

School of Management, Engineering and Technology
Department of Electrical Engineering and Renewable Energy
MECH 433: HVAC

Catalogue Description (2009/2010):	Heating, ventilating, and air conditioning. Application of laws and principles of thermodynamics to analysis, design, and control of mechanically controlled environments for human comfort, animal health, and food preservation. Teaches computation of heating and cooling loads, humidity control, heating, and refrigeration.
Hours/Credits: (Lecture-Lab-Total)	(2-3-3)
Class Schedule:	Once a week, for 1:50 hours, one term
Lab Schedule:	Once a week, for three hours, one term
Prerequisites:	MECH 323
Required Text:	Air Conditioning Principles & Systems, by Edward Pita; Fourth Edition, 2002.
Reference Text:	Various Internet resources.
Course Coordinator:	Tom White
Regular Instructors:	Tom White
Course Objectives – Lecture and Lab:	<p>Upon completion of the lecture and lab, students should be able to:</p> <ul style="list-style-type: none"> • Apply the basic principles of thermodynamics, fluid mechanics, and heat transfer to analyze energy use in buildings. • Identify the main contributions to heating and cooling loads in buildings and how they interact and affect energy use. • Be able to plot psychrometric processes for conditioning air from one state to another. • Compare the basic designs, applications, energy use, and control strategies of at least five major HVAC systems. • Trace the changes in thermodynamic states of the refrigeration cycle and calculate the process coefficient of performance (COP). • Describe the performance characteristics and applications of <i>primary</i> energy systems used in HVAC systems, which include boilers, furnaces, chillers, refrigeration systems, and heat pumps. • Describe the performance characteristics and applications of <i>ancillary</i> energy system components used in HVAC systems, including fans, pumps, heat exchangers, and cooling towers. • Write a quality technical report documenting lab experiments, one that describes the performance and limitations of key HVAC system equipment: boilers, chillers, heat exchangers, and cooling towers.
Topics Covered:	<ul style="list-style-type: none"> • Human comfort and psychrometrics - moist air properties and air conditioning processes. • Load components and calculation of heating loads. Design day and design load criteria. Special considerations for dry climates. • Load components and calculation of cooling loads. Design day and design load criteria. Special considerations for humid climates. • Heating systems – boilers and the Rankine cycle. Part load performance curves. Cogeneration. Heat exchangers. Hydronic piping systems and terminal units. • Air conditioning with direct expansion (DX) cooling, heat pumps, and chillers; evaporative cooling, absorption chillers, and the vapor compression cycle. Economizers, cooling towers and free cooling. • HVAC systems – descriptions and applications. Zoning, controls, and O&M strategies. • Pumps and fans — energy transport through air and water systems. • Energy distribution systems – air and water – ducting and piping.

Relevant Program Outcomes:	(a) an ability to apply knowledge of mathematics, science, and engineering (b) an ability to design and conduct experiments, as well as to analyze and interpret data (d) an ability to function on multi-disciplinary teams (e) an ability to identify, formulate, and solve engineering problems (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 (l) an ability to apply the fundamentals of energy conversion and applications		
Required or Elective:	Required		
Criterion 5:	Engineering Topics		
Prepared By:	Tom White	Updated:	5-4-10