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## MOTORIZED EQUIPMENT MAINTENANCE

### AUTOMOBILE MECHANICS

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*PROGRAM OF STUDY*

5692

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1997  
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**VOCATIONAL and  
TECHNICAL  
EDUCATION**

Québec 

# **AUTOMOBILE MECHANICS**

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***PROGRAM OF STUDY***  
***5692***

# MOTORIZED EQUIPMENT MAINTENANCE

## **AUTOMOBILE MECHANICS**

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### **PROGRAM OF STUDY 5692**

The *Automobile Mechanics* program leads to the  
Secondary School Vocational Diploma (SSVD)  
and prepares the student to practise the trade of

#### **AUTOMOBILE MECHANIC**

---

**Direction générale de la formation professionnelle et technique**

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## TABLE OF CONTENTS

### Page

|                           |          |
|---------------------------|----------|
| <b>INTRODUCTION</b> ..... | <b>1</b> |
| <b>GLOSSARY</b> .....     | <b>3</b> |

### PART I

|                                                                 |           |
|-----------------------------------------------------------------|-----------|
| <b>1. SYNOPTIC TABLE</b> .....                                  | <b>7</b>  |
| <b>2. PROGRAM TRAINING GOALS</b> .....                          | <b>9</b>  |
| <b>3. COMPETENCIES</b> .....                                    | <b>11</b> |
| <b>Grid of Learning Focuses</b> .....                           | <b>12</b> |
| <b>4. GENERAL OBJECTIVES</b> .....                              | <b>13</b> |
| <b>5. FIRST- AND SECOND-LEVEL OPERATIONAL OBJECTIVES</b> .....  | <b>15</b> |
| <b>5.1 Definition</b> .....                                     | <b>15</b> |
| <b>5.2 How to Read First-Level Operational Objectives</b> ..... | <b>16</b> |

### PART II

|                                                                                        |           |
|----------------------------------------------------------------------------------------|-----------|
| <b>MODULE 1: THE TRADE AND THE TRAINING PROCESS</b> .....                              | <b>21</b> |
| <b>MODULE 2: CHARACTERISTICS OF MOTOR VEHICLES</b> .....                               | <b>25</b> |
| <b>MODULE 3: INTERPERSONAL COMMUNICATION</b> .....                                     | <b>29</b> |
| <b>MODULE 4: HEALTH, SAFETY AND ENVIRONMENTAL PROTECTION</b> .....                     | <b>33</b> |
| <b>MODULE 5: WELDING AND CUTTING</b> .....                                             | <b>39</b> |
| <b>MODULE 6: SHOP WORK</b> .....                                                       | <b>43</b> |
| <b>MODULE 7: INTERNAL COMBUSTION ENGINES</b> .....                                     | <b>47</b> |
| <b>MODULE 8: INTERNAL COMBUSTION ENGINE REPAIR</b> .....                               | <b>51</b> |
| <b>MODULE 9: BASIC ELECTRICAL AND ELECTRONIC CIRCUITS</b> .....                        | <b>55</b> |
| <b>MODULE 10: LIGHTING CIRCUIT REPAIR</b> .....                                        | <b>61</b> |
| <b>MODULE 11: ENGINE AND PASSENGER COMPARTMENT</b><br><b>TEMPERATURE SYSTEMS</b> ..... | <b>65</b> |

|                   |                                                             |            |
|-------------------|-------------------------------------------------------------|------------|
| <b>MODULE 12:</b> | <b>COOLING, HEATING AND AIR CONDITIONING SYSTEM</b>         |            |
|                   | <b>MAINTENANCE AND REPAIR</b>                               | <b>69</b>  |
| <b>MODULE 13:</b> | <b>MOTOR VEHICLE MAINTENANCE</b>                            | <b>73</b>  |
| <b>MODULE 14:</b> | <b>JOB SEARCH TECHNIQUES</b>                                | <b>79</b>  |
| <b>MODULE 15:</b> | <b>ROAD HANDLING SYSTEMS</b>                                | <b>83</b>  |
| <b>MODULE 16:</b> | <b>SUSPENSION, STEERING SYSTEM AND CONVENTIONAL</b>         |            |
|                   | <b>BRAKE REPAIR</b>                                         | <b>87</b>  |
| <b>MODULE 17:</b> | <b>TRANSMISSION ASSEMBLIES</b>                              | <b>91</b>  |
| <b>MODULE 18:</b> | <b>TRANSMISSION ASSEMBLY REPAIR</b>                         | <b>95</b>  |
| <b>MODULE 19:</b> | <b>BASIC COMPUTER-CONTROLLED SYSTEMS</b>                    | <b>99</b>  |
| <b>MODULE 20:</b> | <b>STARTING AND CHARGING SYSTEMS AND ELECTROMAGNETIC</b>    |            |
|                   | <b>ACCESSORIES</b>                                          | <b>103</b> |
| <b>MODULE 21:</b> | <b>STARTING SYSTEM, CHARGING SYSTEM AND ELECTROMAGNETIC</b> |            |
|                   | <b>ACCESSORY REPAIR</b>                                     | <b>107</b> |
| <b>MODULE 22:</b> | <b>PASSIVE AND ACTIVE SECURITY SYSTEMS</b>                  | <b>111</b> |
| <b>MODULE 23:</b> | <b>ANTILOCK BRAKE SYSTEM AND SAFETY ACCESSORY REPAIR</b>    | <b>115</b> |
| <b>MODULE 24:</b> | <b>ELECTRONIC IGNITION SYSTEMS</b>                          | <b>119</b> |
| <b>MODULE 25:</b> | <b>ELECTRONIC IGNITION SYSTEM REPAIR</b>                    | <b>123</b> |
| <b>MODULE 26:</b> | <b>ANTIPOLLUTION AND ELECTRONIC INJECTION SYSTEMS</b>       | <b>127</b> |
| <b>MODULE 27:</b> | <b>ANTIPOLLUTION SYSTEM AND ELECTRONIC INJECTION SYSTEM</b> |            |
|                   | <b>MAINTENANCE AND REPAIR</b>                               | <b>133</b> |
| <b>MODULE 28:</b> | <b>ENGINE-TRANSMISSION UNIT INSPECTION</b>                  | <b>137</b> |
| <b>MODULE 29:</b> | <b>STARTING A BUSINESS</b>                                  | <b>141</b> |
| <b>MODULE 30:</b> | <b>ENTERING THE WORK FORCE</b>                              | <b>145</b> |

## INTRODUCTION

The *Automobile Mechanics* program is based on the orientations for secondary school vocational education that calls for the participation of experts from the workplace and the field of education.

The program of study is developed in terms of competencies, expressed as objectives. These objectives are divided into modules, which are organized into teaching blocks. Various factors were kept in mind in developing the program: training needs, the job situation, purposes, goals, and strategies and means used to attain objectives.

The program of study lists the competencies that are the minimum requirements for a Secondary School Vocational Diploma (SSVD) for students in both the youth and adult sectors. It also provides the basis for organizing courses, planning teaching strategies, and designing instructional and evaluation materials.

The duration of the program is 1800 hours, which includes 960 hours spent on the specific competencies required to practise the

trade and 840 hours on general competencies. The program of study is divided into 30 modules, which vary in length from 15 to 105 hours (multiples of 15). The time allocated to the program is to be used not only for teaching but also for evaluation and remedial work.

This document contains two parts. Part I is of general interest and provides an overview of the training plan. It includes a synoptic table of basic information about the modules, a description of the program training goals, the competencies to be developed and the general objectives, and an explanation of operational objectives. Part II is designed primarily for those directly involved in implementing the program. It contains a description of the operational objectives of each module.

In keeping with this broad approach, three accompanying documents will be provided: a teaching guide, an evaluation guide, and a planning guide.

## **GLOSSARY**

### **Program Training Goals**

Statements that describe the educational aims of a program. These goals are the general goals of vocational education adapted to a specific trade or occupation.

### **Competency**

A set of socio-affective behaviours, cognitive skills or psycho-sensori-motor skills that enable a person to correctly perform a role, function, activity or task.

### **General Objectives**

Instructional objectives that provide an orientation for leading the students to attain one or more related objectives.

### **Operational Objectives**

Statements of the educational aims of a program in practical terms. They serve as the basis for teaching, learning and evaluation.

### **Module of a Program**

A component part of a program of study comprising a first-level operational objective and the related second-level operational objectives.

### **Credit**

A unit used for expressing quantitatively the value of the modules in a program of study. One credit corresponds to 15 hours of training. Students must accumulate a set number of credits to graduate from a program.

# **PART I**

## 1. SYNOPTIC TABLE

Number of modules: 30  
 Duration in hours: 1800  
 Credits: 120

Automobile Mechanics  
 CODE: 5692

| CODE    | TITLE OF THE MODULE                                                             | HOURS | CREDITS* |
|---------|---------------------------------------------------------------------------------|-------|----------|
| 841 611 | 1. The Trade and the Training Process                                           | 15    | 1        |
| 841 622 | 2. Characteristics of Motor Vehicles                                            | 30    | 2        |
| 841 632 | 3. Interpersonal Communication                                                  | 30    | 2        |
| 841 641 | 4. Health, Safety and Environmental Protection                                  | 15    | 1        |
| 841 653 | 5. Welding and Cutting                                                          | 45    | 3        |
| 841 664 | 6. Shop Work                                                                    | 60    | 4        |
| 841 675 | 7. Internal Combustion Engines                                                  | 75    | 5        |
| 841 687 | 8. Internal Combustion Engine Repair                                            | 105   | 7        |
| 841 695 | 9. Basic Electrical and Electronic Circuits                                     | 75    | 5        |
| 841 704 | 10. Lighting Circuit Repair                                                     | 60    | 4        |
| 841 712 | 11. Engine and Passenger Compartment Temperature Systems                        | 30    | 2        |
| 841 723 | 12. Cooling, Heating and Air Conditioning System Maintenance and Repair         | 45    | 3        |
| 841 744 | 13. Motor Vehicle Maintenance                                                   | 60    | 4        |
| 841 731 | 14. Job Search Techniques                                                       | 15    | 1        |
| 841 754 | 15. Road Handling Systems                                                       | 60    | 4        |
| 841 767 | 16. Suspension, Steering System and Conventional Brake Repair                   | 105   | 7        |
| 841 776 | 17. Transmission Assemblies                                                     | 90    | 6        |
| 841 787 | 18. Transmission Assembly Repair                                                | 105   | 7        |
| 841 794 | 19. Basic Computer-Controlled Systems                                           | 60    | 4        |
| 841 805 | 20. Starting and Charging Systems and Electromagnetic Accessories               | 75    | 5        |
| 841 815 | 21. Starting System, Charging System and Electromagnetic Accessory Repair       | 75    | 5        |
| 841 823 | 22. Passive and Active Security Systems                                         | 45    | 3        |
| 841 834 | 23. Antilock Brake System and Safety Accessory Repair                           | 60    | 4        |
| 841 844 | 24. Electronic Ignition Systems                                                 | 60    | 4        |
| 841 855 | 25. Electronic Ignition System Repair                                           | 75    | 5        |
| 841 864 | 26. Antipollution and Electronic Injection Systems                              | 60    | 4        |
| 841 876 | 27. Antipollution System and Electronic Injection System Maintenance and Repair | 90    | 6        |
| 841 885 | 28. Engine-Transmission Unit Inspection                                         | 75    | 5        |
| 841 891 | 29. Starting a Business                                                         | 15    | 1        |
| 841 906 | 30. Entering the Work Force                                                     | 90    | 6        |

\* 15 hours = 1 credit

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## 2. PROGRAM TRAINING GOALS

The training goals of the *Automobile Mechanics* program are based on the general goals of vocational education and take into account the specific nature of the trade. These goals are:

**To develop effectiveness in the practice of a trade.**

- To teach students to perform automobile mechanics tasks and activities correctly, at an acceptable level of competence for entry into the job market.
- To prepare students to perform satisfactorily on the job by fostering:
  - intellectual skills and techniques conducive to making wise choices in carrying out tasks;
  - a concern for communicating effectively with superiors, colleagues and customers;
  - a concern for professional ethics;
  - attention to detail, neatness and precision when performing tasks;
  - the acquisition of English and French technical vocabulary;
  - a constant concern for occupational health and safety and environmental protection, as well as for the safety of passengers.

**To ensure integration into the job market.**

- To familiarize students with the job market in general and with automobile mechanics in particular.
- To familiarize students with their rights and responsibilities as automobile mechanics.
- To help students develop a concern for their customers' rights and expectations.

**To foster personal development and the acquisition of trade-related knowledge.**

- To foster independence, a sense of responsibility and the desire to succeed.
- To help students develop a concern for excellence and quality control.
- To help students develop attitudes basic to success in the workplace.
- To help students understand the principles underlying system analysis and the techniques used.
- To help students develop a good work method and a sense of discipline.

**To ensure job mobility.**

- To help students develop a positive attitude toward technological change and continuing education.
- To help students develop the skills required to learn and obtain information.
- To help students develop problem-solving skills and an ability to adapt to various situations.
- To help students prepare for a creative job search.
- To help students assess their potential for and interest in becoming entrepreneurs.

### 3. COMPETENCIES

The competencies to be developed in the *Automobile Mechanics* program are shown in the grid of learning focuses on the following page. The grid lists general and specific competencies as well as the major steps in the work process.

General competencies involve activities common to several tasks or situations. They cover, for example, the technological or scientific principles that the students must understand to practise the trade or occupation. Specific competencies focus on tasks and activities that are of direct use in the trade or occupation. The work process includes the most important steps in carrying out the tasks and activities of the trade or occupation.

The grid of learning focuses shows the relationship between the general competencies on the horizontal axis and the specific competencies on the vertical axis. The symbol (Δ) indicates a correlation between a specific competency and a step in the work process. The symbol (○) indicates a correlation between a general and a specific competency.

The symbols (Δ) and (●) indicate that these relationships have been taken into account in the formulation of objectives intended to develop specific competencies related to the trade or occupation.

