## Materials Science and Engineering Curriculum

Updated 3 November 2020 – GE Core in Red, Major in Black

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Second Semester</th>
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<tbody>
<tr>
<td>160:159 Chemistry I for Engineers GE 3</td>
<td>160:160 Chemistry II for Engineers GE 3</td>
</tr>
<tr>
<td>160:171 Intro to Experimentation GE 1</td>
<td>640:152 Calculus II Math/Phys GE 4</td>
</tr>
<tr>
<td>355:101 Expository Writing GE 3</td>
<td>750:124 Analytical Physics IB GE 2</td>
</tr>
<tr>
<td>640:151 Calculus I Math/Phys GE 4</td>
<td>440:127 Intro Computers for Eng’g GE 3</td>
</tr>
<tr>
<td>750:123 Analytical Physics IA GE 2</td>
<td>440:221 Eng Mechanics:Statics GE 3</td>
</tr>
<tr>
<td>440:100 Engineering Orientation Lec GE 1</td>
<td>_<em><strong>:</strong></em> Hum/SocSci Elective GE 3</td>
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<tr>
<td>Credits 17</td>
<td>Credits 18</td>
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<tr>
<th>Third Semester</th>
<th>Fourth Semester</th>
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<tr>
<td>640:251 Multivariable Calculus GE 4</td>
<td>640:244 Engineering Economics GE 3</td>
</tr>
<tr>
<td>750:227 Analytical Physics IIA GE 3</td>
<td>635:204 Materials Processing M 3</td>
</tr>
<tr>
<td>750:229 Analytical Physics IIA Lab GE 1</td>
<td>635:206 Mat. Thermodynamics M 4</td>
</tr>
<tr>
<td>635:203 Intro to MSE M 3</td>
<td>635:252 Laboratory I M 2</td>
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<tr>
<td>635:205 Crystal Chem &amp; Struct M 3</td>
<td>_<em><strong>:</strong></em> Elective (Dept/Tech) M 3</td>
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<tr>
<td>Credits 17</td>
<td>Credits 16</td>
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<tr>
<th>Fifth Semester</th>
<th>Sixth Semester</th>
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<tr>
<td>635:305 Materials Microprocessing M 3</td>
<td>220:102 Microeconomics GE 3</td>
</tr>
<tr>
<td>635:307 Kinetics of Mat’l Processing M 3</td>
<td>635:314 Strength of Materials M 3</td>
</tr>
<tr>
<td>635:309 Characterization of Materials M 3</td>
<td>635:354 Laboratory III M 2</td>
</tr>
<tr>
<td>635:316 EOM Properties of Materials M 3</td>
<td>635:401 Senior MSE Lab I M 3</td>
</tr>
<tr>
<td>635:353 Laboratory II M 2</td>
<td>_<em><strong>:</strong></em> Elective (Dept/Tech) M 3</td>
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<tr>
<td>_<em><strong>:</strong></em> Elective (Dept/Tech) M 3</td>
<td>_<em><strong>:</strong></em> Elective (Dept/Tech) M 3</td>
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<tr>
<td>Credits 17</td>
<td>Credits 14</td>
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<tr>
<th>Seventh Semester</th>
<th>Eighth Semester</th>
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<tr>
<td>635:402 Senior MSE Lab II M 3</td>
<td>635:404 MSE Seminar M 1</td>
</tr>
<tr>
<td>_<em><strong>:</strong></em> Elective (Dept/Tech) M 3</td>
<td>_<em><strong>:</strong></em> Elective (Dept/Tech) M 3</td>
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<tr>
<td>635:412 MSE Eng Design I M 3</td>
<td>_<em><strong>:</strong></em> Elective (Dept/Tech) M 3</td>
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<tr>
<td>635:403 MSE Seminar M 1</td>
<td>_<em><strong>:</strong></em> Hum/SocSci Elective GE 3</td>
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<tr>
<td>_<em><strong>:</strong></em> Elective (Dept/Tech) M 3</td>
<td>_<em><strong>:</strong></em> General Elective GE 3</td>
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<tr>
<td>_<em><strong>:</strong></em> Elective (Dept/Tech) M 3</td>
<td>_<em><strong>:</strong></em> Elective (Dept/Tech) M 3</td>
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<td>_<em><strong>:</strong></em> Elective (Dept/Tech) M 3</td>
<td>_<em><strong>:</strong></em> Hum/SocSci Elective GE 3</td>
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<tr>
<td>Credits 16</td>
<td>Credits 13</td>
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**Total Credits at Graduation: 128**
Electives

