

I. COURSE DESCRIPTION: An introductory course that introduces heat transfer concepts and principles, preparing for further studies relating to heating, air conditioning and ventilation. Students will also become familiar with the Ontario Building Code (OBC) requirements for the HVAC industry. Topics covered include convective heat transfer, radiation heat transfer, combined mode heat transfer, heat exchangers, insulation and refrigeration. By the end of the course the successful student will be able to predict heat transfer rates within a variety of thermal systems.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

Upon successful completion of this course, the student will demonstrate the ability to:

1. *Demonstrate an understanding of safety as it relates to furnaces, wood/electric combination furnaces and air conditioning systems.*

Potential Elements of the Performance:

- Explore hazards associated with and relating to a variety of heating systems
- Identify with harmful substances, safe work practices, refrigerant safety, and safety working with electricity
- Understand products of combustion in occupied spaces
- Describe how the operating temperature ranges of equipment affects its safe operation
- Identify unsafe situations / conditions related to heating equipment
- Identify deficiencies with heating / cooling equipment

2. *Demonstrate an understanding of the Natural Gas and Propane Codes as they apply to heating equipment.*

Potential Elements of the Performance:

- Describe the OBC requirements for the HVAC industry
- Understand Ontario Regulation 219/01, Ontario Regulation 215/01, Ontario Regulation 212/01, and Ontario Regulation 211/01 made under the Technical Standards and Safety Act, 2000. Identify with the various Ontario Regulations that pertain to the heating industry.
- The student will be introduced to the code books and directed on how to use them to find out if contraventions to the regulations exist by knowing where to look.
- Pertinent references to regulations related to the home inspection industry will be reviewed
- Review safety contraventions related to home heating systems: conditions of natural gas lines, venting and furnace

3. Demonstrate an understanding of the basic principles of heat transfer as they apply to residential heating and cooling equipment.

Potential Elements of the Performance:

- Describe temperature, heat, matter, molecular motion, work and energy
- Examine the psychometrics of moisture content of air
- Identify with the terminology of psychometrics such as: grains per pound, dew point, dry bulb and wet bulb temperatures
- Examine the principles of conduction, radiation, convection, and evaporation closely
- Use the above principles and relate them to the condition of existing heating and cooling equipment
- Describe thermal energy and changes of state
- Determine the energy requirements for changes in temperature and state
- Apply heat transfer concepts to heat exchangers and hot water heating systems
- Describe the laws of physics that relate to vapours and gases

4. Recognize the components of heating and cooling equipment.

Potential Elements of the Performance:

- Explain the functions of various components that are vital to system operations and efficiencies
- Describe the differences between heating and cooling equipment
- Demonstrate an understanding of electrical fundamentals as it relates to the heating and cooling systems
- Identify and understand the ducting system for the heating or cooling appliance
- Determine the positive / negative attributes of different types of heating and cooling equipment (e.g. hot water heating, wood/electric combination furnaces, wood stoves, forced air heating, geothermal, etc.)

5. Explain the basic principles of operation for the heating source and for an air conditioning system.

Potential Elements of the Performance:

- Identify heating fuels such as: natural gas, propane, and oil
- Understand how the calorific values of these fuels pertain to the operation of furnaces
- Understand and be able to explain the principle operation of air to air heat pumps and water source heat pumps
- Identify with the various heat pump components such as: reversing valve, defrost system sensors, reversible driers, etc.

- Understand the vital components of the furnaces: vent motors, indoor blower motors, heat exchangers.
- Explain the critical components of a cooling system: evaporator coil (refrigerant characteristic); condenser coil (refrigerant characteristic)
- Identify conditions that decrease the operating efficiency of a heating system
- Identify conditions that negatively affect the operation of the air conditioning system

6. *Demonstrate a basic knowledge of how heat transfer affects the operation of a Heat Recovery system.*

Potential Elements of the Performance:

- Apply principles of heat transfer to a Heat Recovery System
- Identify and explain function and operation using a cross sectional view of a functioning unit
- Identify the factors that are considered when choosing an HRV for a residential application
- Explain how the cubic feet per minute (CFM) of the furnace relates to the HRV using airflow readings
- Design and properly size residential HRV, furnace and AC systems
- Be able to calculate the performance of a furnace, air conditioning, and HRV by using CFM and temperature readings

7. *Understand how refrigerants work in an air conditioning system*

Potential Elements of the Performance:

- Temperature readings at various locations along the piping joining the evaporator and condenser of an air conditioning system
- Identify that refrigerant hoses are colour coded
- Identify with the different chemical compositions of refrigerants contained within the air conditioning system
- Explain what the different boiling points indicate with a refrigerant and relate this with heat transfer efficiencies
- Identify with the pressure-temperature charts of the refrigerant and understand it's application
- Identify with refrigerant technology wording such as "glide", and "blend"

III. TOPICS:

1. Protect yourself and others.
2. Natural Gas and Propane Codes, related OBC sections.
3. Principles of heat transfer.
4. Components of HVAC systems, including electrical fundamentals
5. Basic principles of operation of HVAC systems.
6. Ventilation configurations and HRV systems.
6. Understanding conditions that increase / decrease efficiency.

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

- Refrigeration and Air Conditioning: An Introduction to HVAC, 4/E
AIR CONDITIONING and REFRIG, Larry Jeffus
© 2004 | Prentice Hall ISBN-10: 0130925713 | ISBN-13:
9780130925718
- Natural Gas and Propane Installation Code (B 149. 1-10)

V. EVALUATION PROCESS/GRADING SYSTEM:

Tests (2)	40 %
Quizzes (8)	40 %
Attendance / participation	5 %
Practical Assignments (3)	15 %
Total	100 %

The following semester grades will be assigned to students:

Grade	Definition	Grade Point Equivalent
A+	90 – 100%	4.00
A	80 – 89%	3.00
B	70 - 79%	2.00
C	60 - 69%	1.00
D	50 – 59%	0.00
F (Fail)	49% and below	
CR (Credit)	Credit for diploma requirements has been awarded.	
S	Satisfactory achievement in field /clinical placement or non-graded subject area.	
U	Unsatisfactory achievement in field/clinical placement or non-graded subject area.	

X	A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.
NR	Grade not reported to Registrar's office.
W	Student has withdrawn from the course without academic penalty.

VI. SPECIAL NOTES:Attendance:

Sault College is committed to student success. There is a direct correlation between academic performance and class attendance; therefore, for the benefit of all its constituents, all students are encouraged to attend all of their scheduled learning and evaluation sessions. This implies arriving on time and remaining for the duration of the scheduled session.

VII. COURSE OUTLINE ADDENDUM:

The provisions contained in the addendum located on the portal form part of this course outline.



HMI202 Heat Transfer – Course Plan

Week	Outcomes	Format	Hrs	Topic/Content	Readings	Assignment	Assessment	Resources
1	1	Lecture	3	<p><i>Protect self and others:</i> Demonstrate an understanding of safety as it relates to furnaces, wood/electric combination furnaces and air conditioning systems. <u>Identify</u> proper Personal Protective Equipment as it relates to his/her personal safety. <u>Explain</u> hazards associated with and relating to the different types of heating systems. <u>Understand</u> products of combustion in occupied spaces. <u>Describe</u> operating temperature ranges of equipment. <u>Identify</u> unsafe situations / conditions relating to heating equipment (e.g. clearance from combustibles)</p>	Chap. 1			Calculators, green tag safety boots, safety glasses Text book <i>Refrigeration and Air Conditioning: An Introduction to HVAC, 4/E.</i> Instructor handouts / training materials B149.1-10 Code Book
2	1,2	Lecture	3	<p><i>Demonstrate an understanding of the Natural Gas and Propane Codes as they apply to heating equipment.</i> <u>Describe</u> OBC requirements for the HVAC industry. <u>Understand</u> Ontario Regulation 219/01, Ontario Regulation 215/01, Ontario Regulation 212/01, and Ontario Regulation 211/01 made under</p>	B149.1-10 Natural Gas and Propane Installation Code		Quiz 1	As above.

				<p>the Technical Standards and Safety Act, 2000. Identify with the various Ontario Regulations that pertain to the heating industry.</p> <p>Identify the locations in the code book where specific regulations are found.</p> <p><u>Explain</u> safety contraventions related to home heating systems: conditions of natural gas lines, venting and furnace</p>				
3,4	3,4	Lecture	3	<p><i>Demonstrate an understanding of the basic principles of heat transfer as they apply to residential heating and cooling equipment.</i> <u>Describe</u> temperature, heat, matter, molecular motion, work and energy.</p> <p><u>Understand</u> the principles of conduction, radiation, convection, and evaporation.</p> <p><u>Explain</u> the above principles and relate them to the condition of existing heating and cooling equipment.</p>	Chap. 2	Assign. # 1	Quiz 2	As above.
			3	<p><i>Demonstrate an understanding of the concepts on how “on demand hot water tanks” operate.</i></p> <p><u>Apply</u> concepts of heat transfer to this operation:</p> <ul style="list-style-type: none"> - identify the condition of heat exchangers. - compare this to hot water heating 	Instructor handouts			

