CONSTRUCTION ELECTRICITY

PROGRAM OF STUDY
EZU-512
1930

ELECTRO-TECHNOLOGY

CONSTRUCTION ELECTRICITY

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EZU-512
1930

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

CONSTRUCTION ELECTRICIAN

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Although much research went into the choice of technical terminology in the English version, some terms may not reflect current usage or may be inaccurate. The Education Development in the English Language team would much appreciate receiving feedback from users of this document. The translators may be contacted at the:

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This program of studies, *Construction Electricity,* is issued in accordance with Section 461 of the **Education Act**.

It has been approved by the Confessional committees of the Conseil supérieur de l'éducation in conformity with the provisions of paragraph (a) of Section 23 of **An Act respecting the Conseil supérieur de l'éducation,** as replaced by Section 569 of the **Education Act** (1988, Chapter 84).

This program has been authorized for teaching *Construction Electricity* in the schools as of

Michel Pagé

Minister of Education

TABLE OF CONTENTS

INTRODUCTION

The *Construction Electricity* program is based on the orientations for secondary school vocational education adopted by the government in 1986. It was designed on the basis of a new framework for developing vocational education programs 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 1 350 hours, which includes 765 hours spent on the specific competencies required to practise the trade or occupation and 585 hours on general competencies. The program of study is divided into 25 modules, which vary in length from 15 to 90 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. The modules are organized into 3 blocks of 450 hours each.

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: 25
Duration in hours: 1 350
Credits: 90

Construction Electricity
SIMCA Code: EZU-512
SESAME Code: 1930

SIMCA	SESAME	TITLE OF THE MODULE	DURATION	CREDITS*
EDN 288	786-011	1. The Trade and the Training Process	15	1
KDN 286	755-001	2. Organizations Involved in Construction	15	1
ECE 283	755-002	3. Health and Safety on Construction Sites	30	2
ECE 289	786-034	4. Using Tools and Anchors	60	4
ECF 288	786-123	5. Drawing Sketches and Diagrams	45	3
ECH 288	786-056	6. DC Circuit Analysis	90	6
ECF 284	786-086	7. Cables and Raceways	90	6
ECF 286	786-105	8. Lighting and Outlet Circuits	75	5
ECG 281	786-142	9. Scaffolding and Rigging	30	2
EDO 281	786-291	10. Communicating in the Workplace	15	1
ECF 283	786-073	11. Using Plans and Specifications	45	3
ECH 289	786-115	12. AC Circuit Analysis	75	5
ECF 289	786-135	13. Low-Voltage Service Entrances	75	5
EDO 282	786-303	14. Installing Luminaires	45	3
EDO 283	786-313	15. Extra-Low-Voltage Controls	45	3
ECG 284	786-325	16. Installing Transformers	75	5
ECG 283	786-165	17. Installing Heating Systems	75	5
ECG 287	786-334	18. Concepts of Electronics	60	4
ECH 282	786-244	19. Installing Alarm Systems	60	4
BDE 289	842-213	20. Combinational Logic	45	3
ECG 285	786-185	21. Installing DC Motors	75	5
ECG 286	786-195	22. Installing AC Motors	75	5
BDF 289	842-304	23. Sequential Logic	60	4
ECH 283	786-254	24. Installing Programmable Controllers	60	4
ECH 286	786-281	25. Job-Search Techniques	15	1

* 15 hours = 1 credit

--- Modules are divided into blocks of 450 hours.
This program leads to a secondary school vocational diploma in Construction Electricity.

2. PROGRAM TRAINING GOALS

The training goals of the *Construction Electricity* program are based on the general goals of vocational education and take into account the specific nature of the trade or occupation. These goals are:

To develop effectiveness in the practice of a trade.

- To teach students to perform construction electricity tasks and activities correctly and at an acceptable level of competence for entry into the job market.
- To prepare students to perform satisfactorily on the job by fostering:
  - the development of intellectual and psychomotor skills needed to install electrical equipment correctly and safely;
  - the development of a concern for effective communication with their future superiors, colleagues and customers;
  - a constant concern for occupational health and safety;
  - the reinforcement of the habits of attention and precision in various tasks.

To ensure integration into the working world.

- To familiarize students with workers' rights and responsibilities.
- To familiarize students with the job market in general and the trade of electrician in particular.

To foster the development of professional knowledge and attitudes.

- To foster independence, a sense of responsibility, and a desire to succeed.
- To foster a concern for excellence.
- To encourage students to assess their own work regularly.
- To help students understand the principles underlying the techniques used.
- To teach students good work habits and to instill a sense of discipline.

To ensure job mobility within the trade.

- To foster a positive attitude toward technological change and new situations.
- To enhance students' ability to learn, make inquiries, and gather information.
- To teach effective job-search skills.

3. COMPETENCIES

The competencies to be developed in the *Construction Electricity* 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 (△) 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 (▲) 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 LEARNING FOCUSES

CONSTRUCTION ELECTRICITY		FIRST-LEVEL OPERATIONAL OBJECTIVES	DURATION (IN HOURS)	WORK PROCESS (major steps)							GENERAL COMPETENCIES (technology, personal development, etc.)													TOTALS	
SPECIFIC COMPETENCIES (directly related to the practice of the specific occupation)				Interpret plans	Plan the work	Adopt safety measures	Prepare the equipment, tools and material	Carry out the work	Carry out the required testing	Clean up the work area	Be familiar with the organizations involved in construction	Apply concepts of health and safety on construction sites	Use basic tools and anchors	Draw basic sketches and circuit diagrams	Analyze direct-current circuits	Use scaffolding and rigging equipment	Communicate in the workplace	Use plans and specifications	Analyze alternating-current circuits	Apply concepts of electronics	Apply concepts of combinational logic	Apply concepts of sequential logic	Use job-search techniques	NUMBER OF OBJECTIVES	DURATION (IN HOURS)
Module	Module										2	3	4	5	6	9	10	11	12	18	20	23	25		
	FIRST-LEVEL OPERATIONAL OBJECTIVES	T									S	S	B	B	B	B	B	B	B	B	B	B	B	13	
	DURATION (IN HOURS)		h								15	30	60	45	90	30	15	45	75	60	45	60	15		585
1	Determine their suitability for the trade and the training process	S	15								○												○		
7	Install cables and raceways	B	90	△	▲	▲	▲	▲		▲		●	●	●	○	○	○	○	○						
8	Install and connect a lighting circuit and an outlet circuit	B	75	△	▲	▲	▲	▲	▲	▲		●	●	●	●	○	○	○	○						
13	Install a low-voltage service entrance	B	75	▲	▲	▲	▲	▲		▲		●	●	○		●	●	●	○						
14	Install and connect luminaires	B	45	▲	▲	▲	▲	▲	▲	▲		●	●	●	○	●	●	●	●			○			
15	Install and connect extra low voltage controls	B	45	▲	▲	▲	▲	▲	▲	▲		●	●	●	○	○	●	●	●	○	○	○			
16	Install and connect transformers	B	75	▲	▲	▲	▲	▲	▲	▲		●	●	○		●	●	●	●						
17	Install and connect a heating system and its controls	B	75	▲	▲	▲	▲	▲	▲	▲		●	●	○	○	●	●	●	●			○			
19	Install and connect an alarm system	B	60	▲	▲	▲	▲	▲	▲	▲		●	●		○	○	●	●	○	●		○			
21	Install and connect a DC motor and its controls	B	75	▲	▲	▲	▲	▲	▲	▲		●	●	●	●	●	●	●	○	●	●	○			
22	Install and connect an AC motor and its controls	B	75	▲	▲	▲	▲	▲	▲	▲		●	●	●	○	●	●	●	●	●	●	○			
24	Install and connect a programmable controller	B	60	▲	▲	▲	▲	▲	△	▲		●	●	○	○	○	●	●	○	●	●	●			
NUMBER OF OBJECTIVES		12																						25	
DURATION (IN HOURS)			765																						1350

S : Situational objective
B : Behavioural objective

△ 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 *Construction Electricity* program are presented below, along with the major statement of each corresponding first-level operational objective.

To develop in the students the basic competencies required to practise a trade.

- Apply concepts of health and safety on construction sites.
- Use basic tools and anchors.
- Draw basic sketches and circuit diagrams.
- Use scaffolding and rigging equipment.
- Analyze direct-current circuits.
- Analyze alternating-current circuits.
- Use plans and specifications.
- Install cables and raceways.

