

SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO



**SAULT
COLLEGE**

COURSE OUTLINE

COURSE TITLE: Motive Power Mobile Air Conditioning and Refrigeration
Theory/Lab/Shop

CODE NO. : MPT204 **SEMESTER:** THREE

PROGRAM: Motive Power Technician – Advanced Repair

AUTHOR: George Parsons

DATE: Aug 2010 **PREVIOUS OUTLINE** N/A

DATED:

APPROVED:

“Corey Meunier”

CHAIR

DATE

TOTAL CREDITS: FOUR

PREREQUISITE(S): N/A

HOURS/WEEK: 5 hours per week theory
2 hours per week lab/shop

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For additional information, please contact Corey Meunier, Chair

School of Technology & Skilled Trades

(705) 759-2554, Ext. 2610

I. COURSE DESCRIPTION:

Upon successful completion, the student will be able to understand the principles of operation, diagnose and repair Truck and Coach, Automotive, and Heavy Duty Equipment, heating, ventilation and air conditioning systems (HVAC) to manufacturer and environmental safety standards.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

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

1. *Explain the purpose and fundamentals of HVAC theory.*

Potential Elements of the Performance:

- thermodynamics
- heat transfer
- climate control systems
- temperature and relative humidity relationship
- change of state, latent and sensible heat
- properties of refrigerants
- gas laws, temperature, pressure and volume
 - storage
 - purchasing
 - recovery
 - disposal
 - legal Issues
- environmental effects of refrigerant

2. *Identify the functions, construction, composition, types, styles and application of Truck and Coach, Automotive and Heavy Equipment HVAC theory and reefer systems.*

Potential Elements of the Performance:

- climate control systems
- reefer circuit components
- heating and ventilation
- electronic
- mechanical
- cycling clutch systems
- orifice tube
- expansion valve
- identify types of refrigerants
 - OEM Recommended
 - alternate
- lubricants
- system control devices
 - zone control
- flow control valves
- system protection devices

- low temperature / pressure
- high temperature / pressure
- **expansion valves and orifice tubes**
- **clutch controls**
- **condensers**
- **receiver dryer**
- **accumulator-dryer**
- **evaporator**
- **heater cores compressors**
- **axial recirculating**
- **radial**
- **variable displacement**
- hoses, lines and fittings
- van insulation requirements

3. Describe the principle(s) of operation of Truck and Coach, Automotive and Heavy Equipment HVAC systems.

Potential Elements of the Performance:

- **heating system operation**
- **AC system operation**
- **climate control**
 - temperature controls
 - airflow management
 - characteristics of refrigerants
- **characteristics of lubricants**
- **system protection devices**
 - low and high-pressure cutout
 - low charge protection
 - low pressure cycling control
- **compressor cycle**
 - cycling clutch
 - variable displacement
- **reefer system operation**
- **cryogenic systems**

4. Perform inspection, testing and diagnostic procedures on Truck and Coach, Automotive and Heavy Equipment HVAC systems.

Potential Elements of the Performance:

- **identify the location of system components and controls**
- **performance test**
 - heating system
 - AC system
 - climate control
- **test for refrigerant and coolant leaks**
- **test system for operating pressure and control functions**
- **outline service requirements of various refrigerants**

5. *Recommend reconditioning or repairs following manufacturers' procedures on Truck and Coach, Automotive and Heavy Equipment HVAC systems.*

Potential Elements of the Performance:

- **outline procedures required removing and replacing HVAC system components**
- **perform drive belt adjustments**
- **demonstrate recovery, recycling, evacuation**
- **recharging procedures**

III. TOPICS:

1. Fundamentals of the refrigeration cycle.
2. Refrigerant types.
3. Compressor operation.
4. Condenser types and styles.
5. Expansion valves and fixed orifice systems.
6. Evaporator types and styles.
7. System design and layout.
8. Evacuation/Recharge Equipment.

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:
Automotive Technology-A Systems Approach – Canadian Edition
Erjavec-Restoule-Playter

Heavy Duty Truck Systems 4th Edition
Bennett-Norman

V. EVALUATION PROCESS/GRADING SYSTEM:

Theory letter grades are based on; (also see attached information below)

- 50% of semester Theory Tests, averaged
- 20% of Final Theory Exam
- 20% of semester theory assignments, averaged
- 10% of assessed employability skills (attendance, punctuality, work ethics, and general attitude)

A **60% Average of the total semester exam, assignments and employability skills** must be achieved to receive a passing grade of at least C in Theory.

