JOHNS HOPKINS UNIVERSITY

DEPARTMENT OF
MATERIALS SCIENCE & ENGINEERING

UNDERGRADUATE ADVISING

MANUAL 2025-2026

For the class of 2029 and later

Contact Information:

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1 SECTION 1: INTRODUCTION

DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING

1.1 What is Materials Science and Engineering?

Materials are essential to the construction of any engineering structure, from the smallest integrated circuit to the largest bridge. In almost every technology, the performance, reliability, or cost is determined by the materials used. As a result, the drive to develop new materials and processes (or to improve existing ones) makes materials science and engineering one of the most important and dynamic engineering disciplines.

The central theme of materials science and engineering is that the relationships among the structure, properties, processing, and performance of materials are crucial to their function in engineering structures. Materials scientists seek to understand these fundamental relationships, and use this understanding to develop new ways for making materials or to synthesize new materials. Materials engineers design or select materials for particular applications and develop improved processing techniques. Since materials scientists and engineers must understand the properties of materials as well as their applications, the field is inherently interdisciplinary, drawing on aspects of almost every other engineering discipline as well as physics, chemistry, and, most recently, biology. Because the field encompasses so many different areas, it is often categorized according to types of materials (metals, ceramics, polymers, semiconductors) or to their applications (biomaterials, electronic materials, magnetic materials, or structural materials).

The department prepares students for successful careers in materials science and engineering, for advanced study in science or engineering, and professional education in other fields. The goal of the undergraduate program is to provide a rigorous and comprehensive curriculum in materials science and engineering as well as in mathematics, basic sciences, humanities, and social sciences. Our low student-to-faculty ratio allows students close contact with faculty in both classroom and research environments, as well as with other students and researchers in the department. As a student in the department, you are encouraged to proceed at your own rate, and to participate in interdisciplinary, interdepartmental, and interschool programs. In the tradition of Johns Hopkins, all of our undergraduate students are encouraged to participate in research, often beginning in their sophomore year, working closely with faculty and graduate students.

1.2 Concentrations

In recognition that biomaterials and nanotechnology represent two of the most rapidly developing areas of materials science and engineering, the Department of Materials Science and Engineering currently offers challenging concentrations in biomaterials or nanotechnology

within its undergraduate program. The successful completion of the biomaterials concentration and nanotechnology concentration will be formally noted on your transcript.

Whether you choose to pursue studies following the standard track, the biomaterials concentration, or the nanotechnology concentration, the coursework specified for the degree will provide a firm grounding in the principles of materials science and engineering. The materials science and engineering faculty strives to maintain the Johns Hopkins University tradition: to train a small number of students of highest quality, whose impact on the scientific and engineering community is large compared with the size of the department and the university. This institutional aspiration can only be realized with the success of our students as they pursue career directions beyond their time at Hopkins. Our degree program is designed to provide an optimum starting point for students with a diversity of career aspirations providing a solid foundation for future career development.

1.2.1 Standard track

The standard track is intended for students with general interests in materials science and engineering. It permits the student to tailor the degree program by allowing a broad range of choices for upper-level engineering electives. Students will learn about a breadth of topics in materials science and engineering and will be well prepared for a career that encompasses various topics within the field.

1.2.2 Biomaterials concentration

The field of biomaterials is concerned with the science and engineering of materials in biology and medicine. Engineered materials are increasingly used in applications such as drug delivery and gene therapy, scaffolds for tissue engineering, and replacement body parts as well as biomedical and surgical devices. The field of biomaterials is an inherently interdisciplinary field that requires deep understanding of the properties of materials in general and the interactions of materials with the biological environment.

The biomaterials concentration is designed to provide a firm grounding in the physics, chemistry, and biology of materials, as well as breadth in general engineering, mathematics, humanities, and social science. In addition, you are encouraged to gain hands-on experience in biomaterials research laboratories. The program seeks to educate you to reach the forefront of leadership in the field of biomaterials engineering. While the fundamental principles of materials science still apply, a complete understanding of biomaterials and their interactions with biological environments requires a greater degree of specialization than the standard undergraduate curriculum provides. In recognition of completion of the biomaterials concentration, you can elect to have your academic transcript annotated to indicate a specialty in biomaterials.

An intent to follow the biomaterials concentration in materials science and engineering must be made by your 5th semester (1st semester junior year). Yous should declare your intent by e-mailing your academic advisor and Lauren Rodgers.

1.2.3 Nanotechnology concentration

Nanotechnology advances the utilization of materials and devices with extremely small dimensions. Nanotechnology is a visionary field, as micro and nanostructured devices impact all fields of engineering, from microelectronics (smaller, faster computer chips) to mechanical engineering (micromotors and actuators) to civil engineering ("smart", self-healing nanocomposite materials for buildings and bridges) to biomedical engineering (biosensors and tissue engineering). Materials Science is central to nanotechnology because the properties of materials can change dramatically when things are made extremely small. This observation is not simply that we need to measure such properties or develop new processing tools to fabricate nanodevices. Rather, our vision is that the wide (and sometimes unexpected!) variety of phenomena associated with nanostructured materials allow us to envision radically new devices and applications that can only be made with nanostructured materials.

The nanotechnology concentration encompasses a curriculum designed to train you in the fundamental interdisciplinary principles of materials science including physics and chemistry, and to expose you to the forefront of nanotechnology research through elective classes as well as in research laboratories. Students in the nanotechnology concentration will be well-prepared for successful careers in materials engineering across a wide range of disciplines. In recognition of completion of the nanotechnology track, you can elect to have his or her academic transcript annotated to indicate a specialty in nanotechnology.

You must declare the intent to satisfy the requirements of the nanotechnology concentration in materials science and engineering by your 5th semester (1st semester junior year). You should declare your intent by e-mailing both your academic advisor and Lauren Rodgers.

1.3 Accreditation

1.3.1 Statement

The BS program in Materials Science and Engineering is accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org, under the General Criteria and the Program Criteria for Materials (1), Metallurgical (2), Ceramics (3) and Similarly Named Engineering Programs.