To develop in the students the specific competencies required to practise the trade of construction electrician.

- Install and connect a lighting circuit and an outlet circuit.
- Install a low-voltage service entrance.
- Install and connect luminaires.
- Install and connect extra-low-voltage controls.
- Install and connect a heating system and its controls.
- Install and connect transformers.
- Install and connect an alarm system.
- Install and connect a DC motor and its controls.
- Install and connect an AC motor and its controls.
- Install and connect a programmable controller.

To develop in the students the complementary competencies required to practise the trade of electrician.

- Communicate in the workplace.
- Apply concepts of combinational logic.
- Apply concepts of electronics.
- Apply concepts of sequential logic.

To develop in the students the competencies required to integrate harmoniously into the work environment.

- Determine their suitability for the trade and the training process.
- Be familiar with the organizations involved in construction.
- Use job-search techniques.

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

SIMCA: EDN 288
SESAME: 786-011

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
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 process.
- Confirm their career choice.

LEARNING CONTEXT

PHASE 1: **Information on the Trade**

- Learning about the nature and requirements of the job: tasks, work conditions, evaluation criteria, rights and responsibilities of workers.

- Learning about the job market in the field of construction electricity: work environments, job prospects, wages, advancement and transfer opportunities, selection of candidates.

- Develop their impressions of the trade (i.e. advantages, disadvantages, requirements).

FIRST-LEVEL OPERATIONAL OBJECTIVE
SITUATIONAL OBJECTIVE

LEARNING CONTEXT

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

- Learning about the training plan: the program of study, the training process, evaluation methods, certification of studies.

- Learning about the skills, aptitudes and knowledge necessary for practising the trade.

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

- Describing their preferences, aptitudes and interests with respect to construction electricity.

- Evaluating their career choice.

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 that hire construction electricians.
- 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.

FIRST-LEVEL OPERATIONAL OBJECTIVE
SITUATIONAL OBJECTIVE

PARTICIPATION CRITERIA

PHASE 1:

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

PHASE 2:

- Give their opinions on some requirements for practising the trade of construction electrician.
- Examine the reference material provided.
- Listen carefully to explanations.
- Express their views on the training program.
- Express clearly their reactions to the trade and the training process.

PHASE 3:

- Write a report that:
  - sums up their preferences, interests and aptitudes;
  - explains how they arrived at their career choice, comparing aspects and requirements of the trade with their preferences, aptitudes and interests.

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 regarding the trade and the training process.
2. Express an interest in sharing their impressions of the trade with the other members of the group.
3. Show respect for themselves and for others.

Before undertaking the activities of Phase 1 (Information on the Trade):

4. Give their personal definition of a construction electrician's job.
5. Develop a method of finding information.
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 (Information on and Participation in the Training Process):

8. Define the terms *skill, aptitude,* and *knowledge.*
9. Describe the nature, function and content of a program of study.

Before undertaking the activities of Phase 3 (Evaluation and Confirmation of Career Choice):

10. Define the term *career choice.*
11. Differentiate among the terms *preference, aptitude* and *interest.*
12. Become aware of the necessity of enjoying one's occupation.
13. Describe the main elements of a report confirming a career choice.

MODULE 2: ORGANIZATIONS INVOLVED IN CONSTRUCTION

SIMCA: KDN 286
SESAME: 755-001

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 familiar with the organizations involved in construction.

SPECIFICATIONS

At the end of this module, the students will:

- Describe the laws and regulations governing labour relations in the construction industry.

- Identify the main roles and responsibilities of employers' organizations and union associations and organizations.

LEARNING CONTEXT

PHASE 1: **Information**

- Becoming familiar with the objective of the unit in the companion guide.

PHASE 2: **Learning**

- Assimilating information on the topic covered.

- Expressing an opinion on the topic and asking questions.

FIRST-LEVEL OPERATIONAL OBJECTIVE
SITUATIONAL OBJECTIVE

LEARNING CONTEXT

PHASE 3: **Reinforcement**

- Reviewing the main elements of the unit.
- Filling out a questionnaire individually.
- Correcting the answers as a group.

INSTRUCTIONAL GUIDELINES

The teacher should:

- Use a suitable room and proper materials.
- Present the material in a dynamic manner.
- Involve students in discussions.
- Make good use of charts and illustrations.

PARTICIPATION CRITERIA

- Participate in 7 out of 9 units.
- Listen attentively.
- Stick to the topic during discussions.
- Ask pertinent questions and give appropriate answers.
- Do the exercises conscientiously.
- Correct the exercises.

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 (Information):

1. Be receptive to information concerning the organizations involved in construction.
2. Express a desire to share their knowledge with the other members of the group.

Before undertaking the activities of Phase 2 (Learning):

3. Explain the main rules of group discussion.

Before undertaking the activities of Phase 3 (Reinforcement):

4. Describe the technique for filling out a questionnaire.

MODULE 3: HEALTH AND SAFETY ON CONSTRUCTION SITES

SIMCA: ECE 283
SESAME: 755-002

Duration: 30 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
apply concepts of health and safety on construction sites.

SPECIFICATIONS

At the end of this module, the students will:

- Be familiar with the laws and regulations governing health and safety on construction sites.
- Be familiar with the roles and responsibilities of safety representatives and safety officers.
- Be aware of the hazards and safety measures related to performing certain tasks.
- Be aware of the hazards and safety measures related to the construction site itself.
- Be aware of the hazards and safety measures related to using certain products.
- Know what to do in the event of an accident.

LEARNING CONTEXT

PHASE 1: **Information**

- Becoming familiar with the objective of the unit in the companion guide.

FIRST-LEVEL OPERATIONAL OBJECTIVE
SITUATIONAL OBJECTIVE

LEARNING CONTEXT

PHASE 2: **Learning**

- Gathering information on the topic covered.
- Forming and expressing an opinion on the topic.
- Asking questions.
- Identifying the main concepts and underlying principles of safe behaviour.
- Assessing their own observance of these principles.

PHASE 3: **Reinforcement**

- Reviewing the main concepts and elements of the unit.
- Filling out a questionnaire.
- Correcting the answers and discussing them if necessary.

INSTRUCTIONAL GUIDELINES

The teacher should:

- Use a suitable room and proper materials.
- Present the material in a dynamic manner.
- Involve students in discussions.
- Make adequate use of teaching materials (e.g. tables, transparencies, films, videotapes, cards).

FIRST-LEVEL OPERATIONAL OBJECTIVE
SITUATIONAL OBJECTIVE

PARTICIPATION CRITERIA

- Participate in at least 18 out of the 20 units, Units 1, 2 and 19 being compulsory.
- Listen attentively.
- Stick to the topic during discussions.
- Ask pertinent questions and give appropriate answers.
- Do the exercises conscientiously.
- Correct the exercises.

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 (Information):

1. Be receptive to information relating to health and safety.
2. Express an interest in sharing their knowledge with the other members of the group.

Before undertaking the activities of Phase 2 (Learning):

3. Gather information.
4. Determine a way of presenting information.
5. Explain the principal rules of group discussion.

Before undertaking the activities of Phase 3 (Reinforcement):

6. Describe the technique for filling out a questionnaire.

MODULE 4: USING TOOLS AND ANCHORS

SIMCA: ECE 289
SESAME: 786-034

Duration: 60 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must
use basic tools and anchors
in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Following instructions and using the sketches required to perform the tasks
- Using electricians' basic hand and power tools
- Performing tasks related to construction electricity
- Fastening material to two pieces of concrete (surface and block)

GENERAL PERFORMANCE CRITERIA

- Observance of health and safety rules and personal and general safety measures
- Conformity to instructions
- Result in conformity with sketch
- Observance of proper techniques
- Tools and material maintained and stored properly
- Clean, careful work
- Respect for environment and layout

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
A. Use hand tools.	- Proper choice of tools - Appropriate and safe use of tools - Accurate results
B. Use power tools.	- Adequate testing and preparation of tools - Appropriate and safe use of tools - Accurate results
C. Use anchors.	- Proper choice of anchor - Proper preparation of anchorings - Proper fastening technique - Solid anchorings

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 (A):

1. Be familiar with the hand tools used in electricity and their characteristics.
2. Demonstrate the techniques for using the various tools.
3. Identify the accidents likely to occur and the precautions to take when using hand tools.
4. Define the methods of maintaining and storing hand tools.
5. Be familiar with the main types of fasteners.

