edu.
- Go to the Registration menu and select "Online Forms."
- Select "Independent Academic Work."
- Complete and submit the form.
- The form will be sent to the student's faculty sponsor via e-mail for approval.
- Once approved, the student will be enrolled for the appropriate course.

Research performed without this pre-approval will not be recognized and accredited.

3 DOUBLE MAJORS AND MINORS

Both Mechanical Engineering and Engineering Mechanics majors may elect to double major or to complete one or more minors.

3.1 *Double Majors*

Students wishing to pursue a double major must contact the Whiting School's Academic Advising office and obtain approval from their academic advisor. Students are responsible for ensuring that course requirements for both majors are met.

3.2 *Majors/Minors*

Students wishing to pursue a minor should confer with the department through which the minor is offered to ascertain the exact requirements. Available minors appear on the Arts and Sciences and Engineering pages.

Note that students must declare a minor, not just simply take the classes that will help meet the minor requirements.

4 FIRST-YEAR SEMINAR REQUIREMENT

All WSE primary majors are required to complete a First-Year Seminar (FYS) or a Design Cornerstone class with a grade of Satisfactory (S). These courses are offered only with the Satisfactory/Unsatisfactory grading system; they are not offered for letter grades.

Mechanical Engineering and Engineering Mechanics majors are required to take mechanical engineering design courses in their first year and may therefore benefit more from enrolling in a 3-credit, discussion-based FYS course rather than the Design Cornerstone course.

Students who receive a U grade in their FYS or Design Cornerstone course must enroll and satisfactorily complete the 2-credit Design Cornerstone course in their second year.

The first-year seminar requirement is waived for students who transfer into the university after the first year. These students must still complete the minimum number of required credits to graduate.

5 FOUNDATIONAL ABILITIES REQUIREMENTS

All students with a primary major within the Whiting School of Engineering must complete the Foundational Abilities (FA) in six designated areas. Grades of C- or higher are required. No Satisfactory/Unsatisfactory (S/U) grades will be accepted, except in cases where a course is offered on an S/U basis only, such as the Bootcamp Computing courses. For Foundational Abilities that require the submission of ePortfolio assignments in an engineering discipline, students must achieve a minimum assessment of "Proficient".

5.1 *FA1 Writing and Communication*

This Foundation Abilities requirement has four parts:

1. **Foundational Course in Writing**: All WSE students are required to successfully complete either

   AS.004.101 Reintroduction to Writing, or
   EN.661.110 Professional Writing and Ethics.

2. **Writing ePortfolio Assignment**: All WSE students must be assessed as at least proficient in one writing ePortfolio assignment. Courses that include at least one assignment eligible for the writing ePortfolio assignment requirement can be identified in SIS by searching for

   AREAS
   ↳ EN FOUNDATIONAL ABILITIES
   ↳ Writing ePortfolio (FA1.1eP).

3. **Foundational Course in Oral Communication**: All WSE students are required to successfully complete the course EN.661.250 Oral Presentations.

4. **Oral Communication ePortfolio Assignment**: All WSE students must be assessed as at least proficient in one oral communication ePortfolio assignment. Courses that include at least one assignment applicable to the oral communication ePortfolio assignment requirement can be identified in SIS by searching for

   AREAS
   ↳ EN FOUNDATIONAL ABILITIES
   ↳ Oral Communication ePortfolio (FA1.2eP).

5.2 *FA2 Scientific and Quantitative Reasoning*

This Foundational Abilities requirement has five parts. Mechanical Engineering and Engineering Mechanics majors will satisfy this requirement by completing the following courses:

1. AS.110.108 Calculus I (Physical Sciences & Engineering)
2. AS.110.109 Calculus II (Physical Sciences and Engineering)
3. EN.553.311 Intermediate Probability and Statistics, or another upper-level course in probability and statistics
4. EN.500.113 Gateway Computing: Python, or EN.500.112 Gateway Computing: JAVA

   Note that if EN.500.112 Gateway Computing: JAVA is taken, Mechanical Engineering and Engineering Mechanics majors are still expected to be proficient in Python for their mechanical engineering courses.
5. Either

   - AS.171.102 General Physics: Physical Science Major II and AS.173.112 General Physics Laboratory II

   or

   - AS.171.108 General Physics for Physical Science Majors (AL) and AS.173.112 General Physics Laboratory II

5.3 *FA3 Creative Expression*

A minimum of 12 credits of coursework in creative expression (FA3) and engagement with society (FA4) is required. At least three (3) of these credits must be earned through a course tagged FA3. Courses with the FA3 tag can be identified in SIS by searching for

AREAS
↳ EN FOUNDATIONAL ABILITIES
↳ Creative Expression (FA3).

In addition to the required FA3 and FA4 courses, students must complete six (6) additional credits from any combination of FA3 or FA4 courses, for a total of 12 credits in FA3 and FA4.

5.4 *FA4 Engagement with Society*

A minimum of 12 credits of coursework in creative expression (FA3) and engagement with society (FA4) is required. At least three (3) of these credits must be earned through a course tagged FA4. Courses with the FA4 tag can be identified in SIS by searching for

AREAS
↳ EN FOUNDATIONAL ABILITIES
↳ Engagement with Society (FA4).

In addition to the required FA3 and FA4 courses, students must complete six (6) additional credits from any combination of FA3 or FA4 courses, for a total of 12 credits in FA3 and FA4.

5.5 *FA5 Ethical Reflection*

This Foundational Abilities requirement has two parts:

1. **Foundational Course in Ethical Reflection**: All WSE students are required to successfully complete one foundational course in ethical reflection.

   Mechanical Engineering majors will satisfy this requirement by completing EN.660.463 Engineering Management & Leadership.

   Engineering Mechanics majors will satisfy this requirement by completing EN.661.110 Professional Writing and Ethics.

5. **Ethical Reflection ePortfolio Assignment**: All WSE students must be assessed as at least proficient in one ethical reflection ePortfolio assignments. Courses that include at least one assignment eligible for the ethical reflection ePortfolio assignment requirement can be identified in SIS by searching for

   AREAS
   ↳ EN FOUNDATIONAL ABILITIES
   ↳ Ethical Reflection ePortfolio (FA5eP).

5.6 *FA6 Conceiving Of and Realizing Projects*

All WSE students must be assessed as at least proficient in two conceiving of and realizing projects ePortfolio assignments. Courses that include at least one assignment eligible for the conceiving of and realizing projects ePortfolio assignment requirement can be identified in SIS by searching for

AREAS
- ↳ EN FOUNDATIONAL ABILITIES
  - ↳ Conceiving of and Realizing Projects ePortfolio (FA6eP).

Bachelor of Science Degree
in the Mechanical Engineering major

6 MECHANICAL ENGINEERING CURRICULUM

6.1 Our Mission

The mission of the B.S. in Mechanical Engineering degree program is to provide a rigorous educational experience that prepares a select group of students for leadership positions in the profession and a lifetime of learning. The faculty is committed to maintaining a modern and flexible curriculum which, building on a foundation of basic sciences and mathematics, develops a solid education in the mechanical engineering sciences. The aim of the Mechanical Engineering program is to build competence in the analysis, design and development of thermal, fluid, and mechanical systems; to promote a broad knowledge of the contemporary social and economic context, and to develop the communication skills necessary to excel.

6.2 Introduction

The program provides fundamental courses in thermal and mechanical systems. Both laboratory instruction and the senior design project allow all students hands-on experience. All students must follow a program approved by their academic advisor and in consultation with their faculty mentor.

Students are encouraged to develop depth in one or two areas chosen from:

- Aerospace Engineering
- Biomechanical Engineering
- Robotics
- Mechanics and Design
- Fluid Mechanics and Thermofluid Systems.

The choice of academic interest is typically decided in the junior year after consultation with the faculty mentor. If you are ready to choose an academic interest prior to your junior year, please discuss your intentions with your mentor.

6.3 Educational Objectives and Student Outcomes

6.3.1 B.S. Mechanical Engineering Educational Objectives

Our primary objective is to educate an exceptional group of engineers who, after graduation, will be successful and on track to become leaders among their peers in the best graduate programs and/or in industry, government laboratories, academia, and other organizations.