1.3.2 Program Educational Objectives

The program has as its objectives that, within 3 to 5 years of completing their studies, our graduates will:

- Be engaged in advanced education, research, and development to advance materials science and engineering; or in professional disciplines that benefit from an understanding of MSE.
- Employ elements of the materials research process in their careers including the use of:

    - critical reasoning to identify fundamental issues and establish directions for investigation
    - creative processes to define specific plans for problem solution
    - analytical thought to interpret results and place them within a broader context
    - application of materials science and engineering solutions to enhance or improve existing and future technology
- Conduct themselves to the highest standards of ethical professional practice, understanding the societal and global effects of their work, and using their knowledge and skills to improve the human condition.
- Maintain their curiosity and expand their knowledge and skills through lifelong learning.

1.3.3 Student Outcomes

Students graduating with a B.S. in Materials Science and 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.

1.4 Annual Enrollment Data

Linked here is our enrollment data, which is updated every fall:
https://engineering.jhu.edu/materials/accreditation/

1.5 Research

1.5.1 Overview

Materials science and engineering is a discipline with a variety of research topics. You are welcome to engage with faculty and participate in a research project that interests you, To view what projects our faculty are currently working on, please visit this link:
https://engineering.jhu.edu/materials/research/

1.5.2 Undergraduate Research Opportunities

Our faculty welcomes undergraduate student participation in research, which can greatly enhance your educational experience beyond coursework. Opportunities are available for everyone, freshmen included, and are not limited to Homewood. Many of our students end up carrying out research at the medical campus. If you are interested in participating in research, please go to the Faculty webpage for a list of our faculty and their research interests. When you have identified the faculty whose research interest aligns with yours, you should reach out to them either by email or in-person.

ForagerOne assists undergraduate students in finding and contacting the right faculty mentors through a database of faculty profiles and a guided application process. You can also find specific open projects that faculty are recruiting for and apply directly to join them.

Many of our students apply for the Provosts Undergraduate Research Awards (PURA), a prestigious 1-year grant with an application deadline of Sept 1st each year.

You can find examples of recent, published articles co-authored by our undergraduate students here: https://engineering.jhu.edu/materials/academics/undergraduate-program/undergraduate-research-publications/

1.6 Advising and Mentoring

DEPARTMENTAL AND UNIVERSITY ADVISING PROCEDURES

When entering the Department of Materials Science and Engineering you will be assigned a **mentor** who is a full-time faculty member in the Department, as well as a professional **academic advisor**. You will plan your program of study in consultation with your **academic advisors**. This program will be designed to meet the University and Departmental degree requirements as well as reflect your individual interests. An anticipated program of study signed by your **mentor** should be filed as early as possible during your residence, and as subsequent changes are made to the program, it is your responsibility to see that a revised and signed program is filed with your **mentor**. You must have an approved program on file no later than the semester before you expect to graduate.

Your assigned **academic advisor** is your primary resource for information regarding your degree program in Materials Science and Engineering and will ensure that you have accurate information regarding degree program requirements. Your **mentor** can also assist you in course selections and program scheduling so that courses are completed in an appropriate sequence. You will meet with your **advisor** and **mentor** at least once a semester to plan your course selections for the next semester. After this meeting, your **advisor** will electronically remove your registration hold allowing you to register for courses online. A similar process is followed for the add-drop period at the beginning of each semester.

For situations that cannot be resolved using the online system, paper forms are available and your advisor's signature is required on all course registration and course change forms. The forms can then be submitted through Student Enrollment and Account Management (SEAM).

You should consult with your **mentor** when you are in the process of identifying educational opportunities outside the degree program such as internships and research experiences as well as study abroad programs. Your **advisor** can also serve as a resource for career planning information, especially as it applies to graduate studies in materials science and engineering or in related science and engineering fields. General information on career planning can be obtained from the Johns Hopkins Career Center. Students interested in pursuing advanced professional studies in medicine or in law are encouraged to contact the Office of Pre-Professional Advising early in their planning process so that entrance requirements for medical and law programs are fulfilled before the fourth year.

While pursuing your degree, you might decide to take selected courses at other universities, transfer the associated credits to Johns Hopkins and use these credits towards completion of your degree requirements. The Whiting School Office of Academic Affairs is available to guide you through this process and can provide you with the appropriate forms. This office also provides information on study abroad programs and can assist you in identifying scholarship opportunities associated with special programs that are available to Hopkins students. This office is responsible for monitoring student progress and will notify those students who are not making satisfactory progress towards their degree and will place them on academic probation if their term grade point average falls below 2.0. This office also provides guidance to students who need assistance in improving their academic performance by referring them to programs designed to refine student work habits. These programs are administered by the Undergraduate Academic Advising Office and are described in this office's website.

Faculty members in the Department of Materials Science and Engineering are committed to assisting in the development of our students and you should feel comfortable consulting informally with faculty members other than your mentor to obtain ideas and directions for your course choices and career development. If you are inclined to do so, you may formally request a change in faculty mentor by contacting the department chair in writing. Students interested in fulfilling the degree requirements in Materials Science and Engineering in addition to those of another department should consult with the advising coordinator of both departments to determine feasibility. **The Director of Undergraduate Studies for Materials Science and Engineering is Professor Orla Wilson, owilson@jhu.edu, Room 108, Maryland Hall.**

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1.7 Double Majors/Minors

1.7.1 Double Majors

If your primary major is in another department (either in Engineering or Arts & Sciences), you may elect to fulfill the requirements for a major in Materials Science and Engineering as well. Upon graduation, a notation is placed on your academic record acknowledging completion of the requirements for the major in MSE. You will receive the degree (BS or BA) associated with your primary major. Completing a second major does not entitle you to a second degree.

To add or drop a second major, complete the appropriate form (available from the Registrar's office). This form must be signed by the director of the undergraduate program in MSE before it is submitted to the Registrar.

Students double-majoring in MSE are required to fulfill all of the requirements for the MSE Degree, including successful completion of the year-long senior design project. This includes the minimum grade requirement of earning a letter grade of C or higher for the MSE core courses.