The logic used in constructing the grid influences the course sequence. Generally speaking, this sequence follows a logical progression in terms of the complexity of the learning involved and the development of the students' autonomy. The vertical axis of the grid shows the competencies directly related to the practice of a specific trade or occupation. These competencies are arranged in a relatively fixed order; therefore, the modules should be taught, insofar as possible, in the order represented on the grid. The modules including the general competencies on the horizontal axis should be taught in relation to those on the vertical axis. This means that some modules are prerequisite to others, while other modules are taught concurrently.

| GRID OF<br>LEARNING FOCUSES<br>IN<br>AUTOMOBILE MECHANICS                              |                                                                       |          | WORK PROCESS<br>(major steps)      |                                              |                       |                |                 |                |                        | GENERAL COMPETENCIES<br>(related to technology, subjects, personal development, etc.) |                                             |                                            |                                               |                      |                                 |                                                       |                                                                     |                                                                                |                              |                                                 |                                                   |                                                              |                                                                                         |                                                               | TOTALS                                                |                                                                          |                                                 |                      |                     |     |     |     |     |
|----------------------------------------------------------------------------------------|-----------------------------------------------------------------------|----------|------------------------------------|----------------------------------------------|-----------------------|----------------|-----------------|----------------|------------------------|---------------------------------------------------------------------------------------|---------------------------------------------|--------------------------------------------|-----------------------------------------------|----------------------|---------------------------------|-------------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------------------------------------------|------------------------------|-------------------------------------------------|---------------------------------------------------|--------------------------------------------------------------|-----------------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------|----------------------|---------------------|-----|-----|-----|-----|
|                                                                                        |                                                                       |          | FIRST-LEVEL OPERATIONAL OBJECTIVES |                                              |                       |                |                 |                |                        | DURATION (IN HOURS)                                                                   |                                             |                                            |                                               |                      |                                 |                                                       |                                                                     |                                                                                |                              |                                                 |                                                   |                                                              |                                                                                         |                                                               |                                                       |                                                                          |                                                 |                      |                     |     |     |     |     |
|                                                                                        |                                                                       |          |                                    |                                              |                       |                |                 |                |                        |                                                                                       |                                             |                                            |                                               |                      |                                 |                                                       |                                                                     |                                                                                |                              |                                                 |                                                   |                                                              |                                                                                         |                                                               |                                                       |                                                                          |                                                 |                      |                     |     |     |     |     |
| SPECIFIC COMPETENCIES<br>(directly related to the practice of the specific occupation) |                                                                       |          | Inspect the vehicle.               | Find information in technical documentation. | Diagnose the problem. | Plan the work. | Do the repairs. | Perform tests. | Tidy up the work area. | Write a report on the work done.                                                      | List the characteristics of motor vehicles. | Communicate with customers and colleagues. | Identify safety and environmental protection. | Weld and cut metals. | Perform repair shop operations. | Analyze the operation of internal combustion engines. | Analyze problems related to basic electric and electronic circuits. | Analyze the operation of engine and passenger compartment temperature systems. | Apply job search techniques. | Analyze the operation of road handling systems. | Analyze the operation of transmission assemblies. | Analyze the operation of a basic computer-controlled system. | Analyze the operation of starting and charging systems and electromagnetic accessories. | Analyze the operation of passive and active security systems. | Analyze the operation of electronic ignition systems. | Analyze the operation of antipollution and electronic injection systems. | Explore the possibility of starting a business. | NUMBER OF OBJECTIVES | DURATION (IN HOURS) |     |     |     |     |
| MODULES                                                                                | FIRST-LEVEL OPERATIONAL OBJECTIVES                                    | DURATION |                                    |                                              |                       |                |                 |                |                        |                                                                                       |                                             |                                            |                                               |                      |                                 |                                                       |                                                                     |                                                                                |                              |                                                 |                                                   |                                                              |                                                                                         |                                                               |                                                       |                                                                          |                                                 |                      |                     |     |     |     |     |
| 1                                                                                      | Determine their suitability for the trade and the training process.   | S        | 15                                 | 105                                          | 60                    | 45             | 60              | 105            | 75                     | 60                                                                                    | 105                                         | 75                                         | 60                                            | 105                  | 75                              | 60                                                    | 105                                                                 | 75                                                                             | 60                           | 105                                             | 75                                                | 60                                                           | 105                                                                                     | 75                                                            | 60                                                    | 105                                                                      | 75                                              |                      |                     | 60  | 105 | 75  | 60  |
| 8                                                                                      | Repair internal combustion engines.                                   | B        | 105                                | 75                                           | 60                    | 45             | 60              | 105            | 75                     | 60                                                                                    | 105                                         | 75                                         | 60                                            | 105                  | 75                              | 60                                                    | 105                                                                 | 75                                                                             | 60                           | 105                                             | 75                                                | 60                                                           | 105                                                                                     | 75                                                            | 60                                                    | 105                                                                      | 75                                              | 60                   | 105                 | 75  | 60  | 105 |     |
| 10                                                                                     | Repair lighting circuits on a motor vehicle.                          | B        | 60                                 | 45                                           | 60                    | 105            | 75              | 60             | 105                    | 75                                                                                    | 60                                          | 105                                        | 75                                            | 60                   | 105                             | 75                                                    | 60                                                                  | 105                                                                            | 75                           | 60                                              | 105                                               | 75                                                           | 60                                                                                      | 105                                                           | 75                                                    | 60                                                                       | 105                                             | 75                   | 60                  | 105 | 75  | 60  | 105 |
| 12                                                                                     | Maintain and repair cooling, heating and air conditioning circuits.   | B        | 45                                 | 60                                           | 105                   | 75             | 60              | 105            | 75                     | 60                                                                                    | 105                                         | 75                                         | 60                                            | 105                  | 75                              | 60                                                    | 105                                                                 | 75                                                                             | 60                           | 105                                             | 75                                                | 60                                                           | 105                                                                                     | 75                                                            | 60                                                    | 105                                                                      | 75                                              | 60                   | 105                 | 75  | 60  | 105 |     |
| 13                                                                                     | Perform general maintenance on a motor vehicle.                       | B        | 60                                 | 45                                           | 60                    | 105            | 75              | 60             | 105                    | 75                                                                                    | 60                                          | 105                                        | 75                                            | 60                   | 105                             | 75                                                    | 60                                                                  | 105                                                                            | 75                           | 60                                              | 105                                               | 75                                                           | 60                                                                                      | 105                                                           | 75                                                    | 60                                                                       | 105                                             | 75                   | 60                  | 105 | 75  | 60  | 105 |
| 16                                                                                     | Repair suspensions, steering systems and conventional brakes.         | B        | 105                                | 75                                           | 60                    | 45             | 60              | 105            | 75                     | 60                                                                                    | 105                                         | 75                                         | 60                                            | 105                  | 75                              | 60                                                    | 105                                                                 | 75                                                                             | 60                           | 105                                             | 75                                                | 60                                                           | 105                                                                                     | 75                                                            | 60                                                    | 105                                                                      | 75                                              | 60                   | 105                 | 75  | 60  | 105 |     |
| 18                                                                                     | Repair transmission assemblies.                                       | B        | 105                                | 75                                           | 60                    | 45             | 60              | 105            | 75                     | 60                                                                                    | 105                                         | 75                                         | 60                                            | 105                  | 75                              | 60                                                    | 105                                                                 | 75                                                                             | 60                           | 105                                             | 75                                                | 60                                                           | 105                                                                                     | 75                                                            | 60                                                    | 105                                                                      | 75                                              | 60                   | 105                 | 75  | 60  | 105 |     |
| 21                                                                                     | Repair starting and charging systems and electromagnetic accessories. | B        | 75                                 | 60                                           | 105                   | 75             | 60              | 105            | 75                     | 60                                                                                    | 105                                         | 75                                         | 60                                            | 105                  | 75                              | 60                                                    | 105                                                                 | 75                                                                             | 60                           | 105                                             | 75                                                | 60                                                           | 105                                                                                     | 75                                                            | 60                                                    | 105                                                                      | 75                                              | 60                   | 105                 | 75  | 60  | 105 |     |
| 23                                                                                     | Repair antilock brakes and safety accessories.                        | B        | 60                                 | 45                                           | 60                    | 105            | 75              | 60             | 105                    | 75                                                                                    | 60                                          | 105                                        | 75                                            | 60                   | 105                             | 75                                                    | 60                                                                  | 105                                                                            | 75                           | 60                                              | 105                                               | 75                                                           | 60                                                                                      | 105                                                           | 75                                                    | 60                                                                       | 105                                             | 75                   | 60                  | 105 | 75  | 60  | 105 |
| 25                                                                                     | Repair electronic ignition systems.                                   | B        | 75                                 | 60                                           | 105                   | 75             | 60              | 105            | 75                     | 60                                                                                    | 105                                         | 75                                         | 60                                            | 105                  | 75                              | 60                                                    | 105                                                                 | 75                                                                             | 60                           | 105                                             | 75                                                | 60                                                           | 105                                                                                     | 75                                                            | 60                                                    | 105                                                                      | 75                                              | 60                   | 105                 | 75  | 60  | 105 |     |
| 27                                                                                     | Maintain and repair antipollution and electronic injection systems.   | B        | 90                                 | 75                                           | 60                    | 45             | 60              | 105            | 75                     | 60                                                                                    | 105                                         | 75                                         | 60                                            | 105                  | 75                              | 60                                                    | 105                                                                 | 75                                                                             | 60                           | 105                                             | 75                                                | 60                                                           | 105                                                                                     | 75                                                            | 60                                                    | 105                                                                      | 75                                              | 60                   | 105                 | 75  | 60  | 105 |     |
| 28                                                                                     | Diagnose the condition of the engine-transmission unit.               | B        | 75                                 | 60                                           | 105                   | 75             | 60              | 105            | 75                     | 60                                                                                    | 105                                         | 75                                         | 60                                            | 105                  | 75                              | 60                                                    | 105                                                                 | 75                                                                             | 60                           | 105                                             | 75                                                | 60                                                           | 105                                                                                     | 75                                                            | 60                                                    | 105                                                                      | 75                                              | 60                   | 105                 | 75  | 60  | 105 |     |
| 30                                                                                     | Enter the work force.                                                 | S        | 90                                 | 75                                           | 60                    | 45             | 60              | 105            | 75                     | 60                                                                                    | 105                                         | 75                                         | 60                                            | 105                  | 75                              | 60                                                    | 105                                                                 | 75                                                                             | 60                           | 105                                             | 75                                                | 60                                                           | 105                                                                                     | 75                                                            | 60                                                    | 105                                                                      | 75                                              | 60                   | 105                 | 75  | 60  | 105 |     |
| NUMBER OF OBJECTIVES                                                                   |                                                                       |          | 13                                 | 980                                          | 980                   | 980            | 980             | 980            | 980                    | 980                                                                                   | 980                                         | 980                                        | 980                                           | 980                  | 980                             | 980                                                   | 980                                                                 | 980                                                                            | 980                          | 980                                             | 980                                               | 980                                                          | 980                                                                                     | 980                                                           | 980                                                   | 980                                                                      | 980                                             | 980                  | 980                 | 980 | 980 | 980 |     |
| DURATION (IN HOURS)                                                                    |                                                                       |          | 980                                | 980                                          | 980                   | 980            | 980             | 980            | 980                    | 980                                                                                   | 980                                         | 980                                        | 980                                           | 980                  | 980                             | 980                                                   | 980                                                                 | 980                                                                            | 980                          | 980                                             | 980                                               | 980                                                          | 980                                                                                     | 980                                                           | 980                                                   | 980                                                                      | 980                                             | 980                  | 980                 | 980 | 980 | 980 |     |

S: Situational objective  
 B: Behavioural objective  
 A: Correlation between a step and a specific competency  
 ▲: Correlation to be taught and evaluated  
 ○: Correlation between a general and a specific competency  
 ●: Correlation to be taught and evaluated

## 4. GENERAL OBJECTIVES

The general objectives of the *Automobile Mechanics* program are presented below, along with the major statement of each corresponding first-level operational objective.

**To develop in the students the competencies required to apply concepts and principles essential to the practice of the trade.**

- Apply concepts related to health, safety and environmental protection.
- Communicate with customers and colleagues.

**To develop in the students the competencies required to analyze the operation of motor vehicle systems.**

- List the characteristics of motor vehicles.
- Analyze the operation of internal combustion engines.
- Analyze problems related to basic electrical and electronic circuits.
- Analyze the operation of engine and passenger compartment temperature systems.
- Analyze the operation of road handling systems.
- Analyze the operation of transmission assemblies.
- Analyze the operation of a basic computer-controlled system.
- Analyze the operation of starting and charging systems and electromagnetic accessories.
- Analyze the operation of passive and active security systems.
- Analyze the operation of electronic ignition systems.
- Analyze the operation of antipollution and electronic injection systems.

**To develop in the students the competencies related to the techniques and procedures used in automobile mechanics.**

- Perform repair shop operations.
- Weld and cut metals.

**To develop in the students the competencies required to maintain and repair mechanical motor vehicle parts.**

- Perform general maintenance on a motor vehicle.
- Repair suspensions, steering systems and conventional brakes.
- Repair transmission assemblies.
- Repair internal combustion engines.
- Maintain and repair cooling, heating and air conditioning systems.

**To develop in the students the competencies required to maintain and repair motor vehicle electrical systems.**

- Repair lighting circuits.
- Repair starting and charging systems and electromagnetic accessories.

**To develop in the students the competencies required to maintain and repair computer-controlled motor vehicle systems.**

- Repair antilock brakes and safety accessories.
- Repair electronic ignition systems.
- Maintain and repair antipollution and electronic injection systems.
- Diagnose the condition of the engine-transmission unit.

**To develop in the students the competencies required to integrate harmoniously into the school and work environments.**

- Determine their suitability for the trade and the training process.
- Apply job search techniques.
- Explore the possibility of starting a business.
- Enter the work force.

## 5. FIRST- AND SECOND-LEVEL OPERATIONAL OBJECTIVES

### 5.1 DEFINITION

A first-level objective is defined for each competency to be developed. Competencies are organized into an integrated training program designed to prepare students to practise the trade or occupation. This systematic organization of competencies produces better overall results than training by isolated objectives. More specifically, it fosters a smooth progression from one objective to the next, saves teaching time by eliminating needless repetition, and integrates and reinforces learning material.

**First-level operational objectives** are the main, compulsory teaching/learning targets and they are specifically evaluated for certification. There are two kinds of operational objectives: behavioural and situational.

- **A behavioural objective** is a relatively closed objective that describes the actions and results expected of the student by the end of a learning step. Evaluation is based on expected results.
- **A situational objective** is a relatively open-ended objective that outlines the major phases of a learning situation. It allows for output and results to vary from one student to another. Evaluation is based on the student's participation in the activities of the learning context.

**Second-level operational objectives** are intermediate teaching/learning targets deemed prerequisite for attaining first-level objectives. They are grouped according to the specifications (see 5.2 A) or the phases (see 5.2 B) of the first-level objective.

The division of operational objectives into first- and second-level objectives is based on a clear distinction between the levels of learning:

- learning involving prerequisite knowledge
- learning involving competencies

Second-level operational objectives indicate prerequisite knowledge. They prepare the students to learn what is necessary to attain the first-level operational objectives, which collectively lead to the development of a competency. The objectives should always be adapted to meet the particular needs of the individual students or groups of students.

First-level operational objectives cover the learning that the students need to develop a competency:

- The specifications or the phases of the objective determine or guide specific learning, thereby allowing the competency to be developed step by step.

- The objective as a whole (i.e. the six components and in particular the last phase of a situational objective) determines or guides the overall learning and the integration and synthesis of this learning, allowing the competency to be developed fully.

To attain the objectives, the following learning activities may be prepared:

- specific learning activities for second-level objectives
- specific learning activities for the specifications or phases of first-level objectives
- general learning activities for first-level objectives

## 5.2 HOW TO READ FIRST-LEVEL OPERATIONAL OBJECTIVES

### A. How to Read a Behavioural Objective

Behavioural objectives consist of six components. The first three provide an overview of the objective:

1. The **expected behaviour** states a competency in terms of the general behaviour that the students are expected to have acquired by the end of the module.
2. The **conditions for performance evaluation** define what is necessary or permissible to the students during evaluation designed to verify whether or not the students have attained the objective. This means that the conditions for evaluation are the same wherever and whenever the program is taught.
3. The **general performance criteria** define the requirements by which to judge whether or not the results obtained are generally satisfactory.

The last three components ensure that the objective is understood clearly and unequivocally:

4. The **specifications of the expected behaviour** describe the essential elements of the competency in terms of specific behaviours.
5. The **specific performance criteria** define the requirements for each of the specifications of behaviour. They ensure a more enlightened decision on the attainment of the objective.
6. The **field of application** defines the limits of the objective, where necessary. It indicates cases where the objective applies to more than one task, occupation or field.

## B. How to Read a Situational Objective

Situational objectives consist of six components:

1. The **expected outcome** states a competency as an aim to be pursued throughout the course.
2. The **specifications** outline the essential aspects of the competency and ensure a better understanding of the expected outcome.
3. The **learning context** provides an outline of the learning situation designed to help the students develop the required competencies. It is normally divided into three phases of learning:
  - information
  - performance, practice or involvement
  - synthesis, integration and self-evaluation
4. The **instructional guidelines** provide suggested ways and means of teaching the course to ensure that learning takes place and that the same conditions apply wherever and whenever the course is taught. These guidelines may include general principles or specific procedures.
5. The **participation criteria** describe the requirements the students must fulfil, which are usually related to each phase of the learning context. They focus on how the students take part in the activities rather than on the results obtained. Participation criteria are normally provided for each phase of the learning context.
6. The **field of application** defines the limits of the objective, where necessary. It indicates cases where the objective applies to more than one task, occupation or field.

## **PART II**

## **MODULE 1: THE TRADE AND THE TRAINING PROCESS**

**CODE: 841 611**

**Duration: 15 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE SITUATIONAL OBJECTIVE**

#### **EXPECTED OUTCOME**

By participating in the required activities of the learning context according to the indicated criteria, the students will be able to **determine their suitability for the trade and the training process.**

#### **SPECIFICATIONS**

At the end of this module, the students will:

- Be familiar with the nature of the trade.
- Understand the training program.
- Confirm their career choice.