A student **cannot rewrite** a test to improve his/her mark.
If a test is missed by a student, without a good reason, an **“Incomplete”** grade is allotted.

The following semester grades will be assigned to students:

Grade	<u>Definition</u>	<i>Grade Point Equivalent</i>
A+	90 – 100%	4.00
A	80 – 89%	
B	70 - 79%	3.00
C	60 - 69%	2.00
D	50 – 59%	1.00
F (Fail)	49% and below	0.00
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.	

**Professor Parsons
Student Assessment Procedure
For Motive Power Technician**

THEORY ASSIGNMENTS

Theory assessment is based on regularly scheduled tests and assignments and final exam. Attendance and home work checks are recorded and used as an aid for counseling.

The following grades will be assigned for **Theory Assignments:**

A+	90 to 100
A	85
A-	80
B +	79
B	75
B-	70
C +	69
C	65
C-	60
D	50
F (Fail)	49 or less.

Assignments will be graded as follows:

- a) One day after the original due date – 70% maximum.
- b) Two or more days after the original due date – 50% maximum.

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.

It is the departmental policy that once the classroom door has enclosed, the learning process has begun. Late arrivers will not be granted admission to the room.

**Professor Parsons
Motive Power Technician Program
Policies and Procedures**

Policy Information Sheet

1. During your program, you are considered to be a member of the Motive Power Department. As such, your actions and department, both in the college and the community reflect on this Department. We trust that your influence will be positive.
2. College policy prohibits the consumption of food and drink in the classrooms and shop. Smoking is allowed only outside of the building in designated smoking areas. **No smokeless tobacco is allowed in theory class or shop class.**
3. CSA approved Safety Glasses and Safety Boots must be worn in the Shop at all times. This means going to and from all of the classrooms located in the shop. It is the responsibility of the **STUDENT** to wear them. You will be marked absent if the aforementioned policy is not adhered to.

**All safety glasses and boots
must meet Sault College CSA approval rating.**

See attachment regarding
Eye, Face and Foot Personal Protection Equipment (PPE)

NO GLASSES-NO BOOTS-NO ENTRY!!

4. Repairs to your private vehicles in our facilities can be educational to you. We will accommodate you if the work is part of our program and schedules in. **No car should be parked in the shop compound or outside a shop door without staff permission and a temporary parking pass clearly displayed.**

- 5. Attendance** – if late, don't bother coming until the next class, you will be marked absent. The student is to be continuously present and actively participating during all scheduled theory and shop classes (scheduled breaks excepted). Every unexcused absence will be reflect on your Employability Skills mark.
- 6.** The student must have safety boots and safety glasses readily available because you may not have a lot of warning when going into shop.
- 7.** Please, coffee breaks only 10 to 12 minutes **MAXIMUM. NOTE: Individual Professors will address each class with their expectations. Some may only allow 10 minutes.**
- 8.** Please refrain from loitering in "C" wing hallways, around shop hallway entry doors and outside entrance doorways/walkways.
- 9.** Drinking alcohol or using drugs at lunch is discouraged and students will be excused from class at the Professor's discretion.
- 10.** Welding attendance is **MANDATORY, as are all related subjects.** It is in your best interests to attend all classes on your schedule. Remember, you need to successfully complete all assigned courses to graduate.
- 11.** If you miss a test with an "**unexcused absence**" (as deemed legitimate by your professor) you will **NOT** be allowed to write that test. Only if; a doctors note, airline ticket, etc., or circumstances arising from a family emergency; and legitimate written proof can be presented to the professor. See item number 16 below for clarification.
- 12.** If a class is missed or going to be missed it is your responsibility to notify in writing (see item #16 below) your Professor and make arrangements for handouts and notes taken while you are away.
- 13.** **The use of cell phones/PDA's, electronic information/image capturing or recording device for any form of communication or recording (voice, text, recording, image, etc...) during theory class or shop is strictly prohibited. Cell phones/PDA's must be silenced during regular class and shop times and must be turned off and kept out of sight during all classes and test sittings. Failure to follow the latter requirement during a test sitting will result in a grade of 0 (zero) being assigned and if not out of sight or being used during class, the unit WILL be confiscated for the duration of the class.**

NO EXCEPTIONS

- 14.** Students may not wear earphones/headphones of any kind (i.e. for playback of recorded music/voice) during theory classes, shop classes and test sittings. This does not include hearing aids as required by hearing impaired students.
- 15.** **NO Lap Top Computers** will be allowed in any class unless proper documentation is provided that the computer is required for learning assistance.
- 16.** **Any request to deviate from the aforementioned course outline requirements must be made to the Professor in writing or via Sault College email. *If* permission is granted it must also be granted in writing or via Sault College email. Verbal requests/permissions are not acceptable. It is the students responsibility to maintain a copy of all such requests and associated permissions.**

Student

Signature: _____

Date: _____

Students refusing to sign this form will not be allowed to register or continue in their course.

