

# HVAC Design, ARE 346P/CE 389H/ARE 389H

Spring 2010

The University of Texas at Austin

Department of Civil, Architectural and Environmental Engineering

**Course Unique Number:** 14965(ARE 346P)/ 15030(CE 389H)/ 15575(ARE 389H) (3 hrs.)

**Classroom and Time:** Tuesday and Thursday 12:30 p.m. – 2:00 p.m. Room ECJ 7.208.

**Course Website:** <http://www.ce.utexas.edu/prof/Novoselac/classes/ARE389H>

**Prerequisites:** For undergraduate students any three of ARE 346N, CE 319F, ME 320/326, ME 339 or consent of instructor

**Instructor:** Dr. Atila Novoselac

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<http://www.ce.utexas.edu/prof/Novoselac>

**Office Hours:** Tuesday and Thursday, 11:00 PM - 12:00 PM or by appointment. I have an open door policy – if my office door is open, I will see students without an appointment. If I am busy, we will schedule a convenient time for both of us.

**Course Catalog Description** Fundamentals of design of heating, ventilation, and air conditioning systems

**Course Objectives:** By taking this class you will be able to:

- 1) Apply fundamental physical principles to HVAC design
- 2) Describe and size each component in an HVAC system
- 3) Design HVAC systems based on manufacturer's datasheets
- 4) Contrast residential systems with commercial systems and use appropriate design techniques for each type of system
- 5) Solve HVAC design problems with high-quality references

**Textbook (required):**

Kuehn, T.H.; Ramsey, J.W.; Threlkeld, J.L. 1998. *Thermal Environmental Engineering (3rd Edition)* Prentice Hall ISBN: 0139172203. **Reprinted with Corrections, June 2001**

**Other References:** (optional – on 2 hour reserve at Engineering Library)

*2005 ASHRAE Handbook: Fundamentals*. IP or SI edition, hard copy or CD (in Reference section of Engineering Library, 2001 editions on 2 hour reserve at Engineering Library).

Spittler, McQuiston, and Parker, (2000), *Heating, Ventilating, and Air Conditioning : Analysis and Design*, 5<sup>th</sup> Edition, Wiley.

Kreider, Curtiss and Rabl, (2002), *Heating and Cooling of Buildings: Design for Efficiency*, 2<sup>nd</sup> Edition, McGraw Hill.

Incropera, DeWitt, (2006), *Fundamentals of heat and Mass Transfer*, John Wiley & Sons.

**Topics:**

1. Background, Introduction and Review	2 wks
2. Heating and Cooling Loads	1 wk
3. Psychrometrics and mass transfer	1 wk
4. Air conditioning and refrigerant cycles	2 wks
5. Chillers and Boilers	1 wk
6. Coils and heat exchangers	2 wks
7. Ducts, air, and water systems	2 wks
8. Large HVAC Systems	2 wk
9. HVAC Control	2 wk
10. Final Project, field trip	<u>1 wk</u>
	15 wks

**Grading:**

Mid-Term Exam	25%
Project	30%
Homework Assignments	40%
Participation	<u>5%</u>
	<b>100%</b>

**Course Letter Grades:** (Numerical Grade)

90-93, >93	A-, A
80-83, >83-86, >86-90	B-, B, B+
70-73, >73-76, >76-80	C-, C, C+
60-63, >63-66, >66-70	D-, D, D+
< 60	F

**Exams and Assignments:**

Homework assignments are a central part of this course. Homework will be assigned approximately five times over the course of the semester. All assignments **are due at the beginning of the period assigned** and those turned in late will count off **10% per day** (no exceptions!--except those listed for the test make-up). Homework assignments should be completed individually.

**There will be one exam on April 08.**

It is important that you are familiar with the course material as the course evolves. Your ability to answer questions and discuss the material will be part of the overall participation evaluation. Therefore, you should review class material ahead of time. I consider a student missing more than three classes of class lectures without excuse to be a serious participation problem. In some cases, I will petition the Office of Student Affairs to drop students from the course who have excessive absences and may withhold the entire participation grade at my discretion for participation problems.

