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MECHANICAL MANUFACTURING

INDUSTRIAL MACHINERY OPERATION

PROGRAM OF STUDY
5730

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5730**

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MECHANICAL MANUFACTURING

INDUSTRIAL MACHINERY OPERATION

PROGRAM OF STUDY 5730

The *Industrial Machinery Operation* program leads to the Diploma of Vocational Studies (DVS) and prepares the student to practise the trade of industrial machinery operator.

Direction générale de la formation
professionnelle et technique

This program of study, *Industrial Machinery Operation*, is issued in accordance with section 461 of the *Education Act* (R.S.Q., c. I-13.3).

In conformity with the provisions of paragraph (a) of section 23 of the *Act respecting the Conseil supérieur de l'éducation* (R.S.Q., c. C-60), as replaced by section 569 of chapter 84 of the 1988 legislation, the confessional committees of the Conseil supérieur de l'éducation have given their opinion on this program of study.

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FOREWORD

Planning studies have shown that the tasks of industrial machinery operators have evolved considerably in the past few years. These changes are due to the requirements associated with quality production, an organization of work focused on job enrichment, the autonomy and accountability of individuals and teams, and the implementation of new technologies. All of these changes have contributed to an increase in the level of competence required for entry into the job market. The studies have also identified a significant labour need, not only in the manufacture of metal and electrical products, but in other sectors of economic activity as well, such as the food and beverage industry, and the wood processing, textile and polymer industries.

Given these changes, the Direction générale de la formation professionnelle et technique has modified the general orientation of the *Industrial Machinery Operation* program initially designed for the mechanical manufacturing sector. The new program meets the needs of various sectors of economic activity requiring this type of labour. Authorized educational institutions will determine, in concert with those responsible for socio-economic development in their region, the sectors of activity on which to focus. This orientation therefore allows for leeway at the local level in order to more effectively meet the specific labour needs of each region.

The implementation of this program necessarily implies close cooperation between the educational institution and the industrial community in the region since it is highly unlikely that a vocational education centre could simulate a sufficiently complex and automated industrial production process.

Although a significant portion of the training must be acquired in the workplace, the educational institution must ensure that the program contributes effectively to the students' basic education and versatility in order to enable them to transfer their learning to any type of company. If the objectives of the program are to be met, the cooperation of the company in the learning process must be analyzed from two points of view: the variety and complexity of industrial machines on which the students will be learning, and the transferability of learning to other types of machines or systems, including those used in other industrial sectors. The selected learning activities must therefore allow the students to situate their role and actions within the production system and to develop their ability to quickly learn how new machines work rather than focusing on immediate performance on the particular machines used during the practical training period.

INTRODUCTION

The *Industrial Machinery Operation* program is based on a 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. 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 Diploma of Vocational Studies (DVS) 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 900 hours, which includes 465 hours spent on the specific competencies required to practise the trade and 435 hours on general competencies. The program of study is divided into 15 modules, which vary in length from 15 to 105 hours (multiples of 15). The time allocated to the program is to be used not only for teaching but also for evaluation and remedial work.

The 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. It also contains suggestions regarding the instructional approach and related content for each module in the program. The suggestions are intended for users of the program and are provided for informational purposes only.

GLOSSARY

Competency

A set of knowledge, skills, perceptions and attitudes that enable a person to correctly perform a work-related activity or task.

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.

General Objectives

Expression of the educational aims of a program in terms of competencies to be developed. The general objectives are broken down into operational objectives.

Module of a Program

A component part of a program of study comprising an operational objective.

Operational Objectives

Statements of the educational aims of a program in practical terms. They serve as the basis for teaching, learning and evaluation. In the competency-based approach, the educational aims are expressed as competencies to be developed.

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.