#### **LEARNING CONTEXT**

##### **PHASE 1: Information on the Trade**

- Learning about the job market in automobile mechanics (i.e. potential work environments, job prospects, wages, advancement and transfer opportunities, hiring criteria) by going on field trips, conducting interviews, studying reference material, and so forth.
- Learning about the nature and requirements of the job (i.e. tasks, working conditions, evaluation criteria, workers' rights and responsibilities) by going on field trips, conducting interviews, studying reference material, and so forth.
- Learning about continuing education (training possibilities, requirements and admissibility) in order to keep up with technological developments and to maintain their qualifications.

## **FIRST-LEVEL OPERATIONAL OBJECTIVE SITUATIONAL OBJECTIVE**

### **LEARNING CONTEXT**

- Presenting the information collected at a group meeting and discussing personal impressions of the trade (i.e. advantages, drawbacks, requirements).

### **PHASE 2: Information on the Program and Participation in the Training Process**

- Discussing the skills, aptitudes and knowledge needed to practise the trade.
- Discussing the professional ethics and attitudes required to practise the trade.
- Becoming familiar with the training program: the program of study, the training process, evaluation methods, certification of studies.
- Discussing how the training program prepares them to find employment in automobile mechanics.
- Giving their first impressions of the trade and the training process.

### **PHASE 3: Evaluation and Confirmation of Career Choice**

- Writing a report in which they:
  - describe their preferences, aptitudes and interests with respect to the trade;
  - assess their career choice by comparing the different facets and demands of the trade with their own preferences, aptitudes and interests.

### **INSTRUCTIONAL GUIDELINES**

The teacher should:

- Create an atmosphere conducive to personal growth and professional development.
- Encourage students to engage in discussions and express their opinions.
- Involve students in learning activities.
- Provide students with the means to acquire a clear, objective understanding of the trade.
- Help students assess their career choice honestly and objectively.
- Organize field trips to establishments associated with the automotive trade.

## **FIRST-LEVEL OPERATIONAL OBJECTIVE SITUATIONAL OBJECTIVE**

### **INSTRUCTIONAL GUIDELINES**

- Make suitable reference material available to the students (e.g. information on the trade and training programs, handbooks).
- Arrange for students to meet with trade specialists.

### **PARTICIPATION CRITERIA**

#### **PHASE 1:**

- Collect information on most of the topics to be covered.
- Express their views on the trade at a group meeting, interrelating the information they have collected.

#### **PHASE 2:**

- Give their opinions on some requirements for practising the trade of automobile mechanic.
- Examine the reference material provided.
- Listen carefully to explanations.
- Express their views on the training program at a group meeting.
- Express their reactions clearly.

#### **PHASE 3:**

- Write a report that:
  - sums up their preferences, interests and aptitudes;
  - explains clearly how they arrived at their career choice.

## SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

**Before undertaking any of the activities:**

1. Be receptive to information on the trade and the training process.
2. Express an interest in sharing their impressions of the trade with the other members of the group.

**Before undertaking the activities of Phase 1:**

3. Gather information.
4. Determine a way of recording and presenting information.
5. Distinguish between tasks and operations.
6. Define the expression *competencies required to enter the job market*.
7. Explain the principal rules of group discussion.

**Before undertaking the activities of Phase 2:**

8. Distinguish the skills from the aptitudes and knowledge required to practise a trade.
9. Describe the nature, function and content of a program of study.

**Before undertaking the activities of Phase 3:**

10. Distinguish personal preferences from aptitudes and interests.
11. Describe the main elements of a report confirming a career choice.

## **MODULE 2: CHARACTERISTICS OF MOTOR VEHICLES**

**CODE: 841 622**

**Duration: 30 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

#### **EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **list the characteristics of motor vehicles** in accordance with the following conditions, criteria and specifications.

#### **CONDITIONS FOR PERFORMANCE EVALUATION**

- Working individually
- Given a motor vehicle
- Using:
  - conventional and computerized technical documentation
  - American and import reference manuals

#### **GENERAL PERFORMANCE CRITERIA**

- Careful use of reference material
- Proper selection and use of technical documentation
- Proper use of English and French terminology and abbreviations

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

### SPECIFIC PERFORMANCE CRITERIA

A. Identify sources of technical information.

- Accurate distinction among the types of conventional and computerized documents available on the market
- Accurate distinction among the types of presentations of information
- Recognition of the relationships between the type of information available and the task to be performed

B. Find technical information with a view to applying it.

- Methodical research
- Accurate location of:
  - general information
  - diagrams
  - recommended work methods
  - figures
  - specifications
- Efficient use of research tools

C. Identify the parts, systems and subsystems of a motor vehicle.

- Accurate explanation of the characteristics of motor vehicles, using the appropriate English or French terminology
- Accurate identification of the parts, systems and subsystems of the vehicle

D. Explain the overall operation of motor vehicles.

- Accurate explanation of the function of each part, system and subsystem
- Accurate identification of the functional relationships between the parts, systems and subsystems

## SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

**Before learning how to find technical information with a view to applying it (B):**

1. Distinguish between a mechanical, electrical or hydraulic diagram and a location diagram.
2. Distinguish among a table of specifications, the manufacturer's recommended work method and a technical bulletin.
3. Distinguish between the general information and the other sections of a repair manual.
4. Identify the different methods of finding information, according to manufacturer.

**Before learning how to identify the parts, systems and subsystems of a motor vehicle (C):**

5. Identify the various types of vehicles and their characteristics.
6. Become aware of the technological development of motor vehicles.
7. Explain the composition of a drive train.

## **MODULE 3: INTERPERSONAL COMMUNICATION**

**CODE: 841 632**

**Duration: 30 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

#### **EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **communicate with customers and colleagues** in accordance with the following conditions, criteria and specifications.

#### **CONDITIONS FOR PERFORMANCE EVALUATION**

- Working individually and in teams
- Given hypothetical situations typical of the working world
- Making an oral presentation
- Writing a report

#### **GENERAL PERFORMANCE CRITERIA**

- Courteous behaviour
- Neat appearance
- Appropriate language level

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

A. Approach customers, superiors and colleagues.

B. Identify customers' needs.

C. Relay technical information verbally and in writing.

D. Use work methods and techniques for communicating in a team.

### SPECIFIC PERFORMANCE CRITERIA

- Appropriate and courteous behaviour
- Selection of appropriate communication style
- Appropriate choice of approach according to communication style and person addressed
- Attention to verbal and non-verbal messages
- Relevant choice of questions
- Accurate interpretation of written and verbal complaints
- Appropriate use of techniques to deal with defensiveness
- Accurate identification of needs
- Use of appropriate techniques to close a discussion
- Relevant choice of information to be relayed according to the need and the situation
- Accurate information
- Clear and coherent communication
- Appropriate use of technical terminology
- Conciseness
- Appropriate language level
- Accurate identification of the factors involved in the formation and cohesion of a work team
- Effective communication with colleagues
- Clear rules and techniques for communicating in a team
- Functional organization of work area

## **SECOND-LEVEL OPERATIONAL OBJECTIVES**

**IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:**

**Before learning how to approach customers, superiors and colleagues (A):**

1. Describe the process of interpersonal communication and the importance of feedback.
2. Identify the styles of communication.
3. Determine their own style of communication, their strengths and their limitations.
4. List the different types of customers.
5. Understand the importance of personal appearance, courtesy and an appropriate language level when dealing with customers.

**Before learning how to identify customers' needs (B):**

6. Describe the techniques for formulating questions.
7. Recognize defensive attitudes in customers lodging complaints and in colleagues in conflict situations.
8. Understand that their own defensiveness affects communication.
9. Show an interest in the customer's problem.

**Before learning how to relay technical information verbally and in writing (C):**

10. Identify the characteristics of effective communication.
11. Understand the importance of using an appropriate language level with customers.
12. Describe the characteristics of a written report.

**Before learning how to use work methods and techniques for communicating in a team (D):**

13. Understand the importance of assisting colleagues and sharing information.
14. State the principles of cooperation and organizational efficiency.
15. Explain the operation of a team with respect to the task, relationships between team members and work methods.

## **MODULE 4: HEALTH, SAFETY AND ENVIRONMENTAL PROTECTION**

**CODE: 841 641**

**Duration: 15 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

#### **EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **apply concepts related to health, safety and environmental protection** in accordance with the following conditions, criteria and specifications.

#### **CONDITIONS FOR PERFORMANCE EVALUATION**

- Working individually
- Given hypothetical or actual situations
- Using:
  - the relevant documentation
  - a list of questions

#### **GENERAL PERFORMANCE CRITERIA**

- Accurate explanations
- Choice of preventive measures appropriate to the operation to be performed
- Accurate use of English and French terminology

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### **SPECIFICATIONS OF THE EXPECTED BEHAVIOUR**

- A. Explain the aspects of the laws related to health, safety and environmental protection that apply to automobile mechanics.
  
- B. Explain the preventive measures to be taken when setting up a repair shop.
  
- C. Associate preventive measures with the risks inherent to the chemicals most commonly used in the trade.

### **SPECIFIC PERFORMANCE CRITERIA**

- Accurate explanation of the objective of the legislation
- Correct identification of measures provided for in the legislation
- Correct identification of measures taken by manufacturers to protect the environment
  
- Accurate description of the safe layout of a repair shop
- Accurate explanation of the importance of neatness for repair shop safety
- Correct identification of the rules for preventing fire in a repair shop
- Accurate identification of methods for storing hazardous materials
  
- Accurate identification of the most commonly used chemicals
- Accurate explanation of the effects of the chemicals on health, safety and the environment
- Accurate association of hazards with corresponding preventive measures
- Accurate identification of equipment for recycling hazardous materials
- Accurate interpretation of WHMIS symbols

## **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

### **SPECIFICATIONS OF THE EXPECTED BEHAVIOUR**

### **SPECIFIC PERFORMANCE CRITERIA**

**D. Associate preventive measures with the performance of trade-related operations.**

- Accurate association of hazards with corresponding preventive measures
- Accurate determination of safe behaviour

**E. Identify different individual safety measures.**

- Accurate association of individual safety measures and occupational hazards

**F. Determine the action to take in the case of an accident or emergency.**

- Recognition of the seriousness of the accident according to the signs and symptoms
- Accurate determination of basic first-aid operations
- Determination of appropriate method of communicating with emergency services

## SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

**Before learning how to explain the aspects of the laws related to health, safety and environmental protection that apply to automobile mechanics (A):**

1. Become aware of the issue of occupational health and safety in Québec.
2. Distinguish between an occupational disease and an industrial accident.
3. Identify the role of health and safety officers.
4. Become aware of the effects of environmental pollution related to the practice of the trade and the operation of automobiles.
5. Describe the types of pollution created by automobiles.
6. Explain the basic principles applied to prevent environmental pollution.

**Before learning how to explain the preventive measures to be taken when setting up a repair shop (B):**

7. List the basic principles underlying the prevention of fires in a repair shop.

**Before learning how to associate preventive measures with the risks inherent to the chemicals most commonly used in the trade (C):**

8. List the hazards associated with exhaust gas.
9. List the hazards associated with the use of greases, oils and solvents.
10. List the hazards associated with the use of refrigerants, fuels, oxidizing agents and gases.

**Before learning how to associate preventive measures with the performance of trade-related operations (D):**

11. Describe the hazards associated with the use of compressed air for cleaning.
12. Describe the hazards associated with the use of electric and air tools.
13. Describe the hazards associated with hoisting and handling.
14. Describe the hazards associated with welding, cutting and heating.
15. Describe the hazards associated with battery maintenance.
16. Describe the hazards associated with vehicle repairs.

## **SECOND-LEVEL OPERATIONAL OBJECTIVES**

**IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:**

**Before learning how to determine the action to take in the case of an accident or emergency (F):**

- 17. List the items usually found in a first-aid kit.**

## **MODULE 5: WELDING AND CUTTING**

**CODE: 841 653**

**Duration: 45 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

#### **EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **weld and cut metals** in accordance with the following conditions, criteria and specifications.

#### **CONDITIONS FOR PERFORMANCE EVALUATION**

- Working individually
- Given mild steel plates for the oxyacetylene welding operations
- Using:
  - an oxyacetylene welding station
  - mild steel and bronze filler rods
  - a cutting torch
  - bolts mounted on assembled parts

#### **GENERAL PERFORMANCE CRITERIA**

- Observance of health and safety rules
- Correct and safe use of tools and welding equipment
- Safe opening and closing of oxyacetylene welding station
- Proper use of English and French terminology

#### **FIELD OF APPLICATION**

- Oxyacetylene and MIG welding and soldering

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

### SPECIFIC PERFORMANCE CRITERIA

A. Prepare the work.

- Appropriate choice of welding tips
- Correct assembly of oxyacetylene welding station
- Appropriate pressure adjustment
- Correct inspection of leak-tightness of welding station
- Proper choice of personal safety equipment
- Proper choice of type of weld according to:
  - the types of metal to be assembled
  - the forces exerted on the part
- Proper tinning of soldering iron

B. Heat parts.

- Appropriate adjustment of pressure and flame
- Mastery of techniques
- Speed of execution
- Uniform heating

C. Weld metals in flat, horizontal and vertical positions, using:

- tin
- autogenous and heterogeneous welding

- Appropriate adjustment of pressure and flame
- Observance of techniques
- Uniformity of weld bead
- Adequate penetration of filler metal
- Resistant welds

D. Cut thin steel and thick steel.

- Appropriate adjustment of pressure and flame
- Observance of techniques
- Clean and regular drag lines

| <b>FIRST-LEVEL OPERATIONAL OBJECTIVE<br/>BEHAVIOURAL OBJECTIVE</b> |                                                                                                                                                                                                                                                         |
|--------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>SPECIFICATIONS OF THE EXPECTED<br/>BEHAVIOUR</b>                | <b>SPECIFIC PERFORMANCE<br/>CRITERIA</b>                                                                                                                                                                                                                |
| E. Disassemble the welding station.                                | <ul style="list-style-type: none"><li>- Careful handling of pressure valves and welding tips</li><li>- Correct installation of caps on cylinder valves</li><li>- Safe storage of equipment and tools</li><li>- Clean tools and neat work area</li></ul> |

## **SECOND-LEVEL OPERATIONAL OBJECTIVES**

**IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:**

**Before learning how to prepare the work (A):**

1. Describe ferrous and nonferrous metals.
2. Explain the laws of physics related to the action of heat on metal.
3. Describe the principles of autogenous and heterogeneous welding.
4. Describe the principles of MIG welding.
5. Distinguish between the metals and alloys used in tinning.
6. Identify the techniques used in repair shops to prevent environmental pollution.
7. State the safety rules related to the handling of gas cylinders, soldering, oxyacetylene welding and cutting.
8. Specify the hazards involved in wearing contact lenses when performing electric arc welding operations.
9. Distinguish among soldering irons according to their use.
10. Distinguish between the specific characteristics of fuels and those of oxidizing agents.
11. Identify the types of oxyacetylene flames according to their characteristics.
12. Distinguish among the types of protective eyewear and their codes.
13. List the hazards involved in the use of oxygen and acetylene.

**Before learning how to cut thin steel and thick steel (D):**

14. Describe the techniques for cutting metals.

**Before learning how to disassemble the welding station (E):**

15. Explain the operations involved in the regular maintenance of welding stations.

## MODULE 6: SHOP WORK

CODE: 841 664

Duration: 60 hours

### FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

#### EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must **perform repair shop operations** in accordance with the following conditions, criteria and specifications.

#### CONDITIONS FOR PERFORMANCE EVALUATION

- Working individually
- Following:
  - instructions on the assembly work to be done
  - written instructions on the measurements to be taken
- Using:
  - hand tools
  - cutting tools
  - measuring instruments

#### GENERAL PERFORMANCE CRITERIA

- Accurate measurements
- Quality and accurate work
- Observance of the rules of health, safety and environmental protection
- Accurate use of English and French terminology

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

### SPECIFIC PERFORMANCE CRITERIA

A. Use hand tools to disassemble and reassemble a simple mechanical device.

- Proper choice of hand, electric and air tools
- Safe use of tools
- Clean tools

B. Measure components and fasteners in the metric and imperial systems using instruments.

- Selection of appropriate instruments
- Careful handling of instruments
- Precise adjustment of instruments before measuring
- Correct use of instruments
- Accurate readings
- Accurate measurements
- Accurate interpretation of measurements

C. Use fasteners.

- Appropriate selection of fasteners
- Quality assemblies
- Quality flares

D. Cut ferrous and nonferrous metals at the workbench.

- Correct use of cutting tools
- Observance of threading and tapping techniques
- Quality threading and tapping
- Successful extraction of a broken screw
- Proper installation of threaded inserts

E. Use repair shop equipment.

- Observance of recommended procedure
- Observance of equipment capacity
- Safe and correct use of equipment
- Appropriate maintenance of equipment
- Safe replacement of grindstone

## SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

**Before learning how to use hand tools to disassemble and reassemble a simple mechanical device (A):**

1. Distinguish among the hand tools commonly used by mechanics.
2. Distinguish among specific hand tools, electric hand tools and air tools.
3. Maintain hand, air and cutting tools.