**Personal Problems:**

**If you have illness or personal problems that will affect your performance during the course of the semester, please let me know as soon as possible. "After the fact" provides little protection unless there are extreme circumstances. I have an answering machine, a fax machine and an e-mail address if you need to get in touch with me after hours. Do not hesitate to use them.**

## **Academic Honesty**

**IMPORTANT!** Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Since such dishonesty harms the individual, all students, and the integrity of the University, policies on scholastic dishonesty will be strictly enforced. For further information, visit the Student Judicial Services web site <http://www.utexas.edu/depts/dos/sjs/>. Remember, **individual** assignments are not group projects and do not build on the efforts of others without due reference

## **Students with Disabilities:**

The University of Texas at Austin provides, upon request, appropriate academic adjustments for qualified students with disabilities. Any student with a documented disability (physical or cognitive) who requires academic accommodations should contact the Services for Students with Disabilities area of the Office of the Dean of Students at 471-6259 as soon as possible to request an official letter outlining authorized accommodations. For more information, contact that Office, or TTY at 471-4641, or the College of Engineering Director of Students with Disabilities at 471-4321.

## **Privacy:**

Web-based, password-protected class sites will be associated with all academic courses taught at the University. Syllabi, handouts, assignments and other resources are types of information that may be available within these sites. Site activities could include exchanging e-mail, engaging in class discussions and chats, and exchanging files. In addition, electronic class rosters will be a component of the sites. Students who do not want their names included in these electronic class rosters must restrict their directory information in the Office of the Registrar, Main Building, Room 1. For information on restricting directory information, see the General Information Catalog or go to: <http://www.utexas.edu/student/registrar/catalogs/gi06-07/app/appc09.html>.

## **Course Evaluations:**

Each student will be given the opportunity to evaluate the course using the standard course/instructor evaluation form during the last week of classes.

## **Dropping the Class:**

*Undergraduate Students:* From the 1st through the 4th class day, an undergraduate student can drop or add a course on ROSE or TEX. From the 5<sup>th</sup> through the 12th class day, a student can drop through ROSE or TEX; adds must be done in the department offering the course. For any drops beginning with the 13th class day, a student must initiate the drop process in the office of the Dean (ECJ 2.200). Departmental advisor and instructor approval may be required.

*Graduate Students:* From the 1st through the 4th class day, graduate students can drop a course on Rose or TEX. Beginning with the 5th class day, graduate students must initiate any adds or drops in their department Graduate students can drop or add a class until the last class day with permission from the departmental Graduate Advisor and the Dean. Students with a 20 hr/week GRA/TA appointment or a fellowship may not drop below 9 hours in a long session.

## **Project:**

There will be one individual final project assigned at the beginning of April.

## TENTATIVE COURSE SCHEDULE

Date	Topics	Assigned Reading	Due Date
01/19	Course introduction and terminology		
01/21	Review: Thermodynamics	Chapter 2	
01/26	No class (ASHRAE meeting)		
01/28	Review: Heat transfer	Chapter 2	
02/02	Review: Fluid dynamics	Chapter 2	
02/04	Psychrometrics	Chapters 7&8	HW1
02/09	Psychrometric chart	Chapters 7&8	
02/11	Evaporative cooling	Chapters 7&8	
02/16	Psychrometric processes	Chapters 7&8	
02/18	HVAC Systems & Cooling towers	Handouts&Ch.10	
02/23	Refrigeration Cycles	Chapter 4	HW2
02/25	Refrigeration Systems	Chapter 4	
03/02	Refrigerants	Chapter 4	
03/04	Heat Exchangers I	Chapter 11	
03/09	Heat Exchangers II	Chapter 11	
03/11	Heat Exchangers III	Chapter 11	HW3
03/23	Wet Heat Exchangers	Chapter 11	
03/25	Air distribution components	Chapter 18	
03/30	Fans and Duct design	Chapter 18	
04/01	Pumps and plumbing	Chapter 18&19	HW4
04/06	Duct and plumbing sizing	Chapter 18&19	
04/08	Review		
04/13	Course projects		<i>Exam</i>
04/15	Principle of HVAC Control	Handouts	
04/20	Variable air volume systems	Handouts	
04/22	Final Project and Load Calculation	Chapters 15&16	
04/27	Automatic Control for HVAC systems	Handouts	<i>Project</i>
04/29	Residential vs. Commercial HVAC Systems		
05/04	Review ( <i>Field trip</i> )		
05/06	Project discussion		Project