Part I

1. SYNOPTIC TABLE

Number of modules: 15
Duration in hours: 900
Credits: 60

Industrial Machinery Operation
Code: 5730

CODE	NO.	TITLE OF THE MODULE	HOURS	CREDITS*
869 512	1	The Trade and the Training Process	30	2
869 525	2	Interpreting Technical Drawings	75	5
869 534	3	Solving Mathematical Problems Related to Industrial Machinery Operation	60	4
869 543	4	Relationships Between the Product to Be Manufactured and the Production Process	45	3
869 552	5	Using a Computerized Workstation	30	2
869 564	6	Quality Control	60	4
869 571	7	Health and Safety	15	1
869 586	8	Shopwork	90	6
869 592	9	Handling Materials	30	2
869 601	10	Job Search Techniques	15	1
872 153	11	New Types of Work Organization	45	3
869 617	12	Operating Conventional Machinery	105	7
869 627	13	Operating an Automated Production System	105	7
869 636	14	Maintaining Machinery	90	6
869 647	15	Entering the Workforce	105	7

* 15 hours = 1 credit

This program leads to a DVS in *Industrial Machinery Operation*.

2. PROGRAM TRAINING GOALS

The *Industrial Machinery Operation* program is designed to train individuals to apply, in whole or in part, the process for manufacturing a product. These individuals will be able to prepare raw and processed materials and machinery; operate conventional or automated production equipment; ensure quality control of manufactured products; handle raw materials and products; prepare products for shipping; and carry out preventive maintenance on the equipment made available to them.

Graduates may practise their trade in a variety of sectors of activity (e.g. mechanical manufacturing, food, wood, textiles, polymers). This requires that the students be able to quickly understand the way a machine or system works, follow the appropriate procedure, find out about the health and safety risks involved, and apply the necessary preventive measures.

This program prepares students to work with equipment of average complexity, including so-called conventional machines, as well as automated production systems. The degree of complexity targeted will include at least:

- control of a workstation comprising at least three machines (e.g. processing, assembly) making up a production line;
- automation of part or all of the control of machines requiring input on different types of interfaces between the operator and the machine;
- a conventional or computerized production system requiring that data be read, input and interpreted, as well as compiled, in particular for purposes of production management and quality control.

Since production equipment in a plant can be found all together or in several different departments, the students must be able to visualize the entire production process in order to understand the effects of their actions on subsequent operations.

In order to ensure the versatility of graduates, the program includes cross-curricular competencies (i.e. solving mathematical problems, interpreting drawings, using a computerized workstation, quality control, occupational health and safety, shopwork, new types of work organization, handling, and maintenance. In addition, four competencies are specific to a given sector: establishing relationships between the product to be manufactured and the production process, operating conventional machinery, operating an automated production system, and entering the workforce.

In accordance with the general goals of vocational education, the training goals of this program are:

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

- To teach students to perform industrial machinery operation tasks and activities correctly, at an acceptable level of competence for entry into the job market.
- To prepare students to perform satisfactorily on the job by fostering:
 - the intellectual skills and techniques needed to organize their thoughts and make wise choices in performing tasks;
 - the ability to organize their work in accordance with production requirements;
 - the ability to understand instructions and procedures manuals;
 - a concern for precision and detailed work;
 - a sense of responsibility with respect to the quality of their work;
 - a constant concern for occupational health and safety;
 - the ability to establish interpersonal relations and work in a team;
 - the acquisition of a technical vocabulary in English and French.

2. To ensure integration into the job market.

- To familiarize students with the job market in general and the trade of industrial machinery operator in particular.
- To familiarize students with new concepts in work organization.
- To familiarize students with their rights and responsibilities as workers.

3. To foster personal and vocational development.

- To help students improve their ability to adapt to change.
- To help students develop their autonomy so that they can become familiar with new technologies.
- To help students understand the relationships between the product to be manufactured and the production process.

4. To ensure job mobility.

- To help students achieve the versatility required to work with conventional and automated machinery in various sectors of economic activity.
- To help students develop a positive attitude toward technological change and professional development.
- To help students develop problem-solving skills.
- To help students prepare for a creative job search.

