SUSTAINABLE PRODUCT DESIGN AND INNOVATION (B.S.)

The Sustainable Product Design and Innovation major at Keene State College is a pre-professional four-year program offering a cross-disciplinary curriculum to give the student a solid foundation in the artistic, scientific, and technical aspects of product design and the social and scientific aspects of sustainability concerns. Product Design involves the synthesis of consumer needs and production capabilities in the creation of new products and their affiliated services. The integrated sustainability issues link the multitude of human factors, environmental, and resource depletion concerns to the decision-making process. The curriculum draws from five disciplines: art, management, mathematics, safety, and industrial/product design to build the student's capacity in design theory and practice, material sciences, production processes, digital technology, and the quantitative and qualitative issues of sustainability and business practices.

All SPDI Majors complete the SPDI major requirements totaling 68 credits. By choosing additional courses noted below, students may elect to further focus their studies by adding an option in General Engineering or in Manufacturing Engineering. These options are not required to complete the SPDI major. The Sustainable Product Design and Innovation major is designed to provide students with a hands-on project-based learning curriculum focusing on real-world applications grounded in a liberal arts foundation. The emphasis on innovation complemented with business management encourages creative problem-solving and entrepreneurship, providing students with the tools to adapt and evolve their career paths to meet the needs of a rapidly changing world. Integrated sustainability values prepare students for engagement in the product realization arena in the "lean" and "green" global production economy. Graduates are prepared to pursue graduate study or transition directly into careers in product design/engineering, technology/evaluation, planning, supply, production, quality control, technical services, marketing, sales, or other related professions.

Integrative Studies Requirements

40 credits minimum

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
<th>Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPDI Core Courses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPDI-110</td>
<td>Elect &amp; Electronic Fund</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IISPDI-151</td>
<td>Product Design Principles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPDI-180</td>
<td>Metal Procs &amp; Proto</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPDI-221</td>
<td>3-D CADD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPDI-302</td>
<td>Properties of Materials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPDI-304</td>
<td>Materials - a Life Cycle View</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPDI-351</td>
<td>Product Design II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management Core Courses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MGT-101</td>
<td>Introduction to Management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MGT-140</td>
<td>Quantitative Decision-Making</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MGT-215</td>
<td>Accounting for Decision Making</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Select one of the following:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MGT-331</td>
<td>Principles of Marketing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MGT/SPDI-446</td>
<td>Competitive Manufacturing Mgt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPDI-170</td>
<td>Intro Woodworking Tech</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSPI-183</td>
<td>Ultra-Precision Manufacturing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPDI-290</td>
<td>Special Topics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPDI-298</td>
<td>Independent Study</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPDI-321</td>
<td>Advanced 3D CADD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPDI-330</td>
<td>Metrology &amp; CMM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPDI-380</td>
<td>CAD/CAM/ CNC Using MasterCAM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSPI-385</td>
<td>Bio-Fabrication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPDI-410</td>
<td>Mechatronics and Automation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPDI-450</td>
<td>Product DfMA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPDI-456</td>
<td>Portfolio Design</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPDI-490</td>
<td>Advance Special Topics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPDI-495</td>
<td>Seminar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPDI-498</td>
<td>Independent Study</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required Allied Discipline Courses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IAART-103</td>
<td>3-D Design</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAFE-215</td>
<td>Human Factors in Safety</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Select at least one of the following:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH courses:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH-111</td>
<td>Applied College Algebra</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH-112</td>
<td>Precalculus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH-211</td>
<td>Calculus I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPDI Capstone Courses</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

40 credits minimum
SPDI-352  Product Design III  4  
SPDI-400  Manufacturing Enterprise  4  

Internships and/or Cooperative Education Experiences are recommended:

SPDI-294  Cooperative Education (counts toward elective credit)  
SPDI-494  Adv Cooperative Education (counts toward elective credit)  

Total Credits  66  

Options

The SPDI Major Pathway is cross-disciplinary and provides a strong foundation in the processes of New Product Design and Manufacturing while integrating Sustainability principles and decision-making methods. This Pathway allows for exploring other Minors and academic interests. While not required for the SPDI major, each student may choose one of the following other Pathways as Options. These Options are General Engineering and Manufacturing Engineering. Courses for the option that also fulfill requirements for the SPDI major are not counted twice for overall college credit. Please note that some courses within the options may require prerequisite courses.