Professor Parsons General Guideline For Motive Power Technician Program

1. ATTENDANCE

A terminal objective of the Motive Power Department is the demonstration of satisfactory attendance and punctuality performance that the Motive Power Industry, itself, relies on, for efficiency, productivity and profitability.

- Absences will affect your learning and your final grade.

- 1.1 Students are encouraged to be present for the full duration of each class. Shop attendance is recorded at the start and end of class. Students are expected to be continuously present and actively participating (scheduled breaks excepted) for the entire class.
- 1.2 If you are absent from class at the time of attendance, you will be marked absent from the entire class.
- 1.3 If you are marked absent, and no reasonable excuse is given your absence will be termed unexcused. There should **NOT** be a reason to **NOT** let us know nor related subject Professors, in writing why you're absent.
- 1.4 Students will lose marks from their theory and shop mark grade for unexcused absences. Poor attendance can mean a repeat of both theory and shop courses if your employment skills are poor. This is based on the 10% Employability Skills.
- 1.5 At 10% of accumulated hours of unexcused absence you will be asked to a scheduled meeting with your Professor and will be asked to sign a contract enabling you to continue the course.
- 1.6 If you are absent from class, the lesson material is your responsibility.

2. BEHAVIOR/ATTITUDE

- 2.1 Students are required to:
 - a) Properly care for and maintain all shop and classroom equipment.

- b) Properly clean the shop/classroom facility and equipment at the end of each class.
 - c) Remain in the class during clean-up and assist in the cleaning and shutting down of their shop/classroom.
- 2.2 Students are expected to conduct themselves in a manner that does not interfere with or obstruct the overall learning environment.
- 2.3 The following activities are not allowed in the shop/classrooms:
 - a) Horseplay.
 - b) Making unnecessary noise.
 - c) Swearing.
 - d) Abusive behavior.
 - e) Smoking, chewing smokeless tobacco, beverages and eating.

3. **ASSIGNMENTS AND THEORY TESTS**

- 3.1 Students are required to hand in assignments or write theory tests on the day and at the time specified/scheduled. See item #16 in the aforementioned document. You must attend 90% of the classes in a unit to be eligible to write the unit exam.
- 3.2 Assignments will be graded as follows:
 - a) One day after the original due date – 70% maximum.
 - b) Two or more days after the original due date – 50% maximum.

NOTE: The only exception of guideline 3 shall be those arising from personal emergencies (i.e. car accident, family death, serious illness, employment reasons) and the student supplies a written statement to that effect. See item #16 in the aforementioned document.

4. **SAFETY**

- 4.1 Students are required to wear their personal protective equipment (i.e. C.S.A approved safety boots and impact safety glasses) at all times while in the shop area. See attached addendum at the end of this document.
- 4.2 Students must not enter the shop area or commence work before their scheduled time.
- 4.3 Students must not work alone or in an unsupervised area.
- 4.4 Students must have lift truck training prior to operating those units.
- 4.5 Students must have equipment training and Technologist/Professor approval before operating any equipment.

- 4.6 Students must not use or operate equipment that is found to be unsafe or damaged. All such equipment must be reported to the Professor or Technologist who will replace and/or repair the said equipment.
- 4.7 Where damaged or unsafe equipment cannot be repaired or replaced, the Professor/Technologist will provide students alternate shop activity.
- 4.8 Students must follow instructions and safe work practices in order to use or operate any shop equipment.

Motive Power

Eye, Face and Foot Personal Protection Equipment (PPE)

Students are required to wear appropriate Personal Protection Equipment (PPE) in designated areas at all times. The designated areas for eye and foot protection in the Motive Power areas are: C1073 (Automotive), C1000, C1010, and C1040 (Truck/Coach and Heavy Equipment) and C1120 (Marine and Small Engines). Appropriate PPE must also be worn when facing hazards outside of these designated areas.