Before learning how to use power tools (B):

6. Be familiar with the power tools used in electricity and their characteristics.
7. Do a routine check of the power tools.
8. Demonstrate the techniques for using power tools.
9. Identify the accidents likely to occur when using power tools.
10. Choose the power tools appropriate to the task to be performed.
11. Define the methods of maintaining and storing power tools.

Before learning how to use anchors (C):

12. Identify the different types of anchors, their characteristics and their uses.
13. Identify the different materials to which anchors may be fastened.
14. Be familiar with the tools required to fasten material.
15. Determine the criteria for choosing an anchor.
16. Describe the techniques for fastening anchors.
17. Be familiar with the quality criteria of anchorings.

MODULE 5: DRAWING SKETCHES AND DIAGRAMS

SIMCA: ECF 288
SESAME: 786-123

Duration: 45 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must
draw basic sketches and circuit diagrams
in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Following instructions
- Using a mechanical part
- Drawing freehand sketches and diagrams

GENERAL PERFORMANCE CRITERIA

- Conformity to instructions
- Clean, careful work

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR

A. Sketch a mechanical part.

SPECIFIC PERFORMANCE CRITERIA

- Proper use of standard drafting lines
- Accurate representation of dimensions in both the metric and the imperial systems of measurement
- Top views, front views and side views appropriately drawn
- Correct proportions

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
B. Draw basic electrical symbols.	- Observance of drawing technique - Appropriate choice of symbols
C. Draw basic circuit diagrams: • line diagrams • ladder diagrams	- Proper drawing techniques - Proper arrangement of elements and symbols

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 sketch a mechanical part (A):

1. Draw geometric figures.
2. Be familiar with the standard drafting lines, their meanings and their uses.
3. Use the metric and imperial systems of measurement.
4. Identify top, front and side views.

Before learning how to draw basic electrical symbols (B):

5. Identify the main components of a basic electrical circuit.
6. Be familiar with the symbols used to represent the main components of a circuit.
7. Describe the technique used to draw symbols.

Before learning how to draw basic circuit diagrams:
- **line diagrams**
- **ladder diagrams (C):**

8. Be familiar with the various types of diagrams used in electricity.
9. Describe the technique used to draw various types of diagrams.

MODULE 6: DC CIRCUIT ANALYSIS

SIMCA: ECH 288
SESAME: 786-056

Duration: 90 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must
analyze direct-current circuits
in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Using a complex circuit containing six resistors
- Using a circuit diagram
- Using the appropriate tools, equipment (assembly benches) and instruments, including a voltmeter, an ammeter and an ohmmeter

GENERAL PERFORMANCE CRITERIA

- Proper use of tools, instruments and equipment
- Clean, careful work
- Observance of health and safety rules
- Expected results:
  - accurate calculation of the parameters of the circuit
  - accurate breakdown of the circuit

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
A. Apply the laws of electricity.	- Correct application of basic principles - Proper use of terminology

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
B. Interpret circuit diagrams.	- Accurate interpretation of symbols and conventions - Circuit consistent with diagram
C. Adopt safety measures.	- Systematic observance of personal and general safety measures
D. Compare the parameters of various circuits.	- Accurate measurements and calculations
E. Connect batteries and storage cells.	- Production of the desired voltage and current
F. Apply the laws of magnetism and electromagnetism.	- Correct application of the basic principles - Appropriate use of terminology

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 apply the laws of electricity (A):

1. Describe the atomic structure of matter.
2. Describe the methods of producing electricity.
3. Explain Ohm's Law and Watt's Law.

Before learning how to interpret circuit diagrams (B):

4. Identify the components of direct-current circuits.
5. Detect the colours used in identification codes.
6. Interpret resistor colour codes.
7. Describe the characteristics of direct-current circuits.

Before learning how to adopt safety measures (C):

8. Explain the usefulness of the main health and safety rules.

Before learning how to compare the parameters of various circuits (D):

9. Test the components of the circuits.
10. Calculate the resistance, current, voltage and power of the circuits.
11. Connect measuring meters to a circuit correctly.
12. Interpret meter scale readings.
13. Measure the parameters of direct-current circuits.

Before learning how to connect batteries and storage cells (E):

14. Describe the characteristics of batteries and storage cells.
15. Check the state of charge of batteries and storage cells.

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 apply the laws of magnetism and electromagnetism (F):

16. Describe the characteristics of magnets.
17. Describe the characteristics of electromagnets.
18. Describe the characteristics of direct-current measuring meters.

MODULE 7: CABLES AND RACEWAYS

SIMCA: ECF 284
SESAME: 786-086

Duration: 90 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must
install cables and raceways
in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- With the help of one person for drawing conductors into raceways
- Following instructions
- Using a sketch of the installation
- Referring to the Québec Electrical Code
- Using the appropriate equipment, tools and material
- Installing a surface wiring system

GENERAL PERFORMANCE CRITERIA

- Observance of health and safety rules
- Proper use of equipment and tools
- Installation in conformity to the Québec Electrical Code and the sketch
- Economical use of material
- Clean, careful work
- Respect for environment and layout

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
A. Plan the installations.	- Appropriate selection of necessary equipment, tools and material
B. Adopt safety measures.	- Systematic observance of personal and general safety measures
C. Bare the cables and fasten them to boxes.	- Proper baring technique - Proper fastening technique - Solid fastenings
D. Perform preliminary operations on raceways such as: • cutting • reaming • threading • bending • assembling	- Accurate measurements - Conformity to instructions - Use of proper techniques - Safe use of equipment and tools
E. Fasten the raceways.	- Proper fastening technique - Solid fastenings - Level raceways
F. Draw conductors into the raceways.	- Proper technique
G. Clean up the work area.	- Clean and orderly 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 installations (A):

1. Be familiar with the various types of cables.
2. Be familiar with boxes and cable accessories.
3. Be familiar with the various types of raceways and their accessories.
4. Become familiar with the Québec Electrical Code.
5. Identify the tables, sections, articles and definitions in the Québec Electrical Code that apply to the installation of cables and raceways.
6. Use the mathematical formulas necessary for installing cables and raceways.
7. Produce wiring diagrams based on circuit diagrams.

Before learning how to adopt safety measures (B):

8. Identify the safety measures to adopt before and during the installation of cables and raceways.

Before learning how to bare the cables and fasten them to boxes (C):

9. Explain the method used for baring and fastening cables.
10. Describe the techniques for fastening cables.

Before learning how to perform preliminary operations on raceways such as:
- **cutting**
- **reaming**
- **threading**
- **bending**
- **assembling (D):**

11. Measure raceways.
12. Demonstrate the techniques for using tools and equipment.

Before learning how to fasten the raceways (E):

13. Describe the technique for fastening raceways.

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 draw conductors into the raceways (F):

14. Mark conductors.
15. Describe the techniques for drawing conductors into raceways.
16. Transmit information properly.

Before learning how to clean up the work area (G):

17. Develop an efficient and safe storage system.

MODULE 8: LIGHTING AND OUTLET CIRCUITS

SIMCA: ECF 286
SESAME: 786-105

Duration: 75 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must
install and connect a lighting circuit and an outlet circuit
in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Following instructions
- Using a sketch of the installation
- Referring to the Québec Electrical Code
- Using the appropriate equipment, tools and material
- Installing a concealed wiring system

GENERAL PERFORMANCE CRITERIA

- Observance of health and safety rules
- Proper use of equipment and tools
- Conformity to the Québec Electrical Code and the sketch
- Clean, careful work
- Respect for environment and layout

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
A. Plan the installation.	- Accurate circuit diagram - Appropriate selection of necessary equipment, tools and material

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
B. Adopt safety measures.	- Systematic observance of personal and general safety measures
C. Prepare the equipment, tools and material.	- Safe handling of equipment, tools and material - Proper testing and preparation
D. Position and fasten the boxes for the lighting and outlet circuits.	- Correct positioning - Proper fastening technique - Solid fastenings - Accurate adjustment of boxes
E. Install the cables.	- Proper installation of cables - Economical use of material
F. Connect the conductors to the distribution panel and to the lighting and outlet devices.	- Proper connection techniques - Proper connections
G. Fasten the devices and test the circuit.	- Proper fastening technique - Solid fastenings - Circuit in good working order
H. Clean up the work area.	- Clean and orderly 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 installation (A):

1. Be familiar with the various types of lighting and outlet circuits, their operation and their uses.
2. Be familiar with the types of outlet switches and their uses.
3. Identify the tables, sections, articles and definitions of the Québec Electrical Code related to the installation of lighting and outlet circuits.
4. Apply the circuit concepts necessary to install lighting and outlet circuits.
5. Identify the alternating-current concepts necessary for the installation.
6. Draw circuit and wiring diagrams.
7. Use the mathematical formulas necessary for installing lighting and outlet circuits.
8. Be familiar with the protective devices against overcurrent necessary for the installation of lighting and outlet circuits.