SPDI: Manufacturing Engineering Option

This option prepares students for career growth and flexibility in many aspects of 21st century manufacturing. Students electing the Manufacturing Engineering option will build on their SPDI major’s knowledge and skills in design thinking, product design and development processes, materials and manufacturing methods, business management, and sustainability, with additional cross-disciplinary courses in Mathematics, Physics, Chemistry, Computer Science, and Statistics. Students also have the opportunity to gain further knowledge and skills that create key competitive advantages in today’s advanced manufacturing companies including LEAN manufacturing, advanced CAD, CAM, CNC programming, metrology, design for manufacturing and assembly, and mechatronics and automation. To fulfill the Manufacturing Engineering option students must take the following courses while fulfilling the requirements for the SPDI major. Failure to do so may impact time to graduation:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPDI-321</td>
<td>Advanced 3D CADD</td>
<td>4</td>
</tr>
<tr>
<td>SPDI-330</td>
<td>Metrology &amp; CMM</td>
<td>2</td>
</tr>
<tr>
<td>SPDI-380</td>
<td>CAD/CAM/ CNC Using MasterCAM</td>
<td>4</td>
</tr>
<tr>
<td>SPDI-410</td>
<td>Mechatronics and Automation</td>
<td>4</td>
</tr>
<tr>
<td>SPDI-450</td>
<td>Product DfMA</td>
<td>4</td>
</tr>
<tr>
<td>SPDI-456</td>
<td>Portfolio Design</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Allied Courses (16 Credits)</th>
</tr>
</thead>
<tbody>
<tr>
<td>INPHYS-141      College Physics I   4</td>
</tr>
<tr>
<td>or INPHYS-241   University Physics I</td>
</tr>
<tr>
<td>PHYS-142       College Physics II    4</td>
</tr>
<tr>
<td>or PHYS-242     University Physics II</td>
</tr>
<tr>
<td>ISCS-140       Programming Foundations I 4</td>
</tr>
<tr>
<td>or ISCS-210     Python Programming</td>
</tr>
<tr>
<td>INCHEM-111     General Chemistry     4</td>
</tr>
</tbody>
</table>

Select one of the following: 4  
- MATH-341  Applied Statistics  
- ISMGT-383  Applied Data Analysis & Vis  
- IIPHYS-342  Data Analysis for Scientists  

Total Credits  40  

SPDI: General Engineering

This option can help prepare the student for career growth and flexibility related to new product design and development, engineering and manufacturing and for further academic study upon graduation in Engineering and Physics. Students electing the General Engineering Option will build on their SPDI major’s knowledge and skills in design thinking, product design and development processes, materials and manufacturing methods, business management, and sustainability, with a strong cross-disciplinary foundation in Math and Physics and in other engineering related disciplines of chemistry, data analytics, and areas of interest. To fulfill this option students must take the following courses while fulfilling the requirements for the SPDI major. Failure to do so may impact time to graduation:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPDI General Engineering Courses (Minimum of 36 Credits)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPDI Core Courses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH-212  Calculus II</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>MATH-335  Linear Algebra</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Physics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INPHYS-241 University Physics I</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>PHYS-242  University Physics II</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Chemistry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INCHEM-111  General Chemistry</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>CHEM-112  Gen Chemistry II</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Allied Courses</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Select one of the following: 4  
- ISCS-210  Python Programming  
- IIPHYS-342  Data Analysis for Scientists  

Total Credits  40  

Students are encouraged to complete a minor or an organized cluster of courses related to their career interests.

**Electives**
Select additional courses of your choice to bring total number of credits earned to 120.

**Degree Requirements**
120 credits
40 credits at the upper-level

Upon completion of the Sustainable Product Design and Innovation B.S. degree, students will gain competency in:

- Creative problem-solving skills.
- Visual literacy – Form and space relationships.
- Design and communication skills.
- Manufacturing materials, processes and testing.
- Business literacy, Industrial planning and control functions.