Aside from the Humanities/Social Science electives, the Materials Science and Engineering (MSE) program contains eight elective slots (4 Department, 3 Technical, and 1 General) that can be used to tailor your degree. You can concentrate in specific areas of MSE, dual major, or prepare for specialized professional training after graduation. Talk to us about your interests and we will help you identify the best possibilities. Contact Prof. Akdoğan (eka@soe.rutgers.edu) for advice.

Department Electives (4)

Take a minimum of 2 Department Electives from this list...(you may take more)
- 635:312 Glass Engineering
- 635:360 Ceramics Engineering
- 635:361 Materials Science and Engineering of Polymers
- 635:362 Physical Metallurgy
...and select remaining Department Elective(s) from this list:
- 635:320 Introduction to Nanomaterials
- 635:321 Structural, Mechanical & Chemical Applications of Nanostructures & Nanomaterials
- 635:322 Photonic, Electronic & Magnetic Applications of Nanostructures & Nanomaterials
- 635:405 Solar Cell Design & Processing
- 635:410 Biological Applications of Nanostructures & Nanomaterials
- 635:413 Materials Science & Engineering: Venture Analysis
- 635:416 Physical & Chemical Properties of Glass
- 635:440 Electrochemical Materials and Devices
- 635:505 Advanced Optical Materials

Technical Electives (3)

Your three technical electives may be selected from the Department Electives list or from the list below. If you wish to take a course not on this list (e.g. graduate courses or courses in other fields), apply to Professor Akdoğan (eka@soe.rutgers.edu) in writing explaining your rationale.
- 01:119: Biological Sciences: only 119:100-103, 131, 140, and 148
- 01:146: Cell Biology & Neurosciences: all except 146:302
- 01:160: Chemistry: all 160:3xx and 4xx
- 01:198: Computer Sciences: all except 198:105, 107, 110 and 170
- 01:447: Genetics & Microbiology: all except 447:302
- 01:460: Geological Sciences: all except 460:206
- 01:694: Molecular Biology & Biochemistry: all
- 01:750: Physics: 750:228/230 and all 750:3xx and 4xx
- 01:960: Statistics: all
- 11:115: Biochemistry: all 115:3xx and 4xx
- 11:126: Biotechnology: all
- 11:127: Bio-resource Engineering: all
- 11:375: Environmental Sciences: all
- 11:400: Food Sciences: only 400:201, 304, 401, and 411
- 11:628: Marine Sciences: all
- 11:670: Meteorology: all
- 14:125: Biomedical Engineering: all 125:2xx and 3xx
- 14:155: Chemical & Biochemical Engineering: all
- 14:180: Civil & Environmental Engineering: all
- 14:332: Electrical & Computer Engineering: all except 301
- 14:440: Packaging
- 14:540: Industrial Engineering: 540:201/202 and all 540:3xx and 4xx
- 14:635: Materials Science and Engineering: all except 407
- 14:650: Mechanical & Aerospace Engineering: all except 650:351

Statistics

One of the following courses must be taken to satisfy the statistics requirement:

- 960:384 Intermediate Statistical Analysis
- 960:401 Basic Statistics for Research
- 960:490 Introduction to Experimental Design

Double Majoring

The MSE curriculum is quite flexible and permits double majoring in certain instances for students with AP credits or transfer credits.

Concentrations

The MSE Department presently has six areas of concentration in which you may specialize and receive a certificate upon graduation. These are highly relevant areas science and engineering that are favored by graduate schools and employers. See the following page. To receive a certificate in any one of these areas you must take at least three of the courses listed.