3. COMPETENCIES

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

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

The grid of learning focuses shows the relationship between the general competencies on the horizontal axis and the specific competencies on the vertical axis. The symbol Δ indicates a correlation between a specific competency and a step in the work process. The symbol O indicates a correlation between a general and a specific competency. Shaded symbols 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 IN INDUSTRIAL MACHINERY OPERATION		FIRST-LEVEL OPERATIONAL OBJECTIVES	DURATION (IN HOURS)	WORK PROCESS (major steps)					GENERAL COMPETENCIES (related to technology, subjects, personal development, etc.)									TOTALS	
				Become familiar with the instructions	Plan the work	Do the work	Carry out quality control	Tidy up	* Interpret technical drawings	* Solve mathematical problems related to industrial machinery operation	* Establish relationships between the product to be manufactured and the production process	Use a computerized workstation	* Carry out the quality control of products	* Avoid occupational health and safety risks	* Do shopwork	* Use job search techniques	Adapt to new types of work organization	NUMBER OF OBJECTIVES	DURATION (IN HOURS)
MODULES	MODULES								2	3	4	5	6	7	8	10	11		
	FIRST-LEVEL OPERATIONAL OBJECTIVES								B	B	B	B	B	B	B	S	B	9	
	DURATION								75	60	45	30	60	15	90	15	45		435
1	Determine their suitability for the trade and the training process	S	30	△	△	△	△	△	○	○	○	○	○	○	○	○	○		
9	Handle materials	B	30	▲	▲	▲	△	▲		●	○	●		●			○		
12	Operate conventional machinery	B	105	▲	▲	▲	▲	▲	●	●	●		●	●	●		●		
13	Operate an automated production system	B	105	▲	▲	▲	▲	▲	●	●	●	●	●	●	●		●		
14	Maintain machinery	B	90	▲	▲	▲	▲	▲	●	●	●	●	●	●	●		●		
15	Enter the workforce	S	105	▲	▲	▲	△	▲	○	○	○	○	○	○	○	○	○		
NUMBER OF OBJECTIVES		6																15	
DURATION (IN HOURS)			465																900

S: Situational objectives
B: Behavioural objectives

△ 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

* Competencies harmonized with the DVS in Machining Techniques

4. GENERAL OBJECTIVES

The general objectives of the *Industrial Machinery Operation* program are presented below, along with the major statement of each corresponding operational objective.

To develop in the students the basic competencies required to perform trade-related tasks.

- Solve mathematical problems related to industrial machinery operation.
- Interpret technical drawings.
- Avoid occupational health and safety risks.
- Carry out the quality control of products.
- Establish relationships between the product to be manufactured and the production process.
- Do shopwork.
- Use a computerized workstation.

To develop in the students the competencies specific to industrial machinery operation.

- Handle materials.
- Operate conventional machinery.
- Operate an automated production system.
- Maintain machinery.

To develop in the students the competencies required to actively participate in multidisciplinary teams in the workplace.

- Adapt to new types of work organization.

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

- Determine their suitability for the trade and the training process.
- Enter the workforce.
- Use job search techniques.

5. OPERATIONAL OBJECTIVES

5.1 DEFINITION

An operational 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.

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.

5.2 HOW TO READ AN OPERATIONAL OBJECTIVE

A. How to Read a Behavioural Objective

Behavioural objectives consist of five components. The first two provide an overview of the objective:

- 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.
- The **conditions for performance evaluation** define what is necessary or permissible to the students during evaluation designed to verify whether or not they have attained the objective. This means that the conditions for evaluation are the same wherever and whenever the program is taught.

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

- The **specifications of the expected behaviour** describe the essential elements of the competency in terms of specific behaviours.
- 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.
- 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.

The third column, **suggested approach or related content**, gives additional information about the learning activities, to be used for informational purposes only. It is important that educational institutions update this information regularly to reflect changes in the job market.

B. How to Read a Situational Objective

Situational objectives consist of six components, and are compulsory. Objectives of this type are found in the first two columns.

