



**I. COURSE DESCRIPTION:**

This course deals with the study and interrelationship of essential basic fundamentals, composition, construction and operating principles of suspension, steering and brake systems. The student will also inspect and test suspension, steering and braking assemblies using manufacture maintenance procedures. The student will perform tire and rim safety inspections following Ministry Standards, along with performance of wheel balance and the reading of tire wear patterns.

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. ***Explain the fundamental theories, characteristics and applications relative to suspension systems according to principles of physics.***

Potential Elements of the Performance:

Explain and describe the following:

**The fundamental theories of suspension systems.**

- Hook's Law
- centre of gravity
- sprung / un-sprung weight

**The characteristics and applications of suspension materials.**

- spring steel
- tempered steel
- synthetic rubber
- fiber composites
- pneumatics
- hydraulics
- negative effects of heating suspension components

2. ***Identify and explain types, and the construction of frames, steering and suspension components according to manufacturers' standards.***

Potential Elements of the Performance:

**Identify various frame types and explain their construction and applications.**

- frames and chassis types
- frame and chassis damage

**Identify various suspension and steering types and components.**

- non independent
- semi independent
- independent
- short- and long-control arms
- twin I beam
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- McPherson strut
- modified strut
- wishbone
- multi link
- steering linkage types
  - parallelogram
  - cross steer
  - rack and pinion
  - haltenberger

**Explain the application and construction of suspension and steering components.**

- springs
- ball joints
- king pins
- strut bearings
- control arms and bushings
- radius rods
- strut rods
- stabilizer bars
- trailing arms wheel hubs
- wheel bearings

- shock absorbers
- steering linkages

**3. *Explain the operation of suspension and steering systems and components according to principles of physics***

Potential Elements of the Performance:

**Explain the operation of suspension and steering systems and components.**

- non independent
- semi independent
- independent
- short- and long-control arms
- twin I beam
- McPherson strut
- modified strut
- strut bearings
- wishbone
- multi link- springs
- leaf
- torsion bars
- air springs
- ball joints
- control arms and bushings
- radius rods
- strut rods
- stabilizers
- trailing arms
- steering linkages
- shock absorbers

**4 Inspect and test suspension and steering systems and components according to manufacturers' recommendations.**

Potential Elements of the Performance:

**Inspect and test suspension and steering components.**

- visual inspection
- dry park check
- measure trim height
- check for corrosion
- check for frame damage
- check springs
  - spring condition and deflection
  - effects of contamination on springs
- check shock absorbers
  - leaks
  - action
  - attachment
- perform suspension system inspection
  - control arm bushing
  - control arm sag
- check wheel bearings
  - preload
  - end-play
- check ball joints wear
- check king-pins wear
- check steering linkages for wear and alignment

**5. *Explain, test, repair and service tires and wheels in according to manufacturers' recommendations.***

Potential Elements of the Performance:

**Explain the purpose and fundamentals of tires and wheels.**

- centrifugal force
- static friction
- kinetic friction
- torquing wheel nuts
- effects of water
- sliding and rolling friction
- sidewall markings
- static and dynamic balance
- nitrogen use

**Explain the construction, types, and application of tires.**

- wheels for cars and light trucks
- tire materials
- radial tire construction
- bias tire construction
- run flat tires
- tires, wheels
  - balancing
  - air pressure
  - tread design and traction

**Perform tests and repairs on tire and wheels assemblies.**

- visual inspection
- check tire matching for dual application
- check tire condition
  - wear
  - defects
- identify and measure radial and lateral wheel and tire run-out
- determine factors that affect tire wear
- determine factors that cause cord separation
- perform static and dynamic wheel balance
- perform tire repair

- check tire type mixing and application
- test wheel runout

**Service tire pressure monitoring systems.**

- Reset , reprogram and calibrate tire pressure monitoring systems

**6. *Explain, identify, inspect and service brake systems and components in according to manufacturers' recommendations.***

Potential Elements of the Performance:

**Explain the fundamentals of braking systems.**

- Pascal's Law
- laws of levers, mechanical advantages
- co-efficient of friction
- velocity and acceleration

**Identify brake system components.**

- brake fluid
- brake lines, hoses and fittings
- master / wheel cylinders
- calipers
- brake shoes and disc pads
- drums and disc
- hydraulic controls
  - metering valves
  - proportional valves
  - pressure differential valves
  - combination valves
- auxiliary mechanical brake assemblies

**Explain the construction and operation of brake system components.**

- master cylinder
- calipers
- wheel cylinders
- shoes and pads
- brake fluid
- hydraulic controls
- self-adjusting mechanisms
- drums and discs
- auxiliary mechanical brake assemblies

**Inspect and service brake systems.**

- check brake fluid
  - level
  - bleeding
  - flushing
  - condition
- check disc brakes
  - calipers function / leakage
  - hardware, guides
  - rotor measurements / thickness, runout
- check drum brakes
  - wheel cylinder function / leakage
  - hardware
  - back plate
  - self-adjusters
  - drum measurements / diameter, out of round
- clean, lube and adjust
- adjust auxiliary mechanical brake assemblies

**Perform steel brake line fabrication.**

- Bending
- Flaring
  - ISO
  - Double inverted

**III. TOPICS:**

1. Fundamental theories, characteristics and applications relative to suspension systems according to principles of physics.
2. Types, and the construction of frames, steering and suspension components according to manufacturers' standards.
3. Operation of suspension and steering systems and components according to principles of physics.
4. Inspect and test suspension and steering systems.
5. Repair and service tires and wheels.
6. inspect and service brake systems and components in according to manufacturers' recommendations



**IV. REQUIRED RESOURCES/TEXTS/MATERIALS:**

Automotive Technology – Third Canadian Edition

Pens, pencils, calculator, 3-ring binder

Items mandatory for Shop:

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

**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.

(Student will be given notice of test and assignment dates in advance)

The following semester grades will be assigned to students:

<b>Grade</b>	<b><u>Definition</u></b>	<i>Grade Point Equivalent</i>
A+	90 – 100%	4.00
A	80 – 89%	3.00
B	70 - 79%	2.00
C	60 - 69%	1.00
D	50 – 59%	0.00
F (Fail)	49% and below	
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 enclosed, the learning process has begun. Late arrivers will not be granted admission to the room.

#### **VII. COURSE OUTLINE ADDENDUM:**

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