

MATERIALS SCIENCE AND ENGINEERING, MASTER OF SCIENCE

Students in this degree program may follow requirements for a concentration in Nanotechnology or may choose electives to focus their studies in areas such as Biotechnology or Nanomaterials. However, a concentration or a focus area is not required for the program. Students can fulfill degree requirements taking courses in the Materials Science and Engineering Program along with materials-related courses from other Engineering for Professionals programs.

Admission Requirements

Applicants must meet the general requirements for admission to graduate study, as outlined in the Admission Requirements (<https://e-catalogue.jhu.edu/engineering/engineering-professionals/admission-requirements/>) section. The applicant's prior education must include:

1. a foundational mathematics sequence (Calculus I, II, III) along with advanced mathematics courses (such as linear algebra, differential equations, probability and statistics, advanced engineering mathematics); and,
2. a calculus-based introductory physics and introductory chemistry course.

This program is best suited to applicants who have received undergraduate degrees in engineering or science-related fields. Applicants whose prior education does not include the prerequisites listed may still enroll under provisional status, followed by full admission status once they have completed the missing prerequisites. Missing prerequisites may be completed at Johns Hopkins University or another regionally accredited institution. Admitted students typically have earned a grade point average of at least 3.0 on a 4.0 scale (B or above) in the latter half of their undergraduate studies. Transcripts from all college studies must be submitted. Professional accomplishments may be included in the application by including a résumé along with letters of reference from the applicant's workplace, but this information is optional. When reviewing an application, the applicant's academic and professional background (if submitted) will be considered.

Program Requirements

A total of ten courses must be completed within five years. The curriculum consists of two core courses and eight electives in materials science and engineering or related fields (400-level or higher with at least five being at the 600- or 700-level). Students may count 400-level courses toward their degree if the course is not offered at the 600-level, and if the department offering the course considers it to be graduate-level, assuming the student has not taken an equivalent course previously. Materials-related elective courses from other programs may be counted towards degree requirements with advisor approval. Students interested in taking the Materials Science and Engineering project courses (EN.515.730 Materials Science and Engineering Project /EN.515.731 Materials Science and Engineering Project) or independent study (EN.515.800 Independent Study in Materials Science and Engineering/EN.515.801 Independent Study in Material Science and Engineering) should discuss their plans with their academic advisor and get prior approval from the program chair. Up to two courses can be from

the Engineering Management Program. Only one C-range grade (C+, C, or C-) can count toward the master's degree.

Courses

Code	Title	Credits
Core Courses		
EN.515.601	Structure and Properties of Materials	3
EN.515.602	Thermodynamics and Kinetics of Materials	3

Courses by Concentration

A total of ten courses must be completed within five years. The curriculum consists of four core courses and six electives in materials science and engineering or related fields (400-level or higher with at least three being at the 600- or 700-level). Materials-related elective courses from other programs may be counted towards degree requirements with advisor approval. Only one C-range grade (C+, C, or C-) can count toward the master's degree.

Concentrations are noted on the student's transcript.

NANOTECHNOLOGY

Code	Title	Credits
Core Courses		
EN.515.601	Structure and Properties of Materials	3
EN.515.602	Thermodynamics and Kinetics of Materials	3
EN.515.616	Introduction To Nanotechnology	3
EN.515.617	Nanomaterials	3

Courses by Focus Area

The focus areas offered represent related groups of courses that are relevant for students with interests in the selected areas. The focus areas are presented as an aid to students in planning their course schedules and are only applicable to students seeking a master's degree. They do not appear as official designations on a student's transcript or diploma.

