

# MECHANICAL ENGINEERING, MASTER OF MECHANICAL ENGINEERING

A focus area must be chosen for this program.

## Admission Requirements

Applicants must meet the general requirements for admission to graduate study, as outlined in the Admission Requirements (<http://e-catalog.jhu.edu/engineering/engineering-professionals/admission-requirements/>) section.

The applicant's prior education must include a bachelor's degree in Mechanical Engineering or a closely related technical discipline. Applicant's prior education should include the following prerequisites:

1. Three semesters of collage calculus (Calculus I, II and III)
2. Two semesters of collage physics (Physics I and II)
3. A course or practical knowledge of a proگرامing language (such as Python, Matlab, or C++)

Applicants whose prior education does not include the prerequisites listed above may still enroll under provisional status, followed by full admission status once they have completed the missing prerequisites. Missing prerequisites may be completed with Johns Hopkins Engineering (all prerequisites beyond calculus are available) or at another regionally accredited institution.

Enrolled students typically have earned a grade point average of at least 3.3 on a 4.0 scale (B+ or above) in their undergraduate studies, though this is not a requirement for admission, nor is it a guarantee. Transcripts from all college studies must be submitted. When reviewing an application, the candidate's academic and professional background will be considered in its totality, and decisions are made on a case-by-case basis. It is strongly advised that applicants submit a maximum of two page curriculum vitae listing their relevant professional background.

## Program Requirements

Ten courses must be completed within five years. Students are required to choose a focus area to follow. The curriculum consists of one core course in mathematics, two core courses for the focus area, three courses chosen among those listed for the student's focus area, and four other part-time or full-time courses. At least two of these four courses must be from a core engineering discipline, and at most two can be chosen from the Engineering Management and Systems Engineering areas. At least one computationally oriented course is strongly recommended as an elective. Only one C-range grade (C+, C, or C-) can count toward the master's degree. All course selections are subject to advisor approval.

### Courses

Code	Title	Credits
<b>Core Courses</b>		
EN.535.641	Mathematical Methods For Engineers <sup>1</sup>	3
<b>Recommended <sup>2</sup></b>		
EN.535.609	Topics in Data Analysis	3
EN.535.610	Computational Methods of Analysis	3

EN.535.742	Applied Machine Learning for Mechanical Engineers	3
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### Focus Areas

Select one of the following Focus Areas:

Biomechanical Engineering (p. 1)

Fluid Mechanics and Thermal Science (p. 1)

Advanced Manufacturing (p. 2)

Robotics, Dynamics, and Controls (p. 2)

Solids/Mechanics of Materials (p. 2)

- <sup>1</sup> This course must be taken in the first semester of the student's program, unless the advisor explicitly allows the student to do otherwise.
- <sup>2</sup> At least one of these computationally oriented courses is strongly recommended as part of the technical electives.

## Courses by Focus Area

Students are required to choose one of five focus areas: Biomechanical Engineering, Fluid Mechanics and Thermal Science, Advanced Manufacturing, Robotics, Dynamics, and Controls, and Solids/Mechanics of Materials. The focus area selected does not appear as an official designation on the student transcript. Each focus area has five required courses. Of these courses, at least two must be completed from Group 1. Post-master's certificate students are not limited to one focus area but can choose their courses among all the courses offered by the program.

### Biomechanical Engineering

Code	Title	Credits
Select five of the following of which two must be from Group 1:		
<b>Group 1</b>		
EN.535.661	Biofluid Mechanics	3
EN.535.663	Biosolid Mechanics	3
EN.535.664	Fundamental Principles for Bio-microfluidic Systems	3
EN.535.750	Biomechanics of the cell: From nano- and micro-mechanics to cell organization and function	3
<b>Group 2 <sup>3</sup></b>		
EN.585.631	Introduction to Biomechanics	3
EN.585.708	Biomaterials	3
EN.585.710	Biochemical Sensors	3
EN.585.720	Orthopedic Biomechanics	3
EN.525.786	Human Robotics Interaction	3

- <sup>3</sup> This list will be updated continuously as more course are developed.