6.3.2 B.S. Mechanical Engineering Student Outcomes

Students graduating with a B.S. in Mechanical Engineering will have demonstrated…

1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3) an ability to communicate effectively with a range of audiences
4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

6.4 Mechanical Engineering Curriculum

Students will earn at least 125 credits while completing the Bachelor of Science degree in Mechanical Engineering.

The Mechanical Engineering curriculum is structured as follows:

First-Year Seminar (2-3 credits; S/U)

- See First-Year Seminar, Section 4

Science (13 credits; grades below C- not accepted)

- EN.530.123 Introduction to Mechanics I
- EN.530.124 Introduction to Mechanics II
  (required for all students, even with AP credit)
- AS.171.102 (or AS.171.108) General Physics II
  (AS.171.106 Electricity and Magnetism is also acceptable)
- AS.173.112 General Physics Lab II
  (required for all students, even with AP credit)
  (AS.173.116 Electricity and Magnetism Lab is also acceptable if AS.171.106 is taken)
- AS.030.101 Introductory Chemistry I

Mathematics (19 credits minimum, 20 credits typically; grades below C- not accepted)

- AS.110.108 Calculus I
- AS.110.109 Calculus II
- Calculus III options – choose one
  - AS.110.202 Calculus III
  - AS.110.211 Honors Multivariable Calculus
- Linear Algebra/Differential Equations options – choose one
  - EN.553.291 Linear Algebra/Differential Equations
  - Both AS.110.201 Linear Algebra and AS.110.302 Differential Equations
  - Both AS.110.212 Honors Linear Algebra and AS.110.302 Differential Equations
  - Both EN.553.295 Linear Algebra for Data Science and AS.110.302 Differential Equations

- A course in Probability and Statistics at the .300-level or above (e.g. EN.553.311 Intermediate Probability and Statistics. AP Statistics is not accepted.)

FA1, FA3, and FA4 Course Requirements (18 credits)

- See Foundational Abilities Requirements, Section 5

Required Engineering Courses (50 credits; grades below C- not accepted)

- EN.530.107/108 MechE Undergraduate Seminar I/II
- EN.530.111 Intro to MechE Design and CAD
- EN.500.113 Gateway Computing – Python
    - EN.500.113 Gateway Computing - Python is the strongly preferred computing option.
    - Some students might take EN.500.112 Gateway Computing - JAVA to work toward a Computer Science or Robotics minor. If EN.500.112 Gateway Computing: JAVA is taken, Mechanical Engineering majors are still expected to be proficient in Python for their mechanical engineering courses. EN.500.133 Bootcamp: Python is recommended to build this proficiency.
    - Section 2.9 of this manual describes alternate courses that can be taken if AP Computer Science credit is earned.
- EN.530.115/116 MechE Freshman Laboratory I/II
- EN.560.201 and EN.560.211 Statics and Mechanics of Materials and Lab
- EN.530.202 and EN.530.212 Dynamics and Lab
- EN.530.215 and EN.530.216 Mechanics Based Design and Lab
- EN.530.231 and EN.530.232 MechE Thermodynamics and Lab
- Electronics options – choose one
    - EN.530.241 and EN.530.243 Electronics and Instrumentation and Lab (preferred)
    - EN.520.230 and EN.520.231 Mastering Electronics and Lab (acceptable)
- EN.530.254 Manufacturing Engineering
- EN.530.327 and EN.530.329 Introduction to Fluid Mechanics and Lab
- EN.530.334 and EN.530.335 Heat Transfer and Lab

- EN.530.343 and EN.530.344 Design and Analysis of Dynamic Systems / Lab
- EN.530.352 Materials Selection
- EN.660.463 Engineering Management and Leadership

Mechanical Engineering Electives (6 credits; grades below C- not accepted)

- Two courses (300-level or higher), any of...
    - EN.530.xxx – All courses in Mechanical Engineering 300-level or higher
    - AS.270.366 Space Instrumentation Project
    - EN.520.495 Microfabrication Laboratory
    - EN.560.449 / EN.560.649 Energy Systems
    - EN.660.345 Multidisciplinary Design I
    - EN.660.346 Multidisciplinary Design II

Technical Electives (9 credits; grades below C- not accepted)

- Two (E), (Q), or (N) courses at or above the 300-level, chosen from any combination of courses in engineering, basic sciences, or mathematics chosen in consultation with the student's academic advisor, *plus…*
- *Either* one more (E), (Q), or (N) course at or above the 300-level, *or* one of these computing options:
    - EN.601.220 Intermediate Programming
    - EN.601.226 Data Structures

  NOTE: The EN.500.11x Gateway Computing and EN.500.13x Bootcamp computing courses **do not count** as technical electives.

Capstone Design (8 credits; grades below C- not accepted)

- EN.530.403 and EN.530.404 MechE Senior Design Project I and II

6.4.1 4-Year Course Planning – Help is Available

It is important to plan all four years of your coursework as early as possible, keeping in mind the frequency of courses offered so you can enroll in all courses required for your degree. Contact your academic advisor to arrange a planning meeting or Ms. Emily Hinton, the department's Lead Academic Advisor at ehinton8@jhu.edu.

6.4.2 Cross-Listing of Courses in SIS

The University allows departments to "cross-list" their courses in SIS so that they appear in multiple departments' SIS course listings. Departments do this to encourage students in majors other than the department's own to easily see their offerings and register for their courses.

Courses that are cross-listed in SIS in other departments may not meet the elective definitions, so choose carefully. Please contact your academic advisor or the academic staff with your questions on whether a course counts for your degree.

6.4.3 Choosing Mechanical Engineering Electives

Students are encouraged to develop depth in one or two areas within mechanical engineering. Examples are provided below. Note that many of the elective courses below are taught every other year.

Mechanics of Materials

- *EN.530.405 Mechanics of Solids and Structures*
- *EN.530.418 / EN.530.619 Aerospace Structures*
- *EN.530.438 / EN.530.638 Aerospace Materials*
- *EN.530.455 / EN.530.655 Additive Manufacturing*
- *EN.530.465 Spacecrafts, Submarines, and Glaciers: Solid Mechanics in Extreme Environments*

Design

- *EN.530.414 Computer-Aided Design*
- *EN.530.430 Applied Finite Element Analysis*
- *EN.530.474 Effective and Economic Design for Biomedical Instrumentation*

Robotics

- *EN.530.420 Robot Actuators and Sensors*
- *EN.530.421 Mechatronics*
- *EN.530.424 Dynamics of Robots and Spacecraft*
- *EN.530.468 / EN.530.668 Locomotion Mechanics: Fundamentals*
- *EN.530.469 / EN.530.669 Locomotion Mechanics: Recent Advances*
- *EN.530.470 Space Vehicle Dynamics and Control*
- *EN.530.475 Locomotion I: Mechanics*

Thermo-fluids and Thermo-fluid Systems

- *EN.530.425 Mechanics of Flight*
- *EN.530.426 Biofluid Mechanics*
- *EN.530.427 / EN.530.627 Intermediate Fluid Mechanics*
- *EN.530.432 Jet and Rocket Propulsion*
- *EN.530.437 Energy Meteorology*
- *EN.530.443 Fundamentals, Principles, and Applications of Microfluidic Systems*
- *EN.530.464 Energy Systems Analysis*
- *EN.530.483 / EN.530.683 Computational Modeling in Aerodynamics and Heat Transfer*
- *EN.530.490 / EN.530.690 Intro to Aero/Hydro Acoustics*

Biomechanics

- *EN.520.495 Microfabrication Laboratory*
- *EN.530.409 Introduction to Mechanobiology*
- *EN.530.410 Biomechanics of the Cell*
- *EN.530.426 Biofluid Mechanics*
- *EN.530.429 Musculoskeletal Biomechanics*
- *EN.530.431 Biomechanics of Development*
- *EN.530.441 Introduction to Biophotonics*
- *EN.530.443 Fundamentals, Design Principles and Applications of Microfluidic Systems*
- *EN.530.448 Biosolid Mechanics*
- *EN.530.473 Molecular Spectroscopy and Imaging*
- *EN.530.474 Effective and Economic Design for Biomedical Instrumentation*
- *EN.530.480 Image Processing and Data Visualization*
- *EN.530.493 / EN.530.693 Fabrication of Biomaterials, Engineered Tissues and Food*

6.5 *Sample Mechanical Engineering Programs*

Sample *Mechanical Engineering* Program for students beginning with Calculus I

This is one possible way to complete the program.

