School of Management, Engineering and Technology
Department of Electrical Engineering and Renewable Energy

REE 455: Energy-Efficient Building Design

Catalogue Description (2009/2010):	Principles of integrated, energy-efficient building design. Application of codes, standards. Energy modeling, simulation. Daylighting, natural ventilation, architectural features of passive solar buildings. Application of renewable resources, net-zero designs. Life-cycle economic analysis. Use of software tools for analyzing building energy systems.
Hours/Credits: (Lecture-Lab-Total)	(3-0-3)
Class Schedule:	Once a week, for 2:50; offered in the Spring term.
Prerequisites:	MECH 433
Required Text:	None. The class uses primary, current materials available free from multiple sources.
Course Coordinator:	Tom White
Regular Instructors:	Tom White
Course Objectives:	Upon completion of the course, a student should be able to: • Explain how end use intensities (EUIs) vary in different buildings and the factors that contribute to different energy use signatures. • Investigate the main contributions to heating, cooling, and ventilation loads in buildings and how they interact and affect energy use. • Use eQUEST/DOE-2 to model a simple building and its HVAC systems, and analyze how energy is used in a building. • Understand the affect of utility rate structures on the average cost of gas and electricity billed. • Describe major design strategies — such as passive solar, daylighting, natural ventilation — used to reduce energy loads and minimize energy use in buildings. • Interpret and apply the Oregon energy code to establish a baseline for determining relative energy savings of an energy-efficient building design. • Use software tools, such as RETScreen, Homer, and others, to analyze at least one of several renewable energy applications for buildings. • Define the terms “net zero” energy, "carbon neutral,” and “green washing” to explain the implications of achieving sustainability goals for different types of buildings. • Specify and analyze cost components of building energy systems. • Identify and resolve a typical ethical dilemma faced by energy analysts in the building modeling community.
Topics Covered:	• Overview of energy modeling using eQUEST and System Analyzer. • Profiles of energy use in buildings; EUI signatures. Resources for modeling and comparison of alternative tools. Principles of Integrated Building Design - Working with architects to incorporate energy efficiency into building systems. • Establishing a building baseline – introduction to energy codes and standards. Code limitations affective energy-efficient design. • Calibrating models and the analysis of simulation results. • Sustainable “green” design using the LEED system. • Applications of renewable energy systems in energy-efficient buildings. • Economic analysis of energy efficiency measures (EEMs); explaining energy efficiency results and alternatives. Standards for reporting and documentation of modeling results. • Ethical considerations working on a design team. • “Green-washing,” carbon-neutral impacts and the trend toward “net zero” energy buildings.
Relevant Program	(a) an ability to apply knowledge of mathematics, science, and engineering

Outcomes:	(b) an ability to design and conduct experiments, as well as to analyze and interpret data (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (d) an ability to function on multi-disciplinary teams (e) an ability to identify, formulate, and solve engineering problems (f) an understanding of professional and ethical responsibility (g) an ability to communicate effectively (j) a knowledge of contemporary issues (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (m) an understanding of the obligations for implementing sustainable engineering solutions		
Required or Elective:	Required		
Criterion 5:	Engineering Topics		
Prepared By:	Tom White	Updated:	5-4-10