

I. COURSE DESCRIPTION:

This course will present advanced hydraulic circuitry, hydrostatic transmission drive systems, hydrodynamic drives, vehicle braking and retarding systems and electronic engine management technology, along with emission controls encountered in the heavy equipment and trucking industries today. Safety elements of the repair industry will be stressed. Demonstrated skills learned in this semester will enable graduates to support the trucking, agricultural, construction, material handling, mining, forestry, railway and equipment rental and equipment dealership industries.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

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

1. Assess and support hydraulic systems and circuits currently encountered in the commercial vehicle and equipment field.

Potential Elements of the Performance:

- Identify hydraulic system components, their construction and operation, disassembly/assembly procedures, servicing and maintenance, and the testing of those components.
- Interpret and follow hydraulic schematic drawings.
- Identify type, construction, purpose and repair procedures for hydrostatic pumps and motors, charge pumps, crossover valves and related components.
- Predict possible failure and wear points within hydrostatic transmission circuits, determine the necessary diagnostic equipment to confirm the problem, and recommend the repair needed.

2. Recognize and determine the maintenance and repair requirements and functions of conventional hydrodynamic drive systems.

: Potential Elements of the Performance

- Distinguish between fluid couplings and torque converters.
- Determine phase and stage and flow paths internally and externally of a dry sump torque converter and a wet sump converter.

Potential Elements of the Performance Continued.....

- Identify fixed, two phase and poly-phase torque converters correctly.
 - Identify a countershaft, and planetary power shift transmission, determine torque paths, and internal, external hydraulic flow.
 - Analyze the results of a torque converter stall test.
 - Analyze the results of a hydraulic stall test and full hydraulic / converter stall test.
3. Support the inspection, diagnostics, repair and / or replacement of commercial vehicle braking system components following the manufacturers 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:

- Distinguish between drum and disc brake assemblies.
 - Identify the fundamental operating principles of hydraulic brake components including master and wheel cylinders, calliper assemblies, hydraulic wedge brake assemblies and hydraulic, air and vacuum boost assemblies.
 - Interpret brake system schematics as applied to hydraulic and air brake systems.
 - Identify manual and self adjusting adjustment mechanisms in both hydraulic and air brake systems.
 - Determine the correct maintenance procedures and the proper tools required for support of vehicle braking systems.
4. Recognize the various retarding systems and the required maintenance and adjustments needed to optimize their effectiveness and performance.

Potential Elements of the Performance

- Classify, identify capacities, and operating fundamentals of vehicle retarding systems including engine compression brakes, exhaust brakes, hydraulic retarders and electrical retarders.

5. Recognize, communicate with, and diagnose faults and maintain electronic engine and power train management systems.

Potential Elements of the Performance

- Distinguish between engine, drive train, hydraulic and overall vehicle microprocessor management.
- Identify advantages of electronic verses conventional engine fuel injection systems
- Categorize electronic devices into input, output or microprocessor hardware.
- Identify the fuel injection system, and their related components of:
 - (a) partial authority systems (PEEC)
 - (b) full authority systems
 - electronic unit injection
 - electronic unit pumps
 - hydraulically actuated electronic unit injection
 - high pressure injection (HPI-TP) Cummins
 - Cummins accumulator pump system
 - common rail systems
 - rotary electronic injection pumps
- Identify analog and digital sensors and actuators and their operating principles.
- Follow diagnostic procedures using various computer software and troubleshooting flow charts and service manuals.
- Interpret active fault codes and logged events.
- Interpret programmed customer parameters.

6. Ensure emission reducing devices are implemented, in working order and maintained to enhance the visual perception of diesel technology and the environment

Potential Elements of the Performance:

- Identify both spark ignition and compression ignition engine exhaust emission make up.
- Distinguish the effect of ignition and injection timing, engine temperature, fuel quality, load, rpm and emission devices on diesel exhaust quality.
- Identify PCV, EGR, vapour capturing devices, air / fuel ratio control devices, and exhaust conditioning devices for modern day gas and diesel engines.
- Identify Cat ACERT engine emission management.

III. TOPICS:

1. HYDRAULICS IV
 - Demand, Summation, and Power Proportioning Systems
 - Hydrostatic Transmissions
 - Hydraulic Diagnostics and Troubleshooting
2. HYDRODYNAMIC DRIVES
 - Fluid couplings
 - Torque Converters
 - Powershift Transmissions - Countershaft, Planetary
 - Stall Testing and Troubleshooting
3. VEHICLE BRAKING SYSTEMS
 - Hydraulic
 - Air
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

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 Heavy Equipment Program considers both HED210-11 Theory and HED211-9 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 postsecondary 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 placement or non-graded subject areas.	
U	Unsatisfactory achievement in field placement or non-graded subject areas.	
X	A temporary grade. This is used in	

NR limited situations with extenuating circumstances giving a student additional time to complete the requirements for a course (see *Policies & Procedures Manual – Deferred Grades and Make-up*). Grade not reported to Registrar's office. This is used to facilitate transcript preparation when, for extenuating circumstances, it has not been possible for the faculty member to report grades.

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, 717, or 491 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.