**Before learning how to measure components and fasteners in the metric and imperial systems using instruments (B):**

4. Distinguish between metric and imperial system units.
5. Describe measuring and control instruments.
6. Describe measuring techniques.
7. Maintain and store measuring instruments.

**Before learning how to use fasteners (C):**

8. Describe assembly techniques.
9. Distinguish among the main threaded fasteners.
10. Classify screws, nuts and bolts.
11. Distinguish among the main unthreaded fasteners.
12. Prepare flexible and semi-rigid tubing connectors and adapters for assembly.

**Before learning how to cut ferrous and nonferrous metals at the workbench (D):**

13. Describe the use of cutting tools.
14. Maintain cutting tools.
15. Describe the physical properties of ferrous and nonferrous metals with respect to their use as cutting tools.
16. Describe the specific characteristics and classifications of drill bits.

## SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

**Before learning how to use repair shop equipment (E):**

17. Describe the hoisting and handling equipment used in repair shops and perform preventive maintenance tasks.
18. Describe the characteristics and the role of the compressed air distribution system and its maintenance points.
19. Describe the characteristics and the role of different types of cleaning equipment and their maintenance points.
20. Describe the use of a hydraulic press and the tests to be done before using it.
21. Maintain bench vises.
22. Distinguish among the different types of grindstones according to the work to be done.

## **MODULE 7: INTERNAL COMBUSTION ENGINES**

**CODE: 841 675**

**Duration: 75 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

#### **EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **analyze the operation of internal combustion engines** in accordance with the following conditions, criteria and specifications.

#### **CONDITIONS FOR PERFORMANCE EVALUATION**

- Working individually
- Using:
  - technical information provided by the instructor
  - mechanical diagrams

#### **GENERAL PERFORMANCE CRITERIA**

- Observance of the rules of health, safety and environmental protection
- Accurate use of English and French terminology

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

- A. Interpret the information in the technical documentation.
  
- B. Identify the types of internal combustion engines and their components.
  
- C. Explain the operation of gasoline and diesel engines.

### SPECIFIC PERFORMANCE CRITERIA

- Selection of the appropriate mechanical diagrams
- Accurate interpretation of the information in the mechanical diagrams
  
- Correct identification of the different types of internal combustion engines
- Accurate identification of components
  
- Accurate explanation of the characteristics of the components:
  - function
  - properties of materials
  - functional relationships among components
  - operation of mechanisms
- Accurate explanation of the principles of operation of two- and four-stroke internal combustion engines
- Accurate description of operating cycles of two- and four-stroke engines
- Accurate description of the overall operation of a four-stroke engine
- Accurate interpretation of specifications related to the performance of an internal combustion engine

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

### SPECIFIC PERFORMANCE CRITERIA

- |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| D. Explain the operation of the lubrication system.                    | <ul style="list-style-type: none"> <li>- Accurate explanation of the operation of the system and its components</li> <li>- Accurate description of the circulation of the lubricant</li> <li>- Accurate explanation of the relationships between the properties of oils and the proper operation of an engine</li> </ul>                                                                                                                                                                        |
| E. Recognize foreseeable anomalies in the engine.                      | <ul style="list-style-type: none"> <li>- Recognition of foreseeable anomalies and their effects on the operation of the engine</li> <li>- Accurate identification of anomalies related to oils</li> </ul>                                                                                                                                                                                                                                                                                       |
| F. Diagnose the mechanical condition of the engine before disassembly. | <ul style="list-style-type: none"> <li>- Appropriate choice of diagnostic equipment, given the latest technological innovations</li> <li>- Proper use of the appropriate equipment</li> <li>- Observance of manufacturer's recommended methods for checking:               <ul style="list-style-type: none"> <li>• compression</li> <li>• vacuum</li> <li>• oil pressure</li> </ul> </li> <li>- Accurate detection of abnormal sounds</li> <li>- Accurate interpretation of results</li> </ul> |

## **SECOND-LEVEL OPERATIONAL OBJECTIVES**

**IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:**

**Before learning how to explain the operation of gasoline and diesel engines (C):**

1. Identify the metals and alloys used in the manufacture of engine components.
2. State the carbon content of iron, steel and cast iron.
3. Describe the different concepts of engine component construction.
4. Interpret torque curves.
5. Explain the technical terms related to engine performance.

**Before learning how to explain the operation of the lubrication system (D):**

6. Explain the process of refining hydrocarbons to obtain motor oil.
7. Explain the characteristics of motor oil:
  - natural properties
  - function of additives

**Before learning how to recognize foreseeable anomalies in the engine (E):**

8. Identify the points of wear of the main components of an internal combustion engine.
9. Interpret troubleshooting charts.

**Before learning how to diagnose the mechanical condition of the engine before disassembly (F):**

10. Explain the relationship between the mechanical condition of an engine and the compression, vacuum and oil pressure.

## **MODULE 8: INTERNAL COMBUSTION ENGINE REPAIR**

**CODE: 841 687**

**Duration: 105 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

#### **EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **repair internal combustion engines** in accordance with the following conditions, criteria and specifications.

#### **CONDITIONS FOR PERFORMANCE EVALUATION**

- Working individually
- Given engines representative of the market
- Using:
  - state-of-the-art tools and instruments
  - engine repair equipment
  - technical documentation

#### **GENERAL PERFORMANCE CRITERIA**

- Observance of the rules of health, safety and environmental protection
- Accurate use and adjustment of instruments
- Careful handling of components
- Accurate interpretation of information found in technical documentation
- Observance of manufacturer's specifications
- Neat and meticulous work
- Keen sense of observation
- Accurate use of English and French terminology

## **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

### **SPECIFICATIONS OF THE EXPECTED BEHAVIOUR**

**A. Plan the work.**

**B. Disassemble an internal combustion engine.**

**C. Determine the condition of the components  
of the cylinder block and head.**

### **SPECIFIC PERFORMANCE CRITERIA**

- Appropriate choice of tasks according to the nature of the repair
- Appropriate choice of techniques and specifications according to the technical documentation
- Appropriate choice of tools and equipment
- Observance of manufacturer's recommendations for the removal and disassembly of components
- Proper use of tools
- Proper cleaning of components
- Appropriate organization of parts
- Detailed visual inspection of each part
- Observance of recommended techniques for inspecting each component
- Accurate measurement of each component
- Accurate interpretation of values obtained with respect to manufacturer's specifications
- Accurate and well-written report on the type of repair to be done

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

### SPECIFIC PERFORMANCE CRITERIA

- |                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>D. Repair and replace the components of the cylinder block and head.</p>                                      | <ul style="list-style-type: none"> <li>- Correct application of manufacturer's recommendations for repairing and replacing components</li> <li>- Proper surface finish on repaired components</li> <li>- Allowances in conformity with manufacturer's specifications</li> <li>- Proper machining of valves and valve seats</li> <li>- Proper valve faces and leak tightness</li> </ul>                                                |
| <p>E. Reassemble the internal combustion engine.</p>                                                             | <ul style="list-style-type: none"> <li>- Observance of recommended techniques and specifications for:                             <ul style="list-style-type: none"> <li>• torque values and sequences</li> <li>• allowances and adjustments</li> </ul> </li> <li>- Complete assembly</li> <li>- Proper use of sealants</li> <li>- Proper installation of fluid and ring seals</li> <li>- Proper organization of work area</li> </ul> |
| <p>F. Determine whether the condition of the engine is in conformity with the manufacturer's specifications.</p> | <ul style="list-style-type: none"> <li>- Observance of recommended procedures</li> <li>- Accurate measurement of compression, vacuum and oil pressure</li> <li>- Correct interpretation of results</li> <li>- Accurate and well-written report</li> </ul>                                                                                                                                                                             |

## **SECOND-LEVEL OPERATIONAL OBJECTIVES**

**IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:**

**Before learning how to plan the work (A):**

1. Use the appropriate method for finding information.
2. Identify the different types of documentation available on engine repair.

**Before learning how to disassemble an internal combustion engine (B):**

3. Identify the chemicals used to clean engine components.

**Before learning how to determine the condition of the components of the cylinder block and head (C):**

4. Identify the equipment and measuring instruments used to diagnose the condition of engine components.
5. Use the proper equipment to detect cracks in a cylinder head.

**Before learning how to repair and replace the components of the cylinder block and head (D):**

6. Select abrasive stones according to the grinding to be done.
7. Use a cylinder head grinder.

**Before learning how to reassemble the internal combustion engine (E):**

8. Identify up-to-date sealing methods.

## **MODULE 9: BASIC ELECTRICAL AND ELECTRONIC CIRCUITS**

**CODE: 841 695**

**Duration: 75 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

#### **EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **analyze problems related to basic electrical and electronic circuits** in accordance with the following conditions, criteria and specifications.

#### **CONDITIONS FOR PERFORMANCE EVALUATION**

- Working individually
- Working on various types of basic circuit assemblies
- Given:
  - educational panels
  - parts
- Using:
  - a multimeter
  - jumpers
  - a test light

#### **GENERAL PERFORMANCE CRITERIA**

- Observance of safety rules and warnings, especially with respect to the battery
- Observance of the rules of health, safety and environmental protection
- Accurate use of English and French terminology

#### **FIELD OF APPLICATION**

- Lighting, rear-window defrost and signalling systems

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

- A. Distinguish among the types of basic electrical and electronic circuits and their components.
  
- B. Explain the operation of basic electric and electronic circuits.
  
- C. Recognize foreseeable anomalies in basic electric and electronic circuits.

### SPECIFIC PERFORMANCE CRITERIA

- Accurate identification of series, parallel and series-parallel circuits
- Accurate identification of the components and their specific characteristics
  
- Accurate description of the specific characteristics of direct current in a conductor wire
- Accurate explanation of Ohm's law according to the type of circuit
- Accurate calculations
- Accurate description of the specific characteristics of the battery and other components of the circuit:
  - construction
  - function
  - operation and underlying principles
- Accurate explanation of the operation of a relay
  
- Recognition of the main foreseeable anomalies
- Accurate explanation of the effect of the anomaly on the operation of the circuit
- Proper choice of diagnostic methods according to the type of anomaly

## **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

### **SPECIFICATIONS OF THE EXPECTED BEHAVIOUR**

**D. Assess the condition of different types of basic electrical and electronic circuits.**

**E. Interpret diagrams and drawings of basic electrical and electronic circuits.**

### **SPECIFIC PERFORMANCE CRITERIA**

- Proper use of the appropriate instruments to detect anomalies:
  - ammeter
  - voltmeter
  - ohmmeter
- Correct interpretation of the results on different scales
- Accurate explanation of the relationship between the results obtained and Ohm's law
- Accurate interpretation of voltage drops
  
- Accurate location of drawings and diagrams in the technical documentation
- Accurate interpretation of information
- Accurate explanation of the operation of lighting system components such as flashers, headlights, passenger compartment lights and parking lights
- Accurate explanation of the path of the current

## SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

**Before learning how to distinguish among the types of basic electrical and electronic circuits and their components (A):**

1. List the applications of electricity in a motor vehicle.
2. Describe the different parts of an electric or electronic circuit.
3. Identify conductors, semi-conductors and insulators in the periodic table.
4. List the applications of conductors, semi-conductors and insulators in motor vehicles.
5. Describe the nature of electricity and its speed.

**Before learning how to explain the operation of basic electric and electronic circuits (B):**

6. Define a chemical reaction.
7. Describe the transformation of electrical energy into thermal energy in a conductor.
8. Describe the relationship between the gauge of a conductor, the intensity of the current and the temperature of the conductor.
9. Describe the coding used to determine the gauge of a conductor.

**Before learning how to assess the condition of different types of basic electrical and electronic circuits (D):**

10. Distinguish between a jumper, a test light, a multimeter and a voltage drop.
11. Identify analog and digital voltmeters, ammeters and ohmmeters.
12. Identify the specific characteristics of digital variable impedance multimeters.
13. Describe the rules for connecting voltmeters, ammeters and ohmmeters.
14. Describe the use of jumpers and test lights with or without a power source, to diagnose a problem.
15. Describe the purpose of measuring voltage drops during diagnosis.
16. Select a logical and effective diagnostic method applicable to a basic circuit.

## **SECOND-LEVEL OPERATIONAL OBJECTIVES**

**IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:**

**Before learning how to interpret diagrams and drawings of basic electrical and electronic circuits (E):**

- 17. Describe the relationships between the electrical drawing, the location diagrams and the detailed diagrams of a harness or a specific component.**

## MODULE 10: LIGHTING CIRCUIT REPAIR

CODE: 841 704

Duration: 60 hours

### FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

#### EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must **repair lighting circuits** in accordance with the following conditions, criteria and specifications.

#### CONDITIONS FOR PERFORMANCE EVALUATION

- Working individually
- Given a motor vehicle
- Using:
  - the appropriate instruments, tools and equipment
  - technical documentation
  - personal safety equipment

#### GENERAL PERFORMANCE CRITERIA

- Observance of safety instructions and warnings
- Proper application of the rules of health, safety and environmental protection
- Neat and meticulous work
- Observance of manufacturer's specifications
- Accurate interpretation of information in technical documentation
- Keen sense of observation
- Accurate use of English and French terminology

#### FIELD OF APPLICATION

- The lighting system and subsystems, i.e. headlights, day lights, flashers, parking lights and passenger compartment lights

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

- A. Interpret the information in the technical documentation.
  
- B. Diagnose the condition of lighting system circuits, components and relays.
  
- C. Plan the work.
  
- D. Replace lighting system components.

### SPECIFIC PERFORMANCE CRITERIA

- Accurate choice of diagrams, drawings and techniques
- Accurate interpretation of diagnostic and repair methods
- Accurate interpretation of information on battery drain
  
- Detailed visual inspection of the system
- Proper use of tools and instruments
- Proper inspection of the vehicle's grounding circuit
- Proper inspection of battery drain
- Observance of diagnostic methods related to:
  - general inspection
  - inspection related to specific problems
- Accurate measurements
- Accurate diagnosis of condition of system
  
- Accurate determination of work to be done
- Proper choice of tools, instruments and equipment
  
- Proper application of manufacturer's recommendations for removing and replacing components
- Concern for system integrity

**FIRST-LEVEL OPERATIONAL OBJECTIVE  
BEHAVIOURAL OBJECTIVE**

**SPECIFICATIONS OF THE EXPECTED  
BEHAVIOUR**

E. Repair wiring harnesses and cables and their components.

F. Verify the operating condition of the system.

**SPECIFIC PERFORMANCE  
CRITERIA**

- Precise application of repair techniques:
  - splicing
  - soldering
  - insulating the splices
- Proper use of specialized tools:
  - terminals
  - connectors
- Proper cleaning of contacts
  
- Appropriate testing of system
- Appropriate organization of work area
- Accurate and well-written report

## **SECOND-LEVEL OPERATIONAL OBJECTIVES**

**IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:**

**Before learning how to interpret the information in the technical documentation (A):**

1. Recognize the hazards involved in repairing circuits.

**Before learning how to diagnose the condition of lighting system circuits, components and relays (B):**

2. Establish the relationship between a voltage drop and a circuit anomaly.
3. Distinguish between diagnostic methods for the general inspection of a system and for inspection related to specific problems.

**Before learning how to repair wiring harnesses and cables and their components (E):**

4. Identify the types of splices.
5. Associate types of fuse wires with manufacturers' codes.

## **MODULE 11: ENGINE AND PASSENGER COMPARTMENT TEMPERATURE SYSTEMS**

**CODE: 841 712**

**Duration: 30 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

#### **EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **analyze the operation of engine and passenger compartment temperature systems** in accordance with the following conditions, criteria and specifications.

