

# Physics 567-- Thermodynamics of Building Design and Technology

Fall 2020  
SUNY College at Cortland  
Physics Department

## Catalog Description:

Principles of heat generation, distribution and retention in residential and commercial buildings. Topics include: analysis of the thermal envelope of buildings, active and passive solar heating technologies, geothermal heat pumps, active and passive cooling systems, and the design and use of energy modeling programs. Prerequisite: PHY 203 or PHY 530 or CHE 431. (3 cr. hr.)

## Required Text:

*Green Building Illustrated* (2014) by Francis D. K. Ching and Ian M. Shapiro ISBN: 978-1-118-56237-6.

## Course Information:

Instructor: Douglas Armstead

Office: 127 Bowers

Office Hours TWR 1-2pm and by appointment.

Course Website <http://facultyweb.cortland.edu/douglas.armstead/F20/BuildingEfficiency.html>

Lecture meets: TR 4:25-5:40pm in Bowers 1113

**Attendance Policy:** The course will include a number of laboratory and field experiences at which attendance is required. Excused absences may be worked out with the instructor ahead of time and may require a separate meeting to be set up in order to catch up on what was missed.

Evaluation of Student Grades will be based on the following components:

Weekly Problem Sets / Labs	30 percent
Two Take Home Exams	15 percent each
Final Group Project	40 percent (10% for first draft, 30% for final draft and presentation)

Every week and a half students will typically be assigned one of two types of projects in addition to the required readings. The first type of assignment will be traditional problem sets that will generally be handed out on Thursday and be due the Tuesday in a week and a half. The second type of assignment will be those based on laboratory exercises conducted during class or on field exercises to which we will travel. As with the traditional problem sets that will generally also be handed out on Thursday and be due the Tuesday in a week and a half. Finally, there will be a semester-long group project (3 to 4 students per group) which will be assigned during the first three weeks of class and will involve both library research and gathering real

world data from on and off campus utilizing the building analysis tools available in our laboratory. The first draft of this project is due on Tuesday November 17, 2020.

**Students with a Disability:**

If you are a student with a disability and wish to request accommodations, please contact the Office of Student Disability Services located in B-40 VanHoesen or call (607) 753-2066 for an appointment. Information regarding your disability will be treated in a confidential manner. Because many accommodations require early planning, requests should be made as early as possible.

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<u>Date</u>	<u>Topic</u>
Sept. 1	Introduction and Overview of Building Energy: Sources and Uses
Sept. 3	Environmental Issues with the Use of Oil and Natural Gas
Sept. 8, 10, 15	Review of Thermodynamic Fundamentals: Heat Transport, Phase Transitions, Refrigeration Cycles, and Heat Pumps
Sept. 17, 22, 24	Heat Loads & Building Envelopes: Wall and Attic Insulation
Sept. 29	Heat Loads & Building Envelopes: Windows and Passive Solar Gain
Oct. 1, 6, 8	Heat Loads & Building Envelopes: Air Infiltration and Ventilation
Oct. 13, 15	Heat Loads: Manual J and Computerized Calculations
Oct. 20, 22	Design of Residential Ground Loops for Ground Source Heat Pumps (Vertical)
Oct. 27, 29	Design of Residential Ground Loops for Ground Source Heat Pumps (Horizontal)
Nov. 3, 5	Sizing of Air Source Heat Pump Systems for Primary Heating
Nov. 10, 12, 17	Design of Forced Air Distribution Systems
Nov. 19	Design of Hydronic Distribution Systems
In Person Instruction ends. Nov. 22	<i>Thanksgiving Break - No Classes</i>

Remote Instruction only.

Dec. 1

Design of Hydronic Distribution

Dec. 3, 8

Domestic Hot Water: Sources and Uses

Dec. 10

Group Project work day

Final exam- group presentations at 4-6pm on Tuesday December 15, 2020.