

**Montclair State University**  
**Department of Physics and Astronomy**  
**BS Physics, ME Mechanical Engineering 5-year Program**

<p><b>I. GenEd Requirement 23 sh</b></p> <p>A. New Student Seminar <i>GNED 199</i> 1</p> <p>C. Communication 9</p> <p style="padding-left: 20px;">C1. Writing</p> <p style="padding-left: 20px;">C2. Literature</p> <p style="padding-left: 20px;">C3. Communication</p> <p>Complete 3 sh from Categories D, F1, and F2: 3</p> <p>D. Fine and Performing Arts</p> <p>F. Humanities</p> <p style="padding-left: 20px;">F1. Great Works and Their Influences</p> <p style="padding-left: 20px;">F2. Philosophical and Religious Perspectives</p> <p>G. Computer Science <i>CSIT 104</i> (0)</p> <p>H. Mathematics <i>MATH 122 or AMAT 120</i> (0)</p> <p>I. Natural Science Laboratory <i>PHYS 191</i> (0)</p> <p>J. Physical Education 1</p> <p>K. Social Science 6</p> <p>Complete 6 credits from Categories K1, K2, K3 or II.B. (World Cultures)</p> <p style="padding-left: 20px;">K1. American and European History</p> <p style="padding-left: 20px;">K2. Global Cultural Perspectives</p> <p style="padding-left: 20px;">K3. Social Science Perspectives</p> <p>K. Interdisciplinary Studies 3</p> <p><b>II. World Languages and Cultures Requirement 3 sh</b></p> <p>A. World Languages 3</p> <p>B. World Cultures (0)</p> <p>(Some World Cultures courses may fulfill Gen Ed requirements.)</p> <p><b>III. Major Requirements 68-72 sh</b></p> <p><b>A. Physics Core (33 sh)</b></p> <p>PHYS 191 University Physics I 4</p> <p>PHYS 192 University Physics II 4</p> <p>PHYS 198 Introductory Physics Seminar 1</p> <p>PHYS 210 Intermediate Mechanics 3</p> <p>PHYS 220 Oscillations, Waves, &amp; Optics 3</p> <p>PHYS 230 Intermediate Physics Laboratory 4</p> <p>PHYS 300 Junior/Senior Physics Seminar 1</p> <p>PHYS 320 Statistical and Thermal Physics 3</p> <p>PHYS 330 Advanced Physics Laboratory 4</p> <p>PHYS 340 Electricity and Magnetism 3</p> <p>PHYS 360 Modern Physics 3</p> <p><b>B. Physics Electives (6-8 sh)</b></p> <p>PHYS 180 Astronomy for Everyone 4</p> <p>PHYS 245 Fundamentals of Electronics 4</p> <p>PHYS 280 Astronomy for Physicists 4</p> <p>PHYS 341 Electronics and Digital Circuits 4</p> <p>PHYS 350 Modern Optics 4</p> <p>PHYS 380 Observational Astronomy 4</p> <p>PHYS 399 Special Topics in Physics 1-4</p> <p>PHYS 451 Radiation and Medical Physics 3</p> <p>PHYS 461 Special &amp; General Relativity 3</p> <p>PHYS 462 Nuclear Physics 4</p> <p>PHYS 464 Quantum Mechanics 3</p>	<p>PHYS 470 Solid State Physics 3</p> <p>PHYS 480 Astrophysics 3</p> <p>PHYS 495 Research/Indep. Study in Physics 1-4</p> <p><b>C. Collateral Requirements (26-27 sh)</b></p> <p>CSIT 104 Computational Concepts 3</p> <p>CHEM 120 General Chemistry I 4</p> <p>CHEM 121 General Chemistry II 4</p> <p>MATH 122 Calc. I or AMAT 120 Applied Calc. A 4</p> <p>MATH 221 Calc. II or AMAT 220 Applied Calc. B 4</p> <p>MATH 222 Calculus III 4</p> <p>and choose one of the following options:</p> <p>AMAT 350 Applied Mathematics I 3</p> <p style="padding-left: 20px;">or PHYS 377 Mathematical Physics 3</p> <p style="padding-left: 20px;">or MATH 325 Differential Equations 4</p> <p><b>D. Program Electives (3-4 sh)</b></p> <p>Choose one physics, math, or applied math course from this list:</p> <p>PHYS 310 Advanced Mechanics 3</p> <p>PHYS 325 Computational Physics 3</p> <p>PHYS 368 Fluid Mechanics 3</p> <p>PHYS 377 Mathematical Physics 3</p> <p>AMAT 240 Introduction to Linear Algebra 3</p> <p>AMAT 356 Mathematical Modeling 3</p> <p>AMAT 360 Numerical Computing 3</p> <p>AMAT 450 Applied Mathematics II 3</p> <p>MATH 225 Linear Algebra 4</p> <p>MATH 421 Partial Differential Equations 3</p> <p>MATH 460 Intro. to Applied Mathematics 3</p> <p>MATH 463 Numerical Analysis 3</p> <p>MATH 464 Operations Research I 3</p> <p>MATH 469 Mathematical Modeling 3</p> <p>AMAT 530 Scientific and Numerical Computing I 3</p> <p>AMAT 534 Data-Driven Modeling and Computation 3</p> <p>AMAT 542 Methods of Applied Mathematics 3</p> <p>AMAT 544 Applied Differential Equations 3</p> <p><b>IV. Transfer credits from Stevens applied to MSU 15 sh</b></p> <p>(Undergraduate engineering courses to prepare for graduate coursework.)</p> <p><b>V. Free Electives 7 - 11 sh</b></p> <p><b>Minimum total required for graduation 120 sh</b></p> <p>Students apply to dual-degree program in 6th semester (Jan. 15th deadline). For admission to Stevens MS program, General Education and major courses must be completed by the end of the 6th semester, with an overall GPA of at least 3.2 and math/science GPA at least 3.0. Admission committee interview required. Enrollment at Stevens commences in year 4.</p> <p><b>Revised May 1, 2020</b></p>
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## **Stevens M.E. in Mechanical Engineering Requirements**