In certain cases, a student may petition the Undergraduate Committee for an exception to the requirements. The Undergraduate Committee considers each such request on a case- by-case

basis, and a student should not necessarily expect that his or her request will be granted if it represents a significant deviation from the prescribed program. You are encouraged to plan your academic coursework carefully and consult with your academic advisors early to avoid difficulties in completing the degree requirements.

Professor Todd Hufnagel (hufnagel@jhu.edu*)* will provide support for all students from other departments pursuing double majors in MSE. If you have any questions about double majoring, please contact him. (Questions regarding your primary major should be addressed to your academic advisor in the corresponding department.) If you do decide to pursue a double major in Materials Science & Engineering, please make an appointment to meet with Professor Hufnagel as early as possible to plan your program of study.

1.7.2 Majors/Minors

If you wish to pursue a minor in another department, you should confer with the department/center through which the minor is offered to ascertain the exact requirements. Available minors appear on the Arts and Sciences and Engineering pages.

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

1.8 Where are our graduates?

Students graduating from the Department of Materials Science and Engineering are prepared for a variety of professional career paths or for further education. Some of our recent graduates are now part of:

Blue Origin	Pacmet Aerospace	Rock Springs Capital
Puttnam Associates	ATI Specialty Alloys	Solvus Global
Schneider	Los Alamos	Amgen
DNA Script	Epic	Pfizer
Abbott	General Motors	US PTO
Oliver Wyman	The New Norm	Deloitte
DEKA	Wiley Rein Patent Law	General Electric
Accenture	Army Research Lab	Applied Physics Lab
Bloom		

Others are pursuing or have recently completed advanced degrees at the following colleges, universities, and institutes:

Northwestern University	North Carolina State	Johns Hopkins University
The University of California, Los Angeles	University of California at Berkeley	Massachusetts Institute of Technology (MIT)
Harvard University	The University of Pennsylvania	The Ohio State University
Rice University	Virginia Tech	Princeton University

Max Planck Institute	Columbia University	Dartmouth College
The University of Notre Dame	University of California at San Francisco School of Dentistry	University of Maryland School of Dentistry
University of Nebraska School of Dentistry	Tufts University School of Medicine	Cooper Medical School of Rowan University
Northwestern School of Medicine	University of California at San Francisco School of Medicine	The University of Washington School of Medicine
American University School of Law	University of Maryland School of Law	

1.9 University Catalog

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

2 SECTION 2: GENERAL DEPARTMENTAL REGULATIONS

2.1 Course Grading

Students majoring in MSE will take their required First-Year Seminar course as Satisfactory/Unsatisfactory. The only other courses that can be taken S/U are Unrestricted Electives.

2.2 AP/IB/GCSE etc.

JHU grants credit for many AP IB and/or GCSE examinations, including chemistry, physics, calculus, economics, statistics, and languages. Visit the External Credits for Incoming Students page for more information.

2.3 Course taken in 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 towards the degree.

If you wish to retake a completed Hopkins course (to absolve a grade of C+ or lower), you must do so at Hopkins.

2.4 Course Waivers

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 sample program. 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. You must earn the prescribed number of credits for each portion of your degree and work with their advisors to select appropriate classes.

2.5 Credit minimums at Johns Hopkins

Students must be registered for a minimum of 12 credits per semester to be considered full-time. For more information about registration policies, see here: https://e-catalogue.jhu.edu/ksas-wse/undergraduate-policies/academic-policies/registration-policies/

2.6 Customized Academic Learning

Please see the Academic Advising website for the most up-to-date information about Customized Academic Learning (CAL): https://engineering.jhu.edu/ug-academic/advising/current-students/cal/

3 SECTION 3: MAJOR DEGREE REQUIREMENTS

Requirements for the BS in Materials Science and Engineering for students entering in Fall 2025 and beyond can be found below. If you entered in Fall 2021 through Spring 2025 you should see this alternate page for prior degree requirements. You should also consult the official Academic Catalog for your entering year for more explicit requirement details. Some of the math, basic science and computing requirements overlap with university-wide Foundational Abilities course requirements as noted by the (FA#) designation below.

General Degree Requirements for the B.S. Degree

- Materials Science and Engineering Core Courses, including Senior Design (30 credits)
    - 510.311: Structure of Materials
    - 510.312: Physical Chemistry of Materials I: Thermodynamics
    - 510.313 (FA5eP): Mechanical Properties of Materials
    - 510.314 (FA1.2eP): Electronic Properties of Materials
    - 510.315: Physical Chemistry of Materials II: Kinetics and Phase Transformations
    - 510.316: Foundations of Biomaterials
    - 510.428: Materials Science Laboratory I
    - 510.429 (FA6eP – Project 1): Materials Science Laboratory II
    - 510.433 or equivalent (FA1.1eP and, in combination with 510.434, FA6eP - Project 2): Senior Design Research,
    - 510.434 or equivalent (FA5eP, and, in combination with 510.433 FA6eP –Project 2): Senior Design/Research II
- Mathematics Courses (20 credits)
    - 110.108 (FA2): Calculus I
    - 110.109 (FA2): Calculus II
    - 110.202: Calculus III

    - 553.291: Linear Algebra and Differential Equations
    - 553.311 (FA2): Intermediate Probability and Statistics
- Upper-level Materials Science and Engineering Electives (15 credits)
- Basic Sciences and Engineering Courses (28 credits) One natural science lecture and its associated laboratory will apply to both the FA2 requirement and the MSE Basic Sciences requirement.
    - 030.101: Introductory Chemistry I
    - 030.102: Introductory Chemistry II
    - 030.105: Introductory Chemistry Laboratory I
    - 030.106: Introductory Chemistry Laboratory II
    - 030.205: Introductory Organic Chemistry I
    - 171.101: General Physics: Physical Science Major I
    - 171.102: General Physics: Physical Science Major II
    - 173.111: General Physics Laboratory I
    - 173.112: General Physics Laboratory I
    - 500.113 (FA2): Gateway Computing: Python
    - 660.463 (FA5): Engineering Management & Leadership
- First Year Seminar or Design Cornerstone, with a grade of S (2-3 credits)
- Foundational Abilities Courses (18 Credits)
    - [FA1.1] AS.004.101 Reintroduction to Writing or EN.661.110 Professional Writing and Ethics (3)
    - [FA1.2] EN.661.250 Oral Presentations (3)
    - [FA3] A course with EN Foundational Ability tag FA3 (3)
    - [FA4] A course with EN Foundational Ability tag FA4 (3)
    - [FA3/4] 6 more credits from courses with EN tag FA3 or FA4 (6)
- Foundational Abilities ePortfolio (5 artifacts, noted above)