* - Students are encouraged to take AS.110.302 Differential Equations (4) and AS.110.201 Linear Algebra or EN.553.295 Linear Algebra for Data Science (4) instead of the combined EN.553.291 L.A./D.E. course (4) if they can work the additional four credits into their schedule. An advantage of taking the courses separately is that AS.110.302 Differential Equations can be counted as a Technical Elective.

FRESHMAN YEAR				
AS.110.108 Calculus I	4		AS.110.109 Calculus II	4
AS.030.101 Intro to Chemistry I	3		EN.500.113 Gateway Computing - Python	3
EN.530.107 MechE Undergrad Seminar I	0.5		EN.530.108 MechE Undergrad Seminar II	0.5
EN.530.111 Intro to MechE Design & CAD	2		EN.530.116 MechE Freshman Lab II	1
EN.530.115 MechE Freshman Lab I	1		EN.530.124 Intro to Mechanics II	2
EN.530.123 Intro to Mechanics I	3		EN.661.110 Professional Writing & Ethics	3
First-Year Seminar	3		EN.661.250 Oral Presentations	3
Total credits	**16.5**		**Total credits**	**16.5**
SOPHOMORE YEAR				
AS.110.202 Calculus III	4		EN.530.202/212 Dynamics / Lab	3+1
AS.171.102 General Physics II	4		EN.530.215/216 Mech Based Design / Lab	3+1
AS.173.112 General Physics Lab II	1		EN.530.241/243 Electronics Instr / Lab	3+1
EN.530.231/232 Thermodynamics / Lab	3+1		EN.553.291 L.A./D.E.*	4
EN.560.201/211 Statics / Lab	3+1			
Total credits	**17**		**Total credits**	**16**
JUNIOR YEAR				
EN.530.254 Manufacturing Engineering	3		EN.530.334/335 Heat Transfer / Lab	3+1
EN.530.327/329 Intro. Fluid Mech / Lab	3+1		EN.530.343/344 DADS / Lab	3+1
EN.530.352 Materials Selection	4		MechE Elective (1)	3
EN.553.311 Intermediate Prob & Stat	4		Technical Elective (1)	3
			FA3 Elective	3
Total credits	**15**		**Total credits**	**17**
SENIOR YEAR				
EN.530.403 MechE Sr. Design Project I	4		EN.530.404 MechE Sr. Design Project II	4
EN.660.463 Eng. Mgmt. & Leadership	3		Technical Elective (3)	3
MechE Elective (2)	3		FA3 or FA4 Elective	3
Technical Elective (2)	3		FA3 or FA4 Elective	3
FA4 Elective	3			
Total credits	**16**		**Total credits**	**13**

Sample *Mechanical Engineering* Program for students with Calculus I AP credit

This is one possible way to complete the program.

* - Students are encouraged to take AS.110.302 Differential Equations (4) and AS.110.201 Linear Algebra or EN.553.295 Linear Algebra for Data Science (4) instead of the combined EN.553.291 L.A./D.E. course (4) if they can work the additional four credits into their schedule. An advantage of taking the courses separately is that AS.110.302 Differential Equations can be counted as a Technical Elective, as long as it is not being counted as one of the courses helping to meet the required 19 math credits.

FRESHMAN YEAR				
AS.110.109 Calculus II	4		AS.110.202 Calculus III	4
AS.030.101 Intro to Chemistry I	3		EN.500.113 Gateway Computing - Python	3
EN.530.107 MechE Undergrad Seminar I	0.5		EN.530.108 MechE Undergrad Seminar II	0.5
EN.530.111 Intro to MechE Design & CAD	2		EN.530.116 MechE Freshman Lab II	1
EN.530.115 MechE Freshman Lab I	1		EN.530.124 Intro to Mechanics II	2
EN.530.123 Intro to Mechanics I	3		EN.661.110 Professional Writing & Ethics	3
First-Year Seminar	3		EN.661.250 Oral Presentations	3
Total credits	**16.5**		**Total credits**	**16.5**
SOPHOMORE YEAR				
AS.171.102 General Physics II	4		EN.530.202/212 Dynamics / Lab	3+1
AS.173.112 General Physics Lab II	1		EN.530.215/216 Mech Based Design / Lab	3+1
EN.530.231/232 Thermodynamics / Lab	3+1		EN.530.241/243 Electronics Instr / Lab	3+1
EN.560.201/211 Statics / Lab	3+1		EN.530.254 Manufacturing Engineering	3
EN.553.291 L.A./D.E.*	4			
Total credits	**17**		**Total credits**	**15**
JUNIOR YEAR				
EN.530.327/329 Intro. Fluid Mech / Lab	3+1		EN.530.334/335 Heat Transfer / Lab	3+1
EN.530.352 Materials Selection	4		EN.530.343/344 DADS / Lab	3+1
EN.553.311 Intermediate Prob & Stat	4		MechE Elective (1)	3
FA3 Elective	3		Technical Elective (1)	3
			FA4 Elective	3
Total credits	**15**		**Total credits**	**17**
SENIOR YEAR				
EN.530.403 MechE Sr. Design Project I	4		EN.530.404 MechE Sr. Design Project II	4
EN.660.463 Eng. Mgmt. & Leadership	3		Technical Elective (3)	3
MechE Elective (2)	3		FA3 or FA4 Elective	3
Technical Elective (2)	3		FA3 or FA4 Elective	3
Total credits	**13**		**Total credits**	**13**

Bachelor of Science Degree
in the Engineering Mechanics major

7 ENGINEERING MECHANICS CURRICULUM

7.1 Our Mission

The mission of the B.S. in engineering mechanics degree program is to provide a rigorous educational experience that prepares a select group of students for leadership positions in the profession and a lifetime of learning. The faculty is committed to maintaining a modern and flexible curriculum which, building on a foundation of basic sciences and mathematics, develops a solid education in the mechanical engineering sciences. The aim of the Engineering Mechanics program is to build competence in the analysis, design, and modeling of fluid and solid systems, and to develop the professional skills necessary to excel as an engineer.

7.2 Introduction

The Engineering Mechanics program concentrates on the scientific fundamentals of the behavior of solids and fluids. The program is designed to be highly flexible while providing the student with a broad scientific and technical background in the mechanical sciences.

The curriculum is intended to enable graduates to explore fundamental questions in many fields of engineering. Emphasis is placed on the basic sciences (mathematics, physics, and chemistry) and on the analysis, modeling, and design aspects of solid and fluid engineering systems. Although specific core courses are required, students are encouraged and guided by their faculty mentor and academic advisor to select an individual program of study, within ABET guidelines, according to their individual interests and goals. This program of study may range from a general study of mechanics or engineering science to specialized programs such as robotics, fluid dynamics, environmental engineering, mechanics of solids, experimental mechanics, dynamical systems, mechanics of materials, or biomechanics.

This flexibility makes the program ideal for double-majors and for those wishing to tailor a strong foundation for graduate work in a wide range of disciplines. All mathematics elective and technical elective courses must be at the .300-level or higher, unless approved by your academic advisor.

7.3 Engineering Mechanics Educational Objectives

7.3.1 B.S. Engineering Mechanics Program Educational Objectives

Our primary objective is to educate an exceptional group of engineers who, after graduation, will be successful and on track to become leaders among their peers in the best graduate programs and/or in industry, government laboratories, academia, and other organizations.

7.3.2 B.S. Engineering Mechanics Student Outcomes

Students graduating from the B.S. in Engineering Mechanics will have demonstrated…

1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3) an ability to communicate effectively with a range of audiences
4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

7.4 *Engineering Mechanics Curriculum*

Students will earn at least 125 credits while completing the Bachelor of Science degree in Engineering Mechanics.

All students must follow a program approved by their academic advisor and in consultation with their faculty mentor.