Eye Protection:

All protective eye wear shall meet the requirements of:

C.S.A. - Z94.3 or A.N.S.I. - Z87.1 +.

Approved safety glasses (lens and frames) shall have side protection such as wrap around design or fixed side shields.

- The minimum acceptable eye protection is a spectacle (class 1A on chart Z94.3)
- Dark tinted spectacles will not be accepted for general indoor use.
- Additional eye and face protection is required for specific hazards.
- Chart Z94.3 outlines the appropriate PPE for specific hazards.

Foot Protection:

- 1. Boot height- minimum 5 ½" uppers (6" boot), measured from the top of the sole.**
- 2. Leather Construction.**
- 3. CSA Green Patch rating.**

Safety boots must be properly laced and not be worn or damaged as to impair their effectiveness.

Eye and Face Protection Passport:

Refer to the attached chart Z94.3 to identify the required eye and face protection for the following scenarios:

1. Minimum eye protection required at all times in a Motive Power area where signage indicates that eye protection must be worn.

Answer _____

2. Required eye protection for testing lead acid batteries where a chemical hazard exists.

Answer _____

3. Required eye protection for Oxyacetylene cutting and welding.

Answer _____

4. Required eye protection for sandblasting using portable equipment (no contained sand blasting cabinet).

Answer _____

5. Grinding, drilling or chipping.

Answer _____

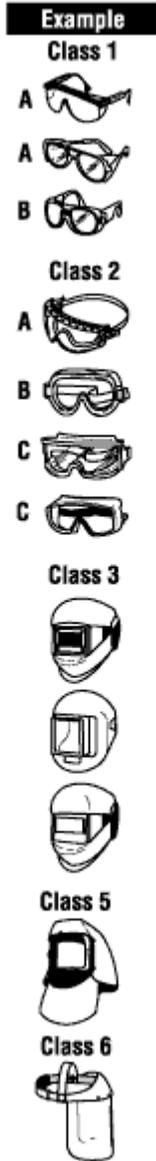
I acknowledge that my Instructor has explained this policy, and I understand that it is my responsibility to wear the appropriate eye, face, and foot protection.

Signed _____

Print Name _____

Date _____

Chart Z94.3		Selection of Eye and Face Protection												
<p>Note: This table cannot cover all possible hazards and combinations that may occur. Examine each situation carefully and select the appropriate protector or combination of protectors.</p> <p>*indicates recommended protection</p>	Spectacles (Class 1)		Goggles (Class 2)			Welding Helmet (Class 3)	Welding Hand Shield (Class 4)	Non-Rigid Hoods (Class 5)				Face Shields (Class 6)		
	A	B	A	B	C			A	B	C	D	A	B	C
Flying Objects														
Chipping, drilling, scaling, grinding, polishing, buffing, riveting, punching, shearing, hammer mills, crushing, heavy sawing, planing, wire and strip handling, hammering, unpacking, nailing, punch press, lathe work, etc.														
	*		*	*				*				*	*	
Flying particles, dust, wind, etc.														
Woodworking, sanding, light metal working and machining, exposure to dust and wind, resistance welding (no radiation exposure), sand, cement, aggregate handling, painting, concrete work, plastering, material batching and mixing														
	*		*	*				*				*	*	
Heat, sparks and splash from molten materials														
Babbiting, casting, pouring molten metal, brazing, soldering, spot welding, stud welding, hot dipping operations														
		*			*									
Acid splash, chemical burns														
Acid and alkali handling, degreasing, pickling and plating operations, glass breakage, chemical spray, liquid bitumen handling														
				*				*					*	
Abrasive blasting materials														
Sand blasting, shot blasting, shotcreting														
				*				*					*	
Glare, stray light (for reduction of visible radiation)														
Reflecting, bright sun and lights, reflected welding flash, photographic copying														
	*		*	*				*				*	*	
Injurious optical radiation (moderate reduction of optical radiation)														
Torch cutting, welding, brazing, furnace work, metal pouring, spot welding, photographic copying														
Injurious optical radiation (large reduction of optical radiation)														
Electric arc welding, heavy gas cutting, plasma spraying and cutting, inert gas shielded arc welding, atomic hydrogen welding														
						*	*							



Notes:**VII. COURSE OUTLINE ADDENDUM:**

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