Before learning how to adopt safety measures (B):

9. Identify the personal and general safety measures applicable to the performance of electrical tasks.

Before learning how to prepare the equipment, tools and material (C):

10. Identify the safety rules applicable to the handling of the equipment, tools and material used in electricity.

Before learning how to position and fasten the boxes for the lighting and outlet circuits (D):

11. Describe the techniques for fastening boxes.
12. Use drilling equipment.

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 install the cables (E):

13. Identify the size of conductors used to install various lighting and outlet circuits.
14. Describe the technique for installing cables.

Before learning how to connect the conductors to the distribution panel and to the lighting and outlet devices (F):

15. Detect the colours used in conductor identification codes.
16. Identify the various types of connections.
17. Identify the various components of a distribution panel.
18. Explain the usefulness of grounding conductors.
19. Describe the techniques for connecting conductors to the distribution panel and to the various devices.

Before learning how to fasten the devices and test the circuit (G):

20. Describe the techniques for fastening the various devices.
21. Switch circuits on.
22. Make simple changes to lighting and outlet circuits.

Before learning how to clean up the work area (H):

23. Develop an efficient and safe storage system.

MODULE 9: SCAFFOLDING AND RIGGING

SIMCA: ECG 281
SESAME: 786-142

Duration: 30 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must
use scaffolding and rigging equipment
in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- With the help of one person for erecting and dismantling scaffolds
- Based on specific needs and following instructions
- Erecting one type of scaffold
- Using the parts necessary for the installation of various types of scaffolds
- For the manual rigging of a motor, compressor or other piece of equipment of similar weight

GENERAL PERFORMANCE CRITERIA

- Observance of health and safety rules
- Conformity to instructions
- Proper use of equipment
- Observance of adequate safety measures
- Observance of ergonomic principles

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
A. Select the type of scaffold and the material according to the work to be done.	- Accurate evaluation of need - Selection of appropriate type of scaffold and necessary material
B. Handle the material.	- Proper handling technique - Safe handling
C. Erect and dismantle the scaffold.	- Proper erection techniques - Solid and appropriate scaffolding - Proper dismantling technique - Appropriate storage of materials
D. Select and prepare the rigging equipment according to the piece of equipment to be moved.	- Accurate calculation and evaluation of load - Appropriate selection of equipment - Proper preparation
E. Test the rigging equipment.	- Complete check
F. Rig the piece of equipment.	- Proper slinging technique - Appropriate and safe rigging

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 select the type of scaffold and the material according to the work to be done (A):

1. Determine the electrical tasks likely to require a scaffold.
2. Be familiar with the various types of scaffolds, their characteristics and their uses.
3. Be familiar with the various types of ladders used by electricians, as well as their characteristics and their uses.

Before learning how to handle the material (B):

4. Describe the techniques for handling material.
5. Identify the accidents likely to occur and the precautions to take when handling material.

Before learning how to erect and dismantle the scaffold (C):

6. List the steps in erecting and dismantling scaffolds.
7. Recognize the necessity of communicating clearly and effectively when erecting and dismantling scaffolds.
8. Identify the accidents likely to occur and the precautions to take when erecting, dismantling and using scaffolds.
9. Be familiar with the various anchors used in scaffolding.
10. Use a scaffold.

Before learning how to select and prepare rigging equipment according to the piece of equipment to be moved (D):

11. Define rigging.
12. Be familiar with the various pieces of equipment that must be moved by electricians.
13. Be familiar with equipment for suspending, lifting and moving loads, and its operation.
14. Solve problems of physics encountered when moving pieces of equipment.

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 test rigging equipment (E):

15. List the steps involved in testing rigging equipment.

Before learning how to rig the piece of equipment (F):

16. Identify the accidents likely to occur and the precautions to take when rigging a piece of equipment.
17. Use the main crane-operator signals.
18. Determine the centre of gravity of various pieces of equipment.
19. Tie knots used to sling pieces of equipment.
20. Describe the techniques for moving loads horizontally, vertically and on inclined planes.

MODULE 10: COMMUNICATION IN THE WORKPLACE

SIMCA: EDO 281
SESAME: 786-291

Duration: 15 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

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

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone, with the participation of one other student
- In simulated workplace situations
- Following instructions
- Without using reference material

GENERAL PERFORMANCE CRITERIA

- Clear and precise communication
- Proper use of the technical terms of the trade

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
A. Communicate in a teamwork situation.	- Effective elimination of obstacles to good communication - Satisfactory demonstration of the attitudes and behaviour necessary for good communication - Use of appropriate language

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
B. Transmit written information.	- Production of a clear order form and list of material - Production of a satisfactory 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 communicate in a teamwork situation (A):

1. Identify the various communication theories.
2. Identify the basic principles of interpersonal communication.
3. Identify the main forms of communication used by electricians workplace.
4. Be familiar with the main obstacles to good communication.
5. Be familiar with the teamwork situations requiring communication.
6. Recognize the importance of an electrician's ability to communicate effectively.

Before learning how to transmit written information (B):

7. Recognize the importance of using the technical terms of the trade correctly.
8. List the various data that may be found on an order form, in a list of material and in a report.

MODULE 11: USING PLANS AND SPECIFICATIONS

SIMCA: ECF 283
SESAME: 786-073

Duration: 45 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must
use plans and specifications
in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Following instructions
- Using residential and commercial plans and specifications

GENERAL PERFORMANCE CRITERIA

- Conformity to instructions
- Appropriate use of plans and specifications

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
A. Locate items on: • electrical plans • architectural plans • heating plans • plumbing plans	- Proper use of legends - Exact positioning of elements in imperial and metric measurements
B. Locate information in specifications.	- Proper use of specifications - Precise information located

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 locate items on:
- **electrical plans**
- **architectural plans**
- **heating plans**
- **plumbing plans (A):**

1. Identify the legal status of a plan.
2. Be familiar with the different types of plans.
3. Determine the general information found on electrical, architectural, heating and plumbing plans.
4. Identify the usefulness of various sections of a plan for electricians.
5. Identify the main symbols used in plans and their meaning.
6. Describe the function and the principle of the scale of a plan.
7. Update plans in writing.

Before learning how to locate information in specifications (B):

8. Describe the purpose of specifications.
9. Recognize the usefulness of specifications for construction electricians.
10. Identify the various sections of specifications and their general content.
11. Describe the method of finding information in specifications.

MODULE 12: AC CIRCUIT ANALYSIS

SIMCA: ECH 289
SESAME: 786-115

Duration: 75 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must
analyze alternating-current circuits
in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Using a series or parallel circuit containing one resistor, one inductor and one condenser
- Following instructions and using a circuit diagram
- Using the appropriate tools, equipment and instruments

GENERAL PERFORMANCE CRITERIA

- Observance of health and safety rules
- Proper use of tools, equipment (assembly benches) and instruments
- Clean, careful work
- Expected results:
  - accurate calculation of the parameters of the circuit
  - accurate breakdown of the circuit

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
A. Interpret the values of a sine wave.	- Accurate interpretation of values - Proper use of terminology

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
B. Interpret diagrams, circuits and phasor diagrams.	- Accurate interpretation of symbols, conventions and phasor diagrams - Circuit in conformity with diagram
C. Adopt safety measures.	- Systematic observance of personal and general safety measures
D. Compare the parameters of circuits: • impedance, reactance • voltage, current • power • phase displacement	- Accurate measurements and calculations

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 values of a sine wave (A):

1. Explain the production of a sine wave.
2. Define the terms associated with alternating current.
3. Calculate the values of a sine wave.
4. Use an oscilloscope.

Before learning how to interpret diagrams, circuits and phasor diagrams (B):

5. Describe the characteristics of inductors.
6. Describe the characteristics of transformers.
7. Describe the characteristics of condensers.
8. Interpret condenser colour codes.
9. Interpret phasor diagrams.

Before learning how to adopt safety measures (C):

10. Explain the usefulness of the main health and safety rules.

Before learning how to compare the parameters of circuits:
- **impedance, reactance**
- **voltage, current**
- **power**
- **phase displacement (D):**

11. Recognize defective components of a circuit by sight, smell or touch.
12. Use alternating-current measuring meters.
13. Calculate and measure the parameters of series and parallel RLC circuits.
14. Calculate and measure the parameters of series and parallel resonant circuits.