### **1. Complete these two required courses:**

ME 635 Modeling and Simulation  
ME 641 Engineering Analysis I

### **2. Complete 4 courses from any of these 7 concentrations:**

#### **Product Design**

ME 520 Analysis and Design of Composites  
ME 615 Thermal Systems Design  
ME 658 Advanced Mechanics of Solids  
ME 659 Advanced Structural Design  
ME 663 Finite Element Method  
ME 665 Advanced Product Development

#### **Manufacturing**

ME 565 Introduction to Additive Manufacturing  
ME 566 Design for Manufacturability  
ME 644 Computer Integrated Design & Manufacturing  
ME 645 Design of Production Systems  
ME 652 Advanced Additive Manufacturing  
ME 653 Design for Additive Manufacturing

#### **Thermal, Fluids, Energy**

ME 510 Power Plant Engineering  
ME 601 Engineering Thermodynamics  
ME 604 Advanced Heat Transfer  
ME 615 Thermal Systems Design  
ME 674 Fluid Dynamics  
ME 675 Computational Fluid Dynamics & Heat Transfer

#### **Pharmaceutical Manufacturing**

ME 530 Introduction to Pharmaceutical Manufacturing  
ME 535 Good Manufacturing Practice in Pharmaceutical Facilities Design  
ME 540 Validation and Regulatory Affairs in Pharmaceutical Manufacturing  
ME 628 Manufacturing and Packaging of Pharmaceutical Oral Solid Dosage Products  
ME 629 Manufacturing of Sterile Pharmaceuticals  
ME 647 Environmental Systems (HVAC) in Healthcare Manufacturing

#### **Medical Devices**

ME 525 Biomechanics  
ME 526 Biofluid Mechanics  
ME 580 Medical Device Design and Technology  
ME 658 Advanced Mechanics of Solids  
ME 660 Medical Devices Manufacturing  
ME 674 Fluid Dynamics

#### **Robotics & Control**

ME 598 Introduction to Robotics  
ME 621 Introduction to Modern Control Engineering  
ME 622 Optimal Control and Estimation of Dynamical Systems  
ME 631 Mechanical Vibrations I  
ME 651 Analytic Dynamics  
ME 654 Advanced Robotics