#### **CONDITIONS FOR PERFORMANCE EVALUATION**

- Working individually
- Given vehicles, parts or engines
- Using:
  - the relevant technical documentation
  - diagrams or illustrations

#### **GENERAL PERFORMANCE CRITERIA**

- Observance of the rules of health, safety and environmental protection
- Meticulous handling of instruments and equipment
- Accurate use of English and French terminology

#### **FIELD OF APPLICATION**

- Heater motors
- Radiator fans
- Temperature systems, excluding electronic air conditioning control systems

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

- A. Interpret the information in the technical documentation.
  
- B. Identify the types of cooling, heating and air conditioning systems and their components.
  
- C. Describe the specific characteristics of the components of each system.
  
- D. Explain the operation of the cooling, heating and air conditioning systems.

### SPECIFIC PERFORMANCE CRITERIA

- Accurate selection of drawings and diagrams of the different systems
- Accurate interpretation of the information in the drawings and diagrams
  
- Accurate identification of the different types of systems
- Accurate identification of the components of the different systems
- Accurate location of the components on the vehicle
  
- Accurate explanation of the function of each component
- Accurate explanation of their operation and related principles
- Accurate explanation of the properties of the materials
  
- Accurate explanation of the operating principles of the systems under various conditions
- Accurate description of the characteristics of lubricants, antifreeze and refrigerants
- Recognition of the hazards related to each system

**FIRST-LEVEL OPERATIONAL OBJECTIVE  
BEHAVIOURAL OBJECTIVE**

**SPECIFICATIONS OF THE EXPECTED  
BEHAVIOUR**

- E. Recognize foreseeable anomalies in the air conditioning system or in the passenger compartment heating or cooling system.
- F. Determine the condition of the cooling and heating systems.

**SPECIFIC PERFORMANCE  
CRITERIA**

- Recognition of foreseeable anomalies and their effects on the operation of the cooling and heating systems
  - Accurate identification of types of contaminants
  - Recognition of anomalies related to refrigerant leaks in the air conditioning system
- F. Determine the condition of the cooling and heating systems.
- Appropriate choice of instruments, given the latest technological innovations
  - Precise use of instruments
  - Accurate interpretation of results

## SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

**Before learning how to describe the specific characteristics of the components of each system (C):**

1. Describe the vaporization of liquids.
2. Describe the liquefaction of gases.

**Before learning how to explain the operation of the cooling, heating and air conditioning systems (D):**

3. Describe pressurization and its effects on the temperature of liquids and gases.
4. Describe the effects of pressure on the boiling point.
5. Describe the natural movement of a mixture of hot and cold liquids.
6. Describe the natural movement of a mixture of hot and cold air.
7. Describe the different means of transferring heat from the combustion chamber to the cooling system.

**Before learning how to recognize foreseeable anomalies in the air conditioning system or in the passenger compartment heating or cooling system (E):**

8. Describe the specific characteristics of acid solutions.
9. Describe oxidation.
10. Describe the electrolytic corrosion of metal.
11. Describe the formation of scale deposit.

**Before learning how to determine the condition of the cooling and heating systems (F):**

12. Describe the density of a liquid.
13. Describe the operation of a hydrometer.

## **MODULE 12: COOLING, HEATING AND AIR CONDITIONING SYSTEM MAINTENANCE AND REPAIR**

**CODE: 841 723**

**Duration: 45 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

#### **EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **maintain and repair cooling, heating and air conditioning systems** in accordance with the following conditions, criteria and specifications.

#### **CONDITIONS FOR PERFORMANCE EVALUATION**

- Working individually
- Given vehicles with air conditioning systems
- Using:
  - the relevant technical documentation
  - the appropriate instruments

#### **GENERAL PERFORMANCE CRITERIA**

- Observance of safety instructions and warnings
- Observance of torque values
- Observance of the rules of health, safety and environmental protection
- Careful handling of vehicle and equipment
- Accurate interpretation of information in technical documentation
- Keen sense of observation
- Accurate use of English and French terminology

#### **FIELD OF APPLICATION**

- Air conditioning system repair is limited to the operations involving the leak tightness of the system.
- Heater motors
- Radiator fans

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

A. Diagnose the condition of the cooling and heating systems.

B. Plan the work.

C. Repair cooling and heating systems.

D. Maintain cooling and heating systems.

### SPECIFIC PERFORMANCE CRITERIA

- Detailed visual inspection of the systems
- Detection of contaminants
- Observance of manufacturer's recommended diagnostic methods
- Careful inspection of each component
- Accurate interpretation of results
- Accurate diagnosis
  
- Accurate determination of work to be done
- Appropriate preparation of equipment
  
- Observance of manufacturer's recommendations for replacing components
- Quality assembly
- Proper application of sealing methods
- Proper use of tools
  
- Belt adjustment in conformity with specifications
- Observance of proportions of water and antifreeze in mixture
- Proper use of cleaning and recycling equipment

**FIRST-LEVEL OPERATIONAL OBJECTIVE  
BEHAVIOURAL OBJECTIVE**

**SPECIFICATIONS OF THE EXPECTED  
BEHAVIOUR**

**SPECIFIC PERFORMANCE  
CRITERIA**

E. Repair leaks in an air conditioning system.

- Proper choice of instruments and equipment, given the latest technological innovations
- Detection of refrigerant leaks
- Safe use of equipment for repairing the air conditioning system
- Observance of manufacturer's recommendations for recovering and recycling refrigerants
- Appropriate replacement of components
- Leak-tight system
- Observance of manufacturer's recommendations for emptying and filling the air conditioning system

F. Check the operating condition and integrity of the systems.

- Appropriate testing of systems
- Quality control
- Accurate and well-written report

G. Tidy up the work area.

- Neat work area
- Appropriate handling and processing of recyclable products

## **SECOND-LEVEL OPERATIONAL OBJECTIVES**

**IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:**

**Before learning how to repair cooling and heating systems (C):**

1. Identify sealants used in cooling systems.
2. Describe the technique of tinning to repair leaks.

**Before learning how to maintain cooling and heating systems (D):**

3. Identify the different types of belts.
4. Describe the environmental regulations currently in force.

## **MODULE 13: MOTOR VEHICLE MAINTENANCE**

**CODE: 841 744**

**Duration: 60 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

#### **EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **perform general maintenance on a motor vehicle** in accordance with the following conditions, criteria and specifications.

#### **CONDITIONS FOR PERFORMANCE EVALUATION**

- Working individually
- Given motor vehicles in operating condition
- Using:
  - the appropriate instruments, tools and equipment
  - the appropriate technical documentation
  - hoisting equipment

#### **GENERAL PERFORMANCE CRITERIA**

- Observance of safety instructions and warnings
- Observance of professional ethics with respect to quality customer service
- Observance of the rules of health, safety and environmental protection
- Careful handling of vehicle and equipment
- Accurate interpretation of information in technical documentation
- Observance of manufacturer's recommended specifications, including torque values
- Proper use of tools, instruments and equipment
- Neat and meticulous work
- Keen sense of observation
- Accurate use of English and French terminology

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

A. Find the safety instructions for the general maintenance of the vehicle.

B. Detect anomalies related to general maintenance.

C. Plan the maintenance work.

### SPECIFIC PERFORMANCE CRITERIA

- Accurate location of instructions on the vehicle and in the technical documentation
- Accurate interpretation of instructions and warnings related to:
  - air bags
  - antilock brakes
  - air conditioning systems
  - batteries
  - catalytic converters
- Detailed visual inspection of the entire vehicle to detect problems related to:
  - the leak-tightness of systems
  - component breakage
  - system integrity
  - wear
  - the condition of the motor oil
  - the lack of lubrication
- Clear and accurate communication of the results of the inspection to the customer
- Proper recommendations on the nature of the work to be done
- Accurate determination of work to be done
- Accurate research and interpretation of manufacturer's maintenance techniques and specifications
- Satisfactory preparation of necessary equipment
- Proper choice of tools, instruments and products

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

### SPECIFIC PERFORMANCE CRITERIA

D. Perform maintenance tasks related to the battery.

- Accurate verification of the state of charge
- Proper use of battery charger
- Appropriate cleaning of terminals and casing
- Precise application of boosting technique
- Replacement of battery in conformity with instructions

E. Perform lubrication tasks.

- Appropriate lubrication of body parts
- Appropriate oil change methods
- Accurate topping-off in components requiring oil
- Appropriate replacement of oil filters for the engine and the automatic transmission
- Minor repairs related to oil leaks

F. Perform maintenance tasks on the wheels.

- Proper replacement of tires on steel and aluminum alloy rims
- Proper repair of tire leaks
- Proper tire rotation
- Precise balancing of wheels
- Observance of torque value and sequence
- Proper replacement of wheel bearings

G. Perform tasks related to the maintenance of the entire vehicle.

- Proper adjustment of body parts
- Accurate replacement and adjustment of belts
- Proper replacement of air filters
- Proper replacement of exhaust system components

**FIRST-LEVEL OPERATIONAL OBJECTIVE  
BEHAVIOURAL OBJECTIVE**

**SPECIFICATIONS OF THE EXPECTED  
BEHAVIOUR**

H. Check the quality of the work.

I. Tidy up the work area.

**SPECIFIC PERFORMANCE  
CRITERIA**

- Appropriate testing of parts repaired
- Maintenance sticker properly filled out and affixed to the vehicle
- Accurate and well-written report
- Relevant recommendations on maintenance follow-up
  
- Neat work area
- Proper recovery of recyclable products

## **SECOND-LEVEL OPERATIONAL OBJECTIVES**

**IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:**

**Before learning how to find the safety instructions for the general maintenance of the vehicle (A):**

**1. Identify the specific hazards related to:**

- air bags
- antilock brakes
- air conditioning systems
- batteries
- catalytic converters
- wheel balancing

**Before learning how to detect anomalies related to general maintenance (B):**

**2. Make recommendations that take into account:**

- passenger safety
- customer satisfaction
- prevention

**3. Detect signs of anomalies according to the wear of a component.**

**4. Fill out a periodic maintenance form.**

**Before learning how to perform maintenance tasks related to the battery (D):**

**5. Identify the instruments used to check the state of charge.**

**6. Differentiate between a trickle charge and a boost charge.**

**7. Describe the hazards involved in boosting a battery, for both the technician and the vehicle.**

**Before learning how to perform lubrication tasks (E):**

**8. Identify the codes and classifications of oils and greases.**

**9. Select the appropriate lubricant for the job.**

## **SECOND-LEVEL OPERATIONAL OBJECTIVES**

**IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:**

**Before learning how to perform maintenance tasks on the wheels (F):**

10. Differentiate among the various types of tires.
11. Explain the reason for rotating tires.
12. Explain the effects of centrifugal force on an unbalanced wheel.
13. Identify the specific characteristics of the weights used to balance wheels.
14. Describe how to use wheel-balancing equipment.
15. Describe the appropriate technique for lubricating bearings.
16. Describe the specific characteristics of bearing greases.

**Before learning how to perform tasks related to the maintenance of the entire vehicle (G):**

17. Identify the specific characteristics of the instruments used to adjust belts.
18. Differentiate among the instruments and equipment used for maintenance work.

## **MODULE 14: JOB SEARCH TECHNIQUES**

**CODE: 841 731**

**Duration: 15 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE SITUATIONAL OBJECTIVE**

#### **EXPECTED OUTCOME**

By participating in the required activities of the learning context according to the indicated criteria, the students will be able to **apply job search techniques.**

#### **SPECIFICATIONS**

During this module, the students will:

- Define the steps involved in a job search.
- Become familiar with different models of résumés and letters of introduction and recognize their main objectives.
- Become familiar with the attitudes and behaviour to adopt or avoid during a job interview.

#### **LEARNING CONTEXT**

##### **PHASE 1: Planning the job search**

- Learning about sources of information available for the job search.
- Determining the steps involved in the job search.

## **FIRST-LEVEL OPERATIONAL OBJECTIVE SITUATIONAL OBJECTIVE**

### **LEARNING CONTEXT**

#### **PHASE 2: Carrying out the job search**

- Defining the parts and objectives of a letter of introduction and a résumé.
- Learning about various models of letters of introduction and résumés; recognizing their strengths and weaknesses, given their objectives with respect to the job sought.
- Determining the attitudes and behaviour to adopt or avoid during a job interview.
- Finding various means of ensuring follow-up.
- Writing a résumé and a letter of introduction.

#### **PHASE 3: Evaluating their potential**

- Recognizing their strengths and weaknesses with respect to each step involved in the job search; finding ways of improving.

### **INSTRUCTIONAL GUIDELINES**

The teacher should:

- Provide the students with material resources and samples to help them in their job search.
- Explain how to use reference material.
- Orient the students toward resource people who can help them in their job search.
- Make sure that the students understand the importance of being equipped for a job search.
- Encourage the students to share ideas and cooperate.

## **FIRST-LEVEL OPERATIONAL OBJECTIVE SITUATIONAL OBJECTIVE**

### **PARTICIPATION CRITERIA**

#### **PHASE 1:**

- Consult the sources of information made available to them.
- Discuss in class the information gathered, its relevance and the logical sequence of operations in a job search.

#### **PHASE 2:**

- Learn about the different models of letters of introduction and résumés provided.
- Discuss in class the attitudes and behaviour to adopt or avoid during a job interview.

#### **PHASE 3:**

- Discuss in class their strengths and weaknesses as they observed them with respect to job search procedures.

## **SECOND-LEVEL OPERATIONAL OBJECTIVES**

**IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:**

**Before undertaking the activities of Phase 1:**

1. Find effective tools for gathering information (e.g. sheets, schedules, agendas).

**Before undertaking the activities of Phase 2:**

2. Explain the objectives of a job interview.
3. Describe various types of job interviews.

## MODULE 15: ROAD HANDLING SYSTEMS

CODE: 841 754

Duration: 60 hours

### FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

#### EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must **analyze the operation of road handling systems** in accordance with the following conditions, criteria and specifications.

#### CONDITIONS FOR PERFORMANCE EVALUATION

- Working individually
- Using:
  - the appropriate technical documentation
  - diagrams or illustrations

#### GENERAL PERFORMANCE CRITERIA

- Observance of safety instructions and warnings
- Careful handling of vehicle and equipment
- Accurate use of English and French terminology

#### FIELD OF APPLICATION

- Steering and suspension systems; shafts, half shafts and joints; brakes (not antilock)
- Excludes computer-controlled suspensions and steering systems

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

- A. Interpret the information found in the technical documentation.
  
- B. Identify the different types of systems and their components:
  - suspension
  - steering system
  - conventional brakes
  - shafts and joints
  
- C. Explain the specific characteristics of the components.
  
- D. Explain the operation of each system.

### SPECIFIC PERFORMANCE CRITERIA

- Appropriate selection of drawings and diagrams of the different systems
- Accurate interpretation of the information in the drawings and diagrams
  
- Correct identification of the different types of systems
- Accurate identification of the parts of each system
- Accurate location of parts on vehicle
  
- Accurate explanation of the function of the components
- Accurate explanation, for each component, of:
  - the properties of the materials
  - its operation and underlying principles
  
- Accurate description of the properties of brake fluids and hydraulic oils
- Accurate explanation of the functional relationships among the different components
- Accurate explanation of the operation of the entire system under different operating conditions
- Accurate description of the geometry of various suspensions

## **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

### **SPECIFICATIONS OF THE EXPECTED BEHAVIOUR**

- E. Recognize foreseeable anomalies.
  
  
  
  
  
  
  
  
  
  
- F. Determine the general condition of the different systems.

### **SPECIFIC PERFORMANCE CRITERIA**

- Correct identification of foreseeable anomalies related to the specific characteristics of the components
- Accurate deduction of the effects of a particular anomaly on:
  - the operation of the system
  - the handling of the vehicle
  
- Detailed visual inspection
- Proper identification of signs of malfunction
- Appropriate testing of systems
- Accurate determination of the degree of wear of the components

## **SECOND-LEVEL OPERATIONAL OBJECTIVES**

**IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:**

**Before learning how to identify the different types of systems and their components:**

- **suspension**
- **steering system**
- **conventional brakes**
- **shafts and joints (B):**

1. Trace the technological development of road handling systems.

**Before learning how to explain the specific characteristics of the components (C):**

2. Distinguish between the specific characteristics of gas shock absorbers and those of hydraulic shock absorbers.
3. Identify the types of universal joints and constant velocity joints used.