First-Year Seminar (2-3 credits; S/U)

- See First-Year Seminar, Section 4

Basic Science (16 credits; grades below C- not accepted)

- A Physics course suite that covers mechanics:
  Recommended option: EN.530.123/124 Introduction to Mechanics I/II
  Another option: AS.171.101 or AS.171.107 General Physics I, and AS.173.111 General Physics Lab I
- AS.171.102 (or AS.171.108) General Physics II
  (AS.171.106 Electricity and Magnetism is also acceptable)
- AS.173.112 General Physics Lab II
  (required for all students, even with AP credit)
  (AS.173.116 Electricity and Magnetism Lab is also acceptable if AS.171.106 is taken)
- AS.030.101 Introductory Chemistry I
- Another basic science elective

Mathematics (23 credits minimum, 24 credits typically; grades below C- not accepted)

- AS.110.108 Calculus I
- AS.110.109 Calculus II
- Calculus III options – choose one
  - AS.110.202 Calculus III
  - AS.110.211 Honors Multivariable Calculus
- Linear Algebra/Differential Equations options – choose one
  - EN.553.291 Linear Algebra/Differential Equations
  - Both AS.110.201 Linear Algebra and AS.110.302 Differential Equations
  - Both AS.110.212 Honors Linear Algebra and AS.110.302 Differential Equations

    - Both EN.553.295 Linear Algebra for Data Science and AS.110.302 Differential Equations
- A course in Probability and Statistics at the .300-level or above (e.g. EN.553.311 Intermediate Probability and Statistics. AP Statistics is not accepted.)
- Another Mathematics Elective (if EN.553.291 Linear Algebra/Differential Equations is taken).

FA1, FA3, and FA4 Course Requirements (18 credits)

- See Foundational Abilities Requirements, Section 5

Required Engineering Courses (28 credits; grades below C- not accepted)

- EN.530.107/108 MechE Undergraduate Seminar I/II
- EN.530.111 Intro to MechE Design and CAD
- EN.500.113 Gateway Computing – Python
    - EN.500.113 Gateway Computing - Python is the strongly preferred computing option.
    - Some students might take EN.500.112 Gateway Computing - JAVA to work toward a Computer Science or Robotics minor. If EN.500.112 Gateway Computing: JAVA is taken, Engineering Mechanics majors are still expected to be proficient in Python for their mechanical engineering courses. EN.500.133 Bootcamp: Python is recommended to build this proficiency.
    - Section 2.9 of this manual describes alternate courses that can be taken if AP Computer Science credit is earned.
- EN.530.115/116 MechE Freshman Laboratory I/II
- EN.560.201 and EN.560.211 Statics and Mechanics of Materials and Lab
- EN.530.202 and EN.530.212 Dynamics and Lab
- EN.530.215 Mechanics Based Design or EN.530.405 Mechanics of Advanced Engineering Structures
- EN.530.216 Mechanics Based Design Lab
- EN.530.231 and EN.530.232 MechE Thermodynamics and Lab
- EN.530.327 and EN.530.329 Introduction to Fluid Mechanics and Lab

Engineering Science Electives (12 credits; grades below C- not accepted)

- One course at or above the 300-level in each of these disciplines:
  - solid mechanics
  - fluid mechanics
  - materials
  - dynamics

Technical Electives (minimum of 18 credits; grades below C- not accepted)

- Five (E), (Q), or (N) courses at or above the .300-level, chosen from any combination of courses in engineering, basic sciences, or mathematics chosen in consultation with the student's academic advisor are required, *plus…*
- *Either* one more (E), (Q), or (N) course at *or* above the .300-level, *or* one of these computing options:
  - EN.601.220 Intermediate Programming
  - EN.601.226 Data Structures

  NOTE: The EN.500.11x Gateway Computing and EN.500.13x Bootcamp computing courses **do not count** as a technical elective.

Capstone Design (8 credits)

- EN.530.403 and EN.530.404 MechE Senior Design Project I and II

7.5 Engineering Sciences Elective Courses

Dynamics courses may be chosen from courses such as:

- AS.110.421 Dynamical Systems
- EN.530.343 and EN.530.344 Design and Analysis of Dynamic Systems and Laboratory
- EN.530.420 Robot Sensors and Actuators
- EN.530.421 Mechatronics
- EN.530.424 / EN.530.624 Dynamics of Robots and Spacecraft
- EN.530.470 Space Vehicle Dynamics and Control

Fluid mechanics courses may be chosen from courses such as:

- EN.530.425 Mechanics of Flight
- EN.530.427 / EN.530.627 Intermediate Fluid Mechanics
- EN.530.432 Jet and Rocket Propulsion

- EN.530.443 / EN.530.643 Fundamentals, Design Principles, and Applications of Microfluidic Systems
- EN.530.483 / EN.530.683 Applied Computational Modeling in Aerodynamics and Heat Transfer
- EN.560.449 / EN.560.649 Energy Systems

Materials courses may be chosen from courses such as:

- EN.530.352 Materials Selection
- EN.530.418 / EN.530.619 Aerospace Structures
- EN.530.438 / EN.530.638 Aerospace Materials
- EN.530.455 / EN.530.655 Additive Manufacturing
- EN.530.605 Mechanics of Solids and Materials
- EN.530.606 Mechanics of Solids and Materials II
- EN.560.330 Foundation Design
- EN.560.730 Finite Element Methods
- EN.510.311 Structure of Materials
- EN.510.312 Thermodynamics of Materials
- EN.510.313 Mechanical Properties of Materials
- EN.510.314 Electronic Properties of Materials
- EN.510.315 Physical Chemistry of Materials

Solid mechanics courses may be chosen from courses such as:

- EN.530.405 Mechanics of Solids and Structures*
- EN.530.418 / EN.530.619 Aerospace Structures
- EN.530.430 Applied Finite Element Analysis
- EN.530.438 / EN.530.638 Aerospace Materials
- EN.530.448 Biosolid Mechanics
- EN.530.455 / EN.530.655 Additive Manufacturing
- EN.530.605 Mechanics of Solids and Materials
- EN.530.606 Mechanics of Solids and Materials II
- EN.560.330 Foundation Design

* If not used to satisfy the Required Engineering Courses.

7.6 *Sample Engineering Mechanics Programs*

Sample *Engineering Mechanics* Program for students beginning with Calculus I

This is one possible way to complete the program.

* - Students are encouraged to take AS.110.302 Differential Equations (4) and AS.110.201 Linear Algebra or EN.553.295 Linear Algebra for Data Science (4) instead of the combined EN.553.291 L.A./D.E. course (4).

FRESHMAN YEAR				
AS.110.108 Calculus I	4		AS.110.109 Calculus II	4
AS.030.101 Intro to Chemistry I	3		EN.500.113 Gateway Computing - Python	3
EN.530.107 MechE Undergrad Seminar I	0.5		EN.530.108 MechE Undergrad Seminar II	0.5
EN.530.111 Intro to MechE Design & CAD	2		EN.530.116 MechE Freshman Lab II	1
EN.530.115 MechE Freshman Lab I	1		EN.530.124 Intro to Mechanics II	2
EN.530.123 Intro to Mechanics I	3		EN.661.110 Professional Writing & Ethics	3
First-Year Seminar	3		EN.661.250 Oral Presentations	3
Total credits	**16.5**		**Total credits**	**16.5**
SOPHOMORE YEAR				
AS.110.202 Calculus III	4		EN.530.202/212 Dynamics / Lab	3+1
AS.171.102 General Physics II	4		EN.530.215/216 Mech Based Design / Lab	3+1
AS.173.112 General Physics Lab II	1		EN.553.291 L.A./D.E.*	4
EN.530.231/232 Thermodynamics / Lab	3+1		Basic Science Elective	3
EN.560.201/211 Statics / Lab	3+1			
Total credits	**17**		**Total credits**	**15**
JUNIOR YEAR				
EN.530.327/329 Intro. Fluid Mech / Lab	3+1		Engineering Science Elective	3
EN.553.311 Intermediate Prob & Stat	4		Engineering Science Elective	3
Technical Elective (1)	3		Technical Elective (3)	3
Technical Elective (2)	3		Technical Elective (4)	3
FA3 Elective	3		Mathematics Elective	4
Total credits	**17**		**Total credits**	**16**
SENIOR YEAR				
EN.530.403 MechE Sr. Design Project I	4		EN.530.404 MechE Sr. Design Project II	4
Engineering Science Elective	3		Technical Elective (6)	3
Engineering Science Elective	3		FA3 or FA4 Elective	3
Technical Elective (5)	3		FA3 or FA4 Elective	3
FA4 Elective	3			
Total credits	**16**		**Total credits**	**13**

Sample *Engineering Mechanics* Program for students with Calculus I AP credit

This is one possible way to complete the program.

