

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:	4
PROGRAM:	Truck and Coach / Heavy Duty Equipment Technician		
AUTHOR:	George Parsons – Lane Ross		
DATE:	Jan 2009	PREVIOUS OUTLINE DATED:	
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APPROVED:		“Corey Meunier”	
		CHAIR	<u>DATE</u>
TOTAL CREDITS:	9		
PREREQUISITE(S):	HED201		
HOURS/WEEK:	8 Hrs / 15 weeks		

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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 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:

- 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.

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
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 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; (also see attached information below)

- 70% on project or shop assignments and on the students ability as measured subjectively by performance on a variety of shop work.
- 30% on employability skills; attendance, punctuality, preparedness, housekeeping, work organization work ethics, and general attitude.

The following semester grades will be assigned to students:

Grade	<u>Definition</u>	<i>Grade Point Equivalent</i>
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% 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:**

Disability Services:

If you are a student with a disability (e.g. physical limitations, visual impairments, hearing impairments, or learning disabilities), you are encouraged to discuss required accommodations with your professor and/or the Disability Services office. Visit Room E1101 or call Extension 2703 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.

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.

Plagiarism:

Students should refer to the definition of “academic dishonesty” in *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.

Class and Shop Conduct – Motive Power Policies and Procedures

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.



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 department, 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.

Guidelines 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 4.0)	- Consistently Outstanding.
A	80 to 89 (Numerical Equivalent 3.75)	- 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.

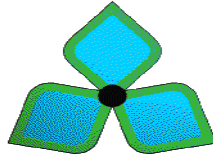
Your **Semester Theory Letter Grade** will be comprised of:

- 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. 70% 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. 30% 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 4.0)	- Consistently Outstanding.
A	80 – 89% (Numerical Equivalent 3.75)	- 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 _____

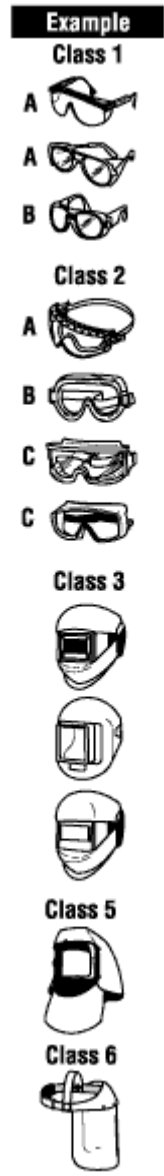
Chart Z94.3

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
<i>Flying Objects</i>															
Chipping, drilling, scaling, grinding, polishing, buffing, riveting, punching, shearing, hammer mills, crushing, heavy sawing, planing, wire and strip handling, hammering, unpacking, nailing, punch press, lathe work, etc.	*			*	*	*			*				*	*	
<i>Flying particles, dust, wind, etc.</i>															
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	*			*	*	*			*				*	*	
<i>Heat, sparks and splash from molten materials</i>															
Babbling, casting, pouring molten metal, brazing, soldering, spot welding, stud welding, hot dipping operations		*				*									
<i>Acid splash, chemical burns</i>															
Acid and alkali handling, degreasing, pickling and plating operations, glass breakage, chemical spray, liquid bitumen handling					*				*					*	
<i>Abrasive blasting materials</i>															
Sand blasting, shot blasting, shotcreting				*					*					*	
<i>Glare, stray light (for reduction of visible radiation)</i>															
Reflecting, bright sun and lights, reflected welding flash, photographic copying	*			*	*	*			*				*	*	
<i>Injurious optical radiation (moderate reduction of optical radiation)</i>															
Torch cutting, welding, brazing, furnace work, metal pouring, spot welding, photographic copying															



<i>Injurious optical radiation (large reduction of optical radiation)</i>												
Electric arc welding, heavy gas cutting, plasma spraying and cutting, inert gas shielded arc welding, atomic hydrogen welding						*	*					

VII. PRIOR LEARNING ASSESSMENT:

Students who wish to apply for advance credit transfer (advanced standing) should obtain an Application for Advance Credit from the program coordinator (or the course coordinator regarding a general education transfer request) or academic assistant. Students will be required to provide an unofficial transcript and course outline related to the course in question.

Credit for prior learning will also be given upon successful completion of a challenge exam or portfolio.