MODULE 13: LOW-VOLTAGE SERVICE ENTRANCES

SIMCA: ECF 289
SESAME: 786-135

Duration: 75 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must
install a low-voltage service entrance
in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- With the help of one person for erecting and dismantling scaffolds
- With the help of one person for drawing conductors into conduits
- Using a residential plan and specifications
- Following instructions
- Referring to the Québec Electrical Code and Hydro-Québec standards
- Using the appropriate equipment, tools and material

GENERAL PERFORMANCE CRITERIA

- Observance of health and safety rules
- Proper use of equipment and tools
- Conformity to the Québec Electrical Code, Hydro-Québec standards and the plan and specifications
- Clean, careful work
- Respect for environment and layout
- Observance of ergonomic principles

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
A. Interpret the plan and use the specifications.	- Correct positioning of components - Proper use of specifications - Adequate sketching of installation
B. Plan the installation.	- Accurate calculation of the service-entrance requirements - Appropriate selection of the necessary equipment, tools and material - Accurate calculation of point of connection
C. Adopt safety measures.	- Systematic observance of personal and general safety measures
D. Prepare the equipment, tools and material.	- Safe handling of equipment, tools and material - Proper testing and preparation
E. Install: • the distribution panel • the meter base • the mast	- Proper installation of panel - Economical use of material - Proper height of base - Proper installation of mast
F. Install the conduits and draw the conductors into them.	- Proper installation of conduits - Proper technique for drawing conductors into conduits
G. Make the electrical connections and test the installation.	- Proper connections at base and panel - Proper connection of grounding conductor - Installation in conformity with checklist
H. Clean up the work area.	- Clean and orderly 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 interpret the plan and use the specifications (A):

1. Identify the characteristics of a three-phase current.
2. Differentiate between single-phase and three-phase service entrances (residential, commercial and industrial).
3. Be familiar with the components of the various types of service entrances.
4. Identify the tables, sections, articles and definitions of the Québec Electrical Code related to the installation of low-voltage service entrances.
5. Identify Hydro-Québec standards regarding the installation of low-voltage service entrances.
6. Determine the main symbols and components of a plan for the installation of a low-voltage service entrance.

Before learning how to plan the installation (B):

7. Calculate service-entrance requirements.
8. List the elements that enable the electrician to calculate a point of connection.
9. Use the concepts of communication necessary for installing a service entrance.

Before learning how to prepare the equipment, tools and material (D):

10. Identify the safety rules applicable to the installation of service entrances.

Before learning how to install:
- the distribution panel
- the meter base
- the mast (E):

11. Describe the techniques for installing panels, meter bases and masts.

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 make the electrical connections and test the installation (G):

12. Describe the techniques for connecting conductors to the panel, meter base and ground.

MODULE 14: INSTALLING LUMINAIRES

SIMCA: EDO 282
SESAME: 786-303

Duration: 45 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must
install and connect luminaires
in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- With the help of one person for erecting and dismantling scaffolds
- With the help of one person for drawing conductors into raceways
- Using a plan and specifications
- Following instructions
- Referring to the Québec Electrical Code
- Referring to the manufacturer's instructions
- Using the appropriate equipment, tools and material
- Installing two different types of luminaires

GENERAL PERFORMANCE CRITERIA

- Observance of health and safety rules
- Proper use of equipment and tools
- Conformity to the Québec Electrical Code, the plan, the specifications and the manufacturer's instructions
- Clean, careful work
- Respect for environment and layout

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
A. Interpret the plan and use the specifications.	- Correct positioning of components - Proper use of specifications - Adequate sketch of installation
B. Plan the installations.	- Appropriate selection of the necessary equipment, tools and material
C. Adopt safety measures.	- Systematic observance of personal and general safety measures - Use of voltmeter to ensure that circuit is dead
D. Prepare the equipment, tools and material.	- Safe handling of equipment, tools and material - Proper testing and preparation
E. Position and fasten the luminaires.	- Correct positioning - Proper fastening technique - Solid fastenings
F. Install the cables.	- Proper installation - Economical use of material
G. Make the electrical connections.	- Proper connections
H. Fasten the luminaires and test them.	- Proper fastenings - Luminaires in good working order
I. Clean up the work area.	- Clean and orderly 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 interpret the plan and use the specifications (A):

1. Identify the different types of luminaires, their uses, their energy efficiency and the applicable CSA standards.
2. Identify the tables, sections, articles and definitions of the Québec Electrical Code relating to the installation of luminaires.
3. Determine the main symbols and components of a plan for the installation of luminaires.

Before learning how to plan the installations (B):

4. Use the concepts of single-phase and three-phase circuit analysis necessary for installing luminaires.
5. Use the mathematical formulas necessary for installing luminaires.
6. Draw circuit diagrams for the installation of luminaires.
7. Use the concepts of communication necessary for installing luminaires.

Before learning how to adopt safety measures (C):

8. Detect the main hazards and safety measures related to the installation of luminaires.

Before learning how to prepare the equipment, tools and material (D):

9. Identify the rules of safety applicable to handling luminaires.

Before learning how to position and fasten the luminaires (E):

10. Describe the techniques for fastening various types of luminaires.

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 install the cables (F):

11. Associate the various types of cables with luminaires.

Before learning how to make the electrical connections (G):

12. Describe the techniques for connecting the various types of luminaires.

Before learning how to fasten the luminaires and test them (H):

13. Describe the techniques for fastening the various devices.
14. Switch on the luminaires.

MODULE 15: EXTRA-LOW-VOLTAGE CONTROLS

SIMCA: EDO 283
SESAME: 786-313

Duration: 45 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must
install and connect extra-low-voltage controls
in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Using plans and specifications for the installation of luminaires
- Following instructions
- Referring to the Québec Electrical Code
- Using the appropriate equipment, tools and material
- Referring to the manufacturer's instructions

GENERAL PERFORMANCE CRITERIA

- Observance of health and safety rules
- Proper use of equipment and tools
- Conformity to the Québec Electrical Code, the plan, the specifications and the manufacturer's instructions
- Clean, careful work

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
A. Interpret the plan and use the specifications.	- Correct positioning of components - Proper use of specifications - Adequate sketch of installation
B. Plan the installation.	- Appropriate selection of equipment, tools and material
C. Adopt safety measures.	- Systematic observance of personal and general safety measures
D. Prepare the equipment, tools and material.	- Safe handling of equipment, tools and material - Proper testing and preparation
E. Fasten the boxes and the relays.	- Proper fastening technique - Solid fastenings
F. Install the cables.	- Proper installation - Economical use of material
G. Make the electrical connections.	- Proper connections
H. Fasten the devices and test the installation.	- Proper fastening technique - Solid fastenings - Controls in good working order
I. Clean up the work area.	- Clean and orderly 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 interpret the plan and use the specifications (A):

1. Identify the different types of controls and relays and their uses.
2. Identify the tables, sections, articles and definitions of the Québec Electrical Code related to the installation of low-voltage controls.
3. Determine the main symbols and components of a plan for the installation of extra-low-voltage controls.

Before learning how to plan the installation (B):

4. Use the concepts of circuit analysis necessary for the installation of extra-low-voltage controls.
5. Use the mathematical formulas necessary for the installation of extra-low-voltage controls.
6. Draw circuit diagrams for the installation of extra-low-voltage controls.
7. Use the concepts of communication necessary for the installation of extra-low-voltage controls.

Before learning how to fasten the boxes and the relays (E):

8. Describe the techniques for fastening boxes and relays.

Before learning how to install the cables (F):

9. Associate the various types of cables with the various types of controls.
10. Describe the techniques for installing cables for extra-low-voltage controls.