FRESHMAN YEAR				
AS.110.109 Calculus II	4		AS.110.202 Calculus III	4
AS.030.101 Intro to Chemistry I	3		EN.500.113 Gateway Computing - Python	3
EN.530.107 MechE Undergrad Seminar I	0.5		EN.530.108 MechE Undergrad Seminar II	0.5
EN.530.111 Intro to MechE Design & CAD	2		EN.530.116 MechE Freshman Lab II	1
EN.530.115 MechE Freshman Lab I	1		EN.530.124 Intro to Mechanics II	2
EN.530.123 Intro to Mechanics I	3		EN.661.110 Professional Writing & Ethics	3
First-Year Seminar	3		EN.661.250 Oral Presentations	3
Total credits	**16.5**		**Total credits**	**16.5**
SOPHOMORE YEAR				
AS.110.201 Linear Algebra	4		AS.110.302 Differential Equations	4
AS.171.102 General Physics II	4		EN.530.202/212 Dynamics / Lab	3+1
AS.173.112 General Physics Lab II	1		EN.530.215/216 Mech Based Design / Lab	3+1
EN.530.231/232 Thermodynamics / Lab	3+1		Basic Science Elective	3
EN.560.201/211 Statics / Lab	3+1			
Total credits	**17**		**Total credits**	**15**
JUNIOR YEAR				
EN.530.327/329 Intro. Fluid Mech / Lab	3+1		Engineering Science Elective	3
EN.553.311 Intermediate Prob & Stat	4		Engineering Science Elective	3
Technical Elective (1)	3		Technical Elective (3)	3
Technical Elective (2)	3		Technical Elective (4)	3
FA3 Elective	3		FA4 Elective	3
Total credits	**17**		**Total credits**	**15**
SENIOR YEAR				
EN.530.403 MechE Sr. Design Project I	4		EN.530.404 MechE Sr. Design Project II	4
Engineering Science Elective	3		Technical Elective (6)	3
Engineering Science Elective	3		FA3 or FA4 Elective	3
Technical Elective (5)	3		FA3 or FA4 Elective	3
Total credits	**13**		**Total credits**	**13**

7.7 4-Year Course Planning – Help is Available

It is important to plan all four years of your coursework as early as possible, keeping in mind the frequency of courses offered so you can enroll in all courses required for your degree. Contact your academic advisor to arrange a planning meeting or Ms. Emily Hinton, the department's Lead Academic Advisor at ehinton8@jhu.edu.

8 SENIOR DESIGN

The Senior Design Project, a unique two-semester course, is the capstone of Johns Hopkins' Mechanical Engineering program. In the class, students, working in small teams, tackle specific design challenges presented by industry, government, and non-profit organizations. The sponsors provide each team with the funds for materials, access to world-class resources, and the technical contacts. Ultimately, each team conceptualizes a novel solution to their sponsor's problem and then designs, constructs, and tests a real-world prototype.

The course requires students to draw upon the four years of knowledge and experience they have gained in their engineering studies and put it to practical use. Students present progress reports throughout the year as they design, build, and test the devices they are developing. Combining engineering theory, budgeting, and time management with interactions with real clients, the senior design project is critical to students' preparation for the transition from school to the workplace.

Initial communication to Juniors about Senior Design preparations may occur as early as the early-Fall semester of the Junior year, but no later than early-Spring of that year.

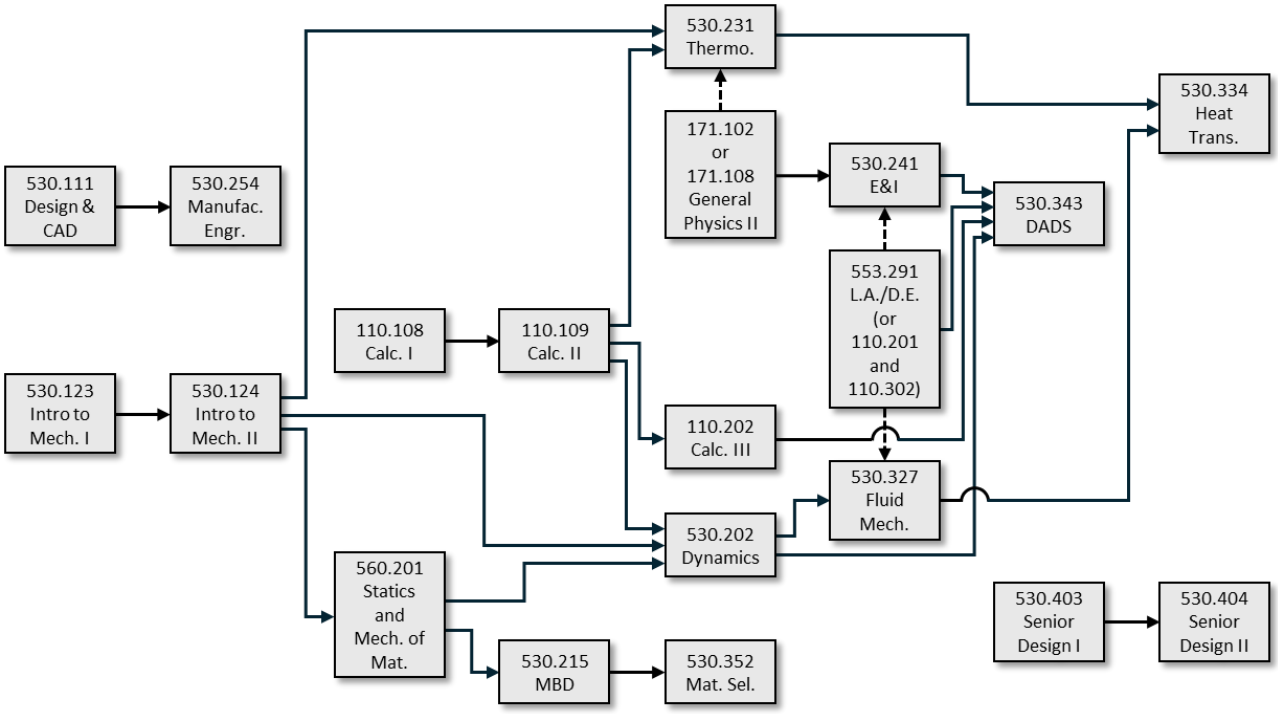
Visit our Senior Design page for more information.

9 CORE MECHE COURSES WITH PREREQUISITES

Several Mechanical Engineering and Engineering Mechanics core courses (and some MechE elective courses) have prerequisites.

Students may not take a MechE course until they have earned a C- or better in all the prerequisites for that course.

The figure below shows the prerequisites for the core Mechanical Engineering and Engineering Mechanics courses.



Prerequisite (Must be taken before): →

Prerequisite or Corequisite (May be taken before or at same time): ↑ ↓

Note: MechE lab courses must be taken at same time as corresponding lecture courses
(e.g. 530.232 MechE Thermodynamics Lab must be taken at same time as 530.231 MechE Thermodynamics)

10 AEROSPACE AND BIOMECHANICS TRACKS

The Mechanical Engineering Department offers two tracks, which may be completed through the completion of courses.

10.1 Aerospace Track

A student may specialize in aerospace engineering once a solid background in the fundamentals of Mechanical Engineering has been developed through the basic Mechanical Engineering courses. This track requires knowledge and background in several fields including advanced dynamics, flight mechanics, propulsion, aerospace materials and structures, signal processing, control systems, astrophysics and space systems.

Students pursuing the Aerospace Track are required to take **at least five** of the following courses.

