RYERSON UNIVERSITY
Department of Mechanical and Industrial Engineering

COURSE OUTLINE

MEC740
ENVIRONMENTAL CONTROL IN BUILDINGS

Prerequisite: MEC514 Applied Thermodynamics, MEC616 Fluid Mechanics II and MEC701 Heat Transfer.

Course Text: **Heating, Ventilating and Air Conditioning, Analysis and Design; 5**th Edition;
Faye C. McQuinston, Jerald D. Parker and Jeffrey D. Spitler;
John Wiley & Sons

Reference Texts: **Principle of Heating, Ventilating and Air Conditioning,**
R. Howell et al.
ASHRAE, 1997

ASHRAE Handbook of Fundamentals,
ASHRAE Atlanta

Handbook of HVAC Design,
N.R. Grimm and R.C. Rossaler; McGraw Hill

Heating and Cooling of Buildings,
J.F. Kreider and A. Rabl; McGraw Hill

Handbook of Hydraulic Resistance; 2nd Edition,
I.E. Idelchik; Hemisphere Publishing

Course Objective:
Using the background knowledge acquired in the prerequisite courses, the students will learn the basics of HVAC analysis and design applied to different applications. Emphasis is given to new technologies, modern controls, and energy conservation in HVAC applications. Usage of computer software packages available for HVAC design and analysis will be encouraged.

Course Organization: Three lecture hours per week for 13 weeks.

Course Evaluation:

Project	10%
Assignments	10%
Tests	30%
Final Examination	50%

(Over)

Note: 1) Late submissions for project and assignments and will be penalized.
2) Two tests will be scheduled during the term and 2 hours in duration each.
3) The final examination will be scheduled during the examination period and 3 hours in duration.
4) All of the required course-specific written reports/assignments/labs will be assessed not only on their technical/academic merit, but also on the communication skills exhibited through them.

Detailed Course Content:

- Review of basics
- Air-conditioning systems; central system components; all-air systems; air-and-water systems; all-water systems; unitary AC; direct expansion systems; heat pump systems; heat recovery in AC systems.
- Moist air properties and conditioning processes; vapour pressure, dew point, specific humidity and relative humidity, wet bulb deviation. Basic air conditioning processes using psychometric charts; heating processes, spray processes; cooling processes, constant SHF method; off design conditions.
- Comfort and health; physiological considerations; environmental comfort indices; comfort conditions; commons contaminants; methods to control contaminants.
- Heat transmission in building structures; fundamentals of load estimating; use of tables; the load estimate process; moisture transmission; heating loads and cooling loads; thermal inertia and solar radiation; software packages for load estimating.
- Energy calculations, degree-day method, bin method, simulation.
- Air conditioning systems; central systems; unitary systems; heat-pumps.
- Fans and fan types; characteristics of centrifugal and axial fans; fan laws; application to a system; system testing and balancing.
- Building air distribution, air-distribution system design; CAV and VAV systems; duct design, selection of acceptable velocities, circular equivalent of rectangular duct, velocity reduction; equal friction, balanced-capacity and static regain method of duct design.
- Mechanical refrigeration theory; centrifugal water chilling plant; single stage and two stage machines; heat pumps; CFC problems; absorption chillers; cooling towers.
- Boilers and furnaces for heating, fuel and heating costs, cogeneration; integrated energy systems.
- Control systems of HVAC systems; indoor air quality monitoring.
- Economics of HVAC.
- Energy management and energy conservation in HVAC systems.

Faculty Course Survey:

Students will be required to complete this survey during the weeks of 10, 11 or 12.

Prepared by: _____ Date: May 14, 2004
W. Leong

Approved by: _____ Date: _____
L. Fang