- The **expected outcome** states a competency as an aim to be pursued throughout the course.
- The **specifications** outline the essential aspects of the competency and ensure a better understanding of the expected outcome.
- The **learning context** provides an outline of the learning situation designed to help the students develop the required competency. It is normally divided into three phases of learning:
 - information
 - performance, practice or involvement
 - synthesis, integration and self-evaluation
- The **instructional guidelines** suggest ways and means of teaching the course to ensure that learning takes place and that it takes place under the same conditions everywhere. These guidelines may include general principles or specific procedures.
- The **participation criteria** describe the requirements the students must fulfil. 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.
- 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.

The third column, **suggested approach or related content**, gives additional information about the learning activities, to be used for informational purposes only. It is important that educational institutions update this information regularly to reflect changes in the job market.

Part II

MODULE 1: THE TRADE AND THE TRAINING PROCESS		CODE: 869 512 30 hours
Expected Outcome	Instructional Guidelines	Suggested Approach
Determine their suitability for the trade and the training process. Specifications: • Become familiar with the nature of the trade. • Understand the training plan. • Confirm their career choice. • Become aware of the importance of the new types of work organization. • Become familiar with learning strategies they can use to keep abreast of technological developments.	• Create a climate that helps the students to enter the job market. • Encourage the students to engage in discussions and express themselves. • Help the students acquire an accurate perception of the trade, especially with respect to the new types of work organization. • Provide the students with the means to assess their career choice honestly and objectively. • Organize field trips to companies that are representative of the work environment, visits to exhibitions, meetings with trade specialists, conferences, etc. • Make available to the students a selection of relevant literature. • Provide the students with an outline for their report and help them produce their documents.	• This program was designed to meet the labour needs in industrial machinery operation in various sectors and to ensure students' versatility. Sectors should be chosen in close cooperation with the different socio-economic partners in the region in order to adapt the program to regional labour needs. • The primary goal of this competency is to allow the students to confirm their career choice. • An overview of the different industries in the region will help the students obtain an enlightened view of job opportunities in the different sectors. • Practice of the trade in the sector(s) chosen by the educational institution could be explored through visits, videos, magazines, prospectuses, the job situation analysis report, etc. • An observation checklist would make it easier to follow the students' progress in developing this competency. • This program can make use of a number of instructional approaches (i.e. work-study, apprenticeship, practicums).

Learning Context	Participation Criteria	Suggested Related Content
PHASE 1: Information on the Trade • Learning about the types of companies that employ industrial machinery operators and about the different types of work organization. • Describing factory production and the different jobs involved.	• Gather information on most of the topics to be covered. • Express their views on the trade and sector at a group meeting, relating them to the information they have gathered.	• Size of the company, sector of economic activity, type of clientele, type of production, manufacturing processes and use of new types of equipment • Management approaches and types of work organization • Stages in the production process: - research and development of new products and processes - optimization of production - training of personnel - planning - performance of transformation or manufacturing processes - inspection (planning and testing) - planning and performance of equipment maintenance - application of management techniques • Association of the stages with specific jobs within a company • Position of the trade in a company organizational chart

Learning Context	Participation Criteria	Suggested Related Content
• Learning about the nature and requirements of the job. • Examining trade-related tasks and operations. • Examining the skills and behaviours needed to practise the trade. • Presenting the information gathered and discussing their views on the advantages, disadvantages and requirements of the trade at a group meeting.		• Reference to Chapter 1 of the job situation analysis report: work environment, job prospects, salaries, opportunities for transfer and advancement, selection of candidates, etc. • Specific requirements of the job • Determination of duties and responsibilities of workers • The role of workers in various work teams • Participation in the optimization of production • Reference to Chapter 2 of the job situation analysis report • Reference to Chapter 3 of the job situation analysis report • Rules governing group discussion • Attitudes and behaviours: respect, politeness, attentiveness • Definition of their preferences and interest with respect to industrial machinery operation

