

SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO



Sault College

COURSE OUTLINE

COURSE TITLE: HEAVY EQUIPMENT III - THEORY
CODE NO. : HED200-13 **SEMESTER:** 3
PROGRAM: Truck and Coach / Heavy Duty Equipment Technician
AUTHOR: Jack Bowes / George Parsons
DATE: Aug/2006 **PREVIOUS OUTLINE DATED:** May/05

APPROVED:

DEAN

DATE

TOTAL CREDITS:

PREREQUISITE(S): HED111-10

HOURS/WEEK: 8 hrs.for 15 wks.

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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, electr. 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 HED200-13 Theory and HED201-9 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 ethics, and general attitude)

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

<u>Grade</u>	<u>Definition</u>	<u>Grade Point Equivalent</u>
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
	Failure – the student has not achieved the objectives of the course and the 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 Registrar's office.	
W	Student has withdrawn from the course without academic penalty.	

VI. SPECIAL NOTES:Special Needs:

If you are a student with special needs (e.g. physical limitations, visual impairments, hearing impairments, or learning disabilities), you are encouraged to discuss required accommodations with your instructor and/or the Special Needs office. Visit Room E1204 or call Extension 493 so that support services can be arranged for you.

Retention of course outlines:

It is the responsibility of the student to retain all course outlines for possible future use in acquiring advanced standing at other postsecondary institutions.

Plagiarism:

Students should refer to the definition of “academic dishonesty” in *Student Rights and Responsibilities*. Students who engage in “academic dishonesty” will receive an automatic failure for that submission and/or such other penalty, up to and including expulsion from the course/program, as may be decided by the professor/dean. In order to protect students from inadvertent plagiarism, to protect the copyright of the material referenced, and to credit the author of the material, it is the policy of the department to employ a documentation format for referencing source material.

Course outline amendments:

The Professor reserves the right to change the information contained in this course outline depending on the needs of the learner and the availability of resources.

Substitute course information is available in the Registrar's office.

VII. PRIOR LEARNING ASSESSMENT:

Students who wish to apply for advanced credit in the course should consult the professor. Credit for prior learning will be given upon successful completion of a challenge exam or portfolio.

VIII. DIRECT CREDIT TRANSFERS:

Students who wish to apply for direct credit transfer (advanced standing) should obtain a direct credit transfer form from the Dean's secretary. Students will be required to provide a transcript and course outline related to the course in question.