University requirements are described in this section of the catalogue: https://e-catalogue.jhu.edu/ksas-wse/undergraduate-policies/academic-policies/requirements-bachelors-degree/

4 SECTION 4: MATERIALS SCIENCE AND ENGINEERING CURRICULUM

4.1 Materials Science Undergraduate Program Requirements

The Department of Materials Science and Engineering offers a program leading to the Bachelor of Science degree. The B.S. for the Materials Science and Engineering degree program is accredited by the Engineering Accreditation Commission of ABET, under the General Criteria and the Program Criteria for Materials (1), Metallurgical (2), Ceramics (3), and Similarly Named Engineering Programs. You must meet the general University requirements for this degree as well as the departmental requirements and must complete the program approved by your advisor.

4.2 Biomaterials concentration

The biomaterials concentration is intended for students with a focused interest in biomaterials. To receive commendation for completion of the biomaterials concentration, you must complete four electives, whose subject matter is some aspect of biomaterials, molecules and cells as a science & engineering elective, a biomaterials laboratory course, and complete a biomaterials-related senior design project. Approval of electives must be made by a student's professional academic advisor and mentor prior to taking the courses, **and your senior design project must be pre-approved by the senior design instructor prior to the fall of your senior year.**

An intent to follow the biomaterials concentration in materials science and engineering must be made by your 5th semester (1st semester junior year). Yous should declare your intent by e-mailing your academic advisor and Lauren Rodgers.

4.3 Nanotechnology concentration

The nanotechnology concentration is intended for students with a focused interest in nanomaterials. To receive commendation for completion of the nanotechnology concentration, you must complete four electives with a focus on nanotechnology, a nanomaterials laboratory course and a nanotechnology senior design project. Many electives are pre-approved as nanomaterials-focused. If you want to take a class that is not already approved, you will need your academic advisor to approve. **Your senior design project must be pre-approved by the senior design instructor prior to the fall of your senior year.**

You must declare their intent to satisfy the requirements of the nanotechnology concentration in materials science and engineering by your 5th semester (1st semester junior year). You should declare your intent by e-mailing both your academic advisor and Lauren Rodgers.

4.4 Course Check-Off List for The Undergraduate Degree – Updated Fall 2025

A convenient course check-off list is provided below. Please note the grade requirements associated with the course requirements.

MATERIALS SCIENCE CORE CLASSES

- Must be passed with letter grade of C or higher
- 30 credits

Course #	Course name	Grade	Credits
510.311	Structure of Materials		3
510.312	Phys. Chem. I: Thermodynamics		3
510.313	Mechanical Properties		3
510.314	Electronic Properties		3
510.315	Phys. Chem. II: Kinetics		3
510.316	Foundations of Biomaterials		3
510.428	Materials Science Lab I		3

510.429	Materials Science Lab II		3
510.433 or 438/440	Senior Design/Research I*		3
510.434 or 439/441	Senior Design/Research II*		3

**Senior design has requirements specific to the Biomaterials and Nanotechnology tracks*

UPPER-LEVEL MATERIALS SCIENCE ELECTIVES

- Letter grade of C or higher
- 300-level or higher
- relevant courses in other departments with prior permission
- 15 credits

Course #	Course name	Credits	Grade

- Customized Academic Learning can only count toward three (3) credits of this requirement.
- Biomaterials/ Nanotechnology Concentration requires 12 credits plus Lab focused on Bio/Nano. Customized Advanced Learning (CAL) can only count toward three (3) credits of the 12 credits required for Bio/Nano electives.

BASIC SCIENCES AND ENGINEERING

- Letter grade of C- or higher
- 28 credits

Course #	Course name	Grade	Credits
171.101	General Physics I or 171.107 General Physics for Physical Science Majors (AL)		4
171.102	General Physics II or 171.108 General Physics for Physical Science Majors (AL)		4
173.111	General Physics I Lab		1
173.112	General Physics II Lab		1
030.101	Intro Chem I		3

030.102	Intro Chem II		3
030.105	Intro Chem Lab I		1
030.106	Intro. Chem Lab II		1
030.205	Intro. Organic Chemistry I		4
500.113	Gateway Computing - Python		3
660.463	Engineering Management & Leadership		3
Total			28

MATHEMATICS

- Letter grade of C- or higher
- 20 credits

Course #	Course name	Grade	Credits
110.108	Calculus I		4
110.109	Calculus II		4
110.202	Calculus III		4
553.291	Linear Algebra & Differential Equations		4
553.311	Intermediate Probability and Statistics		4
Total			20

FOUNDATIONAL ABILITIES COURSES

- Intro to writing, oral communication, FA3 and FA4 are required.
- Letter grade of C- or higher required if taken for letter grade
- 18 credits; 3-credit courses only (WSE requirement)

Course #	Course Type	Course Name and Instructor	Grade	Credits
AS.004.101/ EN.661.110	Reintro to Writing OR Prof. Writing and Ethics			3
EN.661.250	Oral Presentations			3
	Course tagged with EN FA3			3
	Course tagged with EN FA4			3
	Course tagged with EN FA3 or EN FA4			3

	Course tagged with EN FA3 or EN FA4			3
Total				18

UNRESTRICTED ELECTIVES

- 9 credits of unrestricted electives
- Letter grade of C- or higher required if taken for letter grade

Course #	Course name	Grade	Credits
Total			9

- A student who has taken 510.106 Foundations of MSE may count it toward one unrestricted elective.
- For Biomaterials Concentration, one of these must be 580.221 Biochemistry and Molecular Engineering (4 credits). Students can substitute with Cell Bio + Biochem.

