

# Sustainable Materials and Technology (SMT)

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## **SMT 200 Introduction to Sustainable Materials and Technology** (3 credit hours)

The overall goal of the class is to introduce the students to the properties and production, and environmental implications, of common materials, including biobased, metals, plastics and mineral based. The class will connect the structure and mechanical properties of these common materials with the technology used for producing the materials from raw ingredients, and also the processing of these materials into useful items. In addition to the material properties, the environmental impacts, e.g., emissions of carbon, water, and pollutants, will be discussed. The concepts of embodied energy, mass and energy balances, water and land use will all be considered. The concept of Life Cycle Analysis will be introduced and used to evaluate the production of different building materials.

Restriction: SMT majors or with the permission of the instructor

*Typically offered in Fall only*

## **SMT 201 Sustainable Materials for Green Housing** (2 credit hours)

Sustainable Materials for Green Housing

*GEP Interdisciplinary Perspectives*

*Typically offered in Spring only*

## **SMT 202 Anatomy and Properties of Renewable Materials** (3 credit hours)

Formation, cell morphology, cell wall, structure of softwoods, hardwoods, and other renewable materials; variability, naturally occurring defects, biological deterioration, and basic physical and mechanical properties of renewable materials in relation to products utilization. Techniques on hand lens and microscopic identification of renewable materials.

*GEP Natural Sciences*

*Typically offered in Fall only*

## **SMT 203 Physical Properties of Sustainable Materials** (4 credit hours)

Basic concepts involving the interaction of sustainable materials with moisture, heat, and electricity. Concepts needed to perform calculations related to material balance, energy balance, mass transfer by diffusion, and heat transfer by conduction. Principles and application of basic techniques for characterizing the physical properties of materials and for drying of lumber.

*Typically offered in Spring only*

## **SMT 206 Wood Manufacturing Site Visits** (1 credit hours)

Examples of the practical implementation of the value added processes within the wood products industry. Visits to wood products industries will be representative of the primary breakdown and secondary value added product operations that will expand and reinforce classroom instruction. Five days are spent visiting industries to provide an appreciation for the range of products and processes. The student is responsible for room and board; transportation and personal protective equipment are provided.

P: SMT 240

*Typically offered in Summer only*

## **SMT 207 Principles of Sustainable Product Development Lecture** (2 credit hours)

This course is a Human-Centered Design (HCD) approach that involves the interdisciplinary integration of user, ergonomics, and aesthetic needs with technological and production methods to create manufacturable products. Product Development Principles cover user/object interaction, product form, innovation, redesign, and sustainable product development involving materials from natural resources. Students will conduct a research product analysis and translate preexisting products and analyze creative development methods. Minimal ideation to emphasize the product development comprehension.

C: SMT 217 for 15SMTBS students

*Typically offered in Fall only*

## **SMT 210 Sustainable Materials Internship** (1 credit hours)

Experience in the forest products or related industries with a departmentally selected employer. Individualized/Independent Study and Research courses require a Course Agreement for Students Enrolled in Non-Standard Courses be completed by the student and faculty member prior to registration by the department.

Prerequisite: Completion of summer practicum

*Typically offered in Fall, Spring, and Summer*

## **SMT 217 Principles of Sustainable Product Development Laboratory** (1 credit hours)

This lab course is a Human-Centered Design (HCD) approach that involves the interdisciplinary integration of user, ergonomics, and aesthetic needs with technological and production methods to create manufacturable products. Product Development Principles cover user/object interaction, product form, innovation, redesign, and sustainable product development involving materials from natural resources. Students will justify research from SMT 207 with product analysis and ideation with reflective recordings--sketching and hands-on projects that emphasize product development.

C: SMT 207

*Typically offered in Fall only*

## **SMT 232 Recycling to Create a Sustainable Environment** (2 credit hours)

The goal of this class is to link the impetus for recycling and recycled materials to the building of a sustainable world. Recycling efficiencies for various materials will be examined as well as recycling practices and attitudes in other parts of the world. This course will explore the technology, economics, markets, trade and social impacts due to the recycling of materials. Case studies will provide an in-depth examination of the problems and potentials for the recycling of selected recycled materials. The use of Life Cycle Analysis (LCA) to evaluate recycling alternatives will be introduced. The economic, policy, social and resource availability drivers for recycling will be examined as well as the technological, economic, market and social barriers to recycling.

*GEP Interdisciplinary Perspectives*

*Typically offered in Spring only*

## **SMT 240 Introduction to Wood Products Industries** (2 credit hours)

An introduction to wood products including the products and their characteristics produced by the primary and secondary wood products industries, pulp and paper industry, energy and chemical products produced from wood.

P: SMT 202 or permission of the instructor

*Typically offered in Spring only*

**SMT 293 Independent Study in Sustainable Materials & Technology** (1-6 credit hours)

Independent Study for Sustainable Materials & Technology students at the freshman and sophomore level developed under the direction of a faculty member. Individualized/Independent Study and Research courses require a "Course Agreement for Students Enrolled in Non-Standard Courses" be completed by the student and faculty member prior to registration by the department.

*Typically offered in Fall and Summer*

**SMT 294 Independent Study in Sustainable Materials & Technology** (1-6 credit hours)

Independent Study for Sustainable Materials & Technology students at the freshman and sophomore level developed under the direction of a faculty member. Individualized/Independent Study and Research courses require a "Course Agreement for Students Enrolled in Non-Standard Courses" be completed by the student and faculty member prior to registration by the department.

*Typically offered in Fall and Summer*

**SMT 295 Special Topics in Sustainable Materials and Technology** (1-3 credit hours)

Special Topics in Wood Products at the 200 level for offering of courses on an experimental basis.

