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Faculty Availability:	TBA
Program Coordinator:	*TBA*

COURSE OUTLINE ACADEMIC YEAR 2014/2015

Course Title: RESIDENTIAL SYSTEM DESIGN 1			
Course Code: HRAC 200	Schedule Type Code: LEC	Credit Value: 3.0	Class Hours: 60
Programs Heating, Refrigeration and Air Conditioning Technician Heating Refrigeration and Air Conditioning Technology		Pre-Requisite(s): HRAC 150	Co-requisite(s): N/A
Pre-requisite for: HRAC 251, HRAC 252, EMAN 303, HRAI Residential Heat Gain/Loss and HRAI Air System Design Certification Exams			
Restrictions:			

Program outcomes emphasized in this course:

The student will be able to understand the thermodynamic theory involved in the heat gain and the heat loss of a residential dwelling, as well as the theory involved with the design of a residential duct distribution system. The student upon completion of the course will be able to perform residential heat loss and heat gain calculations as well as size the duct distribution system.

Approved By: Michael Auchincloss

Dean/Associate Dean: Michael Auchincloss

Signature: Michael Auchincloss Date: August 2014

Course Description

The student will learn the requirements and procedures for calculating the heat loss and heat gain for residential dwellings and become familiar with the HVAC equipment selection method necessary to meet the building's heating and cooling requirements. Students will also learn the requirements for designing and sizing an air distribution system based on HRAI and ASHRAE standards pertaining to residential buildings. Students will be able to write the HRAI certification exams for Residential Heat loss/Heat Gain and Residential Air System Design.

Course Rationale

Poor indoor comfort/quality is not always the result of equipment failure/malfunction, but also inappropriately sized heating and cooling equipment and/or duct distribution sizing. As well, when applying for a building permit, most municipalities require the submission (in an acceptable format) of the heat loss/heat gain calculations and/or the duct sizing layout and related calculations. Therefore, the information outlined in the course description is essential for the service technician/technologist in order to effectively resolve field problems.

Learning Outcomes

Upon successful completion of this course, students will be able to:

1. Review the theory, definitions and terminology used most frequently in residential heat loss/heat gain design.
2. Calculate the heat gain and the heat loss transmission through the various components of the building envelope
3. Calculate the sensible and/or latent heat gain generated from occupants and equipment/appliances.
4. Determine the factors governing the magnitude of infiltration and ventilation volumes and calculate the related heating and cooling loads on a residential building.
5. Calculate the heat gain and heat loss of ducts located in an unconditioned space.
6. Complete all the necessary heat loss/ heat gain calculations on a room-by-room basis as per the required HRAI forms and tables.
7. Review the theory and terminology used in residential duct systems and air distribution
8. Describe and identify system components such as cooling coils, heat exchangers, filters, fans and other devices common to equipment applied on residential applications.
9. Review the furnace and air conditioning selection procedure based on the heat loss/heat gain calculations and the required external design static pressure.
10. Review the importance of supply registers and return air grilles locations and other design considerations for proper duct sizing and optimum comfort.
11. Calculate the friction losses of standard supply air and return air fittings and review their effects on duct sizing and equipment selection.

12. Calculate the total design system air flow, mixed air temperature, acceptable heating temperature rise, equivalent length of fittings and proper duct design velocity for residential applications.
13. Estimate the sizing of rectangular duct systems using the Equal Friction Method as per HRAI documentation and duct sizing design forms.

Essential Employability Skills
Essential Employability Skills are transferable skills that provide the foundation for a student's academic, vocational, and personal success.

✓	*Communication*	✓	*Critical Thinking & Problem Solving*	✓	*Interpersonal*
✓	*Numeracy*		*Information Management*	✓	*Personal*

Learning Resources

Required Resources:

1. HRAI Residential Heat Loss – Heat Gain Manual

2. HRAI Residential Air System Design Manual

Supplemental Resources:

Manufacturers' Literature.
Various texts and documents as suggested by course instructor.
Various manufacturer instruction sheets, sales brochures, web sites etc.
ASHRAE Book of Fundamentals (current edition)

Copyright

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See the Humber Libraries website (http://library.humber.ca) for additional information regarding copyright and for details on allowable limits.

Learning Delivery Format

Lectures, demonstrations, and related laboratory activities.

Course Content

UNIT	TOPIC(S)	ASSESSMENTS	RESOURCES
1	Heat loss/heat gain building zoning, weather data and general design considerations.		
2	Heat gain and heat loss through building envelope		
3	Internal heat gains from occupants and appliances/equipment.		
4	Duct heat loss/heat gains, infiltration and ventilation load calculations.		
5-7	Complete HRAI heat loss/heat gain forms for various residential example on a room-by-room basis.		
8	**Test #1**		
9	Residential equipment components and selection procedure.		
10	Terminology used in duct design including fittings, diffuser, grille, other components used in a duct distribution system.		
11	Introduction to duct layout and diffuser/grille location and design.		
12-14	Completing duct design calculations using HRAI Duct forms and tables.		
15	**Test #2**		

Please note: this course schedule may change as resources and circumstances require.

Student Evaluations

Activity	Weighting (%)	Learning Outcomes Measured
Test 1	30	1 through 6
Test 2	30	7 through 13
Assignments (4)	40	1 through 15
Total	**100**	

In order to be eligible to write the HRAI Certification Exam an 80% attendance record must be maintained throughout the program. It is the student's responsibility to become aware of the specific attendance requirements for this course.

