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 66 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

Code	Title	Credits	Completed
Major Requirements (66 credits)			_____
SPDI Core Courses			_____
SPDI-110	Electricity & Electronic Fundamentals	4	_____
IISPDI-151	Product Design Principles	4	_____
SPDI-180	Metal Processes & Prototyping	4	_____
SPDI-221	Three Dimensional CADD	4	_____
SPDI-302	Properties of Materials	2	_____
SPDI-304	Materials - a Life Cycle View	4	_____
SPDI-351	Product Design II	4	_____
Management Core Courses			_____
MGT-101	Introduction to Management	4	_____
MGT-140	Quantitative Decision-Making	4	_____
MGT-215	Accounting for Sustainable Business	4	_____
Select **one** of the following:		4	_____
MGT-331	Principles of Marketing		_____
MGT/SPDI-446	Competitive Manufacturing Management		_____
SPDI/Management/Physics Electives			_____
Select **four credits** of the following:		4	_____
MGT-451	Business and Society		_____
INPHYS-131	Engineering Fundamentals		_____
SPDI-121	Design Visualization in PD & Engineer		_____
SPDI-170	Introduction to Woodworking Technology		_____
INSPDI-183	Ultra-Precision Manufacturing		_____
SPDI-290	Special Topics		_____
SPDI-298	Independent Study		_____
SPDI-321	Advanced 3D CADD		_____
SPDI-330	Metrology & CMM		_____
SPDI-380	CAD/CAM/ CNC Using MasterCAM		_____
INSPDI-385	Bio-Fabrication		_____
SPDI-410	Mechatronics and Automation		_____
SPDI-450	Product DfMA		_____
SPDI-456	Portfolio Design		_____
SPDI-490	Advance Special Topics		_____
SPDI-495	Seminar		_____
SPDI-498	Independent Study		_____
Required Allied Discipline Courses			_____
IAART-103	Three-Dimensional Design	4	_____
SAFE-215	Human Factors in Safety	4	_____

Select **at least one** of the following MATH courses:		4	_____
MATH-111	Applied College Algebra		_____
MATH-112	Precalculus		_____
MATH-211	Calculus I		_____
SPDI Capstone Courses			_____
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	Advanced Cooperative Education (counts toward elective credit)		_____
Total Credits		**66**	_____

Options

While not required for the SPDI major, each student may choose one of the following options. These options are **General Engineering** and **Manufacturing Engineering**. 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:

Code	Title	Credits	Completed
Major Requirements (106 credits)			_____
SPDI Core Courses			_____
SPDI-110	Electricity & Electronic Fundamentals	4	_____
IISPDI-151	Product Design Principles	4	_____
SPDI-180	Metal Processes & Prototyping	4	_____
SPDI-221	Three Dimensional CADD	4	_____
SPDI-302	Properties of Materials	2	_____
SPDI-304	Materials - a Life Cycle View	4	_____
SPDI-351	Product Design II	4	_____
Management Core Courses			_____
MGT-101	Introduction to Management	4	_____
MGT-140	Quantitative Decision-Making	4	_____
MGT-215	Accounting for Sustainable Business	4	_____
SPDI/MGT-446	Competitive Manufacturing Management	4	_____
SPDI/Management/Physics Core Course			_____
INPHYS-131	Engineering Fundamentals	4	_____
Required Allied Discipline Courses			_____
IAART-103	Three-Dimensional Design	4	_____
SAFE-215	Human Factors in Safety	4	_____
Select **at least one** of the following MATH courses:		4	_____
MATH-112	Precalculus		_____
MATH-211	Calculus I		_____
SPDI Capstone Courses			_____
SPDI-352	Product Design III	4	_____
SPDI-400	Manufacturing Enterprise	4	_____
In addition to the SPDI major, take the following SPDI courses:			_____
SPDI-321	Advanced 3D CADD	4	_____
SPDI-330	Metrology & CMM	2	_____
SPDI-380	CAD/CAM/ CNC Using MasterCAM	4	_____
SPDI-410	Mechatronics and Automation	4	_____
SPDI-450	Product DfMA	4	_____
SPDI-456	Portfolio Design	2	_____
In addition to the SPDI major, take the following Allied Discipline Courses:			_____
INPHYS-141	College Physics I	4	_____
or INPHYS-241	University Physics I		_____
PHYS-142	College Physics II	4	_____
or PHYS-242	University Physics II		_____

ISCS-140	Programming Foundations I	4	_____
INSAFE-213	Safety Chemistry	4	_____
Select **at least one** of the following:		4	_____
MATH-341	Applied Statistics		_____
ISMGT-383	Applied Data Analysis & Vis		_____
IIPHYS-342	Data Analysis for Scientists		_____
Total Credits		**106**	_____

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 crossdisciplinary 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:

Code	Title	Credits	Completed
Major Requirements (102 credits)			_____
SPDI Core Courses			_____
SPDI-110	Electricity & Electronic Fundamentals	4	_____
IISPDI-151	Product Design Principles	4	_____
SPDI-180	Metal Processes & Prototyping	4	_____
SPDI-221	Three Dimensional CADD	4	_____
SPDI-302	Properties of Materials	2	_____
SPDI-304	Materials - a Life Cycle View	4	_____
SPDI-351	Product Design II	4	_____
Management Core Courses			_____
MGT-101	Introduction to Management	4	_____
MGT-140	Quantitative Decision-Making	4	_____
MGT-215	Accounting for Sustainable Business	4	_____
Select **one** of the following:		4	_____
MGT-331	Principles of Marketing		_____
MGT/SPDI-446	Competitive Manufacturing Management		_____
SPDI/Management/Physics Core Course			_____
INPHYS-131	Engineering Fundamentals	4	_____
Required Allied Discipline Courses			_____
IAART-103	Three-Dimensional Design	4	_____
MATH-211	Calculus I	4	_____
SAFE-215	Human Factors in Safety	4	_____
SPDI Capstone Courses			_____
SPDI-352	Product Design III	4	_____
SPDI-400	Manufacturing Enterprise	4	_____
In addition to the SPDI major, choose the following Allied Discipline Courses:			_____
Mathematics			_____
MATH-212	Calculus II	4	_____
MATH-335	Linear Algebra	4	_____
Physics			_____
INPHYS-241	University Physics I	4	_____
PHYS-242	University Physics II	4	_____
Allied Disciplines			_____
Select **one** of the following:		4	_____
ISCS-210	Python Programming		_____
IIPHYS-342	Data Analysis for Scientists		_____
ISMGT-383	Applied Data Analysis & Vis		_____
Chemistry:			_____
INCHEM-111	General Chemistry	4	_____
CHEM-112	General Chemistry II	4	_____
General Engineering Electives			_____
Select **two** of the following:		8	_____
PHYS-339	Classical Mechanics		_____
SPDI-410	Mechatronics and Automation *		_____
ARCH-375	Statics and Structural Analysis		_____
INOPTC-101	Introduction to Optics		_____
or INOPTC-11 & INOPTC-12	Laser Optics and Thin Film in Optics		_____
MATH-311	Vector Calculus		_____

MATH-312	Differential Equations		_____
Total Credits		**102**	_____

Electives

Select additional courses of your choice to bring total number of credits earned to 120. Students are encouraged to complete a minor or an organized cluster of courses related to their career interests.

Degree Requirements

120 credits
40 credits at the upper-level

Upon completion of the Sustainable Product Design & Innovation major students will demonstrate competencies 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