4.5 Sample Undergraduate Programs for Materials Science and Engineering

Materials Science and Engineering Degree – Standard Track (For a student beginning with Calculus I)

Freshman Fall		Credits	**Freshman Spring**		Credits
030.101	Intro to Chem I	3	030.102	Intro to Chem II	3
030.105	Intro to Chem I Lab	1	030.106	Intro to Chem Lab II	1
110.108	Calc I (FA2)	4	110.109	Calc II (FA2)	4
510.106	Foundations of Materials Sci & Engineering	3	171.101	General Physics I or 171.107 (AL)	4
XXXXXX	First Year Seminar OR Design Cornerstone	3	173.111	General Phys I Lab	1
XXXXXX	Unrestricted Elective	3	500.113	Gateway Computing - Python (FA2)	3
	Total	**16-17**		**Total**	**16**
Sophomore Fall		Credits	**Sophomore Spring**		Credits
510.311	Structure of Materials	3	510.312	Physical Chemistry of Materials I: Thermodynamics	3
030.205	Intro to Organic Chem	4	510.316	Foundations of Biomaterials	3
171.102	General Physics II	4	553.291	Linear Algebra & Differential Eqns	4
173.112	General Phys II Lab	1	661.250	Oral Presentations (FA1.2)	3
110.202	Calc III	4	XXXXXX	Course with EN Foundational Ability tag FA3	3
	Total	**16**		**Total**	**16**
Junior Fall		Credits	**Junior Spring**		Credits
510.313	Mechanical Properties of Materials (FA5eP)	3	510.314	Electronic Properties of Materials (FA1.2eP)	3
510.315	Physical Properties of Materials II: Kinetics & Phase Transformations	3	510.429	Materials Science Lab II (FA6eP - Project 1)	3
510.428	Materials Science Lab I	3	510.4##	Upper-level MSE Elective #1	3
553.311	Intermediate Prob & Stat (FA2)	4	XXXXXX	Course with EN Foundational Ability tag FA4	3
661.110 OR 004.101	Professional Writing and Ethics Reintro. To Writing (FA1.1)	3	XXXXXX	Course with EN Foundational Ability tag FA3/FA4	3
	Total	**16**		**Total**	**15**
Senior Fall		Credits	**Senior Spring**		Credits
510.433	Senior Design I* (FA1.1eP, FA6eP-Project 2)	3	510.434	Senior Design II** (FA5eP, FA6eP-Project 2)	3
510.4##	Upper-level MSE Elective #2	3	510.4##	Upper-level MSE Elective #4	3
510.4##	Upper-level MSE Elective #3	3	510.4##	Upper-level MSE Elective #5	3
660.463	Engineering Management & Leadership (FA5)	3	XXXXXX	Course with EN Foundational Ability tag FA3/FA4	3
XXXXXXX	Unrestricted Elective	3	XXXXXX	Unrestricted Elective	3
	Total	**15**		**Total**	**15**

* FA1.1eP, Must take both EN.510.440 and EN.510.441 to satisfy FA6eP - Project 2** FA5eP, Must take both EN.510.440 and EN.510.441 to satisfy FA6eP - Project 2

Materials Science and Engineering Degree – Biomaterials Concentration (For a student beginning with Calculus I)

Freshman Fall		Credits	**Freshman Spring**		Credits
030.101	Intro to Chem I	3	030.102	Intro to Chem II	3
030.105	Intro to Chem I Lab	1	030.106	Intro to Chem Lab II	1
110.108	Calc I (FA2)	4	110.109	Calc II (FA2)	4
510.106	Foundations of Materials Sci & Engineering	3	171.101	General Physics I or 171.107 (AL)	4
XXXXXX	First Year Seminar OR Design Cornerstone	3	173.111	General Phys I Lab	1
XXXXXX	Unrestricted Elective	3	500.113	Gateway Computing - Python (FA2)	3
	Total	**16-17**		**Total**	**16**
Sophomore Fall		Credits	**Sophomore Spring**		Credits
510.311	Structure of Materials	3	510.312	Physical Chemistry of Materials I: Thermodynamics	3
030.205	Intro to Organic Chem	4	510.316	Foundations of Biomaterials	3
171.102	General Physics II	4	553.291	Linear Algebra & Differential Eqns	4
173.112	General Phys II Lab	1	661.250	Oral Presentations (FA1.2)	3
110.202	Calc III	4	XXXXXX	Course with EN Foundational Ability tag FA3	3
	Total	**16**		**Total**	**16**
Junior Fall		Credits	**Junior Spring**		Credits
510.313	Mechanical Properties of Materials (FA5eP)	3	510.314	Electronic Properties of Materials (FA1.2eP)	3
510.315	Physical Properties of Materials II: Kinetics & Phase Transformations	3	510.429	Materials Science Lab II (FA6eP - Project 1)	3
510.428	Materials Science Lab I	3	510.4##	Upper-level MSE Elective #1	3
580.221	Biochemistry and Molecular Engineering	4	XXXXXX	Course with EN Foundational Ability tag FA4	3
661.110 OR 004.101	Professional Writing and Ethics Reintro. To Writing (FA1.1)	3	XXXXXX	Course with EN Foundational Ability tag FA3/FA4	3
	Total	**16**		**Total**	**15**
Senior Fall		Credits	**Senior Spring**		Credits
510.438	Biomaterials Senior Design I* (FA1.1eP, FA6eP-Project 2)	3	510.434	Biomaterials Senior Design II** (FA5eP, FA6eP-Project 2)	3
510.4##	Upper-level MSE Elective #2 (e.g. Biomolecular Materials)	3	510.430	Biomaterials Lab	3
510.4##	Upper-level MSE Elective #3 (e.g. Biomaterials Principles & Applications)	3	510.4##	Upper-level MSE Elective #5	3
660.463	Engineering Management & Leadership (FA5)	3	XXXXXX	Course with EN Foundational Ability tag FA3/FA4	3
553.311	Probability and Statistics (FA2)	3	XXXXXX	Unrestricted Elective	3
	Total	**15**		**Total**	**15**