- AS.171.321 Introduction to Space, Science, and Technology
- AS.270.318 Remote Sensing of the Environment
- AS.270.366 Spacecraft Instrumentation Project
- EN.530.418 or EN.530.619 Aerospace Structures
- EN.530.424 or EN.530.624 Dynamics of Robots and Spacecraft
- EN.530.425 Mechanics of Flight
- EN.530.427 or EN.530.627 Intermediate Fluid Mechanics
- EN.530.432 Jet & Rocket Propulsion
- EN.530.438 or EN.530.638 Aerospace Materials
- EN.530.465 Spacecrafts, Submarines, and Glaciers: Solid Mechanics in Extreme Environments
- EN.530.470 Space Vehicle Dynamics & Control
- EN.530.483 or EN.530.683 Applied Computational Modeling in Aerodynamics and Heat Transfer

For information on these courses and the frequency of course offerings, please consult the Registrar's course schedule.

10.2 Biomechanics Track

A student may specialize in biomechanics once a solid background in the fundamentals of Mechanical Engineering has been developed through the basic Mechanical Engineering courses.

Students pursuing the Biomechanics Track are required to take **at least five** courses.

Two of the five courses must be from the following:

- EN.510.426 Misfolding diseases and the thermodynamics of protein folding
- EN.530.410 Biomechanics of the Cell
- EN.530.429 Musculoskeletal Biomechanics
- EN.530.431 Biomechanics of Development
- EN.530.441 Introduction to Biophotonics
- EN.530.448 or EN.530.648 Biosolid Mechanics
- EN.530.468 or EN.530.668 Locomotion Mechanics: Fundamentals
- EN.530.469 or EN.530.669 Locomotion Mechanics: Recent Advances
- EN.530.493 Fabrication of Biomaterials, Engineered Tissues and Food
- EN.530.610 Quantitative Cell Mechanics
- EN.530.672 Biosensing & BioMEMS

Three additional courses must be from the following or from the list above:

- EN.520.495 Microfabrication Laboratory
- EN.530.409 Introduction to Mechanobiology
- EN.530.443 or EN.530.643 Fundamentals, Design Principles and Applications of Microfluidic Systems
- EN.530.474 or EN.530.674 Effective and Economic Design for Biomedical Instrumentation
- EN.530.480 Image Processing and Data Visualization
- EN.580.452 Cell and Tissue Engineering Lab
- EN.580.456 Neural and Rehabilitation Engineering

For information on these courses and the frequency of course offerings, please consult the Registrar's course schedule.

10.3 Letter Grades only for Courses Counting Toward a Track

Any course being counted toward a track, whether or not the course is necessary for the degree requirements, must be taken for a letter grade. S/U grades are not accepted for track courses.

10.4 Track Courses Counting toward Degrees

As long as an eligible course is taken in a student's first four years (or eight semesters) as an undergraduate student it will count toward a track. This includes any eligible course being counted for the B.S. degree, or double-counted for the

combined B.S. and M.S.E. degrees, or being counted exclusively for the M.S.E. degree.

Students who are earning only B.S. degrees but need a ninth or tenth semester to complete the degree can use eligible courses taken in those semesters to count toward a track.

Those earning their B.S. degrees at the end of the fourth year (or eighth semester) and return to earn the M.S.E. degree cannot take classes in the ninth semester and beyond to earn a track.

10.5 Recognition

Upon completion of the Aerospace or Biomechanics track, the department will, upon request, send a letter of congratulations of this achievement.

The Maryland Higher Education Commission prohibits the listing of track achievements on diplomas, transcripts, or in transcript notes. We are happy to provide a letter to another institution, potential employer, or other entity a letter describing the track and how a student achieved it. Contact the academic staff at me-academic@jhu.edu if you would like such a letter.

11 ENGINEERING FOR PROFESSIONALS – ANOTHER SOURCE FOR ELECTIVES

Many interesting and relevant online Mechanical Engineering and other engineering courses are available via our Engineering for Professionals program.

- Some Engineering for Professionals (EP) courses can be counted toward the elective sections of our bachelor's degrees. Up to two EP courses can count toward the master's degree.
- Visit the EP Courses page to find available courses. The page can be filtered to select Mechanical Engineering courses.
- Please discuss proposed Engineering for Professionals courses with your academic advisor to confirm that they would qualify for your degree.
- The course registration process is different from the standard registration in the Student Information System (SIS). For instructions to register, visit the Mechanical Engineering Undergraduate Academic Advising page > Course Registration Instructions…

12 STUDY ABROAD

The University offers opportunities to study abroad through the Global Education Office in Levering Hall through one-semester exchange and other study programs. Pre-approved programs are available for Mechanical Engineering students at various universities that fit our curriculum, typically in the first semester of the junior year. Other programs can be crafted for other universities and semesters, as long as students begin planning early.

13 GRADUATION AND COMMENCEMENT

We celebrate the accomplishment of your graduation in a number of ways.

13.1 Honors

There are three methods to recognize our department's outstanding students:

- Membership in Pi Tau Sigma
- Honors upon graduation
- Convocation awards

13.2 Pi Tau Sigma

Juniors and seniors who demonstrate high academic and service achievement can be inducted into the Tau Alpha Chapter of Pi Tau Sigma, the national honorary mechanical engineering fraternity. Members, who are inducted twice yearly, are invited to participate in service-oriented events that benefit the entire Mechanical Engineering community.

13.3 Departmental Honors and University Honors

Upon graduation, all students earning a cumulative grade point average of 3.50 or higher are granted Departmental Honors and University Honors. Honorees are recognized at Commencement as well as on their transcripts and permanent University records.

13.4 Convocation

The department recognizes outstanding students at the Whiting School's annual Convocation awards ceremony presented during the department's Commencement Luncheon.

- The **Charles A. Miller Award** recognizes outstanding academic achievement by an undergraduate in mechanical engineering.
- The **James F. Bell Award** recognizes outstanding research and scholarly achievement in mechanical engineering.
- The **Robert George Gerstmyer Award** recognizes outstanding undergraduate achievement in mechanical engineering.
- The **Creel Family Teaching Assistant Award** recognizes the best teaching assistants in Mechanical Engineering.
- The **William N. Sharpe, Jr. Award** for Student Involvement, named after Professor Emeritus William N. Sharpe, recognizes significant leadership or achievement in extracurricular activities.

- The **Mechanical Engineering Special Achievement** Award is given to students who have demonstrated outstanding leadership and achievement through their involvement in engineering clubs and societies.

14 SENIOR EXIT INTERVIEWS

A requirement for graduation is the Senior Exit Interview. Several weeks before commencement, seniors are required to complete an online Senior Exit survey and arrange an Exit Interview with the Department Head or designated faculty or staff.

15 THE FUNDAMENTALS OF ENGINEERING PROFESSIONAL EXAM

Consider taking the "Fundamentals of Engineering" (FE) Exam, which is available through the National Council of Examiners for Engineering and Surveying (NCEES). The computer-based exam is available year-round.

The benefits of professional licensure:

- Demonstrates that you've accomplished a recognized standard of professional excellence,
- Distinguishes you from others in your profession,
- Provides career options and opportunities that you might not otherwise have,
- Serves as a protection of public health, safety, and welfare by ensuring a specific level of expertise.

Students can take the exam during the final semester of their BS degree or any time after the degree completion.

The Department of Mechanical Engineering will cover the examination fees each year for at least five students. Please contact the academic staff at me-academic@jhu.edu for details.

16 THE COMBINED FIVE-YEAR BACHELOR'S / MASTER'S PROGRAM

The Mechanical Engineering department offers a combined five-year Bachelor's / Master's (BS/MSE) program for Mechanical Engineering and Engineering Mechanics majors.

16.1 Eligibility and Application Process

This program is available *only* to Mechanical Engineering or Engineering Mechanics majors at the Johns Hopkins University.

There are two application deadlines during the course of the year. Juniors can apply for the winter review period in January, and rising seniors can apply for the summer review period in June.

16.2 Whiting School 50% Tuition Fellowship

The Whiting School of Engineering will provide a 50% Dean's Tuition Fellowship for all full-time graduate semesters to all Johns Hopkins alumni who have completed eight semesters. Mechanical Engineering BS/MSE students will be eligible for this fellowship beginning their ninth semester.

