

# Materials Science and Engineering Curriculum

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

## First Semester

160:159	Chemistry I for Engineers	GE	3
160:171	Intro to Experimentation	GE	1
355:101	Expository Writing	GE	3
640:151	Calculus I Math/Phys	GE	4
750:123	Analytical Physics IA	GE	2
440:100	Engineering Orientation Lec	GE	1
____:____	Hum/SocSci Elective	GE	3
<b>Credits</b>			<b>17</b>

## Second Semester

160:160	Chemistry II for Engineers	GE	3
640:152	Calculus II Math/Phys	GE	4
750:124	Analytical Physics IB	GE	2
440:127	Intro Computers for Eng'g	GE	3
440:221	Eng Mechanics:Statics	GE	3
____:____	Hum/SocSci Elective	GE	3
<b>Credits</b>			<b>18</b>

## Third Semester

640:251	Multivariable Calculus	GE	4
750:227	Analytical Physics IIA	GE	3
750:229	Analytical Physics IIA Lab	GE	1
960:xxx*	Statistics (*211, 384, 401, 490)	M	3
635:203	Intro to MSE	M	3
635:205	Crystal Chem & Struct	M	3
<b>Credits</b>			<b>17</b>

## Fourth Semester

640:244	Differential Equations	GE	4
635:204	Materials Processing	M	3
635:206	Mat. Thermodynamics	M	4
635:212	Physics of Materials	M	3
635:252	Laboratory I	M	2
<b>Credits</b>			<b>16</b>

## Fifth Semester

635:305	Materials Microprocessing	M	3
635:307	Kinetics of Mat'l Processing	M	3
635:309	Characterization of Materials	M	3
635:316	EOM Properties of Materials	M	3
635:353	Laboratory II	M	2
____:____	Elective (Dept/Tech)	M	3
<b>Credits</b>			<b>17</b>

## Sixth Semester

540:343	Engineering Economics	GE	3
635:314	Strength of Materials	M	3
635:354	Laboratory III	M	2
635:401	Senior MSE Lab I	M	3
OR (only one of 401/411 is required)			
635:411	MSE Eng Design I	M	3
____:____	Elective (Dept/Tech)	M	3
<b>Credits</b>			<b>14</b>

## Seventh Semester

635:402	Senior MSE Lab II	M	3
OR (only one of 402/412 is required)			
635:412	MSE Eng Design I	M	3
635:403	MSE Seminar	M	1
____:____	Elective (Dept/Tech)	M	3
____:____	Elective (Dept/Tech)	M	3
____:____	Elective (Dept/Tech)	M	3
____:____	Hum/SocSci Elective	GE	3
<b>Credits</b>			<b>16</b>

## Eighth Semester

635:404	MSE Seminar	M	1
____:____	Elective (Dept/Tech)	M	3
____:____	Elective (Dept/Tech)	M	3
____:____	Hum/SocSci Elective	GE	3
____:____	General Elective	GE	3
<b>Credits</b>			<b>13</b>

**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](mailto: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](mailto: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
- 01:640: Mathematics: 640:250 and all 640:3xx and 4xx except 640:336, 338, 339, and 436
- 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](mailto: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.

Concentration	Acceptable Courses (Choose 3)
<b>Biomaterials</b> Faculty coordinators: Professors Mann & Fabris.  Note: One course from each of the two groups marked with ** and ❖ is required.	<ul style="list-style-type: none"><li>• 01:119:101 General Biology I(3)**</li><li>• 01:119:102 General Biology II(3)</li><li>• 01:160:307 Organic Chemistry I (4)**</li><li>• 01:694:214 Introduction to Molecular Biology Research(3)</li><li>• 14:125:404 Introduction to Biomaterials (3)❖</li><li>• 14:635:410 Biological Applications of Nanomaterials(3) ❖</li></ul>
<b>Electronic and Optical</b> Faculty coordinator: Professor Safari	<ul style="list-style-type: none"><li>• 14:635:322 Photonic, Electronic and Magnetic Applications of Nanostructures and Nanomaterials (3)</li><li>• 14:635:405 Solar Cell Design and Processing (3)</li><li>• 14:635:413 Solar Technology Venture Analysis (3)</li><li>• 14:332:466 Opto-Electronic Devices (3)</li><li>• 14:635:505 Advanced Optical Materials (3)</li><li>• 12:750:305 Modern Optics (3)</li><li>• 12:750:406 Introductory Solid State Physics (3)</li></ul>
<b>Energy Conversion and Storage</b> Faculty coordinators: Professors Klein & Amatucci	<ul style="list-style-type: none"><li>• 11:375:322 (F) Energy Technology and its Environmental Impact (3)</li><li>• 14:635:405 (F) Solar Cell Design and Processing (3)</li><li>• 14:332:402 (S) Sustainable Energy: Choosing Among Options (3)</li><li>• 14:635:440 (S) Electrochemical Devices (3)</li><li>• 14:332:361 (S) Electronic Devices (pre-requisite is Principles of Electrical Engineering 14:332:222) (3)</li><li>• 14:332:460 (S) Power Electronics (pre-requisite is Electronic Devices 14:332:361) (3)</li></ul>
<b>Metallurgy</b> Faculty coordinators: Professors Akdoğan & Sills	<p><i>Note: For this concentration, a student must take all 4 of the listed courses</i></p> <ul style="list-style-type: none"><li>• 14:635:206 Thermodynamics of Materials (3)</li><li>• 14:635:307 Kinetics of Materials Processing (3)</li><li>• 14:635:314 Strength of Materials (3)</li><li>• 14:635:363 Physical Metallurgy (3)</li></ul>
<b>Nanomaterials</b> Faculty coordinators: Professors O'Carroll & Klein	<ul style="list-style-type: none"><li>• 14:635:320 Introduction to Nanomaterials (3)</li><li>• 14:635:410 Biological Applications of Nanomaterials (3)</li><li>• 16:635:604 Introduction to Nanoscience and Nanotechnology (3)</li><li>• 16:635:321 Structural, Mechanical, and Chemical Properties of Nanomaterials. (3)</li></ul>

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**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)

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**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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Check with the Undergraduate Director Professor Akdoğan  
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