Questions on any aspect of the curriculum?
Check with the Undergraduate Director Professor E. K.Akdoğan
eka@soe.rutgers.edu
Room 114, McLaren Ceramics Building
(848) 445-4513
The 7 Optional MSE Concentrations

Enhance your MSE experience with a Concentration in one or more specific areas of interest described below. A certificate will be awarded at graduation based on completion of the requirements. You may earn multiple certificates.

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Acceptable Courses (Choose 3)</th>
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</table>
| **Biomaterials**       | • 01:119:101 General Biology I(3)**  
                          | • 01:119:102 General Biology II(3)  
                          | • 01:160:307 Organic Chemistry I (4)**  
                          | • 01:694:214 Introduction to Molecular Biology Research(3)  
                          | • 14:125:404 Introduction to Biomaterials (3)❖  
                          | • 14:635:410 Biological Applications of Nanomaterials(3)❖  
                          |
| **Electronic and Optical** | • 14:635:322 Photonic, Electronic and Magnetic Applications of Nanostructures and Nanomaterials (3)  
                          | • 14:635:405 Solar Cell Design and Processing (3)  
                          | • 14:635:413 Solar Technology Venture Analysis (3)  
                          | • 14:332:466 Opto-Electronic Devices (3)  
                          | • 14:635:505 Advanced Optical Materials (3)  
                          | • 12:750:305 Modern Optics (3)  
                          | • 12:750:406 Introductory Solid State Physics (3)  
                          |
| **Energy Conversion and Storage** | • 11:375:322 (F) Energy Technology and its Environmental Impact (3)  
                          | • 14:635:405 (F) Solar Cell Design and Processing (3)  
                          | • 14:332:402 (S) Sustainable Energy: Choosing Among Options (3)  
                          | • 14:635:440 (S) Electrochemical Devices (3)  
                          | • 14:332:361 (S) Electronic Devices (pre-requisite is Principles of Electrical Engineering 14:332:222) (3)  
                          | • 14:332:460 (S) Power Electronics (pre-requisite is Electronic Devices 14:332:361) (3)  
                          |
| **Metallurgy**          | • 14:635:206 Thermodynamics of Materials (3)  
                          | • 14:635:307 Kinetics of Materials Processing (3)  
                          | • 14:635:314 Strength of Materials (3)  
                          | • 14:635:363 Physical Metallurgy (3)  
                          |
| **Nanomaterials**       | • 14:635:320 Introduction to Nanomaterials (3)  
                          | • 14:635:410 Biological Applications of Nanomaterials (3)  
                          | • 16:635:604 Introduction to Nanoscience and Nanotechnology (3)  
                          | • 16:635:321 Structural, Mechanical, and Chemical Properties of Nanomaterials. (3)  
                          |

Note: One course from each of the two groups marked with ** and ❖ is required.

Electronic and Optical
Faculty coordinator: Professor Safari

Metallurgy
Faculty coordinators: Professors Akdoğan & Sills

Nanomaterials
Faculty coordinators: Professors O’Carroll & Klein
### Packaging Materials

**Faculty coordinators:**
Professors Lehman & Nosker

*Note: For this concentration, a student must take at least 2 of the 3 635 courses*

- 14:635:312 Glass Engineering
- 14:635:361 Polymer Engineering
- 14:635:362 Physical Metallurgy
- 14:440:301 Intro to Packaging 3
- 14:440:302 CAD in Packaging 3
- Other Packaging Engineering or Science Elective (TBD)

### Polymers

**Faculty coordinators:**
Professors Lehman & Wenzel

*Note: For this concentration 635:361 is required*

- 01:160:307 Organic Chemistry I (4)
- 14:635:361 Materials Science and Engineering of Polymers
- 16:155:551 Polymer Science and Engineering
- 14:440:301 Introduction to Packaging
- Polymer Engineering or Science Elective (TBD)

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**Questions on any aspect of the curriculum?**

Check with the Undergraduate Director Professor Akdoğan

[eka@soe.rutgers.edu](mailto:eka@soe.rutgers.edu)

Room 114, Malcolm McLaren Center for Ceramics Building

(848) 445-4513