## SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

## SAULT STE. MARIE, ONTARIO

Sault College

# CICE COURSE OUTLINE

**COURSE TITLE:** Heavy Equipment II Theory

**CODE NO. :** HED111 **SEMESTER:** Winter
**MODIFIED CODE:** HED011

**PROGRAM:** Truck & Coach/Heavy Duty Equipment Technician

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**MODIFIED BY:** Shirley Timmerman, Learning Specialist CICE Program

**DATE:** Jan/2008 **PREVIOUS OUTLINE DATED:** Jan/2007

**APPROVED:**

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**CHAIR, COMMUNITY SERVICES** **DATE**

**TOTAL CREDITS:** 10

**PREREQUISITE(S):** HED101/HED0101

**HOURS/WEEK:** 8 Hours

## I. COURSE DESCRIPTION:

HED111 will compliment diesel engine theory taken in the first semester, as well as add cylinder head reconditioning, cooling and lubrication systems, exhaust, turbocharging and aftercooling, air induction systems, as well as the varying drive train components encountered in heavy duty and truck / coach power trains. Truck and trailer coupling devices will be studied as well. Safety elements of the repair industry will be stressed. Skills learned in this semester can be applied to the construction, material handling, mining, forestry, equipment rental, and transportation industries.

## II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

Upon successful completion of this course, the student with the assistance of a Learning Specialist will demonstrate the basic ability to:

1. Inspect, analyze and understand the repair procedures for engine cylinder head components, and valve trains.

   Potential Elements of the Performance:
   - Recommend proper valve grinding techniques
   - Recognize valve guide replacement or reconditioning methods
   - Identify the correct valve seat grinding or cutting angles and proper machining sequence to ensure optimum valve performance.

2. Recognize the various engine lubrication components and understand their operating principles and maintenance requirements.

   Potential Elements of the Performance:
   - Identify lube pump type and operating fundamentals.
   - Recognize the where and why of safety valves, pressure regulating valves, by-pass valves, and priority circuits.
   - Identify and understand the maintenance procedures for full-flow and partial flow filters, and centrifugal devices.
   - Identify the various types and location of oil coolers.
   - Recognize lubrication API and SAE ratings and their purpose.

3. Support the heavy equipment and truck maintenance industries by recognizing components and identifying the correct cooling system analysis, maintenance and preventive maintenance procedures.

   Potential Elements of the Performance:
   - Recognize radiators, rad caps, water pumps, seals, heat exchangers, thermostatic controls, fans, fan drives, and shutters, and the proper diagnostics and maintenance, repair or replacement of those components.
   - Ensure air cooled engine and heat exchanger systems are in working order and maintained.

4. Evaluate and maintain the various air induction and exhaust systems in the heavy equipment and truck industries.

   Potential Elements of the Performance:
   - Identify inspect and maintain air pre-cleaners, single and multi-stage air filters, mechanical blowers, turbochargers and after coolers.
   - Measure and assess air restriction, exhaust back pressure and crankcase blow-by accurately and safely.

5. Measure engine horsepower and torque on a dynamometer and be able to calculate fuel consumption under various load full throttle conditions.

   Potential Elements of the Performance:
   - Ensure safe start-up and operation of a water brake dynamometer.
   - Interpret BSFC performance graph data for full or part load fuel consumption.

6. Diagnose and recommend repair and maintenance procedures for heavy equipment and truck related drive train components.

   Potential Elements of the Performance:
   - Identify and understand the operating fundamentals and adjustment and repair/replacement procedures for push release, pull release and over centered clutches.
   - Calculate simple and compound gear train speed outcomes and ratio.
   - Recognize the various gear set advantages, and special lubricants and maintenance procedures.
   - Follow power flows through single and multi-countershaft manual transmissions, recognize shifter mechanisms and safety devices such as detents and interlocks.
   - Recognize torque convertor construction and operation.
   - Follow torque flow through countershaft and planetary powershift transmissions.