Before learning how to make the electrical connections (G):

11. Describe the techniques for connecting the various controls.

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 fasten the devices and test the installation (H):

12. Describe the techniques for fastening the various devices.
13. Switch on control systems.

MODULE 16: INSTALLING TRANSFORMERS

SIMCA: ECG 284
SESAME: 786-325

Duration: 75 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must
install and connect transformers
in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- With the help of one person for erecting and dismantling scaffolds
- With the help of one person for drawing conductors into conduits
- Using a plan and specifications
- Following instructions
- Referring to the Québec Electrical Code
- Using the appropriate equipment, tools and material
- Installing three single-phase transformers in a three-phase circuit

GENERAL PERFORMANCE CRITERIA

- Observance of health and safety rules
- Proper use of equipment and tools
- Conformity to the Québec Electrical Code, the plan and the specifications
- Clean, careful work
- Respect for environment and layout

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
A. Interpret the plan and use the specifications.	- Correct positioning of components - Proper use of specifications - Adequate production of electrical drawing
B. Plan the installation.	- Appropriate selection of equipment, tools and material - Accurate identification of the characteristics of transformers
C. Adopt safety measures.	- Systematic observance of personal and general safety measures
D. Prepare the equipment, tools and material.	- Safe handling of equipment, tools and material - Proper testing and preparation
E. Position and fasten the transformers.	- Correct positioning - Proper fastening technique - Solid fastenings
F. Install the conduits and draw the conductors into them.	- Proper installation of conduits - Economical use of material - Proper technique for drawing conductors into conduits
G. Make the electrical connections.	- Proper connection of transformers - Proper connection of load
H. Test the transformers.	- Proper primary and secondary voltages
I. Clean up the work area.	- Clean and orderly 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 interpret the plan and use the specifications (A):

1. Identify the different types of transformers, their components and their composition.
2. Identify the possible risks to the environment associated with materials used in the construction of transformers.
3. Identify the electrical characteristics of single-phase and three-phase transformers with and without loads.
4. Identify the tables, sections, articles and definitions of the Québec Electrical Code related to the installation of transformers.
5. Determine the main symbols and components of a plan for the installation of transformers.

Before learning how to plan the installation (B):

6. Use the circuit concepts necessary for the installation of transformers.
7. Determine the size of conductors used according to the load connected.
8. Be familiar with the safety measures against overcurrent necessary for the installation of transformers.
9. Use the mathematical formulas necessary for the installation of transformers.
10. Use the concepts of communication necessary for the installation of transformers.

Before learning how to adopt safety measures (C):

11. Identify the personal and general safety measures applicable before installing transformers.

Before learning how to prepare the equipment, tools and material (D):

12. Identify the safety rules applicable to the handling of transformers.

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 position and fasten the transformers (E):

13. Describe the hazards and safety measures related to welding machines.
14. Use flame-cutting and arc-welding equipment.
15. Describe the techniques for fastening transformers.

Before learning how to make the electrical connections (G):

16. Check the polarity of the transformers.
17. Be familiar with the various types of transformer connections.
18. Describe the techniques for connecting load transformers and the ground.
19. Connect grounding conductors using the thermit welding technique.

Before learning how to test the transformers (H):

20. Switch on transformers.

MODULE 17: INSTALLING HEATING SYSTEMS

SIMCA: ECG 283
SESAME: 786-165

Duration: 75 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must
install and connect a heating system and its controls
in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- With the help of one person for erecting and dismantling scaffolds
- Using a plan and specifications
- Following instructions
- Referring to the Québec Electrical Code
- Using the appropriate equipment, tools and material
- For the installation of a heating system including one baseboard heater controlled by a line voltage thermostat and one controlled by an extra-low-voltage thermostat

GENERAL PERFORMANCE CRITERIA

- Observance of health and safety rules
- Proper use of equipment and tools
- Conformity to the Québec Electrical Code, the plan and the specifications
- Clean, careful work
- Respect for environment and layout
- Observance of ergonomic principles

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
A. Interpret the plan and use the specifications.	- Correct positioning of components - Proper use of specifications - Adequate sketch of installation
B. Plan the installation.	- Appropriate selection of necessary equipment, tools and material
C. Adopt safety measures.	- Systematic observance of personal and general safety measures
D. Prepare the equipment, tools and material.	- Safe handling of equipment, tools and material - Proper testing and preparation
E. Position and fasten the heating unit.	- Correct positioning - Proper fastening technique - Solid fastenings
F. Install the components of the system.	- Proper installation of controls - Proper wiring
G. Make the electrical connections.	- Proper connection of components - Proper connection of system to panel
H. Test the heating system.	- Heating system in good working order
I. Clean up the work area.	- Clean and orderly 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 interpret the plan and use the specifications (A):

1. Be familiar with the different types of heating systems.
2. Identify the ways in which heat is diffused.
3. Explain the main operating principles of the various types of heating systems.
4. Identify the tables, sections, articles and definitions of the Québec Electrical Code related to the installation of heating systems.
5. Determine the main symbols and components of a plan for the installation of a heating system.
6. Identify the main types of controls.

Before learning how to plan the installation (B):

7. Consult the manufacturer's instructions.
8. Use concepts of DC circuit analysis necessary for the installation of heating systems.
9. Be familiar with the safety measures against overcurrent necessary for the installation of heating systems.
10. Use the mathematical formulas necessary for the installation of heating systems.
11. Use the concepts of communication necessary for the installation of heating systems.

Before learning how to adopt safety measures (C):

12. Identify the hazards and safety measures applicable to the installation of a heating system.

Before learning how to prepare the equipment, tools and material (D):

13. Identify the safety rules applicable to the handling of heating units.

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 position and fasten the heating unit (E):

14. Describe the techniques for fastening the various units.

Before learning how to install the components of the system (F):

15. Associate the types of cables with the various types of heating systems.
16. Identify the size of cables used for the installation of the various types of heating systems and their insulators.
17. Position the heating-system controls.
18. Describe the different cables used to install heating systems.

Before learning how to make the electrical connections (G):

19. Describe the techniques for connecting the controls to the heating units.
20. Describe the techniques for connecting the systems to the distribution panel.

Before learning how to test the heating system (H):

21. Switch on heating systems.
22. Diagnose an operational problem.
23. Service heating systems.

MODULE 18: CONCEPTS OF ELECTRONICS

SIMCA: ECG 287
SESAME: 786-334

Duration: 60 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must
apply concepts of electronics
in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Using diagrams
- Following instructions
- Using the appropriate manuals
- Using the appropriate material and measuring meters

GENERAL PERFORMANCE CRITERIA

- Proper use of measuring meters
- Conformity to instructions

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
A. Assemble a bridge rectifier circuit using junction diodes.	- Appropriate selection of diodes according to their rating - Circuit in conformity with diagram - Safe insulation of circuit - Accurate wave shapes

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
B. Assemble a basic power supply regulated by a Zener diode.	- Appropriate selection of Zener diode according to its rating - Assembly in conformity with diagram - Safe insulation of circuit - Accurate calculation of percentage of regulation
C. Assemble an amplifier circuit using transistors.	- Circuit in conformity with diagram - Circuit in good working order
D. Assemble an AC control circuit using thyristors (triac).	- Circuit in conformity with diagram - Safe insulation of circuit - Circuit in good working order

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 assemble a bridge rectifier circuit using junction diodes (A):

1. Differentiate between electricity and electronics.
2. Recognize the usefulness of concepts of electronics for the construction electrician.
3. Be familiar with the characteristics of P and N semiconductors.
4. Describe the operation of a diode and its use as a rectifier.
5. Explain the principle of full-wave rectification produced by a bridge rectifier.
6. Identify the different wave shapes using an oscilloscope.
7. Identify the main rectifier circuits.

Before learning how to assemble a basic power supply regulated by a Zener diode (B):

8. Identify the sections and components of a regulated power supply and their functions.
9. Be familiar with the characteristics of the Zener diode.
10. Check the voltages and the wave shapes.
11. Be familiar with the main circuits of a regulated power supply.

Before learning how to assemble an amplifier circuit using transistors (C):

12. Describe the operating principle of bipolar transistors.
13. Be familiar with basic assemblies.
14. Describe the principle of amplification.
15. Be familiar with the main amplifier circuits.

Before learning how to assemble an AC control circuit using thyristors (triac) (D):

16. Identify the main types of thyristors, their uses and their symbol.
17. Describe the operating principle of various thyristors.
18. Be familiar with the main circuits containing thyristors.