A full-time graduate semester is defined as a semester during which a graduate student takes a minimum of 9 credits.

16.3 Master's Degree Requirements

The department requirements for an M.S.E. in Mechanical Engineering are described in Sections "A" and "B":

Section A: Completion of a set of advanced one-semester as approved by your graduate advisor.

1) **Six courses, each 3-credits or more** from any department other than the Center for Leadership Education.
2) **Additional courses totaling 6 credits** – which can include any of these options:
    - Two 3-credit courses from any department other than the Center for Leadership Education.
    - One 3-credit (or more) course from any department and up to 3 credits from the Center for Leadership Education (EN.660.xxx, EN.661.xxx, EN.662.xxx, and EN.663.xxx), either two 1.5-credit courses or one 3-credit course.
    - Six credits from the Center for Leadership Education, any combination of 1.5-credit or 3-credit courses.

In addition…

a) **At least four courses must be at the graduate level** (xxx.600 or higher, up to two Engineering for Professionals xx5.4xx or higher).

b) **No more than four courses may be at the advanced undergraduate level** (full-time programs xxx.400 – xxx.499, Engineering for Professionals xx5.3xx).

c) **EN.xx5.xxx – courses from the Engineering for Professionals (EP) program** – no more than two EP courses can count.

d) **At least two courses should be in applied mathematics, numerical analysis, or computational methods.** This requirement can be waived in writing by your graduate advisor, if sufficient prior preparation in these areas can be demonstrated.

e) **Ineligible Courses:** EN.530.800 Independent Study, EN.530.801 PhD Graduate Research, EN.530.820 MSE All-Course Graduate Research, EN.530.821 Master's Essay - Research and Writing, EN.530.822 Master's Essay – Co-Op, EN.530.823 MSE Graduate Research, EN.530.897 Graduate Research – Summer, and other departments' Graduate Research, Independent Study, and Special Studies are not eligible courses to complete Section A's requirement. See Section B below on how research courses may be able to count.

f) At least 4 courses if taking an "all-course option", or at least 3 courses if writing an essay – must be **Mechanical Engineering or related courses**:

- EN.530.4xx or higher - Mechanical Engineering
- Any of these courses:
  - EN.580.451/452 (Fall/Spring) – Cell and Tissue Engineering
  - Intro to Linear Systems – any one of EN.530.616, EN.520.601, or EN.580.616.
  - EN.560.469 / EN.560.669 Energy Systems
  - EN.560.772 Nonlinear Finite Element Methods
  - EN.560.773 Finite Element Methods
  - EN.520.495 Microfabrication Engineering
  - EN.520.773 Advanced Topics in Fabrication and Microengineering
- EN.535.xxx – courses from the Engineering for Professionals (EP) program, no more than two EP courses can count.

SECTION B: In addition to the eight courses above, students must also complete either two more courses or an essay:

COURSE OPTION

Two additional one-semester graduate-level courses (xx.xxx.6xx or higher, Engineering for Professionals EN.xx5.4xx or higher).

- One of these courses can be **EN.530.823 MSE Graduate Research.** Students must also have completed the appropriate Responsible Conduct of Research and Research Laboratory Safety courses.
- **Ineligible Courses:** EN.530.800 Independent Study, EN.530.801 Ph.D. Graduate Research, EN.530.821 Master's Essay Research and Writing, or EN.530.822 Master's - Co-Op, and other departments' Graduate Research, Independent Study, and Special Studies are not eligible courses to complete Section B's requirement.

ESSAY OPTION

An M.S.E. essay (the official title of master's theses at Johns Hopkins) acceptable to your graduate advisor and one other eligible reader.

There are two options to complete the essay:

- **Conduct Laboratory Research**
  - Work with world-renowned engineering professors by conducting original research to produce an essay worthy of publication.
  - Students must register for the course EN.530.823 MSE Graduate Research every semester that he or she works on master's essay research and writing. This is separate from the Ph.D. dissertation.
- **Work in a Cooperative Educational Environment (Co-Op)**
  - To broaden the practical training for master's students, the Institute for Nanobiotechnology (INBT) teams with companies to provide an immersive master's industry "co-op" experience in a professional working environment. Goals and objectives are developed for the student in conjunction with faculty and INBT academic advisors, which will be used to complete the master's essay.
  - Course Registration
    - All students must register for EN.530.822 Master's Essay – Co-Op and EN.910.600 (Fall and Spring) or EN.500.805 (Summer) Non-Resident Status every semester that he or she works in a co-op program to prepare to write a master's essay.

- International students completing the degree with an Essay - Co-Op option must also enroll for EN.500.851 Engineering Research Practicum and apply for Curricular Practical Training (CPT). Visit these sites for information: applying for CPT and extending the F-1 visa.

The courses can be taken in one semester of six credits or split into three-credit courses over two semesters. Students who subsequent semesters to continue their essay work can simply register for the same course each semester.

16.4 Master's Degree Timeline – All-Course or Essay-Research

Combined 5th Year Master's students can generally expect to complete degrees in this timeframe:

Junior/Senior Undergraduate Years

- Double-count two .400-level academic courses from the bachelor's degree.
- Take two courses that count for the master's degree but do not count for the bachelor's degree.

Fifth Year, Semester 1

- Complete required introductory courses: Academic Ethics, Title IX & Harassment Prevention, Responsible Conduct of Research, Effort Reporting-Certifier, and Opioid Awareness
- Take 3 academic courses
- If taking or planning to take a research course or writing an essay, register for and complete:
    - …required Lab Safety online modules and optional EN.500.601 Research Lab Safety course.
    - (All-course only) EN.530.823 MSE Graduate Research, 3 credits
    - (Essay-Research only) EN.530.823 MSE Graduate Research, 3 credits

Fifth Year, Semester 2

- All-Course: Take 3 academic courses and graduate.
- Essay:
    - Take 1 academic course
    - (Essay-Research only) EN.530.823 MSE Graduate Research, 3 credits
    - Continue essay research and begin writing the essay.

- Complete the essay, have readers approve, submit essay to the library, and then graduate. Note that some students writing an essay may need a third semester to complete the program.

If students do not take two courses outside the bachelor's degree in their undergraduate years, they may have to return for a third semester. It is not recommended to take more than three courses in a semester. Please talk to your graduate advisor first if you want to take more than three courses in one semester.

16.5 Master's Degree Timeline –Essay-Co-Op

Combined 5th Year Master's students can generally expect to complete degrees in this timeframe:

Junior/Senior Undergraduate Years

- Double-count two .400-level academic courses from the bachelor's degree.
- Take 2-3 courses that count for the master's degree but do not count for the bachelor's degree. See "Fifth Year, Semester 1" for important course planning information.

Fifth Year, Semester 1

- Complete required introductory courses: Academic Ethics, Title IX & Harassment Prevention, Responsible Conduct of Research, Effort Reporting-Certifier, and Opioid Awareness
- During the summer before the semester begins, review the information in the INBT Master's Co-Op website including all dropdown menus and FAQs.
- Early in the semester, meet with the INBT Master's Co-Op office for guidance on planning courses, seeking a Co-Op employer, and seeking an essay advisor within the Department of Mechanical Engineering.
- Take 3 academic courses if you completed 3 courses for the master's degree by the end of your senior year. If you complete 2 master's courses by the end of your senior year, take 4 academic courses. Note that while taking 4 academic courses is not recommended, it is possible with careful time planning. Please talk to your graduate advisor first if you want to take more than three courses in one semester in the fifth year.

Fifth Year, Semester 2

- EN.530.822 MSE Essay-Co-Op, 6 credits
- Go on Non-Resident status. All other courses must be completed before starting the Co-Op.

- Complete the co-op work experience and begin writing the essay.
- Complete the essay, have readers approve, submit essay to the library, and then graduate. Note that some students writing an essay may need a third semester to complete the program.

16.6 Bachelor's / Master's Course Double Counting

Students either in a bachelor's/master's program or seeking a master's degree in the Whiting School, after having earned a Whiting School or Krieger School of Arts and Sciences bachelor's degree may double-count two courses (.400-level or higher) to both programs with the permission of the master's faculty advisor.