- Identify various universal joints, their construction and operation, phasing and angle requirements.
- Recognize construction and purpose and operating principles of single and double reduction differentials, interaxle differentials, limited slip, differential locks and torque proportioning differentials.
- Identify and understand reduction final drives including planetary, pinion-bull gear, and chain type.

7. Support the truck transportation maintenance and repair industry by identifying and recommending the proper replacement / repair / or maintenance of coupling pintle and fifth wheel assemblies.

   Potential Elements of the Performance:

   - Identify and understand the operating principles of fifth wheel and pintle hook coupling devices, their inherent wear points and the accurate testing and assessment of these vital components.

## III. TOPICS:

1. Engine Cylinder Heads and Valve Trains
2. Engine Lubrication Systems
   - Lubricants
3. Engine Cooling Systems
   - Air
   - Liquid
4. Engine Air Induction and Exhaust Systems
5. Engine Performance
   - Torque
   - Horsepower
   - BSFC
6. Drive Trains
   - Clutches
   - Gears
   - Manual Transmissions
   - Drive Lines
   - Differentials
   - Final Drives
7. Coupling Devices
   - Fifth Wheel Construction and Operation

## 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 Truck and Coach / Heavy Duty Equipment Technician program considers both HED 111 Theory and HED 110 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 exam average
- 20% of semester theory assignment average
- 10% of assessed employability skills ( attendance, punctuality, work ethics, and attitude )

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 |
| | 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 E1101 or call extension 2703 so that support services can be arranged for you.

Communication:
The College considers ***WebCT/LMS*** as the primary channel of communication for each course. Regularly checking this software platform is critical as it will keep you directly connected with faculty and current course information. Success in this course may be directly related to your willingness to take advantage of the ***Learning Management System*** communication tool.

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 the *Student Code of Conduct*. 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 Chair's secretary. Students will be required to provide a transcript and course outline related to the course in question.

## CICE Modifications:

**Preparation and Participation**

1. A Learning Specialist will attend class with the student(s) to assist with inclusion in the class and to take notes.
2. Students will receive support in and outside of the classroom (i.e. tutoring, assistance with homework and assignments, preparation for exams, tests and quizzes.)
3. Study notes will be geared to test content and style which will match with modified learning outcomes.
4. Although the Learning Specialist may not attend all classes with the student(s), support will always be available. When the Learning Specialist does attend classes he/she will remain as inconspicuous as possible.

### A. Tests may be modified in the following ways:

1. Tests, which require essay answers, may be modified to short answers.
2. Short answer questions may be changed to multiple choice or the question may be simplified so the answer will reflect a basic understanding.
3. Tests, which use fill in the blank format, may be modified to include a few choices for each question, or a list of choices for all questions. This will allow the student to match or use visual clues.
4. Tests in the T/F or multiple choice format may be modified by rewording or clarifying statements into layman's or simplified terms. Multiple choice questions may have a reduced number of choices.

### B. Tests will be written in CICE office with assistance from a Learning Specialist.

***The Learning Specialist may:***

1. Read the test question to the student.
2. Paraphrase the test question without revealing any key words or definitions.
3. Transcribe the student's verbal answer.
4. Test length may be reduced and time allowed to complete test may be increased.

### C. Assignments may be modified in the following ways:

1. Assignments may be modified by reducing the amount of information required while maintaining general concepts.
2. Some assignments may be eliminated depending on the number of assignments required in the particular course.

***The Learning Specialist may:***

1. Use a question/answer format instead of essay/research format
2. Propose a reduction in the number of references required for an assignment
3. Assist with groups to ensure that student comprehends his/her role within the group
4. Require an extension on due dates due to the fact that some students may require additional time to process information
5. Formally summarize articles and assigned readings to isolate main points for the student
6. Use questioning techniques and paraphrasing to assist in student comprehension of an assignment

### D. Evaluation:

Is reflective of modified learning outcomes.