# Module 1:
## Sustainable Homes: Introduction & Philosophy

## OVERVIEW:

This module provides an introduction to and exploration of the philosophy of sustainable building practices in the residential sector. Students will explore the details, benefits, and requirements of various sustainable building programs available in the region. Students will learn about the Integrated Design Process (IDP) and how IDP enables a more cohesive team effort and a smarter, more sustainable design. Process management will be discussed in the context of green building and the course final project will be introduced.

1.1 Philosophy of Green Building Programs
- 1.1.1 Design Process Changes
- 1.1.2 Construction Process Changes-Quality Management

1.2 Green Building Programs
- 1.2.1 Program Details
- 1.2.2 Applied Learning

1.3 Why Do Builders Want To Use a Green Building Rating System?
- 1.3.1 What Is the Value of Certification?
- 1.3.2 How Does Third-Party Verification Contribute to the Value?

1.4 Integrated Design Process
- 1.4.1 Benefits of IDP
- 1.4.2 Implementing IDP

1.5 Administrative and Construction Management Process Impacts
- 1.5.1 Incorporating Sustainability into Your Practice
- 1.5.2 Incorporating Your Practices into Green Building Programs
- 1.5.3 Codes and Policies
- 1.5.4 Occupancy and Owner's Manuals

1.6 The Importance of Place
- 1.6.1 Integrated Holistic Energy Design
- 1.6.2 The Other Influence

Tours of two sustainable homes.

## Knowledge Objectives

- Explore the philosophy, necessity, and benefits of various sustainable building programs.
- Articulate the intent and application of Integrated Design Processes (IDP).
- Identify various green building certification programs and their features.

## Skills Objectives

- Identify the process changes necessary to achieve green building goals.
- Create strategies to incorporate planning, implementation, and documentation into your next project.

## Attitude Objectives

- Internalize the values of green building and commit to ensuring best practices in the field.
- Incorporate IDP concepts into daily professional practice.
- Appreciate the necessity and benefits of IDP.

# Module 2:
## Building Science Fundamentals

## OVERVIEW:

This module provides an exploration of the fundamental laws that govern the dynamic flows within a building in order to understand the interconnectedness of house systems. These fundamentals are necessary tools to use when making design, construction, and operation decisions that affect the sustainability of projects**.** Students will analyze best practices for managing thermal, air, and moisture flows to create a house that is healthy, safe, energy efficient, and durable.

2.1 Fundamental Natural Laws of Thermodynamics

- 2.1.1 Thermal Flows (Heat Transfer)
  - Conduction, Convection, Radiation
- 2.1.2 Air
  - Uncontrolled Air Movement
  - Mechanisms of Air Flow
- 2.1.3 Moisture
  - Water Management
  - Moisture Management
  - Transport Mechanisms

2.2 U-value and R-value Calculations

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## Knowledge Objectives

- Understand the natural laws that drive the thermal, air, and moisture flows within a house.
- Develop strategies for analyzing how dynamic flows affect the performance of a house.

## Skills Objectives

- Communicate building science fundamentals to others.
- Use actual house plans to calculate the overall UA of a house and analyze potential efficiency improvements.
- Calculate wall assembly U-values and evaluate the optimum orientation of a house.

## Attitude Objectives

- Utilize sound building science fundamentals to make optimum choices when designing and building / remodeling a home.
- Incorporate appropriate and reputable tools in decision-making.
- Appreciate the need for an improvement in current building practices.

# Module 3:
## High Performance Building Envelopes

## OVERVIEW:

This module explores various high-performance wall and roof assemblies, including continuous exterior insulation and staggered stud framing. Students will learn principles that can be applied to existing homes and new construction projects, including durable wall design, insulation strategies and air sealing, product selection, staging, and construction. This module addresses the importance of performance testing and diagnostics to verify the performance of installed equipment and the home's envelope.

3.1 Building Envelope Performance

- 3.1.1 Value of Constructability
- 3.1.2 Design Choices
  - Existing Assemblies
- 3.1.3 Implementation
  - Quality Management Planning
  - Communication with Construction Team
  - Insulation and Air Sealing
  - Moisture Management and Vapor Permeability
- 3.1.4 Overview of Wall and Roof Assemblies
  - *Walls:* 2x6; 2x6 with exterior rigid foam; double stud; staggered stud 8-inch; I-joists; SIPs; ICF
  - *Roofs:* standard truss; raised heel truss; parallel chord cantilevered truss; I-Joist (vaulted)

3.2 Performance Testing and Diagnostics

Tours of two sustainable homes.