Information is available on the Whiting School Academic Policies page, then select "Policy on Double-Counting Courses."

17 OTHER FIVE-YEAR MASTER'S PROGRAMS

Johns Hopkins offers many master's degree programs in addition to the M.S.E. program in Mechanical Engineering. Other popular 5th-year programs among mechanical engineering students are:

- Master of Science in Engineering in Robotics
- Master of Science in Engineering Computer Science
- Master of Science in Engineering Management

18 LIBRARIES

The Milton S. Eisenhower Library offers a variety of online, research, and book lending services.

We have a dedicated librarian who will help students with finding research information, library services, and other resources. The librarian also advocates and budgets for subscribed online resources. Mr. Stephen Stich is the librarian for the Department of Mechanical Engineering. He welcomes your inquiries at sstich@jhu.edu.

The Library also purchases books and journals based on departmental requests. Student requests for books and journals should be discussed with their academic advisor who may communicate the request to the faculty member designated as the Library Liaison, currently Professor Jaafar El-Awady, who is located at Latrobe 124, and can be contacted at jelawady@jhu.edu or 410-516-6683.

19 INTERNSHIPS, SCHOLARSHIPS, JOBS, AND CAREERS

The Johns Hopkins University and the Whiting School of Engineering offer resources to help you find internships during the summer months, assistance in the process of searching for jobs before and after graduation, and help in determining your career path and identifying opportunities. The department will forward opportunities it receives to students.

You are strongly encouraged to take advantage of these resources, as successful career and opportunity planning begins with you.

19.1 Internships, Research Positions, and Jobs

Information regarding research positions, internships, study abroad, career planning, scholarships, grants, and fellowships are linked to the "After You Graduate" page.

19.2 Scholarships

Information on scholarships is available on the "Scholarships and Fellowships" bar of the Mechanical Engineering "Academic Advising – Undergraduate" page.

19.3 Careers and Career Planning

The Life Design Lab at Homewood offers practical advice on determining a career path, resume preparation, interviewing, appropriate dress, and on-campus recruiting by companies.

You can set up a Handshake account to receive information on the latest career recruiting events and surf their site for the other services offered. The Life Design Lab also welcomes you to visit at available drop-in hours to discuss your questions and get help with your career planning decisions.

Also, visit the department's Careers and Life page for an undergraduate Career Guide and information on planning, networking, and job hunting.

20 MECHANICAL ENGINEERING UNDERGRADUATE STUDENT COUNCIL (MUSC)

MUSC is a student-run organization that focuses on improvements to the department as it applies to the undergraduate students. It is comprised of nine members: two students from each of the four class levels.

Projects include planning recreational activities for the department, suggesting improvements and additions to the curriculum, and requesting updates in department resources. Any student who has ideas for changes, updates, and

improvements is strongly encouraged to speak to the class representatives. Freshman appointments for class representatives are made in the Fall.

21 STUDENT GROUPS

There are many opportunities to participate in student groups, professional engineering clubs, team projects, and competitions. The Mechanical Engineering Departments supports several student groups, including:

- ASME, the American Society of Mechanical Engineers
- Blue Jay Racing
- Design, Build, Fly
- The AstroJays (rocketry)
- Hopkins Student Wind Energy Team
- Volunteers for Medical Engineering
- Hopkins Mars Rover Team
- Hopkins Themed Entertainment Team (amusement park rides)

Campus-wide student groups, clubs, athletics, and activities are available to everyone.

22 OFFICE OF STUDENT DISABILITY SERVICES

The Office of Student Disability Services (SDS) assists full-time undergraduate and graduate students in the Krieger School of Arts and Sciences and the Whiting School of Engineering with disability concerns, in compliance with the provisions of the Americans with Disabilities Act of 1990 (ADA) and Section 504 of the Rehabilitation Act of 1973.

SDS assists the University community in understanding the effects of disabilities and in eliminating the physical, technical, attitudinal and programmatic barriers that limit the range of opportunities for students with disabilities, as well as provides individuals with reasonable accommodations. The SDS maintains and protects the confidentiality of individual records as required by law.

For additional information and to access the services of the SDS office, view their website, call 410-516-4720, or e-mail studentdisabilityservices@jhu.edu. You may also visit their office in 385 Garland Hall.

23 LABORATORY SAFETY

Lab Safety is the responsibility of all who use, maintain, or visit the labs within Mechanical Engineering. Laboratory researchers are responsible for working with the principal investigator to become familiar with the appropriate hazard information and safety policies before performing any work.

Visit the Homewood Campus Laboratory Safety page for important information.

Principal Investigator (PI) is assigned for each lab. That person is responsible for the safe operation of the lab, training on all chemicals in the work area, the training of the persons on the equipment within the lab, and is a ready source to answer any questions on a specific lab about its operation and all safety aspects. The PI's for each lab are listed on the entrance door to each lab.

24 WSE MANUFACTURING

The WSE Manufacturing facilities and our self-service machine shop are located in the basement of the Wyman Park Building. The self-service machine shop is open to students, faculty, and staff across the Johns Hopkins University. Proper trainings on the use of the facilities and equipment are required before students may use these resources.

25 COMPUTING

Many computing resources are available to the Johns Hopkins community. The Information Technology page offers an overview of the IT Organization, its projects and services, support for applications and general questions, and news about emerging technologies and strategic imperatives, as well as e-mail, web, and file sharing services.

25.1 What Kind of Computer and Software is Needed

The Mechanical Engineering department recommends PCs over Macs. This is because many of the software programs used in our curriculum will only run on the Windows operating system. Mac users must create workarounds for some programs, usually partitioning their hard drives, which can create other problems.

Our alumni recommend these attributes for your computer:

- RAM: at least 16 GB and preferably 32 GB
- CPU: At least 4 cores and at least 3.5 GHz
- Hard drive: Solid-state hard drive (SSD) with at least 512 GB
- Video card: A dedicated graphics card (e.g. NVIDIA GTX) is better than an integrated card, especially for CAD work with at least 3 GB.
- Monitor: A 14-inch screen is fine, and a large second monitor for home use is ideal.
- Mouse: You must have a wireless mouse for CAD work.

The University offers a discount student rate for laptops and other hardware.

25.2 *JHU Information Technology*

Information Technology at Johns Hopkins is the online resource for IT-related information. Their primary focus is to support the missions of the Johns Hopkins Institutions and provide technology solutions for faculty, staff, patients, and students in support of teaching, research, and patient care.

This Web site serves as a repository for all IT-related information at Johns Hopkins. You will find a lot of useful information within this site, including an overview of the IT Organization, its projects and services, support for applications and general questions, and news about emerging technologies and strategic imperatives.

25.3 *WSE Information Technology*

WSE IT is tasked with supporting the IT needs of the Whiting School community.

25.4 *Software Downloads*

The university owns licenses for many software packages, many which may be downloaded. Please visit the Software Downloads page to learn more.

25.5 *Academic Computer Lab – Krieger Hall*

The Krieger Computer lab, which offers a wide variety of Mac and Windows operating systems loaded with all kinds of software: MATLAB, Mathematica, Microsoft Office, Adobe products and more are available in 160 Krieger Hall.

26 NOTICE OF NON-DISCRIMATORY POLICY

The Johns Hopkins University admits students of any race, color, sex, religion, national or ethnic origin, handicap or veteran status to all of the rights, privileges, programs, benefits, and activities generally accorded or made available to students at the University. It does not discriminate on the basis of race, color, sex, religion, sexual orientation, national or ethnic origin, handicap or veteran status in any program or activity, including the administration of its educational policies, admission policies, scholarship and loan programs, and athletic and other University-administered programs. Accordingly, the University does not take into consideration personal factors that are irrelevant to the program involved.

Questions regarding access to programs following Title VI, Title IX, and Section 504 should be referred to the Affirmative Action Officer, 205 Garland Hall, 410-516-8075.

27 FOR MORE INFORMATION…

Visit the Mechanical Engineering page or any of these pages:

- The people of Mechanical Engineering
- Academic Advising
- Info For Undergraduate Students – for most information that undergrad students seek.