MODULE 19: INSTALLING ALARM SYSTEMS

SIMCA: ECH 282
SESAME: 786-244

Duration: 60 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must
install and connect an alarm system
in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Using a plan
- Following instructions
- Referring to the Québec Electrical Code
- Using the appropriate equipment, tools and material

GENERAL PERFORMANCE CRITERIA

- Observance of health and safety rules
- Proper use of equipment and tools
- Conformity to the Québec Electrical Code and the plan
- Clean, careful work
- Respect for environment and layout

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
A. Interpret the plan.	- Correct positioning of components - Adequate sketch of installation

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
B. Plan the installation.	- Appropriate selection of necessary equipment, tools and material
C. Adopt safety measures.	- Systematic observance of personal and general safety measures
D. Prepare the equipment, tools and material.	- Safe handling of equipment, tools and material - Proper testing and preparation
E. Install the control panel and the boxes.	- Proper installation
F. Install the cables or the conduits.	- Proper installation - Economical use of material
G. Connect the conductors to the devices.	- Proper connection
H. Test the circuits.	- Proper testing technique - Proper use of measuring meters
I. Fasten the devices.	- Proper fastening technique - Solid fastenings
J. Connect the conductors to the panel and test the system.	- Proper connections - System in good working order
K. Clean up the work area.	- Clear and orderly 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 interpret the plan (A):

1. Be familiar with the different types of alarm systems.
2. Identify the different types of controls and their uses.
3. Define the various operating methods of alarm systems.
4. Identify the tables, sections, articles and definitions of the Québec Electrical Code related to the installation of alarm systems.
5. Determine the main symbols and components of a plan for the installation of an alarm system.

Before learning how to plan the installation (B):

6. Use the concepts of electronics necessary for the installation of alarm systems.
7. Use the mathematical formulas necessary for the installation of alarm systems.
8. Use the concepts of communication necessary for the installation of alarm systems.

Before learning how to install the control panel and the boxes (E):

9. Describe the techniques for installing a control panel and boxes.

Before learning how to install the cables or the conduits (F):

10. Associate cables and conduits with various types of systems.

Before learning how to connect the conductors to the devices (G):

11. Describe the techniques for connecting the conductors to the devices.

Before learning how to test the circuits (H):

12. Describe the technique for testing 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 fasten the devices (I):

13. Describe the technique for fastening devices.

Before learning how to connect the conductors to the panel and test the system (J):

14. Determine the type of connection according to the plan and the control panel.
15. Switch on alarm systems.

MODULE 20: COMBINATIONAL LOGIC

SIMCA: BDE 289
SESAME: 842-213

Duration: 45 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must
apply concepts of combinational logic
in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Using a system or assembly diagram
- Using manufacturers' manuals
- Using worksheets
- Using logic components
- Using the appropriate tools and instruments
- Using wiring material

GENERAL PERFORMANCE CRITERIA

- Observance of health and safety rules
- Proper use of material
- Systematic work method
- Observance of the parameters of the circuit when switching on
- Operation in conformity with the diagrams
- Appropriate interpretation of symbols

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
A. Apply concepts of Boolean algebra.	- Observance of rules

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
B. Convert numbers from one base to another.	- Accurate conversions
C. Develop truth tables.	- Construction according to the rules - Accuracy of results
D. Reduce equations using a Karnaugh map.	- Reduction of equations with a maximum of four variables - Accuracy of results
E. Adopt safety measures.	- Systematic observance of personal and general safety measures
F. Assemble basic circuits.	- Circuits in conformity with diagrams and instructions - Neat presentation
G. Repair circuits.	- Conformity to information contained in the diagram and instructions - Appropriate selection and use of measuring meters
H. Clean up the work area.	- Neatness of work area and proper storage of 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 apply concepts of Boolean algebra (A):

1. Define the various laws of Boolean algebra.

Before learning how to convert numbers from one base to another (B):

2. Solve conversion problems in various number systems.

Before learning how to develop truth tables (C):

3. Identify the various cells or components.
4. Explain the construction of their truth table and its operation.

Before learning how to reduce equations using a Karnaugh map (D):

5. Explain Karnaugh's rules.
6. Write equations based on groups.
7. Translate equations into diagrams.

Before learning how to adopt safety measures (E):

8. Explain the usefulness of the main health and safety rules.

Before learning how to assemble basic circuits (F) and to repair circuits (G):

9. Assemble and disassemble components.

Before learning how to clean up the work area (H):

10. List the operations necessary for cleaning up.

MODULE 21: INSTALLING DC MOTORS

SIMCA: ECG 285
SESAME: 786-185

Duration: 75 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must
install and connect a DC motor and its controls
in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- With the help of one person for assembling and dismantling scaffolds
- With the help of one person for drawing conductors into conduits
- Using a plan
- Following instructions
- Referring to the Québec Electrical Code
- Using the appropriate equipment, tools and material
- Using prepared conduits
- Installing two push buttons controlling a DC motor starter

GENERAL PERFORMANCE CRITERIA

- Observance of health and safety rules
- Proper use of equipment and tools
- Respect for characteristics of motor
- Conformity to the Québec Electrical Code and the plan
- Clean, careful work
- Respect for environment and layout
- Observance of ergonomic principles

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
A. Plan the installation.	- Proper selection of necessary equipment, tools and material - Precise identification of characteristics of motor
B. Adopt safety measures.	- Systematic observance of personal and general safety measures
C. Prepare the equipment, tools and material.	- Safe handling of equipment, tools and material - Proper testing and preparation
D. Fasten the starter and the boxes.	- Proper fastening technique - Solid fastenings
E. Install the conduits and draw the conductors into them.	- Proper installation - Economical use of material - Proper technique for drawing conductors into conduits
F. Make the electrical connections and fasten the devices.	- Proper connections - Proper fastening technique - Solid fastenings
G. Test the motor.	- Proper use of measuring meters - Proper testing technique - Controls in good working order
H. Clean up the work area.	- Clean and orderly 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 installation (A):

1. Identify the different types of DC motors and generators.
2. Explain the basic operating principles of DC motors and generators.
3. Identify, using instruments, the characteristics of various DC motors and generators.
4. State the information that may be found on the nameplate of a DC motor or generator.
5. Identify the tables, sections, articles and definitions of the Québec Electrical Code related to the installation of DC motors, DC generators, and their controls.
6. Identify the various types of DC motor controls.
7. Use the concepts of direct-current circuit analysis necessary for the installation of DC motors, DC generators, and their controls.
8. Use the mathematical formulas necessary for the installation of DC motors, DC generators, and their controls.
9. Use the concepts of electronics and combinational logic necessary for the installation of DC motor and generator controls.
10. Determine the main symbols and components of a plan for the installation of DC motors, DC generators, and their controls.

Before learning how to adopt safety measures (B):

11. Identify the personal and general safety measures applicable to the installation of DC motors, DC generators, and their controls.

Before learning how to prepare the equipment, tools and material (C):

12. Identify the safety rules applicable to the handling of motors and generators.
13. Rig motors and generators.
14. Fasten DC motors and generators.

Before learning how to fasten the starter and the boxes (D):

15. Describe the techniques for fastening the starter and the boxes.

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 make the electrical connections and fasten the devices (F):

16. Describe the techniques for fastening the devices.
17. Demonstrate the techniques for connecting the various types of DC motors, DC generators, and their controls.

Before learning how to test the motor (G):

18. Switch on motors and generators.
19. Diagnose an operational problem.
20. Service motors, generators, and their controls.

MODULE 22: INSTALLING AC MOTORS

SIMCA: ECG 286
SESAME: 786-195

Duration: 75 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must
install and connect an AC motor and its controls
in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- With the help of one person for assembling and dismantling scaffolds
- With the help of one person for drawing conductors into conduits
- Using a plan
- Following instructions
- Referring to the Québec Electrical Code
- Using the appropriate equipment, tools and material
- Using prepared conduits
- Installing two push buttons controlling a magnetic AC motor starter (the starter must be mounted in a cabinet also containing a transformer and terminals)

GENERAL PERFORMANCE CRITERIA

- Observance of health and safety rules
- Proper use of equipment and tools
- Respect for characteristics of motor
- Conformity to the Québec Electrical Code and the plan
- Clean, careful work
- Respect for environment and layout
- Observance of ergonomic principles

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
A. Plan the installation.	- Proper selection of necessary equipment, tools and material - Precise identification of characteristics of motor
B. Adopt safety measures.	- Systematic observance of personal and general safety measures
C. Prepare the equipment, tools and material.	- Safe handling of equipment, tools and material - Proper testing and preparation
D. Fasten the control cabinet and the boxes.	- Proper fastening technique - Solid fastenings
E. Install the conduits and draw the conductors into them.	- Proper installation - Economical use of material - Proper technique for drawing conductors into conduits
F. Make the electrical connections and fasten the devices.	- Proper connections - Proper fastening technique - Solid fastenings
G. Test the motor.	- Proper use of measuring meters - Proper testing technique - Motor and controls in good working order
H. Clean up the work area.	- Clean and orderly 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 installation (A):

1. Identify the different types of single-phase and three-phase AC motors and generators.
2. Explain the basic operating principles of AC motors and generators.
3. Identify, using instruments, the characteristics of various AC motors and generators.
4. State the information that may be found on the nameplate of an AC motor or generator.
5. Identify the tables, sections, articles and definitions of the Québec Electrical Code related to the installation of AC motors, AC generators, and their controls.
6. Identify the various types of AC motor controls.
7. Use the concepts of alternating-current circuit analysis necessary for the installation of AC motors, AC generators, and their controls.
8. Use the mathematical formulas necessary for the installation of AC motors, AC generators, and their controls.
9. Use the concepts of electronics and combinational logic necessary for the installation of AC motors, AC generators, and their controls.
10. State the role and list the components of a control cabinet.
11. Determine the main symbols and components of a plan for the installation of AC motors, AC generators, and their controls.