## Knowledge Objectives

- Analyze ten different building envelope systems.
- List potential insulation, ventilation, and water management strategies.
- Explain the value of performance testing.

## Skills Objectives

- Select appropriate design features and assemblies according to project objectives.
- Integrate building envelope details into plans and specifications.

## Attitude Objectives

- Transform practices to include informed envelope decisions.

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# Module 4:
## Mechanical Systems & Performance Testing

## OVERVIEW:

This module provides an overview of load reduction and an exploration of many design and product options for conditioning systems within a home. Just as performance testing is necessary to verify the envelope's construction, performance testing and verification of systems are also key components to creating high-performance sustainable homes.

4.1 Integrated System Design

- 4.1.1 Review Climate Responsiveness/Passive Strategies
- 4.1.2 Review Load Minimization
- 4.1.3 Fuel Choice and Future Proofing
- 4.1.4 Integrating Mechanical Systems
- 4.1.5 Lighting
- 4.1.6 Sound

4.2 Performance Testing & Verification

- 4.2.1 Forced Air Systems
- 4.2.2 Ventilation System Verification
- 4.2.3 Measurement & Verification

Tours of two sustainable homes.

## Knowledge Objectives

- Recognize the relative impact of various building components and system types on the total energy load of a house.
- Become familiar with residential system types, their applications, limitations, and benefits.
- Explain lighting design approaches and technologies, as well as daylighting benefits and limitations.
- Recognize various types of performance testing and verification techniques and analysis.

## Skills Objectives

- Evaluate system types using actual house plans.
- Complete room-by-room load calculations for an example house.
- Select appropriate systems according to the project objectives.
- Communicate integrated system specifications to all project team members.

## Attitude Objectives

- Incorporate load reduction as the first step in system design in all future projects.
- Set performance goals for your next project.

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# Module 5:
## Health, Materials, and Water

## OVERVIEW:

This module provides an overview of the rationale for designing for a healthy indoor environment and conserving natural resources. Students will explore various health implications associated with design, material selection, and construction methods. Students will also explore innovative water conservation strategies and analyze construction waste management strategies. Most importantly, successful integration of these strategies will be emphasized during activities and course discussions.

5.1 Health Impacts of the Built Environment

- 5.1.1 Types of Pollutants and Risks
- 5.1.2 Prevention and Mitigation: Indoor Pollutants
- 5.1.3 Prevention and Mitigation: Outdoor Sources

5.2 Materials

- 5.2.1 Green Materials Considerations
- 5.2.2 The Ideal Green Material – Does it Exist?
- 5.2.3 Green Materials Tools and Resources
- 5.2.4 Implementation

5.3 Construction Waste Management

5.4 Water

- 5.4.1 The Need for Water Conservation
- 5.4.2 Water Conservation Strategies
- 5.4.3 Site Water Management

Tours of two sustainable homes.

## Knowledge Objectives

- Document health risks in a home.
- List healthy and efficient alternatives to traditional materials and technologies.
- Practice a holistic materials approach concerning health and life cycle assessment.
- Explore strategies to improve water conservation both within a home and on site.
- Explore strategies to optimize a site's stormwater management.

## Skills Objectives

- Analyze various building materials using various green criteria.
- Identify local and regional sources for optimum material selection.
- List strategies for reducing water consumption within a house and outside a house.
- List strategies for reducing a site's impact on fish and wildlife habitat.

## Attitude Objectives

- Adhere to design and construction strategies to create healthy indoor environments that are resource efficient.
- Recognize the need for water and resource conservation.
- Incorporate low-impact development (LID) practices in all future practices.

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# Module 6:
## Process & Synthesis

### OVERVIEW:
This course will utilize the knowledge and skills acquired in Modules 1-5 and will emphasize the integration of these into students' own design and construction process. The end goal is to have the tools and confidence to provide comprehensive green process management to future projects.

6.1 Importance of Process Management

6.2 Final Project Presentations

6.3 Course Review

6.4 Marketing yourself as a Sustainable Homes Professional

6.5 Certification Exam

6.6 Graduation

### Knowledge Objectives
- Identify stages within the integrated design process (IDP).
- Identify potential team members involved in an integrated project.

### Skills Objectives
- Utilize project management tool developed throughout course.
- Identify strategies within each project stage to meet project objectives.
- Create your own green project process management tool.

### Attitude Objectives
- Promote sustainable building and design by passing forward information, skills, and inspiration gained in this course.
- Empathize with various trades, skill levels, language levels, and experience levels.

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