*Typically offered in Fall, Spring, and Summer*

**SMT 301 Chemistry of Sustainable Materials** (3 credit hours)

Introduction of polymer science concepts (thermal transitions, molecular weight, viscoelasticity) to sustainable materials such as wood, cork, starch, silk, etc. Detailed instruction on the chemistry of sustainable materials including reactivity, decay, the chemical aspects of thermal treatments, the separation of sustainable materials into their individual components, the reactivity and modification of the individual components, and the conversion of sustainable materials into energy products.

Prerequisite: CH 101 and CH 102 and CH 220

*Typically offered in Spring only*

**SMT 302 Processing of Biomaterials** (4 credit hours)

Principles of the manufacturing processes used in the sustainable and renewable materials industries. Content includes primary and secondary manufacturing, theory of machining basics, and biomaterials-based composite fabrication. Field trips might require meeting outside of class time.

Prerequisite: SMT 202 or SMT 203

*Typically offered in Spring only*

**SMT 307 Product Visualization** (3 credit hours)

This course covers the visual representation of objects intended for product development using 3D CAD software. Parametric solid modeling of parts and assemblies and creating orthographic views drawings using Solidworks, Rhinoceros and additional CAD software. This course is intended to visually enhance product development ideation. We will also study other forms of technology for ideation, for example, but not limited to 3D printing, 3D scanning, Laser Cutter/Engraver, and CNC machines. In this course, students will conduct research and produce solutions focusing on sustainability with 2D and 3D visual communication development.

P: SMT 207 and SMT 217

*Typically offered in Spring only*

**SMT 308 Wood Processing** (4 credit hours)

Principles of the manufacturing processes used in the wood products industries. Content includes primary and secondary manufacturing, theory of machining basics, and solid wood and wood-based composite fabrication. Field trips might require meeting outside of class time.

SMT 202 and SMT 240 or permission of the instructor

*Typically offered in Fall only*

**SMT 310 Introduction to Industrial Ecology** (3 credit hours)

In this course, students will explore the main concepts of industrial ecology for sustainable materials. Students will learn about environmental supply chain, manufacturing of products from sustainable materials such as wood and agricultural materials, and how we can learn from nature to close the manufacturing loop. To support the activities in these technical areas, students will also learn how to better manage time, how to work efficiently in teams, and how best to interact with their co-workers.

*GEP Interdisciplinary Perspectives*

*Typically offered in Fall only*

**SMT 320 Industrial Chemical Pollutants** (2 credit hours)

Introduction to the sources, fates, and analysis of common chemical pollutants from industrial sources. Content will focus predominantly on chemicals from industries related to the production and use of sustainable materials such as wood, bamboo, cork, silk, renewable plastics, etc.

P: SMT 301

*Typically offered in Spring only*

**SMT 330 Project Management for Sustainability** (3 credit hours)

Main concept and principles of Project Management (PM). Different tools utilized in project management will be covered. Relationship between project management and sustainability will be emphasized. With the concepts and tools learned in class, students will learn how to better manage their time, how to work efficiently in teams, and how best to interact with their superiors.

Restriction: Junior or Senior Standing

*Typically offered in Fall only*

**SMT 346 Sustainable Materials Business Marketing** (3 credit hours)

This course will examine the business and marketing approaches in the forest products industry from a theoretical as well as an applied perspective. Students will learn the importance of business processes and how products, price, distribution, and promotion plays a role in the purchase behavior of consumers. Students will analyze situations and cases to solve real and hypothetical business problems in the forest products industry.

*Typically offered in Spring only*

**SMT 441 Mechanical Properties of Sustainable Materials** (4 credit hours)

Overview of statics. Concepts of stress and strain. Mechanical properties of elastic and viscoelastic materials. Application of elastic theory to axial loading and bending, orthotropic elasticity of lamina and laminates, buckling of columns. Principles and application of basic techniques for characterizing the mechanical properties of sustainable materials.

Prerequisite: MA 121 and PY 211 and SMT 203

*Typically offered in Spring only*

**SMT 444 Sustainable Composites and Biopolymers** (3 credit hours)

Manufacture, properties, and processing of lignocellulosic composites and polymers such as laminates, strandboard, particleboard, fiberboard, and nanocomposites. Principles and application of basic techniques for manufacture and testing of composites according to product and quality standards.

Prerequisite: SMT 301 and Senior standing in SMT

*Typically offered in Fall only*

**SMT 450 Sustainable Business and Innovation** (2 credit hours)

Theories, practice and case studies of sustainability and innovation in corporate settings. Content will include sustainability and environmental management, innovation, new business development and R&D, change management, corporate strategy and strategic alignment.

Prerequisite: Junior or senior standing

*Typically offered in Fall only*

**SMT 483 Capstone in Sustainable Materials and Technology** (3 credit hours)

Capstone course in sustainable materials and technology; integration of sustainable material and technology concepts with economic, environmental, and societal considerations; case studies and practicum in sustainable materials and technologies.

Restricted to students with Senior Standing in SMT

*Typically offered in Spring only*

**SMT 493 Independent Study in Sustainable Materials & Technology** (1-6 credit hours)

Independent Study for Sustainable Materials & Technology students at the advanced level developed under the direction of a faculty member. Individualized/Independent Study and Research courses require a "Course Agreement for Students Enrolled in Non-Standard Courses" be completed by the student and faculty member prior to registration by the department.

*Typically offered in Fall, Spring, and Summer*

**SMT 494 Independent Study in Sustainable Materials & Technology** (1-6 credit hours)

Independent Study for Sustainable Materials & Technology students at the advanced level developed under the direction of a faculty member. Individualized/Independent Study and Research courses require a "Course Agreement for Students Enrolled in Non-Standard Courses" be completed by the student and faculty member prior to registration by the department.

*Typically offered in Fall, Spring, and Summer*