SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO

SAULT
COLLEGE

COURSE OUTLINE

COURSE TITLE: HEAVY EQUIPMENT III – THEORY Fall 2010

CODE NO. : HED200 **SEMESTER:** THREE

PROGRAM: Truck and Coach / Heavy Duty Equipment Technician

AUTHOR: Lane Ross

DATE: Aug/10 **PREVIOUS OUTLINE DATED:** Aug/09

APPROVED:

"Corey Meunier"
CHAIR

_____
DATE

TOTAL CREDITS: 13

PREREQUISITE(S): HED101

HOURS/WEEK: 8 hrs.for 15 wks.

I. COURSE DESCRIPTION:

This course will present hydraulic circuitry, basic electrical principles, battery, charging and cranking circuits, diesel fuel supply systems and injection basics for pressure/ time, in-line and rotary pumps as well as hydraulic injectors. Safety elements of the repair industry will be stressed. Demonstrated skills learned in this semester will enable students to support the trucking, agricultural, construction, material handling, mining, forestry, railway and equipment rental industries.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

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

1. Recognize hydraulic components and their proper function in mobile equipment and schematic circuits, and determine the correct diagnostic flow-meter and pressure tests as well as cycle time, temperature, and sound troubleshooting techniques.

Potential Elements of the Performance:

- Recognize hydraulic operating principles, force and torque multiplication.
- Identify reservoir, filter, pump and actuator components, their purpose and function within a hydraulic circuit.
- Identify directional control valves, their classification and operating characteristics.
- Distinguish between pressure relief, reducing, and sequence valves, their function and effect, in hydraulic circuits.
- Recognize holding valves, their safety responsibility and working characteristics.
- Recognize axial and radial piston pumps, their operating principles, intended safeguards and maintenance checks
- Recommend the correct troubleshooting techniques to determine component faults for both pressure and flow related problems.

2. Competently interpret electrical circuit schematics, identify components, their operating principles and maintenance required, recommend the proper troubleshooting techniques with multi-meter and testing equipment for electrical circuit maintenance and repair.

Potential Elements of the Performance:

- Identify electrical energy, its sources, terminology for measurement of flow and pressure and power ratings.
- Calculate circuit resistance, amperage and voltage drops.
- Identify analog and digital multimeter characteristics, their proper and practical uses.

- Identify lead acid battery construction, operating principles, safety considerations, maintenance and testing procedures.
- Recognize magnetic and electro-magnetic sources and components, force fields, polarities and amp/turn field relationships.
- Recognize electronic, semiconductive devices, their construction, operating principles and use in charging alternators and voltage regulators and micro processing controls.
- Identify electrical charging components, construction, operating principles, maintenance and testing.
- Identify engine cranking systems including air and hydraulic starters.
- Identify electrical cranking motor operation, construction, maintenance and testing procedures.
- Recommend the proper troubleshooting technique, instrument and correct installation for isolating electrical circuit faults.

3. Recognize and recommend the proper service and maintenance of diesel fuel supply systems encountered in the mobile equipment industries.

Potential Elements of the Performance:

- Identify diesel fuel oil and its characteristics and safety considerations.
- Identify fuel tank, water traps, primary filters, charge pump and regulator valves, priming devices, secondary filters, bleeding devices and charge pressure check points.
- Identify combustion requirements for diesel compression ignition.
- Identify the requirements of all fuel injection systems as to timing, rate, distribution, atomization, duration and metered amount of fuel.
- Recognize pressure – time fuel injection systems, their individual components, operation principles, adjustment and maintenance.
- Recognize and identify multiplunger in – line injection pump components including governors, air/fuel ratio devices, and their operating principles.
- Distinguish hydraulic injectors from mechanical, unit, and electronically controlled unit injectors, determine their operating principles and testing criteria and adjusting procedure.
- Identify mechanically actuated, unitized injectors, operation and maintenance procedures.
- Identify Stanadyne rotary distributor fuel injection pumps, operation, timing and maintenance.
- Identify sleeve metering rotary distributor injection pumps, operation, timing and maintenance.

II. TOPICS:

1. Hydraulics – Hydraulic basics, reservoirs, pumps, filters, relief valves, directional and pressure control valves, cylinders, holding valves, hydraulic motors, and various troubleshooting techniques

2. Electrical – Basics, meters, circuits and calculations, batteries, cranking and charging systems, electrical troubleshooting

3. Fuel supply systems – charge pumps, primary and secondary filters, water separators, fuel heaters

4. Fuel Injection systems - Pressure / time, in-line multiplunger, hydraulic injectors, unit injection, rotary distributor pumps
   (i) Stanadyne
   (ii) VE Bosch

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

Heavy Duty Truck Systems 4th Edition (Thomson Delmar)
Diesel Technology (Nelson Thompson)
Diesel Technology Workbook
Vickers Mobile Hydraulics Manual
Power Trains (John Deere)
Pens, pencils, coloured pencils, calculator, and 3-ring binder

V. EVALUATION PROCESS/GRADING SYSTEM:

The Heavy Equipment Program considers both HED200 Theory and HED201 Shop to be *co-requisites.* Students must successfully complete both courses in the same semester.