## **MODULE 16: SUSPENSION, STEERING SYSTEM AND CONVENTIONAL BRAKE REPAIR**

**CODE: 841 767**

**Duration: 105 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

#### **EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **repair suspensions, steering systems and conventional brakes** in accordance with the following conditions, criteria and specifications.

#### **CONDITIONS FOR PERFORMANCE EVALUATION**

- Working individually
- Given state-of-the-art vehicles and components
- Using:
  - specialized tools and appropriate instruments
  - the relevant technical documentation
  - hoisting equipment

#### **GENERAL PERFORMANCE CRITERIA**

- Observance of safety instructions and warnings
- Careful handling of tools, equipment, instruments and vehicle
- Accurate interpretation of information in technical documentation
- Proper use of tools and equipment
- Neat and meticulous work
- Observance of torque values
- Accurate measurements
- Keen sense of observation
- Proper use of technical documentation
- Accurate use of English and French terminology

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### FIELD OF APPLICATION

- Suspensions, steering systems, conventional brakes, shafts, half-shafts and joints
- Excludes computer-controlled suspensions and steering systems and alignments

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

#### A. Diagnose the condition of the different systems:

- suspension
- steering system
- conventional brakes
- shafts, half-shafts and joints

#### B. Plan the work.

#### C. Replace components of the different systems.

#### D. Disassemble the components.

### SPECIFIC PERFORMANCE CRITERIA

- Detailed visual inspection
- Precise application of manufacturer's recommendations
- Correct interpretation of results
- Accurate diagnosis
- Accurate determination of work to be done
- Preparation of appropriate:
  - tools, equipment and instruments
  - products
  - technical documentation
- Correct and safe application of manufacturer's recommended removal and replacement techniques
- Precise adjustments in conformity with requirements
- Proper lubrication
- Proper application of manufacturer's recommended disassembly techniques
- Proper cleaning of parts
- Orderly organization of parts
- Observance of inspection techniques
- Detection of defective part

**FIRST-LEVEL OPERATIONAL OBJECTIVE  
BEHAVIOURAL OBJECTIVE**

**SPECIFICATIONS OF THE EXPECTED  
BEHAVIOUR**

**SPECIFIC PERFORMANCE  
CRITERIA**

**E. Apply maintenance and repair techniques.**

- Correct and safe application of techniques for bleeding the brakes and power steering system
- Appropriate use of techniques for sealing components and lines
- Adequate adjustments for each system
- Proper lubrication of each system
- Precise machining of brake components
- Proper cleaning of brake system
- Appropriate replacement of component parts

**F. Reassemble components.**

- Observance of manufacturer's recommended reassembly techniques
- Adequate and accurate adjustments
- Proper lubrication
- Appropriate organization of work station

**G. Check the operating condition of the systems.**

- Appropriate testing of systems
- Quality control
- Accurate and well-written report

## SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

**Before learning how to diagnose the condition of the different systems:**

- suspension
- steering system
- conventional brakes
- shafts, half-shafts and joints (A):

1. Recognize signs of wear.

**Before learning how to plan the work (B):**

2. Recognize the specialized tools for each system.

**Before learning how to apply maintenance and repair techniques (E):**

3. Find the tolerances for the machining of brake discs and drums.
4. Describe how to use brake bleeder sets.
5. Describe how to use machining equipment for brake discs and drums.
6. Identify the hazards involved in cleaning brakes, bleeding antilock brakes and machining discs and drums.

**Before learning how to check the operating condition of the systems (G):**

7. Take into account the safety of passengers.

## **MODULE 17: TRANSMISSION ASSEMBLIES**

**CODE: 841 776**

**Duration: 90 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

#### **EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **analyze the operation of transmission assemblies** in accordance with the following conditions, criteria and specifications.

#### **CONDITIONS FOR PERFORMANCE EVALUATION**

- Working individually
- Using:
  - the relevant technical documentation
  - diagrams or illustrations

#### **GENERAL PERFORMANCE CRITERIA**

- Observance of safety instructions and warnings
- Careful handling of vehicle
- Observance of the rules of health, safety and environmental protection
- Accurate use of English and French terminology

#### **FIELD OF APPLICATION**

- Gear boxes, differentials, clutches, transfer cases

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

- A. Interpret the information in the technical documentation.
  
- B. Identify different types of systems and their components.
  
- C. Explain the specific characteristics of the components.
  
- D. Explain the operation of each system.

### SPECIFIC PERFORMANCE CRITERIA

- Appropriate selection of drawings and diagrams of the different systems
- Accurate interpretation of the information in the drawings and diagrams
  
- Accurate identification of different types of systems:
  - manual transmission
  - automatic transmission
  - clutch and hydraulic coupling
  - front- and rear-wheel drive
  - four-wheel drive
  - differential
- Identification of the components of each system
- Accurate location of components on vehicle
  
- For each component, accurate explanation of:
  - its function
  - the properties of the materials
  - its operation and underlying principles
  - adjustment techniques
  
- Accurate explanation of the relationships among the different components
- Accurate explanation of the operation of the systems under different conditions

## **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

### **SPECIFICATIONS OF THE EXPECTED BEHAVIOUR**

- E. Recognize foreseeable anomalies.
- F. Determine the general condition of the different systems.

### **SPECIFIC PERFORMANCE CRITERIA**

- Appropriate identification of foreseeable anomalies related to the specific characteristics of the components
- Accurate deduction of the effects of a particular anomaly on:
  - the operation of the system
  - the handling of the vehicle
- Detailed visual inspection
- Detection of signs of malfunction
- Appropriate testing of system

## **SECOND-LEVEL OPERATIONAL OBJECTIVES**

**IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:**

**Before learning how to identify different types of systems and their components (B):**

1. Describe the specific characteristics of the different systems.

**Before learning how to explain the specific characteristics of the components (C):**

2. Compare the advantages and disadvantages of the different types of gears.

**Before learning how to explain the operation of each system (D):**

3. Describe the progression of movement through the parts of the drive train.

**Before learning how to recognize foreseeable anomalies (E):**

4. Interpret the codes of lubricants used.

## **MODULE 18: TRANSMISSION ASSEMBLY REPAIR**

**CODE: 841 787**

**Duration: 105 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

#### **EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **repair transmission assemblies** in accordance with the following conditions, criteria and specifications.

#### **CONDITIONS FOR PERFORMANCE EVALUATION**

- Working individually
- Given state-of-the-art vehicles and components
- Using:
  - recent, specialized tools and instruments appropriate to the system
  - the appropriate technical documentation

#### **GENERAL PERFORMANCE CRITERIA**

- Accurate interpretation of information in technical documentation
- Observance of safety instructions and warnings
- Careful handling of tools, equipment, instruments and vehicle
- Proper use of tools, instruments and equipment
- Neat and meticulous work
- Observance of specifications, including torque values
- Keen sense of observation
- Accurate use of English and French terminology

#### **FIELD OF APPLICATION**

- Work on automatic transmission assemblies, excluding diagnosis and rebuilding

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

**A. Diagnose the condition of the different transmission parts:**

- manual gear box
- differential
- transfer case
- clutch

**B. Plan the work.**

**C. Replace components of the different systems.**

**D. Disassemble components.**

### SPECIFIC PERFORMANCE CRITERIA

- Detailed visual inspection
- Accurate determination of the condition of transmission joints, shafts and half-shafts
- Observance of manufacturer's recommendations
- Correct interpretation of results
- Accurate diagnosis
  
- Accurate determination of work to be done
- Preparation of appropriate:
  - tools, equipment and instruments
  - products
  - technical documentation
  
- Correct application of manufacturer's recommended removal and installation methods
- Appropriate and precise adjustments
- Proper lubrication
  
- Observance of manufacturer's recommended disassembly methods
- Proper cleaning of parts
- Organization of parts
- Observance of inspection techniques
- Detection of defective part

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

### SPECIFIC PERFORMANCE CRITERIA

- |                                                                |                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| E. Apply maintenance and repair techniques.                    | <ul style="list-style-type: none"> <li>- Proper application of technique for bleeding the hydraulic clutch</li> <li>- Proper use of methods of sealing components and lines</li> <li>- Appropriate adjustments to each system</li> <li>- Proper lubrication of each system</li> <li>- Correct replacement of component parts</li> <li>- Proper repair of internal threads</li> </ul> |
| F. Reassemble the components.                                  | <ul style="list-style-type: none"> <li>- Observance of manufacturer's recommended reassembly techniques</li> <li>- Precise adjustments</li> <li>- Proper lubrication</li> <li>- Appropriate organization of work area</li> </ul>                                                                                                                                                     |
| G. Perform tasks on an automatic gear box.                     | <ul style="list-style-type: none"> <li>- Accurate determination of the nature of contaminants in the oil</li> <li>- Observance of removal and installation techniques</li> <li>- Leak-tightness of transmission and lines</li> <li>- Correct installation of gear box on vehicle</li> </ul>                                                                                          |
| H. Check the operating condition and integrity of the systems. | <ul style="list-style-type: none"> <li>- Appropriate testing of systems</li> <li>- Quality control</li> <li>- Appropriate recommendations</li> <li>- Accurate and well-written report</li> </ul>                                                                                                                                                                                     |

## **SECOND-LEVEL OPERATIONAL OBJECTIVES**

**IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:**

**Before learning how to plan the work (B):**

1. Identify the tools and equipment used for each system.

**Before learning how to apply maintenance and repair techniques (E):**

2. Select the appropriate maintenance products for each system.
3. Describe the methods and products used to seal the systems.

**Before learning how to reassemble the components (F):**

4. Explain the importance of centring the friction disc.

## **MODULE 19: BASIC COMPUTER-CONTROLLED SYSTEMS**

**CODE: 841 794**

**Duration: 60 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

#### **EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **analyze the operation of a basic computer-controlled system** in accordance with the following conditions, criteria and specifications.

#### **CONDITIONS FOR PERFORMANCE EVALUATION**

- Working individually
- Given:
  - parts
  - instructional panels
  - engines equipped with a computer
- Using:
  - a multimeter
  - an analyzer
  - an oscilloscope
  - jumper cables
  - the appropriate technical documentation
  - drawings or diagrams

#### **GENERAL PERFORMANCE CRITERIA**

- Observance of safety instructions and warnings
- Careful handling of instruments and equipment
- Accurate use of English and French terminology

## **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

### **SPECIFICATIONS OF THE EXPECTED BEHAVIOUR**

- A. Identify the parts of a basic computer-controlled system.
  
- B. Describe the specific characteristics of the different types of components.

### **SPECIFIC PERFORMANCE CRITERIA**

- Accurate identification of the sensor, the microprocessor and the actuator
- Accurate distinction among the functions of the parts
  
- Accurate description of the specific characteristics of different types of sensors:
  - construction
  - operation and underlying principles
  - nature of the signal
- Simple, accurate explanation of the specific characteristics of the operation of the microprocessor:
  - signal processing and amplification
  - memory
  - calculation
  - decision-making strategy
  - control of actuators
- Accurate description of the specific characteristics of the different types of actuators:
  - construction
  - type of action
  - operation and underlying principles

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

C. Explain the operation of a system comprising a sensor, a microprocessor and an actuator.

D. Recognize foreseeable anomalies in the circuits of a computer-controlled system.

E. Diagnose the condition of a basic computer-controlled system and its components.

### SPECIFIC PERFORMANCE CRITERIA

- Accurate explanation of the functional relationships between the sensor, the microprocessor and the actuator
- Correct identification of the types of signals a sensor can send
- Correct identification of the types of functions a microprocessor can perform
- Correct identification of the types of functions an actuator can perform

- Recognition of foreseeable anomalies related to the characteristics of the components
- Accurate explanation of the effects of foreseeable anomalies on the operation of the system
- Brief description of the coding systems used by the microprocessor to indicate an anomaly

- Selection of appropriate information
- Choice of appropriate state-of-the-art diagnostic equipment
- Proper consideration of warnings to avoid damaging the system
- Accurate measurements using different types of instruments:
  - an analyzer
  - an oscilloscope
- Accurate explanation of results obtained

## SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

**Before learning how to describe the specific characteristics of the different types of components (B):**

1. Distinguish between magnetism and electromagnetism.
2. Explain the laws of magnetism and electromagnetism.
3. Distinguish between electromechanical components and components that use only electromagnetism.

**Before learning how to explain the operation of a system comprising a sensor, a microprocessor and an actuator (C):**

4. Distinguish among the types of circuits.

**Before learning how to recognize foreseeable anomalies in the circuits of a computer-controlled system (D):**

5. Describe static electricity and its behaviour with respect to insulators.
6. Describe the negative effects of electrostatic phenomena on electronic components.
7. Describe preventive measures to protect the integrity of electronic components.

**Before learning how to diagnose the condition of a basic computer-controlled system and its components (E):**

8. Describe the information provided by the different manufacturers.
9. Find the manufacturer's recommended diagnostic procedure.

## **MODULE 20: STARTING AND CHARGING SYSTEMS AND ELECTROMAGNETIC ACCESSORIES**

**CODE: 841 805**

**Duration: 75 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

#### **EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **analyze the operation of starting and charging systems and electromagnetic accessories** in accordance with the following conditions, criteria and specifications.

#### **CONDITIONS FOR PERFORMANCE EVALUATION**

- Working individually
- Using:
  - the appropriate technical documentation
  - diagrams or illustrations

#### **GENERAL PERFORMANCE CRITERIA**

- Observance of safety instructions and warnings
- Observance of the rules of health, safety and environmental protection
- Precise handling of instruments
- Accurate use of English and French terminology

#### **FIELD OF APPLICATION**

- Starting and charging systems
- Electromagnetic accessories:
  - windshield wipers
  - electric windows
  - electric door locks
  - dashboard instruments
  - signals
  - rear window defrost

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

- A. Find information in the technical documentation.
  
- B. Identify the starting and charging systems and the electromagnetic accessories, and their components.
  
- C. Describe the specific characteristics of the components.
  
- D. Explain the operation of the systems.
  
- E. Recognize foreseeable anomalies in each system.

### SPECIFIC PERFORMANCE CRITERIA

- Selection of the appropriate electrical drawings and diagrams of the different systems
- Accurate interpretation of the information in the drawings and diagrams
  
- Correct identification of the different types of systems
- Accurate identification of the components of each system
- Accurate location of components
  
- Accurate description of the specific characteristics of the components:
  - function
  - construction
  - operation and underlying principles
  
- Accurate explanation of the functional relationships between the different components
- Accurate explanation of the operation of all the systems under different operating conditions
  
- Correct identification of foreseeable anomalies related to the characteristics of the components
- Correct identification of anomalies specific to the battery
- Accurate explanation of the effects of anomalies on the operation of a system

**FIRST-LEVEL OPERATIONAL OBJECTIVE  
BEHAVIOURAL OBJECTIVE**

**SPECIFICATIONS OF THE EXPECTED  
BEHAVIOUR**

F. Check the performance of the starting and charging systems.

**SPECIFIC PERFORMANCE  
CRITERIA**

- Proper choice of available state-of-the-art equipment and instruments
- Proper use of starting and charging system testing equipment
- Accurate interpretation of results
- Observance of manufacturer's recommendations

## SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

**Before learning how to identify the starting and charging systems and the electromagnetic accessories, and their components (B):**

1. Trace the technological development of starting and charging systems.

**Before learning how to describe the specific characteristics of the components (C):**

2. Differentiate between permanent magnet starters and conventional starters.
3. Describe the influence of ambient temperature on the chemical reaction of the battery.

**Before learning how to explain the operation of the systems (D):**

4. Compare the advantages and disadvantages of conventional and sealed batteries.

## **MODULE 21: STARTING SYSTEM, CHARGING SYSTEM AND ELECTROMAGNETIC ACCESSORY REPAIR**

**CODE: 841 815**

**Duration: 75 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

#### **EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **repair starting and charging systems and electromagnetic accessories** in accordance with the following conditions, criteria and specifications.