* FA1.1eP, Must take both EN.510.440 and EN.510.441 to satisfy FA6eP - Project 2** FA5eP, Must take both EN.510.440 and EN.510.441 to satisfy FA6eP - Project 2

Materials Science and Engineering Degree – Nanomaterials Concentration (For a student beginning with Calculus I)

Freshman Fall		Credits	Freshman Spring		Credits
030.101	Intro to Chem I	3	030.102	Intro to Chem II	3
030.105	Intro to Chem I Lab	1	030.106	Intro to Chem Lab II	1
110.108	Calc I (FA2)	4	110.109	Calc II (FA2)	4
510.106	Foundations of Materials Sci & Engineering	3	171.101	General Physics I or 171.107 (AL)	4
XXXXXX	First Year Seminar OR Design Cornerstone	3	173.111	General Phys I Lab	1
XXXXXX	Unrestricted Elective	3	500.113	Gateway Computing - Python (FA2)	3
	Total	**16-17**		**Total**	**16**
Sophomore Fall		Credits	**Sophomore Spring**		Credits
510.311	Structure of Materials	3	510.312	Physical Chemistry of Materials I: Thermodynamics	3
030.205	Intro to Organic Chem	4	510.316	Foundations of Biomaterials	3
171.102	General Physics II	4	553.291	Linear Algebra & Differential Eqns	4
173.112	General Phys II Lab	1	661.250	Oral Presentations (FA1.2)	3
110.202	Calc III	4	XXXXXX	Course with EN Foundational Ability tag FA3	3
	Total	**16**		**Total**	**16**
Junior Fall		Credits	**Junior Spring**		Credits
510.313	Mechanical Properties of Materials (FA5eP)	3	510.314	Electronic Properties of Materials (FA1.2eP)	3
510.315	Physical Properties of Materials II: Kinetics & Phase Transformations	3	510.429	Materials Science Lab II (FA6eP - Project 1)	3
510.428	Materials Science Lab I	3	510.4##	Upper-level MSE Elective #1	3
553.311	Intermediate Prob & Stat (FA2)	4	XXXXXX	Course with EN Foundational Ability tag FA4	3
661.110 OR 004.101	Professional Writing and Ethics Reintro. To Writing (FA1.1)	3	XXXXXX	Course with EN Foundational Ability tag FA3/FA4	3
	Total	**16**		**Total**	**15**
Senior Fall		Credits	**Senior Spring**		Credits
510.433	Nanomaterials Senior Design I* (FA1.1eP, FA6eP-Project 2)	3	510.434	Nanomaterials Senior Design II** (FA5eP, FA6eP-Project 2)	3
510.442	Nanomaterials Lab (Upper Level MSE Elective #2)	3	510.4##	Upper-level MSE Elective #4	3
510.4##	Upper-level MSE Elective #3	3	510.4##	Upper-level MSE Elective #5	3
660.463	Engineering Management & Leadership (FA5)	3	XXXXXX	Course with EN Foundational Ability tag FA3/FA4	3
XXXXXXX	Unrestricted Elective	3	XXXXXX	Unrestricted Elective	3
	Total	**15**		**Total**	**15**

* FA1.1eP, Must take both EN.510.440 and EN.510.441 to satisfy FA6eP - Project 2** FA5eP, Must take both EN.510.440 and EN.510.441 to satisfy FA6eP - Project 2

4.6 Upper Level MSE Electives

4.6.1 Elective courses for Degree Concentrations

ELECTIVES FOR NANOTECHNOLOGY AND BIOMATERIALS CONCENTRATIONS

Course Offering Schedule (as of July 17, 2025)

Course Number	Course Title	Instructor	Semester Offered
Nanotechnology Concentration (select 4, to go with required 510.442)			
510.400	Introduction to Ceramics	McGuiggan	Spring 2027
510.420	Stealth Science and Engineering	Spicer	Fall 2027
510.422	Micro- and Nano- Structured Materials and Devices	TBD	Spring
510.452	Materials in Extreme Environments	Taheri	Spring 2027
510.443	Chemistry and Physics of Polymers	Katz	Fall 2026
510.442	Nanomaterials Lab	McGuiggan	Fall
510.453	Materials Characterization	McGuiggan	Fall
510.457	Materials Science of Thin Films	Weihs	Fall 2027
510.466	Introduction to Computational Materials Modelling	Oses	Fall
510.425	Advanced Batteries	Garcia-Mendez	Spring
520.495	Microfabrication Laboratory	Andreou	Fall
540.403	Colloids and Nanoparticles	Bevan	Spring
540.415	Interfacial Nano Systems	Liu	Fall
Biomaterials Concentration (select 4, to go with required 510.430)			
510.402	Dynamics of Soft Materials	McGuiggan	Spring 2026
510.407	Biomaterials Principles and Applications	Gu	Fall
510.426	Biomolecular Materials I: Soluble proteins and amphiphiles	Hristova	Fall
510.430	Biomaterials Laboratory	Lin	Spring
510.436	Biomaterials for Cell Engineering	Gu	Spring
510.443	Chemistry and Physics of Polymers	Katz	Fall 2026
530.436	Bioinspired Science and Technology	Kang	Fall

540.402	Metabolic Systems Biotechnology	Betenbaugh	Fall
540.403	Colloids and Nanoparticles	Bevan	Spring
540.428	Supramolecular Materials and Nanomedicine	Cui	Spring
540.465	Engineering Principles of Drug Delivery	Sofou	Fall
580.441	Cellular Engineering	Green	Fall
580.442	Tissue Engineering	Kathuria	Fall
580.444	Biomedical Applications of Glycoengineering	Yarema	Spring

This list is NOT meant to be exhaustive. Other courses on campus can be selected, as long as they focus on bio or nano (email Prof. Orla Wilson owilson@jhu.edu if you have candidates or questions).

