

ARCE 764 -- Advanced Thermal Analysis of Buildings (“ATAB”) Spring Semester 2017

Meeting Time: TR 9:30 a.m. to 10:45 a.m.

Meeting Place: 2410 LEEP2 = the ARCE BMES lab

Instructor: Brian A. Rock, Ph.D., P.E., F. ASHRAE
Office: 2134-D Learned Hall, 785-864-3603, docrock@ku.edu
Office Hours: almost any time I'm in 2134-D, or by appointment

Catalog Description:

Manual and computational methods for determining steady-state and transient thermal loads in buildings. Advanced analysis of energy consumption given choices in building materials and mechanical systems.

Prerequisites: ARCE 217 and ARCE 660, or consent of the instructor.

References: Fundamentals volume of the ASHRAE Handbook, I-P edition, ASHRAE, 2009 or 2013; see the instructor.
Cooling and Heating Load Calculation Manual, a.k.a. “ASHRAE GRP-158”, Rudoy and Cuba. ASHRAE, Inc., 1979.
Cooling and Heating Load Calculation Manual, 2nd ed., McQuiston and Spitler. ASHRAE, Inc., 1992.
Cooling and Heating Load Calculation Principles, Pedersen et al. ASHRAE, Inc., 1998.
Load Calculation Applications Manual, Spitler. ASHRAE, Inc. First edition: 2009; second edition: 2014.
Heat transfer textbook(s), e.g., Fundamentals of Heat and Mass Transfer, Incropera and DeWitt.
Various software and programming manuals.

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| <i>Grading:</i> | Homework | 50% | Final Grades: |
| | Semester Project | 50% | 90% to 100% = "A" |
| | | | 80% to 89.9% = "B" |
| | | | 70% to 79.9% = "C" |
| | | | 60% to 69.9% = "D" |
| | Total = | 100% | 59.9% or less = "F" |

Each homework solution is due one week after assignment unless otherwise stated by the instructor in class. Late homework loses 10% per full or partial 24 hours. Advance written notice, acceptable physical proof and reason, and verification are required for a class obligation to be rescheduled; voluntary events are not acceptable.

Final Exam: No “exam”, but students will present their semester projects in 2410 LEEP2 during the 7:30-10:00 a.m. Thursday, May 11th final exam session.

Other: 1) Students are expected to abide by KU's academic integrity policies found via studentaffairs.ku.edu/academic-integrity and enr.ku.edu/policies. Discovered violations are reported to the CEAE Department and the Dean's Office. Penalties for academic misconduct range from score reduction on an assignment or project to dismissal from the School or KU. 2) All course content is copyrighted, e.g., by ASHRAE, so get written permission in advance before redistributing, etc.

The Academic Achievement & Access Center (AAAC) coordinates accommodations and services for all KU students who are eligible. If you have a disability for which you wish to request accommodations and have not contacted the AAAC, please do so as soon as possible. Their office is at Room 22 Strong Hall, and their phone number is 785-864-4064 (V/TTY).

Project: Each student will research a particular topic over the semester, do a study, write a manuscript on it using technical-paper style, and present his or her findings to the class. Especially well-done manuscripts, after further work, may be submitted for publication.

Potential, specific topics will be discussed in class. Examples of general topics are “zero energy” buildings, foundations’ heat transfer, and optimal insulation levels. Feel free to propose an ATAB topic for your semester project, discussed in class or not, to the instructor.

Final Presentation:

Your presentation should be about 20 minutes, plus five minutes for questions; have paper copies of your full presentation as handouts. A PC, LCD projector, and screen are available in the classroom. If you present with PowerPoint or similar software, bringing your file on an USB memory stick has worked well.

A suggestion for the organization of your presentation is:

- Title slide with your name, date, etc.
- Problem Statement
- Description of your approach (base case, variations)
- Results and Discussion
- Conclusions and Recommendations
- Key References

Semester project due dates:

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|---------------------------------|--------------------|
| Draft title & description | January 24, 2017 |
| Outline/background/bibliography | February 14, 2017 |
| First draft (hardcopy) | April 4, 2017 |
| Final manuscript (hardcopy) | May 4, 2017 (LDOC) |
| Presentation | May 11, 2017 |

LDOC = Last Day of Class

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Spring 2017 Semester

Course Objectives

Methods of teaching: lectures, examples, discussions, readings, homework, project, etc.

- ☞ To continue learning the terminology and "language" of the arts and sciences that form the field of heating, ventilating, and air-conditioning engineering and energy management
- ☞ To understand and apply methods for the steady-state and transient analysis of buildings' thermal loads, ventilation, and energy use
- ☞ To evaluate and optimize energy consumption in buildings
- ☞ To consider the energy conservation properties of various building materials
- ☞ To perform an independent study (project) of an ATAB topic

HOMEWORK

- ☞ Be neat; rewrite if needed. See the example handout.
- ☞ Use engineering paper (front side only) for hand calculations, graph or computer paper for graphs, and appropriate paper for drawings and computer output.
- ☞ Show all calculations, units, conversions, and references. Show one complete sample calculation for repetitive calculations, but show all the results.
- ☞ Box the final answer (only!) for each problem. Provide a cover page with a summary or table of results for lengthy assignments.
- ☞ Organize the pages so your text reads from the bottom or the right. Then staple all the pages together in the upper left-hand corner. Write your name on the outside and the inside.
- ☞ If less than 12 pages or so, fold lengthwise. If thicker, leave unfolded.