				systems.				
5,6	4	Lecture	3	<p><i>Recognize the components of heating and cooling equipment.</i> <u>Explain</u> the functions of various components that are vital to system operations and efficiencies. <u>Identify</u> the process to evaluate age and relative condition of HVAC equipment.</p>	Chap. 2		Quiz 3	As above.
			3	<p><i>Describe the differences between heating and cooling equipment.</i> <u>Apply:</u> Determine the positive / negative attributes of different types of heating and cooling equipment (e.g. hot water heating, wood/electric combination furnaces, wood stoves, forced air heating, geothermal, etc.)</p>	Instructor handouts			
7	4	Lecture	3	<p><i>Demonstrate an understanding of electrical fundamentals as it relates to the heating and cooling systems.</i> <u>Identify</u> the condition of wiring for various heating and cooling equipment and <u>describe</u> how they have been wired. <u>Identify</u> wiring alterations that (may) have been made to equipment.</p>	Chap. 3		Test # 1	As above.

8	4	Lecture	3	<p><i>Identify and understand the ducting system for the heating or cooling appliance.</i></p> <p><u>Describe</u> and determine if unacceptable alterations have been made between the size of the duct system and the BTU capacity of the piece of equipment, including supply plenum of furnaces, return air drops and branch runs.</p>	Chap. 5	Assign. # 2	Quiz # 4	As above.
9	5	Lecture	3	<p><i>Explain the basic principles of operation for the heating source.</i></p> <p><u>Understand</u> the vital components and operation of furnaces: vent motors, indoor blower motors, heat exchangers.</p> <p><u>Understand</u> the operating components of heat pump operations.</p>	Instructor handouts			As above.
10	5	Lecture	3	<p><i>Explain the basic principles of operation for an air conditioning system.</i></p> <p><u>Review</u> critical components of a cooling system. Explain the: evaporator coil (refrigerant characteristic) condenser coil (refrigerant characteristic)</p> <p>Understand conditions that affect heat transfer in a negative or positive way and recognize each situation.</p>	Chap. 4		Quiz # 5	As above.

11	5	Lecture	3	<p>Identify conditions that decrease the operating efficiency of a heating system.</p> <p><u>Examine</u> the in-depth operation of a fuel burning appliance and its components. Use the temperature values attained when checking heat transfer efficiencies.</p> <p><u>Understand</u> that temperature differences are critical to the efficient operation of the unit.</p>	Chap. 5			As above.
12	5	Lecture	3	<p>Identify conditions that negatively affect the operation of the air conditioning system.</p> <p><u>Explain</u> where to take temperature readings and transfer resultant values into an efficiency rating for how the system is functioning.</p>	Chap. 4		Quiz # 6	As above.
13	6	Lecture	3	<p>Demonstrate basic knowledge of the operation of a Heat Recovery system.</p> <p><u>Understand</u>, through in depth schematics, the operation of an HRV, applying principles of heat transfer and using a cross sectional view of a functioning unit.</p> <p><u>Recognize</u> various air pollutants such as asbestos, mould and other allergens</p> <p>Understand the function of different types of air filters such as: hepa, pleated, and electronic air filters.</p>	<i>Readings here?</i>			As above.

14,15	6	Lecture	3	<p><i>Understand how an incorrectly installed HRV system can be harmful to the indoor air quality; describe how to properly design a complete residential system.</i></p> <p><u>Describe</u> possible options, then <u>design</u> properly installed HRV, furnace and air conditioning systems, understanding the different ways an installation can function properly and properly sizing the system(s) to the application.</p>	Chap. 5	Assign. # 3	Quiz # 7	As above.
		Lecture	3	<p><i>Understand that poorly installed equipment can increase hydro cost substantially.</i></p> <p>A detailed explanation of how poorly installed equipment increases hydro costs.</p>	Instructor handouts		Test # 1	
16	7	Lecture	3	<p><i>Understand how refrigerants work in an air conditioning system.</i></p> <p>Temperature readings at various locations along the piping joining the evaporator and condenser of an air conditioning system.</p> <p>Review concepts and entertain questions.</p>	Chap. 2		Quiz # 8	As above.