#### **CONDITIONS FOR PERFORMANCE EVALUATION**

- Working individually
- Given vehicles representative of the market
- Using:
  - the appropriate technical documentation
  - specialized tools and recent instruments
  - hoisting equipment

#### **GENERAL PERFORMANCE CRITERIA**

- Observance of safety instructions and warnings
- Accurate interpretation of information in technical documentation
- Observance of specifications, especially torque values
- Observance of the rules of health, safety and environmental protection
- Careful handling of instruments
- Keen sense of observation
- Accurate use of English and French terminology

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### FIELD OF APPLICATION

- Starting and charging systems
- Electromagnetic accessories:
  - windshield wipers
  - electric windows
  - electric door locks
  - dashboard instruments
  - signals
  - rear window defrost

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

A. Diagnose the condition of the starting and charging systems and the electromagnetic accessories.

B. Plan the work.

C. Replace components.

### SPECIFIC PERFORMANCE CRITERIA

- Detailed visual inspection of systems
- Accurate inspection of vehicle's grounding circuit
- Accurate inspection of battery drain
- Observance of manufacturer's recommended diagnostic methods for:
  - general inspection
  - inspection related to a specific problem
- Accurate interpretation of results
- Accurate diagnosis
  
- Accurate determination of work to be done
- Proper choice of tools, instruments and documentation
- Appropriate preparation of material
  
- Correct application of manufacturer's recommended removal and installation techniques
- Proper adjustments

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

### SPECIFIC PERFORMANCE CRITERIA

D. Disassemble components of the starting and charging systems.

- Correct application of manufacturer's recommended disassembly techniques
- Proper cleaning of parts
- Accurate location of anomaly

E. Repair components and circuits.

- Observance of manufacturer's recommended repair techniques
- Correct application of techniques for the repair of harnesses and cables, including soldering
- Proper cleaning of electrical contacts
- Proper adjustment of components
- Proper replacement of component parts

F. Reassemble the components.

- Proper application of manufacturer's recommended reassembly techniques

G. Verify the operating condition and integrity of the systems.

- Appropriate testing of systems
- Quality control
- Accurate and well-written report
- Neatness of work area

## **SECOND-LEVEL OPERATIONAL OBJECTIVES**

**IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:**

**Before learning how to plan the work (B):**

1. Identify the specialized tools for replacing connectors.

**Before learning how to repair components and circuits (E):**

2. Describe the current labour market trends with respect to the repair of certain components.

## **MODULE 22: PASSIVE AND ACTIVE SECURITY SYSTEMS**

**CODE: 841 823**

**Duration: 45 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

#### **EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **analyze the operation of passive and active security systems** in accordance with the following conditions, criteria and specifications.

#### **CONDITIONS FOR PERFORMANCE EVALUATION**

- Working individually
- Given educational panels or simulators
- Using:
  - the appropriate technical documentation
  - diagrams or illustrations

#### **GENERAL PERFORMANCE CRITERIA**

- Observance of safety instructions and warnings
- Accurate interpretation of information in technical documentation
- Accurate use of English and French terminology

#### **FIELD OF APPLICATION**

- Antilock brakes, air bags, seat belts and telescopic steering columns
- Excludes fuel shut-off systems

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

- A. Interpret the information in the technical documentation.
  
- B. Identify the security systems and their components:
  - antilock and antiskid devices
  - air bags
  - automatic seat belts
  - telescopic steering columns
  - antitheft devices
  
- C. Describe the specific characteristics of the components of each type of system.

### SPECIFIC PERFORMANCE CRITERIA

- Accurate location of electrical and hydraulic drawings and diagrams
- Accurate interpretation of the information in the drawings and diagrams
- Accurate interpretation of safety instructions
  
- Correct identification of different types of systems
- Accurate identification of the components of the different systems
- Accurate location of components on vehicle
  
- Accurate explanation of the function of the sensors, the microprocessor and the actuators specific to each system
- Accurate description of the specific characteristics of the mechanical and hydraulic components:
  - function
  - construction
  - operation and underlying principles

**FIRST-LEVEL OPERATIONAL OBJECTIVE**  
**BEHAVIOURAL OBJECTIVE**

## SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

**D. Explain the operation of the security systems.**

## SPECIFIC PERFORMANCE CRITERIA

- Accurate explanation of the operation of all the systems under different operating conditions
- Simple explanation of the operation of the microprocessor
- Accurate explanation of the functional relationships between the different components
- Accurate explanation of foreseeable strategies used by the microprocessor of a computer-controlled security system

**E. Identify foreseeable anomalies.**

- **Correct identification of foreseeable anomalies related to the characteristics of the components**
- **Accurate explanation of the effects of foreseeable anomalies on the operation of each system**

**F. Use the instruments designed to troubleshoot computer-controlled security systems.**

- Proper choice of state-of-the-art diagnostic equipment
- Proper application of warnings to avoid damaging the systems and endangering oneself
- Accurate interpretation of information

## SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

**Before learning how to identify the security systems and their components:**

- antilock and antiskid devices
- air bags
- automatic seat belts
- telescopic steering columns
- antitheft devices (B):

1. Trace the technological development of braking systems.
2. Trace the technological development of motor vehicle security systems.
3. Distinguish between *active* and *passive*.

**Before learning how to describe the specific characteristics of the components of each type of system (C):**

4. Recognize the specific construction characteristics of the computer-controlled part.
5. Distinguish between the operation of normally open and normally closed relays.

**Before learning how to explain the operation of the security systems (D):**

6. Describe the usefulness of an antilock system.
7. Explain the concept of *strategy*.

## **MODULE 23: ANTILOCK BRAKE SYSTEM AND SAFETY ACCESSORY REPAIR**

**CODE: 841 834**

**Duration: 60 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

#### **EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **repair antilock brakes and safety accessories** in accordance with the following conditions, criteria and specifications.

#### **CONDITIONS FOR PERFORMANCE EVALUATION**

- Working individually
- Given vehicles equipped with antilock brake systems and air bags
- Using:
  - the appropriate state-of-the art instruments and tools
  - the manufacturer's technical documentation
  - hoisting equipment

#### **GENERAL PERFORMANCE CRITERIA**

- Observance of safety instructions and warnings
- Observance of specifications, especially torque values
- Neat and meticulous work
- Accurate interpretation of information in technical documentation
- Observance of the rules of health, safety and environmental protection
- Careful handling of electronic components
- Keen sense of observation
- Accurate use of English and French terminology

#### **FIELD OF APPLICATION**

- Antilock brake systems, traction control (antiskid) devices and air bags
- Excludes mechanical brake parts

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

- A. Diagnose anomalies in:
- antilock brake systems
  - traction control (antiskid) devices
  - air bags
- B. Plan the work.
- C. Replace components of:
- antilock brake systems
  - traction control (antiskid) devices
  - air bags

### SPECIFIC PERFORMANCE CRITERIA

- Detailed visual inspection of systems
- Observance of manufacturer's recommended diagnostic method for symptoms with and without self-diagnostic code
- Observance of manufacturer's recommended techniques for the general inspection of the systems
- Precise use of instruments
- Accurate interpretation of results
- Accurate diagnosis of the anomaly
- Accurate determination of work to be done
- Proper choice of instruments, tools, equipment and documentation
- Appropriate preparation of materials
- Observance of manufacturer's recommended removal and installation techniques
- Proper application of manufacturer's recommended techniques for deactivating air bags and depressurizing antilock brakes
- Proper adjustment of sensors

**FIRST-LEVEL OPERATIONAL OBJECTIVE  
BEHAVIOURAL OBJECTIVE**

**SPECIFICATIONS OF THE EXPECTED  
BEHAVIOUR**

**SPECIFIC PERFORMANCE  
CRITERIA**

D. Repair circuits.

- Observance of manufacturer's recommended repair techniques
- Precise application of harness repair techniques
- Appropriate cleaning of electrical contacts

E. Check the operating condition and integrity of the systems.

- Appropriate testing of systems
- Quality control
- Accurate and well-written report
- Neatness of work area

## SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

**Before learning how to diagnose anomalies in:**

- antilock brake systems
- traction control (antiskid) devices
- air bags (A):

1. List the hazards involved in repairing security systems.
2. Check the brake fluid level.

**Before learning how to replace components of:**

- antilock brake systems
- traction control (antiskid) devices
- air bags (C):

3. Show concern for the safety of passengers.

## **MODULE 24: ELECTRONIC IGNITION SYSTEMS**

**CODE: 841 844**

**Duration: 60 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

#### **EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **analyze the operation of electronic ignition systems** in accordance with the following conditions, criteria and specifications.

#### **CONDITIONS FOR PERFORMANCE EVALUATION**

- Working individually
- Using:
  - the appropriate technical documentation
  - diagrams or illustrations

#### **GENERAL PERFORMANCE CRITERIA**

- Observance of safety instructions and warnings
- Observance of the rules of health, safety and environmental protection
- Accurate use of English and French terminology

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

### SPECIFIC PERFORMANCE CRITERIA

- |                                                                                                       |                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A. Interpret the information in the technical documentation.                                          | <ul style="list-style-type: none"> <li>- Correct choice of electrical drawings and diagrams of the different systems</li> <li>- Accurate interpretation of the information in the drawings and diagrams</li> </ul>                                                                                                    |
| B. Identify electronic ignition systems with and without a distributor, and their components.         | <ul style="list-style-type: none"> <li>- Correct identification of systems with and without a distributor</li> <li>- Accurate identification of the components of each system</li> <li>- Accurate location of components</li> </ul>                                                                                   |
| C. Describe the specific characteristics of the components of systems with and without a distributor. | <ul style="list-style-type: none"> <li>- Accurate description of the specific characteristics of the components:               <ul style="list-style-type: none"> <li>• function</li> <li>• construction</li> <li>• operation and underlying principles</li> </ul> </li> </ul>                                        |
| D. Explain the operation of electronic ignition systems with and without a distributor.               | <ul style="list-style-type: none"> <li>- Accurate explanation of the operation of all the systems under different operating conditions</li> <li>- Simple explanation of the operation of a microprocessor</li> <li>- Accurate explanation of the functional relationships between the different components</li> </ul> |
| E. Explain the basic strategies of the microprocessor that apply to spark control.                    | <ul style="list-style-type: none"> <li>- Accurate explanation of foreseeable strategies on:               <ul style="list-style-type: none"> <li>• ignition timing</li> <li>• self-diagnostic</li> <li>• fail-soft operation</li> </ul> </li> </ul>                                                                   |

**FIRST-LEVEL OPERATIONAL OBJECTIVE  
BEHAVIOURAL OBJECTIVE**

**SPECIFICATIONS OF THE  
EXPECTED BEHAVIOUR**

- F. Identify foreseeable anomalies in electronic ignition systems.
- G. Check the performance of systems, using an ignition oscilloscope.

**SPECIFIC PERFORMANCE  
CRITERIA**

- Correct identification of foreseeable anomalies related to the characteristics of the components
- Accurate explanation of the effects of foreseeable anomalies on the operation of the systems:
  - abnormal combustion
  - auto-ignition
  - parasite drag
- Appropriate choice of recent digital and analog ignition oscilloscopes
- Proper use of ignition oscilloscope
- Accurate interpretation of ignition oscillations in the primary and secondary circuits

## SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

**Before learning how to identify electronic ignition systems with and without a distributor, and their components (B):**

1. Trace the technological development of ignition systems.

**Before learning how to explain the operation of electronic ignition systems with and without a distributor (D):**

2. Describe the function of the spark in the exhaust stroke in an ignition system without a distributor.
3. Describe the operation of breaker systems in conventional ignition systems.

**Before learning how to identify foreseeable anomalies in electronic ignition systems (F):**

4. Explain the process of refining hydrocarbons to obtain gasoline.
5. Explain the significance of the octane rating.
6. Explain the effects of foreseeable anomalies on the other systems of the motor vehicle.

## **MODULE 25: ELECTRONIC IGNITION SYSTEM REPAIR**

**CODE: 841 855**

**Duration: 75 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

#### **EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **repair electronic ignition systems** in accordance with the following conditions, criteria and specifications.

#### **CONDITIONS FOR PERFORMANCE EVALUATION**

- Working individually
- Given vehicles and engines equipped with electronic ignition, with and without a distributor
- Using:
  - state-of-the-art instruments
  - the appropriate technical documentation
  - hoisting equipment

#### **GENERAL PERFORMANCE CRITERIA**

- Observance of the rules of health, safety and environmental protection
- Observance of specifications, especially torque values
- Proper use of technical documentation
- Neat and meticulous work
- Careful handling of electronic components
- Keen sense of observation
- Accurate use of English and French terminology

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

A. Select diagnostic strategies for ignition systems with and without a distributor.

B. Diagnose anomalies.

C. Plan the work.

### SPECIFIC PERFORMANCE CRITERIA

- Correct identification of manufacturer's recommended procedure:
  - for the general inspection of the system
  - on the basis of anomaly codes
  - on the basis of symptoms
- Accurate interpretation of the information in the technical documentation
- Appropriate choice of procedure
- Detailed visual inspection of the systems
- Observance of diagnostic procedure related to:
  - general inspection
  - specific symptoms
  - anomaly codes
- Methodical use of instruments
- Correct interpretation of results
- Accurate determination of anomaly
- Accurate determination of work to be done
- Proper choice of tools
- Preparation of necessary materials

**FIRST-LEVEL OPERATIONAL OBJECTIVE  
BEHAVIOURAL OBJECTIVE**

**SPECIFICATIONS OF THE EXPECTED  
BEHAVIOUR**

**SPECIFIC PERFORMANCE  
CRITERIA**

- |                                                                |                                                                                                                                                                                                                                                                                                            |
|----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| D. Replace components of electronic ignition systems.          | <ul style="list-style-type: none"><li>- Accurate application of techniques for repairing wiring harnesses and cables</li><li>- Proper use of tools</li><li>- Correct application of manufacturer's recommended removal and installation techniques</li><li>- Appropriate and precise adjustments</li></ul> |
| E. Repair electrical circuits.                                 | <ul style="list-style-type: none"><li>- Observance of manufacturer's recommended repair techniques</li><li>- Proper application of techniques for repairing harnesses and cables</li><li>- Proper cleaning of electrical contacts</li></ul>                                                                |
| F. Check the operating condition and integrity of the systems. | <ul style="list-style-type: none"><li>- Appropriate testing of systems</li><li>- Quality control</li><li>- Accurate, well-written report</li><li>- Neatness of work area</li></ul>                                                                                                                         |

## **SECOND-LEVEL OPERATIONAL OBJECTIVES**

**IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:**

**Before learning how to diagnose anomalies (B):**

1. Establish relationships between engine compression and the high voltage produced by the ignition system.
2. Describe the potential of the equipment.

**Before learning how to replace components of electronic ignition systems (D):**

3. Identify types of high-tension wires.
4. Describe the specific characteristics of high-tension wires.

## **MODULE 26: ANTIPOLLUTION AND ELECTRONIC INJECTION SYSTEMS**

**CODE: 841 864**

**Duration: 60 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

#### **EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **analyze the operation of antipollution and electronic injection systems** in accordance with the following conditions, criteria and specifications.

#### **CONDITIONS FOR PERFORMANCE EVALUATION**

- Working individually
- Using:
  - the appropriate technical documentation
  - diagrams or illustrations

#### **GENERAL PERFORMANCE CRITERIA**

- Observance of safety instructions and warnings
- Observance of the rules of health, safety and environmental protection
- Accurate use of English and French terminology

#### **FIELD OF APPLICATION**

- Injection systems, including fuel shut-off strategies
- On-board diagnostic (OBD) systems for pollution control

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

- A. Find the information in the technical documentation.
  
- B. Identify injection and antipollution systems and their components.
  
- C. Describe the specific characteristics of the components of each type of system.

