The Minor in Nanoscale Science & Engineering

Nanotechnology deals with materials, structures and devices with dimensions that are in the 1- to 100-nm length scale. These entities have properties (physical, chemical and biological) that are very different from their bulk counterparts, and they can be tuned to obtained novel and desired functionalities. The goal of this minor is to enhance the student's background, knowledge and skills in the topical area of nanotechnology. The minor covers classes in several fields of science and engineering; it encompasses all of the departments in the McKelvey School of Engineering and several in Arts & Sciences. It is open to undergraduate students pursuing an engineering degree or a related Arts & Sciences major (e.g., chemistry, physics, biology, environmental studies, pre-med).

The minor in nanoscale science and engineering involves the following components. Starting with courses covering the fundamentals, students gain knowledge in synthesis and applications as well as characterization, structure and modeling. Two additional requirements are the cleanroom lab class (MEMS 5801 Micro-Electro-Mechanical Systems I) and the completion of a faculty-supervised independent study project over the course of at least two semesters. The mix of classes should provide the student with a significant background in nanotechnology, and it should promote independent thinking through the student's work on a research or educational project.

Units required: 18

Required courses: Select from the following menus:

Fundamentals (choose one course):

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biol 4810</td>
<td>General Biochemistry I</td>
<td>3</td>
</tr>
<tr>
<td>Chem 401</td>
<td>Physical Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>Chem 465</td>
<td>Solid-State and Materials Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>EECE 305</td>
<td>Materials Science</td>
<td>3</td>
</tr>
<tr>
<td>MEMS 3601</td>
<td>Materials Engineering</td>
<td>3</td>
</tr>
<tr>
<td>MEMS 3610</td>
<td>Materials Science</td>
<td>3</td>
</tr>
<tr>
<td>Physics 217</td>
<td>Introduction to Quantum Physics</td>
<td>3</td>
</tr>
<tr>
<td>Physics 352</td>
<td>Physics of Biomolecules</td>
<td>3</td>
</tr>
<tr>
<td>Physics 472</td>
<td>Solid State Physics</td>
<td>3</td>
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Synthesis & Applications (choose one course):

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<tr>
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<tbody>
<tr>
<td>EECE 504</td>
<td>Aerosol Science and Technology</td>
<td>3</td>
</tr>
<tr>
<td>EECE 534</td>
<td>Environmental Nanochemistry</td>
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Characterization, Structure and Modeling (choose one course):

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<tbody>
<tr>
<td>Chem 479</td>
<td>Computational Chemistry and Molecular Modeling</td>
<td>3</td>
</tr>
<tr>
<td>Chem 543</td>
<td>Physical Properties of Quantum Nanostructures</td>
<td>3</td>
</tr>
<tr>
<td>Chem 550</td>
<td>Mass Spectrometry</td>
<td>3</td>
</tr>
<tr>
<td>EECE 516</td>
<td>Measurement Techniques for Particle Characterization</td>
<td>3</td>
</tr>
<tr>
<td>MEMS 5602</td>
<td>Non-metallics</td>
<td>3</td>
</tr>
<tr>
<td>MEMS 5603</td>
<td>Materials Characterization Techniques I</td>
<td>3</td>
</tr>
<tr>
<td>MEMS 5604</td>
<td>Materials Characterization Techniques II</td>
<td>3</td>
</tr>
<tr>
<td>MEMS 5612</td>
<td>Atomistic Modeling of Materials</td>
<td>3</td>
</tr>
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Cleanroom Laboratory/Theory Class (required):

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</thead>
<tbody>
<tr>
<td>MEMS 5801</td>
<td>Micro-Electro-Mechanical Systems I</td>
<td>3</td>
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Independent Study Project (required):

Students should sign up for at least two semesters of independent study and work on a project related to nanotechnology under the supervision of a faculty member. A list of projects with potential faculty mentors will be circulated during the spring semester each year. Before completing the independent study project, students must be registered for the nanoscale science and engineering minor program, and they must have completed at least two of the classes from the above categories. Students can also come up with their own ideas for projects, but these require approval from the Nanoscale Science and Engineering Minor Committee and a faculty mentor.

The classes listed above will count for elective credit for all Engineering majors; however, students should check with their major advisers to confirm this.

Committee to Oversee Nanoscale Science and Engineering Minor

Rohan Mishra (https://mems.wustl.edu/faculty/Pages/default.aspx?bio=106) (MEMS, Coordinator), Pratim Biswas
Visit the EECE website (https://eece.wustl.edu/undergraduate/programs/Pages/minors.aspx) for more information.