Before learning how to adopt safety measures (B):

12. Identify the personal and general safety measures applicable to the installation of AC motors, AC generators, and their controls.

Before learning how to prepare the equipment, tools and material (C):

13. Identify the safety rules applicable to the handling of motors and generators.
14. Rig motors and generators.
15. Fasten motors or generators.

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 fasten the control cabinet and the boxes (D):

16. Describe the techniques for fastening the control cabinet and the boxes.

Before learning how to make the electrical connections and fasten the devices (F):

17. Describe the techniques for fastening the devices.
18. Demonstrate the techniques for connecting the various types of AC motor and generator controls.

Before learning how to test the motor (G):

19. Switch on motors and generators.
20. Diagnose an operational problem.
21. Service motors, generators, and their controls.

MODULE 23: SEQUENTIAL LOGIC

SIMCA: BDF 289
SESAME: 842-304

Duration: 60 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must
apply concepts of sequential logic
in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Using reference manuals
- Using manufacturers' specification sheets
- Using a system diagram
- Using logic components
- Using the appropriate tools and instruments
- Using wiring material

GENERAL PERFORMANCE CRITERIA

- Observance of health and safety rules
- Neat presentation of circuits or diagrams
- Proper use of material
- Observance of the parameters of the circuit when switching on
- Operation in conformity with the plans

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
A. Select the various components.	- Proper selection of components based on their application

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
B. Draw diagrams.	- Neatness of diagrams - Observance of rules
C. Adopt safety measures.	- Systematic observance of personal and general safety measures
D. Assemble circuits.	- Conformity to diagrams and instructions - Respect for characteristics of components
E. Repair circuits.	- Conformity to information contained in the diagram and instructions - Appropriate selection and use of measuring meters
F. Clean up the work area.	- Neatness of work area and proper storage of 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 select the various components (A):

1. Identify the components.
2. Interpret the symbols.
3. Describe the roles of the various components.

Before learning how to draw diagrams (B):

4. Describe the various start, stop and run modes.

Before learning how to adopt safety measures (C):

5. Explain the usefulness of the main health and safety rules.

Before learning how to assemble circuits (D):

6. Use tools and equipment correctly and carefully.
7. Install the components correctly.
8. Show concern for the good working order of components.

Before learning how to repair circuits (E):

9. Adjust the various parameters of the circuits correctly.
10. Detect one or several problems.
11. Show concern for the good working order of components.

Before learning how to clean up the work area (F):

12. List the operations necessary for cleaning up.

MODULE 24: INSTALLING PROGRAMMABLE CONTROLLERS

SIMCA: ECH 283
SESAME: 786-254

Duration: 60 hours

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

EXPECTED BEHAVIOUR

To demonstrate the required competency, the students must
install and connect a programmable controller
in accordance with the following conditions, criteria and specifications.

CONDITIONS FOR PERFORMANCE EVALUATION

- Working alone
- Using plans
- Following instructions
- Referring to manufacturer's instructions
- Using the appropriate equipment, tools and material
- Installing a programmable controller and the elements necessary for its power supply and for control of input and output (two input devices and two output devices will have to be installed)

GENERAL PERFORMANCE CRITERIA

- Observance of health and safety rules
- Proper use of equipment and tools
- Conformity with plan
- Clean, careful work
- Respect for environment and layout

FIRST-LEVEL OPERATIONAL OBJECTIVE
BEHAVIOURAL OBJECTIVE

SPECIFICATIONS OF THE EXPECTED BEHAVIOUR	SPECIFIC PERFORMANCE CRITERIA
A. Interpret the plans.	- Correct positioning of components - Correct interpretation of wiring plan - Adequate sketch of installation
B. Plan the installation.	- Appropriate selection of necessary equipment, tools and material
C. Adopt safety measures.	- Systematic observance of personal and general safety measures
D. Prepare the equipment, tools and material.	- Safe handling of equipment, tools and material - Proper testing and preparation
E. Position and fasten the cabinet, the controller and the devices.	- Correct positioning - Proper fastening technique - Solid fastenings
F. Position the wires and make the electrical connections.	- Proper positioning of wires - Economical use of material - Proper connections
G. Check the controller's power supply and the input and output control circuit.	- Correct voltage - Control circuit in good working order
H. Clean up the work area.	- Clean and orderly 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 interpret the plans (A):

1. Be familiar with the general components of a programmable controller.
2. Describe the operating principle and use of a programmable controller.
3. Determine the main symbols and components of a wiring plan and a plan for the installation of a programmable controller.

Before learning how to plan the installation (B):

4. Use the concepts of direct- and alternating-current circuits necessary for the installation of a programmable controller.
5. Use the concepts of electronics, combinational logic and sequential logic necessary for the installation of programmable controllers.
6. Use the concepts of communication necessary for the installation of programmable controllers.

Before learning how to prepare the equipment, tools and material (D):

7. Identify the precautions to take when handling programmable controllers.

Before learning how to position and fasten the cabinet, the controller and the devices (E):

8. Describe the fastening techniques.

Before learning how to position the wires and make the electrical connections (F):

9. Describe the wiring and connecting techniques.

Before learning how to check the controller's power supply and the input and output control circuit (G):

10. Describe the procedures for testing the power supply and the input and output control circuit.

MODULE 25: JOB-SEARCH TECHNIQUES

SIMCA: ECH 286
SESAME: 786-281

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
use job-search techniques.

SPECIFICATIONS

At the end of this module, the students will:

- Plan a job search in the construction industry in Québec.
- Become familiar with writing a résumé and a letter of introduction.
- Identify the attitudes and behaviours to adopt and to avoid when looking for a job.

LEARNING CONTEXT

PHASE 1: **Planning a Job Search**

- Being familiar with the characteristics of a job search in the construction industry in Québec.
- Describing the steps involved in a job search in the construction industry.
- Planning their job search.

FIRST-LEVEL OPERATIONAL OBJECTIVE
SITUATIONAL OBJECTIVE

LEARNING CONTEXT

PHASE 2: **Job-Search Techniques**

- Gathering the information necessary for writing a résumé and a letter of introduction.

- Determining the proper attitudes and behaviours to adopt when establishing professional contacts.

PHASE 3: **Self-Evaluation**

- Recognizing their strengths and weaknesses with respect to job-search techniques.

INSTRUCTIONAL GUIDELINES

The teacher should:

- Make suitable reference material available to the students.
- Ensure that the students understand the particular context of looking for a job in the construction industry.
- Help the students with their research and their decisions.

PARTICIPATION CRITERIA

PHASE 1:

- Establish a sufficiently complete list of the steps involved in a job search.

PHASE 2:

- Possess most of the information necessary to write their résumé and letter of introduction.
- Name a few attitudes and behaviours to adopt when establishing contacts prior to obtaining a job.

FIRST-LEVEL OPERATIONAL OBJECTIVE
SITUATIONAL OBJECTIVE

PHASE 3:

- Specify some personal strengths and weaknesses with respect to job-search techniques.

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 (Planning the Job Search):

1. Describe the steps involved in looking for a job.
2. Determine the labour associations and organizations that can help them get a job in the construction industry.
3. Identify the resources and institutions whose purpose it is to help people find jobs.
4. Name the firms to contact when looking for a job in the construction industry.

Before undertaking the activities of Phase 2 (Job-Search Techniques):

5. List the various job-search techniques.
6. List the information contained in a résumé and a letter of introduction.
7. Consult references on how to write a résumé and a letter of introduction.
8. Justify the usefulness of a résumé and a letter of introduction when looking for a job as a construction electrician.