#### **Micro/Nano Systems**

ME 573 Introduction to MEMS  
ME 581 Introduction to BioMEMS  
ME 680 Fundamentals of Micro/Nano Fluidics  
ME 681 Applications of Advanced Micro/Nano Materials, Structures, and Devices  
NANO 525 Techniques of Surface and Nanostructure Characterization  
NANO 600 Nanoscale Science and Technology

### **3. Choose 4 elective courses.**

A maximum of 2 may be non-ME courses. Of the 2 non-ME courses, a maximum of one may be a non-SES course (i.e. any Stevens graduate course). A student may substitute a Project (ME 800 Special Problems in Mechanical Engineering, 3 credits) or a Master's Thesis (ME 900 Thesis in Mechanical Engineering, 6 credits) for the appropriate number of courses.

**Suggested Sequence for Five-Year Plan****First Year (MSU)**

<b>Fall</b>	<b>Total: 18cr</b>	<b>Spring</b>	<b>Total: 18cr</b>
I. PHYS 191 University Physics I (4) H. MATH122 Calc I or AMAT120 App Calc A(4)* G. CSIT 104 Computational Concepts (3) C1. Writing (3) A. New Student Seminar (1) D, F1, or F2 Gen. Ed. Course (3)		PHYS 192 University Physics II (4) PHYS 198 Introductory Physics Seminar (1) MATH 221 Calc II or AMAT 220 App Calc B (4) C2. Literature (3) C3. Communication (3) K1, K2, K3, or World Cultures Course (3)	

**Second Year (MSU)**

<b>Fall</b>	<b>Total: 18cr</b>	<b>Spring</b>	<b>Total: 16cr</b>
PHYS 220 Oscillations, Waves, & Optics (3)** PHYS 230 Intermediate Physics Lab (4) MATH 222 Calculus III (4) CHEM 120 General Chemistry I (4) L. Interdisciplinary Studies (3)		PHYS 360 Modern Physics (3)** AMAT 350 or PHYS 377 (3) [or MATH 325 (4)] CHEM 121 General Chemistry II (4) K1, K2, K3, or World Cultures Course (3) Free Elective (3)	

**Third Year (MSU)**

<b>Fall</b>	<b>Total: 18cr</b>	<b>Spring</b>	<b>Total: 17cr</b>
PHYS 210 Intermediate Mechanics (3)** PHYS 330 Advanced Physics Lab (4) PHYS 300 Junior/Senior Physics Seminar (1) Physics Elective (4) Free Elective (3) World Language I (3)		PHYS 340 Electricity and Magnetism (3)** PHYS 320 Statistical and Thermal Physics (3)** Program Electives (3) Physics Elective (4) Free Elective (3) J. Physical Education (1)	

**Fourth Year (Stevens)**

<b>Fall</b>	<b>Total: 15cr ("swing credits")</b>	<b>Spring</b>	<b>Total: 12cr</b>
ME 126 Mechanics of Solids (4) ME 322 Engineering Design VI (2) ME 345 Modeling and Simulation (3) ME 361 Design of Machine Components (3) ME 354 Heat Transfer (3)		ME 483 Control Systems (3) ME 491 Manufacturing Processes & Systems (3) ME 635 Modeling & Simulation (3); required ME 641 Engineering Analysis I (3); required	

**Fifth Year (Stevens)**

<b>Fall</b>	<b>Total: 12cr</b>	<b>Spring</b>	<b>Total: 12cr</b>
ME Concentration Course I (3) ME Concentration Course II (3) ME Elective Course I (3) ME Elective Course II (3)		ME Concentration Course III (3) ME Concentration Course IV (3) ME Elective Course III (3) ME Elective Course IV (3)	

Note: General Education, World Languages/Cultures, and free electives can be taken in any sequence, but C1 and C2 should be completed in Year 1.

\*Students who do not have a strong (4 year) background in high school mathematics, including exponential, logarithmic, and trigonometric functions are advised to take MATH 111 Applied Precalculus before Calculus I.

\*\* The PHYS 210, 320, 340 and PHYS 220, 360 sequences are offered in alternate years and can be taken in Year 2 or Year 3. Most 200-level and higher physics courses are offered on an alternate-year schedule.