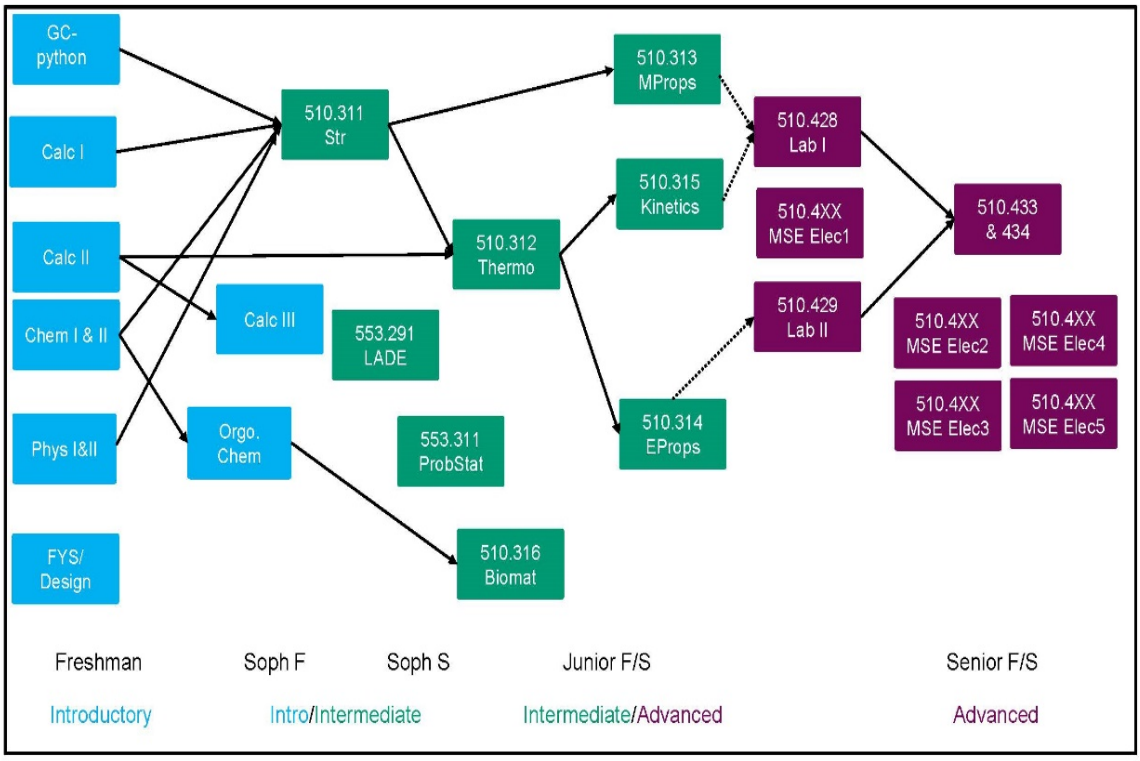
4.6.2 Frequency of Elective Offerings

Some electives are only taught every 2 years so you must consider this while course-planning. In the above tables, these courses are shown in red.

4.6.3 Engineering for Professionals – Another Source for Electives

Many interesting and relevant online Materials Science and Engineering and other engineering elective courses are available via our Engineering for Professionals program. You can visit the EP Courses page to find available courses at any time. You should discuss any EP courses you think might be appropriate with your academic advisor so that the course can be approved.

4.7 Materials Science and Engineering Course Dependency Map



5 SECTION 5: SENIOR DESIGN

Senior Design is a two-semester course sequence (Fall, then Spring) that must be completed by every student in the major. It is the capstone of the MSE undergraduate program and culminates in the annual WSE Design Day which occurs each May. You have the option to work on either a Design Team project or an individual project in a research group. Either way, the course requires you to draw upon the knowledge and experience you have gained in your studies thus far and apply it to a design problem in the field. You will present a proposal and progress reports throughout the year as you move through the design process. Many of our design teams work with clinicians at the medical school and all consist of seniors working alongside underclassmen. You can reach out to Orla Wilson for more information.

6 SECTION 6: THE COMBINED FIVE-YEAR BACHELORS/MASTERS PROGRAM

The Department of Materials Science and Engineering offers a Combined Bachelor's/Master's (CBM) program that allows highly motivated undergraduate students to earn both a Bachelor of Science (BS) and a Master of Science in Engineering (MSE) degree in a streamlined five-year

timeframe. This program is designed to provide an accelerated path for students seeking advanced knowledge and research experience in materials science. Students typically apply in their junior year and once admitted, begin integrating graduate-level coursework and research during their senior year. The CBM program is ideal for students interested in deepening their expertise, pursuing research-intensive careers, or preparing for doctoral studies.

To qualify, current JHU undergraduates must apply by the end of the first semester of their senior year, typically no later than their seventh semester, and must be enrolled in the graduate program by the start of their final undergraduate semester. For questions specific to the combined program, interested students should reach out to **Lauren Rodgers, Academic Program Administrator** in the Department of Materials Science & Engineering. General inquiries can also be directed to the department office at **DMSE@jhu.edu** or by calling (410) 516-8145.

If you are a master's student interested in gaining industry experience, the Institute for Nanobiotechnology (INBT) master's co-op program is a great way to earn your degree, get industry experience, and get paid. The program partners you with a company and allows you to have a six month credited and paid internship equal to a year of academic research. For information on how to apply, visit https://inbt.jhu.edu/masters or click here.

7 SECTION 7: STUDY ABROAD

Our students have enjoyed semester-long experiences worldwide (most recently at the University of New South Wales, Australia, and the National University of Singapore). Visit the Global Education office page for information.

8 SECTION 8: HOPKINS SEMESTER

This is an optional, semester-long, mentored, immersive experience, providing a high-level synthesis of concepts learned during students' first and second years of coursework. Design projects, artistic endeavors, research projects, commercial ventures, professional internships, and community-based projects all serve as possible means to achieve the learning goals intended.

9 SECTION 9: GRADUATION AND COMMENCEMENT

We celebrate your graduation from the program every May with a small departmental event as well as the University-wide ceremony.