Theory letter grades are based on;

- 70% of semester theory examination average
- 20% of semester theory assignment average
- 10% of assessed employability skills
  (attendance, punctuality, work ethic and general attitude)

The following semester grades will be assigned to students in post-secondary courses:

Grade	Definition	Grade Point Equivalent
A+	90 - 100%	4.00
A	80 - 89%	3.75
B	70 - 79%	3.00
C	60-69%	2.00
D	50-59%	1.00
F (Fail)	49% or 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.

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.

Class and Shop Conduct – Motive Power Policies and Procedures

The Heavy Equipment Program considers both HED200 Theory and HED201 Shop to be *co-requisites.* Students must successfully complete both courses in the same semester.

VII. COURSE OUTLINE ADDENDUM:

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

Motive Power Department
Truck/Coach-Heavy Equipment
Department 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 deportment, 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.

Note: All safety glasses and boots must meet Sault College CSA approval rating. See attachment RE: 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 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). For every unexcused absence you will be deducted 1% per class period missed from that specific unit for the time missed.

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 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 test sittings. Failure to follow the latter requirement during a test sitting will result in a grade of 0 (zero) being assigned.* 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.

Guideline For
Truck/Coach-Heavy Equipment

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 test.

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.

Student Assessment
Procedure For Truck/Coach-Heavy Equipment
THEORY

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

The following grades will be assigned:

A+ 90 to 100 (Numerical Equivalent 4.00) - Consistently Outstanding.

A 80 to 89 (Numerical Equivalent 4.00) - Outstanding Achievement

B 70 to 79 (Numerical Equivalent 3.00) - Consistently Above Average Achievement.

C 60 to 69 (Numerical Equivalent 2.00) - Satisfactory or Acceptable Achievement.

D 50 to 59. (Numerical Equivalent 1.00) - Acceptable when other marks average to a passing grade.

F (Fail) 49% and below (Numerical Equivalent 0:00) – Unacceptable Performance

CR – (Credit) Credit for diploma requirements has been awarded

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 the Registrars office.

W – Student has withdrawn from the course without academic penalty.

Your **Semester Theory Letter Grade** will be comprised of:

- 70% of Semester Theory Exam Average.
- 20% of Semester Theory Assignment Average.
- 10% of Assessed and Employability Skills (attendance, punctuality, attitude and work ethics)

A **60% Average of the total semester exam and assignments** must be achieved to receive a passing grade 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.

Student Assessment
Procedure For Truck/Coach-Heavy Equipment
SHOP

Shop assessment is based on two criteria:

1. 50% on project or shop assignments and on the students' ability as measured subjectively by performance on a variety of shop tasks. Such assignments or projects not received on time will be degraded accordingly.

2. 50% on employability skills. Attendance, punctuality, preparedness (safety boots, glasses, coveralls on and ready to work), house keeping, work organization and general attitude.

The following grades will be assigned:

A+ 90 – 100% (Numerical Equivalent 4.00) - Consistently Outstanding.

A 80 – 89% (Numerical Equivalent 4.00) - Outstanding Achievement.

B 70 – 79% (Numerical Equivalent 3.00) - Consistently Above Average Achievement.

C 60 – 69% (Numerical Equivalent 2.00) - Satisfactory or Acceptable Achievement

D 50 – 59% (Numerical Equivalent 1.00) - Acceptable when other marks average to a passing grade

F (Fail) 49% or below (Numerical Equivalent 0.00) - Repeat – Objectives of course not achieved and course must be repeated

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 the Registrars office.

W – Student has withdrawn from the course without academic penalty.

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 _____

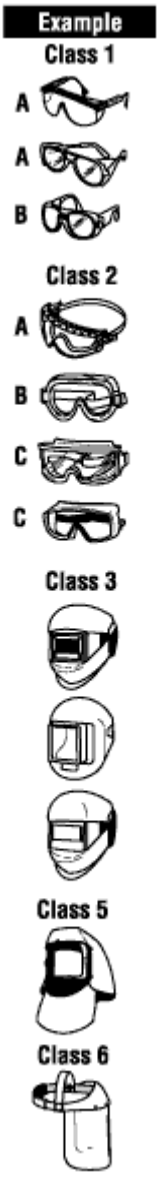
Date _____

Chart Z94.3 Selection of Eye and Face Protection

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.

*indicates recommended protection

	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, planning, 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															