Learning Context	Participation Criteria	Suggested Related Content
PHASE 2: Information on Training and Participation in the Training Process • Learning about the program of study and the training process. • Sharing their initial reactions to the trade and the training program. • Learning about the concept of techno-watch and further training.	• Study carefully the written material provided. • Express their views on the program of study at a group meeting. • Gather information about techno-watch.	• Program of study: synoptic table, program training goals and general objectives, specific objectives and standards • Evaluation, certification of studies and course structure • Comparisons between the job situation analysis report and the competencies included in the program • Opportunities afforded by technological development, new types of work organization, new materials, etc. • Resources for the continual upgrading of knowledge with respect to technological development • Adaptation to new management approaches • Career progress • Change of career direction • Development of trade-related knowledge, general knowledge, etc. • Examination of opportunities afforded by further training

Learning Context	Participation Criteria	Suggested Related Content
- Learning about training aids for: - researching - organizing information - memorizing - archiving	- Gather information about learning strategies. - Identify their learning style and preferred strategies.	- Research methods - Effective reading techniques - Types of questions to ask to find missing information - Examples of mnemonic techniques: - imagination – visualization (creation of mental images) - association – classification (visual, logical, sound associations, etc.) - substitution – simplification (acronyms, acrostics, etc.) - mnemonic cards - Methods of classifying information
PHASE 3: Evaluation and Confirmation of Their Career Choice - Producing a report in which they: - state their preferences, aptitudes and interest with respect to the trade - assess their career choice by comparing the different aspects and requirements of the trade with their own preferences, aptitudes and interests	- Using the outline provided by the instructor, write a report that: - sums up their preferences, aptitudes and interests - explains clearly how they arrived at their career choice	

MODULE 2: INTERPRETING TECHNICAL DRAWINGS		CODE: 869 525 75 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach
Interpret technical drawings.	- Given: - detail and assembly drawings in metric and imperial units of measurement - drawings illustrating an assembly method or other illustrations - instructions - Using: - technical documentation - tables - drafting standards	- Select drawings that will be used for the specific competencies. - Help the students develop spatial perception by having them read examples of descriptive geometry. - Keep assembly drawings for the end of the module. - Research related to the manufacture of parts should be integrated into the relevant specific competencies. - Accustom the students to consulting drawings that use English and French terminology. - In order to ensure versatility, use drawings representative of the various industries in the region.

Specifications	Performance Criteria	Suggested Related Content
1. Visualize a complete part.	1.1 Accurate differentiation among the types of projections: - American and European orthographic projections - axonometric projections 1.2 Proper identification of views and sections 1.3 Accurate interpretation of lines and hatching lines 1.4 Accurate identification of part on assembly drawing 1.5 Accurate observations of the shape of the part and its position in the whole 1.6 Proper drawing of symmetry of illustrated part 1.7 Relevant association of lines, points and surfaces in different views	• Arrangement of views • Perspectives • Projection plane • Contour lines • Visible and hidden lines • Centre lines • Top view • Front view • Side view (right and left) • Full, partial, half and broken-out sections • Auxiliary views: depth dimensions, front view, top view • Revolved and removed sections • Standard hatching lines for the materials used • Sectional plan • Break line • Standards and conventions • Cut-away view of threads • Principles underlying projection • Reference plane

Specifications	Performance Criteria	Suggested Related Content
2. Interpret the dimensioning.	2.1 Thorough identification of information needed for the job: - dimensions - dimensions with tolerances - form and positioning tolerances, and backlash - nomenclature of threads - fit tolerances 2.2 Determination of value of: - dimensions - dimensions with tolerances - form tolerances - positioning tolerances - backlash - size and location dimensions 2.3 Relevant associations between the dimensions and the surfaces of various views	• Extension line • Dimension line • Standardized dimensioning • Dimensions with tolerances: reference, basic, minimum and maximum dimensions, and minimum and maximum limits • Form tolerances: straightness, flatness, circularity and cylindricity • Positioning tolerances: location, parallelism, squareness, coaxiality, symmetry and angularity • Single and double backlash • Standardized adjustments: - clearance fit - transition fit - interference fit • Symbols • Modifying symbols • Reference surfaces
3. Find complementary information in technical drawings.	3.1 Proper identification of information in: - title block - list of terms used - annotations 3.2 Thorough identification of information needed 3.3 Accurate interpretation of symbols, codes and abbreviations	• