SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO

SAULT
COLLEGE

COURSE OUTLINE

COURSE TITLE: Heavy Equipment IV - Shop

CODE NO. : HED211 **SEMESTER:** FOUR

PROGRAM: Truck and Coach / Heavy Duty Equipment Technician

AUTHOR: Lane Ross

DATE: Feb 1/11 **PREVIOUS OUTLINE DATED:** Jan 2010

APPROVED:

"Corey Meunier"
CHAIR **DATE**

TOTAL CREDITS: 9

PREREQUISITE(S): HED200

HOURS/WEEK:

For additional information, please contact Corey Meunier, Chair
School of Technology & Skilled Trades
(705) 759-2554, Ext. 2610

I. COURSE DESCRIPTION:

This hands-on shop course compliments and reinforces the theory taken in HED210-11 during the winter, fourth semester. The course content requires the student to perform a wide variety of shop assignments and projects that will later assist the graduate in trade related employment in the heavy equipment, trucking, agricultural, construction, material handling, mining, forestry, railway, equipment rental and dealership industries. As each shop assignment is completed, the student will be required to write a service report that summarizes the assembly, maintenance service, and testing procedures and the specifications encountered.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

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

1. ***Maintain mobile hydrostatic systems and circuits by competently diagnosing, repairing/replacing components, analyzing failure causes, removing problems and testing and adjusting to ensure efficient hydrostatic performance.***

   Potential Elements of the Performance:

   - Remove, disassemble, inspect and replace charge pumps.
   - Disassemble, inspect and determine operating principles of various hydraulic motors (LSHT and HSLT)
   - Disassemble, inspect and identify the operation of hydrostatic control valves and optional valving and purpose and location.
   - Perform all pressure checks on a live hydrostatic closed loop circuit (Sunstrand)

2. ***Support the servicing, troubleshooting and repairing, and maintaining of hydrodynamic fluid drives encountered in heavy duty commercial vehicles.***

   Potential Elements of the Performance

   - Disassemble and inspect and determine phase and stage and flow paths within a dry sump torque converter.
   - Disassemble, determine phase/stage and flow paths within a wet sump torque converter.
   - Assemble fixed, two phase and poly-phase torque converters correctly.
   - Identify complete hydraulic flow circuit of a typical torque converter including charge pump, reservoir, filters, coolers and all regulating valves on shop equipment.
   - Disassemble a countershaft powershift transmission and determine oil flow and operation.
   - Disassemble a planetary powershift transmission and follow the torque routes and oil flow within the assembly.

- Perform a torque converter stall test and analyze the results.
- Perform a hydraulic stall test and full converter/hydraulic stall test and analyze the results.

3. ***Support the inspection, diagnostics, repair and / or replacement of commercial vehicle braking systems and components following the manufacturer's procedures and guidelines. Students may also work toward an Ontario "Z" air brake endorsement certificate for successful completion of their air brake written and practical tests.***
   Potential Elements of the Performance:
   - Fabricate double flare brake lines.
   - Perform inspection, disassembly and repair of air brake components including valves, calliper assemblies, wedge brake assemblies, and air over hydraulic brake boosters.
   - Perform inspections and identify potential faults of air brake air supply systems including reservoirs, spitters and drains, air dryers, compressors, governors, safety valves and check valves.
   - Perform foundation brake inspections for cam and bushing wear, lining, brake drum and related component condition.
   - Perform foundation brake stroke length check.
   - Perform "S" cam manual slack adjuster adjustment.
   - Perform air brake component functional tests including low pressure warning devices, compressor build up time, air governor cut in and cut out pressures, air loss rate pressures, tractor protection valve operation, trailer brake application, spring brake application, and dual brake primary and secondary reservoir and check valve operation.

4. ***Maintain, repair and adjust the various vehicle-retarding systems used in the heavy equipment and trucking industries.***
   Potential Elements of the Performance

   - Disassemble, inspect and identify the operating principles of engine compression brakes, exhaust brakes reassemble, adjust and test run.
   - Operate, test and identify the operation of hydraulic retarders.

5. ***Support the heavy equipment off-road and on-road trucking repair and maintenance industries by correctly diagnosing, analyzing, and repairing the faults of electronically managed engine and powertrain systems.***

Potential Elements of the Performance

- Identify electronic microprocessors, sensors and actuator components, their location and purpose, on a variety of shop engines.
- Perform an engine self-diagnostic test using lamp flash codes.
- Inspect, remove and replace pins and sockets in various wire harness connectors.
- Perform engine diagnostics of active and logged faults using the ECAP tool, Pro-link 2000, and various P.C diagnostic programs on:
  - 3176 Cat simulator
  - 3176 Cat engine
  - 3406E Cat engine
  - 60 Series Detroit engine
  - Volvo/Detroit Series 60 engine
  - N14E Cummins
- Perform a “snapshot” diagnostic procedure

Change a customer parameter.

5. ***Support the heavy equipment off-road and on-road trucking repair and maintenance industries by correctly diagnosing, analyzing, and repairing the faults of electronically managed engine and powertrain systems.***

Potential Elements of the Performance

- Identify electronic microprocessors, sensors and actuator components, their location and purpose, on a variety of shop engines.
- Perform an engine self-diagnostic test using lamp flash codes.
- Inspect, remove and replace pins and sockets in various wire harness connectors.
- Perform engine diagnostics of active and logged faults using the ECAP tool, Pro-link 2000, and various P.C diagnostic programs on:
  - 3176 Cat simulator
  - 3176 Cat engine
  - 3406E Cat engine
  - 60 Series Detroit engine
  - Volvo/Detroit Series 60 engine
  - N14E Cummins
- Perform a “snapshot” diagnostic procedure

Change a customer parameter.

6. ***Inspect, analyze, repair and adjust diesel engine emission devices to improve and maintain an improved visual perception of diesel technology.***
   Potential Elements of the Performance:
   - Perform snap throttle opacity tests on various turbocharged shop diesels.
   - Test and inspect the air/fuel ratio control on a Cat 3406.

7. ***Understand and explain and perform Heavy Duty Air Conditioning System, troubleshooting and repair A/C Systems, evacuate and recharge A/C Systems as they apply to off road equipment and on road heavy-duty trucks. Identify the Environmental concern as it pertains to refrigerants and the destruction of the ozone layer.***
   Potential Elements of the Performance
   - Perform A/C System evacuation using approved methods according to government regulations and manufacturers specifications.
   - Perform recharging of an A/C System using approved methods and according to government and manufacturers specifications.
   - Practice proper safety procedures as they apply to refrigerants.
   - Perform approved leak testing diagnostic procedures.

III. TOPICS:

1. HYDROSTATICS
   - Hydrostatic Transmissions
   - Hydrostatic Diagnostics and Troubleshooting

2. HYDRODYNAMIC DRIVES
   - Fluid couplings
   - Torque Converters
   - Powershift Transmissions - Countershaft, Planetary
   - Stall Testing and Troubleshooting

3. VEHICLE BRAKING SYSTEMS
   - Air
   - Hydraulic

4. VEHICLE RETARDING SYSTEMS
   - Engine Compression Systems (Jake Brake)
   - Exhaust Retarders
   - Hydraulic Retarders
   - Electric Retarders

5. ELECTRONIC ENGINE MANAGEMENT
   - Partial Authority Systems
     (I) PEEC
   - Full Authority (I) EUI systems
     (II) EUP systems
     (III) HEUI systems
     (IV) Cummins HPI - TP systems
     (V) Cummins Accumulator Pump system
     (VI) Common Rail systems
     (VII) Stanadyne rotary
     (VIII) Bosch rotary

6. EMISSION CONTROL SYSTEMS
   - Air / fuel Ratio Controls
   - Crankcase Ventilation
   - Evaporative Management
   - Catalytic Converters
   - Scrubbers and Filters
   - Exhaust Recirculation (EGR)
   - Cat ACERT Technology

7. AIR CONDITIONING SYSTEMS
   - Perform A/C evacuation using approved methods.
   - Perform A/C recharging procedures using approved equipment.
   - Perform Leak testing methods.
   - Evacuation/Recharge Equipment.

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, Binder and Paper

V. EVALUATION PROCESS/GRADING SYSTEM:

The following semester grades will be assigned to students:

Grade	**Definition**	*Grade Point Equivalent*
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.

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.