SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE TITLE:	Drive Train Systems
CODE NO. :	AST614 **APP LEVEL:** ONE
PROGRAM:	AUTOMOTIVE SERVICE TECHNICIAN APPRENTICESHIP – Level 1
AUTHOR:	Stephen Kent
DATE:	December 2015 **PREVIOUSLY UPDATED:** August 2015
APPROVED:	*"Corey Meunier"* **CHAIR**
TOTAL CREDITS:	Five
PREREQUISITE(S):	NIL
HOURS/WEEK:	Taught in eight-week block format (36 hours)

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

I. COURSE DESCRIPTION:

In this course the student will be able to describe the construction, basic operating principles, servicing and testing techniques of the following drive train systems, clutch assemblies, manual transmission and manual transaxles. The student will also demonstrate their ability to disassemble, test and inspect manual transmissions / transaxles and clutches.

Students will be required to follow proper safety procedures when performing the above tasks according to both Sault College Motive Power Department Standards and Vehicle Manufacturers safety regulations and specifications.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

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

1. Visually inspect, diagnose, troubleshoot and perform repairs on clutch systems and components according to manufacturers' recommendations.

Potential Elements of the Performance:

Explain the basic fundamentals of clutch assemblies.

- clamping force
- centrifugal force
- mechanical advantage
- hydraulic advantage
- static and sliding friction
- co-efficient of friction
- friction and heat
- inertia

Identify the specific components of dry disc clutch assemblies.

- dry disc clutch assemblies
- flywheel / ring gear
- pressure plate
- clutch friction disc and hub assembly
- input shaft
- pilot bearing / bushing
- release bearing
- mechanical release mechanisms
- hydraulic release mechanisms

- clutch housings
- clutch control systems
- safety switch

Describe the operation of clutches assemblies.

- disengagement and engagement
- single and dual disc clutches
- wave / cushion spring
- hub / torsional springs
- semi-centrifugal clutches
- flywheel / ring gear
- pressure plate
- power flow
- pilot bushing / bearing
- clutch control systems
- safety switch

Perform inspection, diagnostics and troubleshooting procedures on clutch assemblies.

- perform visual / functional inspection
    - fly wheel
    - ring gear
    - clutch disc
    - pressure plate
    - clutch and housing alignment
    - clutch control system
    - safety switch

Explain repair operations on clutch assemblies.

- familiarization with manufacturers' service procedures
- clutch adjustment
- clutch overhaul procedures
- machining practices
- failure analysis
- lubrication practices
- fluid levels
- verify the repair operations

2. Basic gear theory and operation

Potential Elements of the Performance:

Explain the basic fundamentals of gears.
- mechanical advantage
- laws of levers as applied to gears
- torque vs speed
- input / output rotational speed
- gear ratios
- shafts, splines and gears

Identify the specific characteristics of gears.
- gear nomenclature
- gear types
- simple, compound, and idler gear trains
- gear ratio calculations
- shafts
- bearings and bushings
- spacers and thrust washers

Describe the operation of gears.
- gears
- timing
- shafts
- power flow
- thrust control
- bearings and bushings

3. Describe the operation of manual transmissions / transaxles according to manufacturers' standards.

Potential Elements of the Performance:

Explain the basic fundamentals of manual transmissions / transaxles.
- purpose
- functions
- types
    - sliding selective
    - constant mesh
- applications

Identify the specific components of manual transmissions and transaxles.

- manual transmission / transaxle
    - case, shafts, gears, synchronizers,
    - bearings, bushings, thrust washers, shims, gaskets, seals
    - transaxle final drive
    - lubrication
- shift controls
    - direct, remote
    - shafts, cables, levers
    - detent, interlock mechanisms, shift blocks

Describe the operation of manual transmissions / transaxles.

- gear ratios
- power flows
- power flow variations
- synchronizer
- shift controls
- lubrication

4. Perform visual inspection, test, diagnose and repair manual transmission / transaxle according to manufacturers' recommendations.

Potential Elements of the Performance:

Perform inspection, testing, and diagnostic procedures on manual transmissions.

- identify component failures and causes
- check fluid level
- adjust linkage
- identify noise
- identify vibration

Perform service and repair procedures.

- describe procedures to remove and install a transmission / transaxle
- dismantle and assemble manual transmission / transaxle
- verify power flow through gears
- check end play / run-out
- verify shift controls
- perform torque procedures for re-assembly

- perform alignment requirement
- identify fluid / lubrication requirements

III. TOPICS:

1. Clutches

2. Basic gear theory and operation

3. Describe the operation of manual transmissions / transaxles

4. Perform visual inspection, test, diagnose and repair manual transmission / transaxle

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

Automotive Technology – Third Canadian Edition

The following items are mandatory for entrance to the Shop:

- Shop coat or coveralls
- CSA approved steel toe boots (high top)
- CSA approved safety glasses

Pen, pencils, calculator, and 3-ring binder

V. EVALUATION PROCESS/GRADING SYSTEM:

The final grade for this course will be based on the results of classroom, assignments and shop evaluations weighed as indicated:

- Classroom – 60% of the final grade is comprised of term tests
- Assignments – 10% of the final grade is comprised of a number of technical reports
- Shop – 30% of the final grade is comprised of attendance, punctuality, preparedness, student ability, work organization and general attitude

Students will be given notice of test and assignment dates in advance

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.

If a faculty member determines that a student is at risk of not being successful in their academic pursuits and has exhausted all strategies available to faculty, student contact information may be confidentially provided to Student Services in an effort to offer even more assistance with options for success. Any student wishing to restrict the sharing of such information should make their wishes known to the coordinator or faculty member.

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.

It is the departmental policy that once the classroom door has been closed, the learning process has begun. Late arrivers will not be granted admission to the room.

Laptops or Cell phones are not allowed to be on in the classrooms or shop areas during class time.

VII. COURSE OUTLINE ADDENDUM:

The provisions contained in the addendum located on the Student Portal, form part of this course outline.