### SPECIFIC PERFORMANCE CRITERIA

- Correct choice of electrical drawings and diagrams of the different types of systems
- Accurate interpretation of the information in the drawings and diagrams
  
- Correct identification of different types of systems with and without multiplexing
- Electronic injection systems:
  - central
  - multipoint
  - sequential
  - supercharged
- Antipollution systems:
  - recovery of gas vapour
  - exhaust gas recirculating
  - air lift
  - catalytic converter
- Accurate identification of the components of each type of system
  
- Accurate description of the specific characteristics of the components:
  - function
  - construction
  - operation and underlying principles

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

### SPECIFIC PERFORMANCE CRITERIA

D. Explain the operation of each system.

- Correct description of mixtures required according to operating conditions
- Accurate explanation of the effect of physical and chemical factors on the mixture and the formation of pollutants
- Accurate explanation of the operation of each system:
  - open loop
  - closed loop
  - under different operating conditions
- Accurate explanation of the functional relationships among the different components of the systems
- Accurate description of the specific operational characteristics of a system in the power stroke

E. Explain foreseeable basic microprocessor strategies.

- Accurate explanation of foreseeable strategies for:
  - duration of injection
  - control of different pollutants
  - self-diagnostic
  - fail-soft operation
  - adaptiveness
  - actuator control

F. Identify foreseeable anomalies.

- Correct identification of foreseeable anomalies related to the composition of gasoline
- Accurate explanation of the effects of foreseeable anomalies on the operation of each system

## **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

### **SPECIFICATIONS OF THE EXPECTED BEHAVIOUR**

- G. Verify the performance of the systems,  
using an exhaust gas analyzer.

### **SPECIFIC PERFORMANCE CRITERIA**

- Proper choice of state-of-the-art exhaust gas analyzer
- Proper use of exhaust gas analyzer
- Accurate interpretation of results obtained

## **SECOND-LEVEL OPERATIONAL OBJECTIVES**

**IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:**

**Before learning how to identify injection and antipollution systems and their components (B):**

1. Trace the technological development of fuel and antipollution systems.

**Before learning how to describe the specific characteristics of the components of each type of system (C):**

2. Describe the forces created by supercharging.
3. Describe the specific construction characteristics of a supercharged engine.

**Before learning how to explain the operation of each system (D):**

4. List operating conditions:
  - cold start
  - idle and fast idle
  - acceleration
  - loaded and wide open throttle
  - supercharged
5. List the physical and chemical factors that may affect the mixture and the formation of pollutants:
  - intake air temperature
  - coolant temperature
  - air pressure
  - pressure of the intake manifold
  - oxygen content of the exhaust gas
6. Describe the rules related to environmental protection.
7. Describe the advantages of injection systems.

**Before learning how to explain foreseeable basic microprocessor strategies (E):**

8. Describe the microprocessor vacuum control strategy.

## SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

**Before learning how to identify foreseeable anomalies (F):**

9. Describe the natural properties of gasoline.
10. Explain the function of additives.
11. Identify the specific characteristics of the new fuels.

## **MODULE 27: ANTIPOLLUTION SYSTEM AND ELECTRONIC INJECTION SYSTEM MAINTENANCE AND REPAIR**

**CODE: 841 876**

**Duration: 90 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

#### **EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **maintain and repair antipollution and electronic injection systems** in accordance with the following conditions, criteria and specifications.

#### **CONDITIONS FOR PERFORMANCE EVALUATION**

- Working individually
- Given engines and vehicles representative of the market
- Using:
  - state-of-the-art tools and instruments
  - hoisting equipment

#### **GENERAL PERFORMANCE CRITERIA**

- Observance of the rules of health, safety and environmental protection
- Observance of safety instructions and warnings
- Observance of manufacturer's specifications, including torque values
- Correct choice and proper use of technical documentation
- Proper choice of instruments
- Accurate interpretation of information found in technical documentation
- Keen sense of observation
- Accurate use of English and French terminology

## **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

### **FIELD OF APPLICATION**

- Including on-board diagnostic (OBD) pollution-control systems
- Central, multipoint, sequential and supercharged injection systems
- Antipollution systems
  - recovery of gas vapour
  - exhaust gas recirculating
  - air lift
  - catalytic converter

### **SPECIFICATIONS OF THE EXPECTED BEHAVIOUR**

- A. Diagnose anomalies in antipollution and electronic injection systems.
  
- B. Plan the work.
  
- C. Replace components on different types of systems.

### **SPECIFIC PERFORMANCE CRITERIA**

- Accurate determination of anomaly
- Detailed visual inspection of the system
- Observance of manufacturer's recommended diagnostic procedures:
  - for general inspection
  - for a symptom
  - using codes
- Accurate use of instruments
- Correct interpretation of results
  
- Accurate determination of the work to be done
- Proper choice of tools, equipment and products
  
- Correct application of manufacturer's recommended removal and installation techniques
- Correct use of specialized tools
- Correct, precise adjustments
- Proper cleaning of components

**FIRST-LEVEL OPERATIONAL OBJECTIVE  
BEHAVIOURAL OBJECTIVE**

**SPECIFICATIONS OF THE EXPECTED  
BEHAVIOUR**

- D. Make the appropriate repairs to each system.
- E. Clean the electronic injection systems.
- F. Check the operating condition and integrity of the systems.

**SPECIFIC PERFORMANCE  
CRITERIA**

- Observance of manufacturer's recommended repair techniques
- Proper application of repair techniques for:
  - wire harnesses and cables
  - gas lines
  - vacuum lines
- Proper cleaning of electrical contacts
- Correct use of cleaning equipment
- Detailed verification of leak-tightness of systems
- Appropriate testing of systems
- Quality control
- Accurate and well-written report
- Neatness of work area

## **SECOND-LEVEL OPERATIONAL OBJECTIVES**

**IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:**

**Before learning how to diagnose anomalies in antipollution and electronic injection systems (A):**

- 1. Explore future prospects for diagnostic methods.**
- 2. Establish relationships between anomalies in injection systems and those in antipollution systems.**

**Before learning how to make the appropriate repairs to each system (D):**

- 3. Apply flaring techniques.**

## **MODULE 28: ENGINE-TRANSMISSION UNIT INSPECTION**

**CODE: 841 885**

**Duration: 75 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

#### **EXPECTED BEHAVIOUR**

To demonstrate the required competency, the students must **diagnose the condition of the engine-transmission unit** in accordance with the following conditions, criteria and specifications.

#### **CONDITIONS FOR PERFORMANCE EVALUATION**

- Working individually
- Given:
  - recent vehicles with integrated computerized systems
  - hypothetical situations
- Using:
  - the appropriate state-of-the art instruments
  - the manufacturer's technical documentation
  - hoisting equipment

#### **GENERAL PERFORMANCE CRITERIA**

- Observance of the rules of health, safety and environmental protection
- Observance of safety instructions and warnings
- Proper use of technical documentation
- Accurate interpretation of information in technical documentation
- Neat and meticulous work
- Observance of professional ethics
- Accurate use of English and French terminology

## FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE

### SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

- A. Get information on the problem from the customer.
- B. Test the operation of heated and unheated exhaust gas oxygen sensors.
- C. Measure the exhaust gas emission rate.
- D. Test the operation of all the integrated computer-controlled systems.
- E. Find the causes of intermittent anomalies with and without using anomaly codes.

### SPECIFIC PERFORMANCE CRITERIA

- Relevant questions to determine the problem
- Accurate interpretation of information received
- Appropriate visual inspection
- Proper test of operation of sensors and their reaction time
- Proper use of an analyzer and a digital oscilloscope
- Accurate interpretation of results
- Observance of manufacturer's recommendations for analyzing the composition of exhaust gas
- Accurate interpretation of results
- Accurate measurement of combustion residue
- Proper test of relative compression and vacuum of cylinders
- Observance of manufacturer's recommended inspection techniques
- Accurate interpretation of results
- Accurate location of problem
- Observance of diagnostic methods using anomaly codes
- Accurate interpretation of results
- Accurate location of problem
- Accurate identification of different causes of anomalies

## **FIRST-LEVEL OPERATIONAL OBJECTIVE BEHAVIOURAL OBJECTIVE**

### **SPECIFICATIONS OF THE EXPECTED BEHAVIOUR**

- F. Find the causes of anomalies related to abnormally high emission rates.**
  
- G. Inform the customer of the diagnosis.**

### **SPECIFIC PERFORMANCE CRITERIA**

- Observance of diagnostic methods using anomaly codes
- Accurate interpretation of results
- Accurate location of problem
  
- Accurate diagnosis
- Relevant recommendations
- Accurate and well-written report

## **SECOND-LEVEL OPERATIONAL OBJECTIVES**

**IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:**

**Before learning how to get information on the problem from the customer (A):**

1. Explain the importance of confidentiality.
2. Interpret the symptoms written by a third party on the work order.

**Before learning how to test the operation of heated and unheated exhaust gas oxygen sensors (B):**

3. Describe the importance of oxygen sensors in the operation of integrated systems.
4. Distinguish between the operation of an oxygen sensor installed in front of the catalytic converter and one installed behind it.

**Before learning how to measure the exhaust gas emission rate (C):**

5. Describe the units used to measure exhaust gas.

**Before learning how to test the operation of all the integrated computer-controlled systems (D):**

6. Describe the possibilities of the main diagnostic equipment.
7. Distinguish between the results obtained by testing the compression of a cylinder and that obtained by testing the relative compression of the cylinders.

**Before learning how to find the causes of intermittent anomalies with and without using anomaly codes (E):**

8. Describe the difficulties associated with the diagnosis of an intermittent anomaly.
9. Describe the strategies for locating an intermittent anomaly.

## **MODULE 29: STARTING A BUSINESS**

**CODE: 841 891**

**Duration: 15 hours**

### **FIRST-LEVEL OPERATIONAL OBJECTIVE SITUATIONAL OBJECTIVE**

#### **EXPECTED OUTCOME**

By participating in the required activities of the learning context according to the indicated criteria, the students will be able to **explore the possibility of starting a business.**

#### **SPECIFICATIONS**

During this module, the students will:

- Describe the current situation and future prospects for the creation of a business in automobile mechanics.
- Explore business opportunities.
- Describe the requirements for and the steps involved in starting a business.
- Assess their potential for and interest in entrepreneurship.
- Identify local resources: technical and financial support, training, business community.

#### **LEARNING CONTEXT**

##### **PHASE 1: Information**

- Learning about the role of entrepreneurship in Québec's economic development.
- Learning about the strengths and weaknesses of the local market and about business opportunities.
- Gathering the information necessary to plan and start a business.
- Learning about the characteristics of entrepreneurs: qualities, faults, attitudes, behaviour and competencies.

## **FIRST-LEVEL OPERATIONAL OBJECTIVE SITUATIONAL OBJECTIVE**

### **LEARNING CONTEXT**

- Learning about the sources of technical and financial support and training and the business community.

### **PHASE 2: Participation**

- Analyzing the factors that are favourable and unfavourable to entrepreneurship in automobile mechanics.
- Developing a procedure to write a business plan.
- Thinking about their entrepreneurial potential.
- Participating in various activities:
  - round table discussion with entrepreneurs
  - video and discussion on starting a business
  - interviews
  - reading

### **PHASE 3: Evaluation**

- Taking stock of their own entrepreneurial characteristics.
- Assessing the possibility of starting a business.

## **FIRST-LEVEL OPERATIONAL OBJECTIVE SITUATIONAL OBJECTIVE**

### **INSTRUCTIONAL GUIDELINES**

The teacher should:

- Plan activities to spark the students' interest (e.g. a video).
- Take special care in the choice of resource people and in the planning of activities with them.
- Make sure the students have access to reference material and information on local resources.
- Promote creativity, allowing the students to explore various business ideas.
- Encourage the students to share ideas and express themselves.
- Encourage the students to participate throughout the module.
- Create an atmosphere of trust and confidentiality, allowing the students to explore all the aspects of their personality free of prejudice.

### **PARTICIPATION CRITERIA**

#### **PHASE 1:**

- Gather relevant information on entrepreneurial possibilities, the steps involved in starting a business and the available resources.
- Gather relevant information on the profile of an entrepreneur.

#### **PHASE 2:**

- Cooperate actively in group work to analyze the factors that are favourable and unfavourable to starting a local business in automobile mechanics.
- Prepare a summary of the steps involved in carrying out a project.
- Fill out a questionnaire to determine their own entrepreneurial profile.
- Participate in the suggested activities.

#### **PHASE 3:**

- Write a report detailing:
  - aspects of their personality to be improved;
  - their potential for and interest in starting a business.

## **SECOND-LEVEL OPERATIONAL OBJECTIVES**

**IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:**

**Before undertaking the activities of Phase 1:**

- 1. Be aware of the characteristics of small and medium-size automobile mechanics businesses in their region.**
- 2. Find sources of information on starting a business.**
- 3. Use a research method.**

**Before undertaking the activities of Phase 2:**

- 4. Show concern for explaining their ideas and opinions clearly.**
- 5. Know the rules governing group discussion.**
- 6. Participate in the activities.**

**Before undertaking the activities of Phase 3:**

- 7. Agree to assess their participation in the activities.**

## MODULE 30: ENTERING THE WORK FORCE

CODE: 841 906

Duration: 90 hours

### FIRST-LEVEL OPERATIONAL OBJECTIVE SITUATIONAL OBJECTIVE

#### EXPECTED OUTCOME

By participating in the required activities of the learning context according to the indicated criteria, the students will be able to **enter the work force.**

#### SPECIFICATIONS

During this module, the students will:

- Become familiar with consumer protection rules.
- Apply practicum-search techniques.
- Perform trade-related activities in the workplace.
- Assess the training received in the light of their workplace experience.

#### LEARNING CONTEXT

##### PHASE 1: Consumer Protection

- Learning about the sections of the *Consumer Protection Act* pertaining to automobile repair.
- Learning about the evaluation and invoicing forms in conformity with the Act.
- Developing respect for the rights and expectations of the consumer with regard to automobile repair.

## **FIRST-LEVEL OPERATIONAL OBJECTIVE SITUATIONAL OBJECTIVE**

### **LEARNING CONTEXT**

#### **PHASE 2: Practicum Search**

- Finding possible employers.
- Applying for a practicum position and following up.

#### **PHASE 3: Trade-related Activities in the Workplace**

- Approaching businesses in order to prepare for the practicum.
- Making sure that the practicum agreement conforms to the regulations.
- Participating in tasks performed by automobile mechanics.
- Writing a report listing the main tasks and operations performed in the workplace.

#### **PHASE 4: Evaluation of the Practicum and the Training**

- Presenting a report detailing the tasks and operations performed in the workplace.
- Assessing the relevance of their training with respect to workplace requirements.
- Stating the specific and complementary training needs in automobile mechanics.

### **INSTRUCTIONAL GUIDELINES**

The teacher should:

- Distribute and explain information documents on consumer protection.
- Simulate job interviews.
- Assist the students in their search for a practicum position.
- Provide educational assistance to students in the workplace.

## **FIRST-LEVEL OPERATIONAL OBJECTIVE SITUATIONAL OBJECTIVE**

### **PARTICIPATION CRITERIA**

#### **PHASE 1:**

- Show an interest in the *Consumer Protection Act*.

#### **PHASE 2:**

- Write a résumé.
- Show enthusiasm and persuasiveness during interviews.

#### **PHASE 3:**

- Carry out a search for a practicum position.
- Respect the rules governing work in a garage.
- Participate actively in trade-related activities.
- Show sustained interest throughout the activity.
- Write a practicum report detailing the activities performed.

#### **PHASE 4:**

- Write an essay on the tasks and operations performed during the practicum.
- Emphasize the strengths and weaknesses of the training received.

## SECOND-LEVEL OPERATIONAL OBJECTIVES

IN ORDER TO ACHIEVE THE FIRST-LEVEL OBJECTIVE, THE STUDENTS SHOULD HAVE PREVIOUSLY ATTAINED SECOND-LEVEL OBJECTIVES, SUCH AS:

**Before undertaking any of the activities:**

1. Show interest in information on the trade.
2. Show interest in a practicum in the workplace in automobile mechanics.

**Before undertaking the activities of Phase 1:**

3. Develop a responsible attitude toward the cost of repairs.
4. Develop an open attitude toward consumer rights with respect to automobile repair.
5. Observe professional ethics in automobile mechanics.

**Before undertaking the activities of Phase 2:**

6. Ask automobile mechanics about the qualities normally sought in apprentice mechanics.
7. Learn about the requirements of the trade at entry level.

**Before undertaking the activities of Phase 3:**

8. Be familiar with the objectives of a practicum.
9. List the tasks and operations desired.
10. Show respect toward co-workers and customers.

**Before undertaking the activities of Phase 4:**

11. Become aware of the requirements of the school in terms of the practicum.
12. Show a desire to contribute to the improvement of the school by constructively criticizing the training received.



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