NANOMATERIALS

Code	Title	Credits
Courses		
EN.515.611	Computational Molecular Dynamics	3
EN.515.620	Nanoparticles	3
EN.515.622	Micro and Nano Structured Materials & Devices	3
EN.515.628	Introduction to Solid State Chemistry	3
EN.515.654	Introduction to Micro- and Nano-fabrication	3
EN.525.606	Electronic Materials	3
EN.525.621	Introduction to Electronics and the Solid State	3
EN.530.445	Introduction to Biomechanics ¹	3
EN.530.603	Applied Optimal Control ¹	3
EN.540.403	Colloids and Nanoparticles ²	3
EN.540.415	Interfacial Science with Applications to Nanoscale Systems ²	3
EN.585.710	Biochemical Sensors	3
EN.615.641	Mathematical Methods for Physics and Engineering	3
EN.615.665	Modern Physics	3
EN.615.747	Sensors and Sensor Systems	3
EN.615.780	Optical Detectors & Applications	3

¹ EN.530.xxx courses are offered through the full-time Department of Mechanical Engineering.

² EN.540.xxx courses are offered through the full-time Department of Chemical & Biomolecular Engineering.

BIOTECHNOLOGY

Code	Title	Credits
Courses		Credits
EN.515.607	Introductory Biomaterials	3
EN.515.621	Biomolecular Materials I: Soluble Proteins & Amphiphiles	3
EN.515.661	Introduction to Polymer Science	3
EN.530.445	Introduction to Biomechanics ¹	3
EN.535.663	Biosolid Mechanics	3
EN.535.684	Modern Polymeric Materials	3
EN.540.428	Supramolecular Materials and Nanomedicine	3
EN.545.622	Introduction to Polymeric Materials	3
EN.545.662	Polymer Design and Bioconjugation	3
EN.580.442	Tissue Engineering ²	3
EN.580.641	Cellular Engineering ²	4
EN.585.601	Physiology for Applied Biomedical Engineering I	3
EN.585.602	Physiology for Applied Biomedical Engineering II	3
EN.585.613	Medical Sensors & Devices	3
EN.585.615	Mathematical Methods	3
EN.585.708	Biomaterials	3
EN.585.709	Biomechanics of Cells and Stem Cells	3
EN.585.710	Biochemical Sensors	3
EN.585.729	Cell and Tissue Engineering	3
EN.585.734	Biophotonics	3

¹ EN.530.xxx courses are offered through the full-time Department of Mechanical Engineering.

² EN.580.xxx courses are offered through the full-time Department of Biomedical Engineering.

Other Electives

Code	Title	Credits
Courses		Credits
EN.515.603	Materials Characterization	3
EN.515.605	Electrical, Optical and Magnetic Properties	3
EN.515.615	Physical Properties of Materials	3
EN.515.617	Nanomaterials	3
EN.515.628	Introduction to Solid State Chemistry	3
EN.515.634	Fundamentals of Metamaterials	3
EN.515.635	Mechanical Properties of Materials	3
EN.515.636	Chemical Synthesis and Processing of Advanced Materials	3
EN.515.640	Stealth Science and Engineering	3
EN.515.646	Artificial Intelligence Methods for Materials Science	3
EN.515.651	Manufacturing Materials and Processes	3
EN.515.655	Metal Additive Manufacturing	3
EN.515.658	Design for Additive Manufacturing	3

EN.515.661	Introduction to Polymer Science	3
EN.525.691	Fundamentals of Photonics	3
EN.535.606	Advanced Strength Of Materials	3
EN.535.635	Introduction to Mechatronics	3
EN.535.731	Engineering Materials: Properties and Selection	3
EN.615.611	Classical Physics	3
EN.615.680	Materials Science	3
EN.615.780	Optical Detectors & Applications	3

Project Courses and Independent Study Courses

These elective courses can be taken with Advisor approval.

Code	Title	Credits
Courses		Credits
EN.515.730	Materials Science and Engineering Project	3
EN.515.731	Materials Science and Engineering Project	3
EN.515.800	Independent Study in Materials Science and Engineering	3
EN.515.801	Independent Study in Material Science and Engineering	3

Please refer to the course schedule (<https://ep.jhu.edu/courses/>) published each term for exact dates, times, locations, fees, and instructors.