At graduation, all students carrying a cumulative GPA of at least 3.50 will receive University Honors. For our Departmental Honors, a cumulative GPA of at least 3.80 is required. More information on university requirements can be found here: https://advising.jhu.edu/student-roadmap/seniors/honors/

The department recognizes outstanding senior students by presenting some annual awards, usually at the departmental graduation event. Here are the descriptions of these awards:

MATERIALS SCIENCE AND ENGINEERING ACHIEVEMENT AWARD

For outstanding academic achievement by a graduating senior in Materials Science and Engineering.

SENIOR DESIGN ENGINEERING AWARD

In recognition of outstanding contributions to the design and conduct of a team/individual research project in the Department of Materials Science and Engineering.

ROBERT B. POND SR. ACHIEVEMENT AWARD

Awarded to the graduating senior in the Department of Materials Science who best exemplifies Robert Pond's commitment to scholarly and humane values.

10 SECTION 10: INTERNSHIPS, SCHOLARSHIPS, AND CAREERS

Here is where our current students have earned internships:
https://docs.google.com/spreadsheets/d/1EbX6cWLBdoRY5Kh6o-31RPle4W3qoHgepKm0WxSKv-g/edit?gid=0#gid=0

11 SECTION 11: MATERIALS RESEARCH SOCIETY STUDENT CHAPTER

Here is where you can find information on the MRS Student Chapter:
https://engineering.jhu.edu/materials/academics/undergraduate-program/student-groups/

12 SECTION 12: LAB SAFETY

All students working in laboratories in the department are required to complete lab safety training. For information and instructions, visit this webpage:
https://engineering.jhu.edu/materials/lab-safety/

13 SECTION 13: ACADEMIC ETHICS

The strength of the university depends on the integrity of those who engage in its mission. Ethical behavior results in trust providing an atmosphere in which the open and free exchange of ideas can occur. Trust allows us to come together, helping each of us reach levels that we could never achieve alone. The absence of ethical and considerate behavior engenders mistrust among the members of the university community and erodes the quality discourse. It divides us and ultimately degrades what we know and who we are.

The Department of Materials Science and Engineering strives to uphold the ideals of academic integrity and seeks to create an atmosphere in which all members of the Department display the highest degree of ethical conduct. Creating this atmosphere is the responsibility of all members of the Department – students, faculty and staff – and can only be achieved with the consistent education of its members about the standards of academic honesty and ethical behavior.

Briefly, acts of academic dishonesty include cheating on exams, plagiarism, reuse of assignments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition. University approved procedures for addressing academic

ethics violations are published in the Undergraduate Academic Ethics Board Constitution . Students accused of academic dishonesty are encouraged to consult the Ethics Board Constitution as well as with the Dean of Student Life in Office of Homewood Student Affairs. More information on academic ethics at Johns Hopkins is available, a https://studentaffairs.jhu.edu/policies-guidelines/

Office of the Dean of Student Life

Voice: 410-516-8208

deanofstudents@jhu.edu

14 SECTION 14: RESOURCES

14.1 Technical Communication Lab

The Technical Communication Lab is available to all students to help with scientific writing, presentation practice, ESL (English as a Second Language) consultations, and more. To book an appointment, visit: https://engineering.jhu.edu/cle/technical-communication-lab/

14.2 Counseling Resources

Making the transition to the university can be difficult and the pressures of coursework, relationships and career decisions can be overwhelming. You are not alone. While your roommate, your friends or your advisor might be able to help you get through difficult times, there are problems that you might face that are best addressed by seeking out counselors who can best guide and advise you on how to handle them. There are trained professional counselors available in the Counseling Center (https://studentaffairs.jhu.edu/counselingcenter/) who can confidentially assist you in addressing your problems. Staffed by professional psychologists and consulting psychiatrists, the Counseling Center offers counseling services that are free and confidential, as prescribed by law. Typical concerns may include test anxiety and academic performance, relationship issues, family problems, career concerns, stress, general unhappiness, self-confidence, as well as many other concerns. There also exists a confidential peer-counseling program (A Place to Talk – APTT, http://pages.jh.edu/~aptt/about.html) staffed by undergraduate students who are familiar with the pressures of undergraduate life at Hopkins and can assist students with those common problems that all undergraduates face during their time here.

Johns Hopkins Mental Health Services –Homewood location

3003 N Charles St Homewood Apartments Suite S-200

Baltimore, MD 21218

https://studentaffairs.jhu.edu/counselingcenter/

https://studentaffairs.jhu.edu/counselingcenter/additional-resources/ Voice: 410-516-8278

APTT – A Place to Talk

Facebook: APLACETOTALKJHU

email: admin.aptt@gmail.com

14.3 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 Materials Science and Engineering. He welcomes your inquiries at sstich@jhu.edu.

15 SECTION 15: MORE INFORMATION

Resource	URL
Matsci Department Website	https://engineering.jhu.edu/materials/
Student Enrollment and Account Management (SEAM)	https://support.sis.jhu.edu/case-home
Whiting School of Engineering – Academic Policies and Procedures	https://e-catalogue.jhu.edu/engineering/full-time-residential-programs/undergraduate-policies/academic-policies/
Whiting School of Engineering – Office of Undergraduate Advising	https://engineering.jhu.edu/advising/
Office of Pre-Professional Advising	http://studentaffairs.jhu.edu/preprofadvising/
Learning Den Tutoring	https://academicsupport.jhu.edu/learning-den/
Life Design Lab	https://studentaffairs.jhu.edu/life-design/ https://jhu.joinhandshake.com/login
Homewood Student Affairs	https://studentaffairs.jhu.edu/
Student Health and Wellness Center	https://studentaffairs.jhu.edu/student-health
Global Education Office (Study Abroad)	https://studyabroad.jhu.edu/
ASEN Catalog	https://e-catalogue.jhu.edu/

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Department Head: Michael Kessler, mrk@jhu.edu | 206A Maryland Hall

WSE Office of Academic Advising: wseadvising@jhu.edu (410) 516-7395, Wyman Park Bldg

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