

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

Comfortable indoor environment is a major goal in the design of buildings. To achieve this challenging goal in cold climate, several factors should be considered simultaneously. This course addresses design of buildings for cold climate to provide comfortable and productive environment while reducing the negative environmental effects at the global level (e.g. reducing demands for fossil fuels)

## **Objectives**

The main objectives of the course are as follows:

1. To develop architectural designs that integrate mechanical systems, using approximate methods (for sizing of ducts and other components).
2. To understand the basic principles of heat transfer mechanisms and to perform simple heat loss calculations.
3. To understand the organization of major mechanical system components in relation to other systems, including structure, enclosure, lighting, movement, plumbing and fire safety.
4. To understand the principles of ventilation in cold climates.
5. To comprehend the design considerations of building systems for thermal and air quality control, including thermal comfort, climate, as well as noise issues (especially those related to mechanical systems).
6. To acquire awareness of issues related to energy efficiency and renewable energy applications.

## **Teaching Approach**

The course will be presented in lecture and workshop mode. 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. The assignment is conceptual design of a ventilation and thermal control system for the studio project, using rules of thumb for sizing.

## **Content: Topic Areas & Detailed Class Schedule**

The functions and characteristics of thermal and ventilation systems will be reviewed, together with their place in the development of design concepts. Components and terminology will be discussed, as well as quantitative design methods and elementary sizing procedures. Factors in systems selection will be examined, including:

1. Thermal comfort and air quality.
2. Types of ventilation and thermal control systems.
3. Performance criteria for the evaluation of systems, (e.g. system capabilities, energy efficiency, energy codes).
4. Visual treatment of systems.
5. Interrelationship of systems (e.g., envelope and active thermal control).
6. Heat transfer processes.
7. Other issues: water and waste systems, noise considerations, and mechanical movement.

Week 1	Jan. 15	
Week 2	Jan. 22	Introduction, Thermal comfort, Building setting and effect on heating and cooling (e.g. Natural ventilation, solar gain), Introduction to heating and cooling loads (heat gain and losses), Case study of architectural HVAC planning
Week 3	Jan. 29	Quiz1; Summary of HVAC systems for large buildings, Approximate spatial sizing of HVAC equipment. Assignment 1- Project description.
Week 4	Feb. 5	Quiz 2, Distribution systems, planning the core of buildings, Approximate sizing of ducts. Assignment 2: Zoning table and primary selection for systems projects.
Block week	Feb. 12	Desk Crits 1: Preliminary selection of environmental systems
Week 5	Feb. 19	Block week
Week 6	Feb. 26	Quiz 3, Mechanical systems for housing and small buildings. Review of ventilation and Indoor air quality. Noise considerations
Week 7	Mar. 5	Quiz 4. Energy Standards and Performance, Environmental Rating Systems, group review
Week 8	Mar. 12	Desk Crits 2
Week 10	Mar. 26	Exam

### Means of Evaluation

Evaluation will be based on:

Design Project	50%
Assignments	10%
Quiz	20%
Test	20%
Total	100%

The test will be closed book. Writing and the grading thereof is a factor in the evaluation of the project.

### Grading

Final grades will be reported as letter grades, with the final grade calculated according to the 4-point range. Grading will be based on the following scale:

Grade	Grade Point Value	4-Point Range	Percent	Description
A+	4.00	4.00	95-100	Outstanding - as evaluated by
A	4.00	3.85-4.00	90-94.99	Excellent - superior performance showing comprehensive understanding of the subject matter
A-	3.70	3.50-3.84	85-89.99	Very good performance
B+	3.30	3.15-3.49	80-84.99	Good performance
B	3.00	2.85-3.14	75-79.99	Satisfactory performance
B-	2.70	2.50-2.84	70-74.99	Minimum pass for students in the Faculty
C+	2.30	2.15-2.49	65-69.99	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	2.00	1.85-2.14	60-64.99	
C-	1.70	1.50-1.84	55-59.99	
D+	1.30	1.15-1.49	50-54.99	
D	1.00	0.50-1.14	45-49.99	
F	0.00	0-0.49	0-44.99	

Notes:

A student who receives a "C+" or lower in any one course will be required to withdraw regardless of their grade point average (GPA) unless the program recommends otherwise. If the program permits the student to retake a failed course, the second grade will replace the initial grade in the calculation of the GPA, and both grades will appear on the transcript.

**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
- Additional materials will be posted on the course website.

**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: B8 Environmental Systems, C2 Building Systems Integration, B10 Building Service Systems

The following CACB Student Performance Criteria will be covered in this course at a

secondary level: B4 Sustainable Design, C1 Detailed Design Development, C4 Comprehensive Design.

**Notes:**

As a quarter course, the class will run about 50% of the weeks of the term, plus time for the test.

1. Written work, term assignments and other course related work may only be submitted by e-mail if prior permission to do so has been obtained from the course instructor. Submissions must come from an official University of Calgary (ucalgary) email account.
2. Academic Accommodations. The Academic Accommodations Policy can be found at: <http://www.ucalgary.ca/access/accommodations/policy>. It is the students' responsibility to request academic accommodations. If you are a student with a documented disability who may require academic accommodations and have not registered with Student Accessibility Services, please contact them at 403.220.6019. Students who have not registered with Student Accessibility Services are not eligible for formal academic accommodations. More information about academic accommodations can be found at [www.ucalgary.ca/access](http://www.ucalgary.ca/access). You are also required to discuss your needs with your instructor no later than fourteen (14) days after the start of this course.
3. The instructor may reduce grades for assignments and components thereof when submitted after deadlines.
4. 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.

5. 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
6. Emergency Evacuation/Assembly Points (<http://www.ucalgary.ca/emergencyplan/assemblypoints>)
7. Safewalk information (<http://www.ucalgary.ca/security/safewalk>)
8. Contact Info for: Student Union (<http://www.su.ucalgary.ca/page/affordability-accessibility/contact>); 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>).