

Environmental Control Systems
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EVDA 615 Q(1.5-0)
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Introduction

A major function of buildings in the very cold Prairie climate is creation of a comfortable indoor environment. The course addresses design of Prairie buildings to provide shelter with low negative environmental effects at the global level (e.g., by reducing demands for fossil fuels). Other mechanical systems including water and waste, active fire protection and mechanical movement are also addressed.

Objectives

1. Ability to develop architectural designs that effectively integrate large mechanical systems, using approximate sizing of ducts and other components.
2. Ability to carry out simple heat loss calculations.
3. Understanding of the organization of major mechanical system components in relation to other systems, including structure, enclosure, lighting, movement, plumbing and fire safety.
4. Understanding of basic heat transfer and ventilation matters pertinent to cold climates, such as thermal bridging and ventilation heat recovery
5. Awareness of considerations in system design for thermal and air quality control, including thermal comfort, climate, precedents, and biosphere effects.
6. Awareness of issues related to energy efficiency and renewable energy applications for cold climate buildings.

Teaching Approach

The course will be presented through lectures, site visits, readings, and workshops. The course is connected with the comprehensive studio through the required development of building system concepts. Typical approaches to systems design will be reviewed in terms of air distribution approach and spatial organization. Site visits will provide an opportunity to view systems and equipment firsthand. The assignment is conceptual design of a ventilation system for the studio project, using rules of thumb for sizing.

Content: Topic Areas

1. The functions and characteristics of thermal and ventilation systems will be reviewed, as well as their place in the development of design concepts. Components and terminology will be discussed, as well as elementary sizing procedures. Factors in systems design will be examined.
2. Thermal comfort and air quality.
3. Types of ventilation and thermal control systems.
4. Performance criteria for the evaluation of systems, (e.g., system capabilities, cost, energy efficiency, energy codes).
5. Visual treatment of systems.
6. Interrelationship of systems (e.g., envelope and active thermal control).
7. Heat transfer processes.
8. Other issues: water and waste systems, active fire and smoke control, wind effects, mechanical movement systems, costs for environmental control systems.

Means of Evaluation

Evaluation will be based on:

Project	75%
Quizzes	15%
Test	10%
Total	100%

The final test will be an open book examination.

Grading

Grading will be based on the following scale:

Letter Grade	4-Point Range	Description
A+	4.00	Outstanding - evaluated by instructor
A	3.85-4.00	Excellent - superior performance showing comprehensive understanding of the subject matter
A-	3.50-3.84	Very good performance
B+	3.15-3.49	Good performance
B	2.85-3.14	Satisfactory performance
B-	2.50-2.84	Minimum pass for students in the Faculty of Graduate Studies
C+	2.15-2.49	All final grades below B- are indicative of failure at the graduate level and cannot be counted toward Faculty of Graduate Studies course requirements.
C	1.85-2.14	
C-	1.50-1.84	
D+	1.15-1.49	
D	0.50-1.14	
F	0-0.49	

Readings

The course texts are

The Architect's Studio Companion: Rules of Thumb for Preliminary Design, 5th ed. 2007
E. Allen and J. Iano
Wiley ISBN-13: 9780470641910

W.T. Grondzik, A.G. Kwok, B. Stein, J. S. Reynolds,
Electrical and Mechanical Equipment for Buildings (11th Edition), 2010 (selected chapters)
Wiley, ISBN 978-0-470-19565-9

Canadian Architectural Certification Board - Performance Criteria Met by Course

The following CACB Student Performance Criteria will be covered in this course at a primary level: B6 Life Safety Systems (active systems), B8 Environmental Systems, B10 Building Service Systems, C2 Building Systems Integration.

The following CACB Student Performance Criteria will be covered in this course at a secondary level: B4 Sustainable Design, B11 Building Economics (elemental cost of HVAC systems), C1 Detailed Design Development.

Notes

1. Written work, term assignments and other course-related project work must be submitted via the course Blackboard system.
2. It is the student's responsibility to request academic accommodations. If you are a student with a documented disability who may require academic accommodation and have not registered with the Disability Resource Centre, please contact their office at 220-8237. Students who have not registered with the Disability Resource Centre are not eligible for formal academic accommodation. You are also required to discuss your needs with your instructor no later than fourteen (14) days after the start of this course.
3. Plagiarism - Plagiarism involves submitting or presenting work in a course as if it were the student's own work done expressly for that particular course when, in fact, it is not. Most commonly plagiarism exists when:(a) the work submitted or presented was done, in whole or in part, by an individual other than the one submitting or presenting the work (this includes having another impersonate the student or otherwise substituting the work of another for one's own in an examination or test), (b) parts of the work are taken from another source without reference to the original author, (c) the whole work (e.g., an essay) is copied from another source, and/or, (d) a student submits or presents work in one course which has also been submitted in another course (although it may be completely original with that student) without the knowledge of or prior agreement of the instructor involved. While it is recognized that scholarly work often involves reference to the ideas, data and conclusions of other scholars, intellectual honesty requires that such references be explicitly and clearly noted. Plagiarism is an extremely serious academic offence. It is recognized that clause (d) does not prevent a graduate student incorporating work previously done by him or her in a thesis. Any suspicion of plagiarism will be reported to the Dean, and dealt with as per the regulations in the University of Calgary Graduate Calendar.
4. Information regarding the Freedom of Information and Protection of Privacy Act (<http://www.ucalgary.ca/secretariat/privacy>) and how this impacts the receipt and delivery of course material.
5. Emergency Evacuation/Assembly Points (<http://www.ucalgary.ca/emergencyplan/assemblypoints>).
6. Safewalk information (<http://www.ucalgary.ca/security/safewalk>).
7. Contact Info for: Student Union (<http://www.su.ucalgary.ca/page/affordability-accessibility/su-structure/contact-info>); Graduate Student representative (<http://www.ucalgary.ca/gsa/>) and Student Ombudsman's Office (<http://www.su.ucalgary.ca/page/quality-education/academic-services/student-rights>).
8. The instructor may reduce grades for assignments and components thereof when submitted after deadlines.

Detailed Schedule

- Tu., Jan. 8 (1) Introduction to Active and Passive Environmental Control Systems
- Tu., Jan. 15 (2) Site Visit 1: ICT Building (overhead VAV mixing system)
- Tu., Jan. 22 (3) Air Distribution System Types; Quiz 1
- Tu., Jan. 29 (4) Site Visit 2 - EEEL (displacement ventilation system, radiant slab cooling),
TFDL (underfloor system)
- Tu., Feb. 5 (5) Approximate Spatial Sizing of HVAC Equipment and System Components 1
- Tu., Feb. 12 (6) Approximate Spatial Sizing of HVAC Equipment and System Components 2
Quiz 2
- Tu., Feb. 19 block week
- Tu., Feb. 26 (7) Site Visit 3 - Child Development Centre (plant room, heat recovery)
- Tu., Mar. 5 (8) Heat Gains and Losses I: Conductive and Convective Heat Transfer
- Tu., Mar. 12 (9) Heat Gains and Losses II: Infiltration & Ventilation, Solar Gains, Internal Gains
- Tu., Mar. 19 (10) Systems for Housing and Small Buildings; Quiz 3
- Tu., Mar. 26 (11) Thermal Comfort and Indoor Air Quality;
Energy Standards and Performance
- Tu., Apr. 2 (12) Environmental Rating Systems, Life Safety Systems, Mechanical Movement
- Tu., Apr. 9 (13) Water-Waste Systems; Wind and Noise Considerations
- Tu., Apr. 16 (14) Final Test