### FLUID MECHANICS and Thermal Science

Code	Title	Credits
<b>Required Courses</b>		
Select five of the following of which two much be from Group 1:		
<b>Group 1</b>		
EN.535.621	Intermediate Fluid Dynamics	3
EN.535.633	Intermediate Heat Transfer	3
EN.535.634	Applied Heat Transfer	3
EN.535.735	Computational Fluid Dynamics	3
<b>Group 2</b>		
EN.535.614	Fundamentals Acoustics	3

EN.535.625	Turbulence	3
EN.535.652	Thermal Systems Design and Analysis	3
EN.535.661	Biofluid Mechanics	3
EN.535.662	Energy and Environment	3
EN.535.664	Fundamental Principles for Bio-microfluidic Systems	3
EN.535.670	Advanced Aerodynamics	3
EN.535.737	Multiscale Modeling and Simulation of Mechanical Systems	3

**advanced Manufacturing**

Code	Title	Credits
<b>Required Courses</b>		
Select five of the following of which two must be from Group 1:		
<i>Group 1</i>		
EN.535.628	Computer-Integrated Design and Manufacturing	3
EN.535.659	Manufacturing Systems Analysis	3
EN.535.660	Precision Mechanical Design	3
EN.535.673	Mechanized Assembly: Hardware and Algorithms	3
<i>Group 2</i>		
EN.535.623	Intermediate Vibrations	3
EN.535.627	Computer-Aided Design	3
EN.535.633	Intermediate Heat Transfer	3
EN.535.642	Control Systems for Mechanical Engineering Applications	3
EN.535.672	Advanced Manufacturing Systems	3
EN.535.684	Modern Polymeric Materials	3
EN.515.658	Design for Additive Manufacturing	3

**Robotics, Dynamics, and Controls**

Code	Title	Credits
<b>Required Courses</b>		
Select five of the following of which two must be from Group 1:		
<i>Group 1</i>		
EN.535.622	Robot Motion Planning	3
EN.535.630	Kinematics & Dynamics of Robots	3
EN.535.642	Control Systems for Mechanical Engineering Applications	3
EN.535.724	Dynamics of Robots and Spacecraft	3
<i>Group 2</i>		
EN.535.612	Intermediate Dynamics	3
EN.535.623	Intermediate Vibrations	3
EN.535.627	Computer-Aided Design	3
EN.535.628	Computer-Integrated Design and Manufacturing	3
EN.535.635	Introduction to Mechatronics	3
EN.535.645	Digital Control and Systems Applications	3
EN.535.659	Manufacturing Systems Analysis	3
EN.535.660	Precision Mechanical Design	3
EN.535.673	Mechanized Assembly: Hardware and Algorithms	3
EN.530.691	Haptic Interface Design for Human-Robot Interaction	3
EN.535.726	Robot Control	3

EN.535.741	Optimal Control and Reinforcement Learning	3
EN.535.782	Haptic Applications	3

**SOLIDS/MECHANICS OF MATERIALS**

Code	Title	Credits
<b>Required Courses</b>		
Select five of the following of which two must be from Group 1:		
<b>Group 1</b>		
EN.535.606	Advanced Strength Of Materials	3
EN.535.623	Intermediate Vibrations	3
EN.535.632	Applied Finite Elements	3
EN.535.731	Engineering Materials: Properties and Selection	3
<b>Group 2</b>		
EN.535.612	Intermediate Dynamics	3
EN.535.627	Computer-Aided Design	3
EN.535.643	Plasticity	3
EN.535.660	Precision Mechanical Design	3
EN.535.663	Biosolid Mechanics	3
EN.535.684	Modern Polymeric Materials	3
EN.535.711	Symmetries of Crystalline Solids	3
EN.535.732	Fatigue and Fracture of Materials	3
EN.535.748	Stress Waves, Impacts and Shockwaves	3
EN.515.658	Design for Additive Manufacturing	3

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