School Specific Field:

Assignments must be submitted on or before the "due date", as directed by the professor. Late submissions, without valid reasons (such as illness or emergency) will be penalized at 6% per day, up to maximum of 4 days (24%) unless otherwise determined by the professor. Days of lateness will include weekends and holidays. Claims of illness or other emergencies may have to be documented, if required by the professor.

All assignments are to be submitted on the due day REGARDLESS OF THEIR DEGREE OF COMPLETION. If all course work has not been submitted by the end of classes, and a grade of 50 or greater has been awarded an INC will be awarded. If all work is not submitted by the end of the second week following the end of the course, the final grade will based on the submitted work only. Normal late penalties will apply.

Attendance

Students are expected to attend classes regularly. A minimum of 85% attendance at lectures is required. A penalty of up to 6% of the final mark may be deducted for frequent absenteeism without valid reason. It is the student's responsibility to become aware of the specific attendance requirements for this course.

Degree Students:
In addition to meeting all program specific course and credit requirements, students must have a Cumulative Program Grade Point Average (CPGPA) of ≥ 65 in order to be eligible for graduation.

Diploma Students:
In addition to meeting all program specific course and credit requirements, students must have a Cumulative Program Grade Point Average (CPGPA) of ≥ 60 in order to be eligible for graduation.

Policies and Procedures

It is the student's responsibility to be aware of the College Academic Regulations which can be found on the following website: http://www.humber.ca/academic-regulations

In addition, and the School of Applied Technology also has a handbook which outlines specific program-based policies and procedures. This handbook, can be found on the following websites: www.humber.ca and school site www.humber.ca/appliedtechnology.

Academic Integrity

Academic integrity is essentially honesty in all academic endeavors. Academic integrity requires that students avoid all forms of academic misconduct or dishonesty, including plagiarism, cheating on tests or exams or any misrepresentation of academic accomplishment.

Research Activity

Research activity carried out in this course is only for professional skills development as defined by the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS). This activity includes gathering information from humans by means of observation, surveys, and/or interviews only as these activities relate to professional practice. The results or findings of these activities will not be disseminated beyond the classroom.

Academic Concern/Appeals

If a student has questions or concerns regarding a grade on an assignment or test, the student should discuss the matter with the faculty member. The Program Co-ordinator and/or the Associate Dean may be asked to assist if the faculty member and student are unable to resolve issues. For additional information please refer to Section 13 of College's Academic Complaint and Appeal Policy at the web site identified above.

Prior Learning Assessment Recognition (PLAR)

Course credits may be granted in recognition of prior learning, and that Application for Consideration is made through the Office of the Registrar at http://www.humber.ca/plar/docs/pla.pdf.
Each course outline must indicate method(s) of assessment.

Challenge Exam	*Portfolio*	*Skills Test*	*Interview*	*Other (Specify)*	*Not Available For PLAR*
√			√	HRAI Equivalencies	

Disability Services

Humber seeks to create a welcoming environment where equity, diversity and safety of all groups are fundamental. Humber is dedicated to providing equal access to students with disabilities. The Disability Services staff are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations. If you require academic accommodations, contact:

Disability Services: http://www.humber.ca/disabilityservices/

North Campus: (416) 675-6622 X5180
Lakeshore Campus: (416) 675-6622 X3265

Disclaimer

While every effort is made by the professor/faculty to cover all material listed in the outline, the order, content, and/or evaluation may change in the event of special circumstances (e.g. time constraints due to inclement weather, sickness, college closure, technology/equipment problems or changes, etc.). In any such case, students will be given appropriate notification in writing, with approval from the Dean (or designate) of the School.

Appendix

Essential Employability Skills (MTCU Requirements)	Graduates of the program reliably demonstrate the ability to:
Communication	
Reading	1. communicate clearly, concisely and correctly in the written, spoken and visual form that fulfills the purpose and meets the needs of the audience 2. respond to written, spoken, or visual messages in a manner that ensures effective communication
Writing	
Speaking	
Listening	
Presenting	
Numeracy	
Understanding and Applying Mathematical Concepts and Reasoning	3. execute mathematical operations accurately
Analysing and using Numerical Data	
Conceptualizing	
Critical Thinking & Problem Solving	
Analysing	4. apply a systematic approach to solve problems 5. use a variety of thinking skills to anticipate and solve problems
Synthesising	
Evaluating	
Decision-Making	
Creative and Innovative Thinking	
Information Management	
Gathering and managing information	6. locate, select, organize and document information using appropriate technology and information systems 7. analyse, evaluate and apply relevant information for a variety of sources
Selecting and using appropriate tools and technology for a task or project	
Computer literacy	
Internet skills	
Interpersonal	
Teamwork	8. show respect for the diverse opinions, values, belief systems n and contributions of others 9. interact with others in groups or teams in ways that contribute to the effect working relationships and the achievement of goals
Relationship management	
Conflict resolution	
Leadership	
Networking	
Personal	
Managing self	10. manage the use of time and other resources to complete projects 11. take responsibility for one's actions, decisions, and consequences
Managing change and being flexible and adaptable	
Engaging in reflective practice	
Demonstrating personal responsibility	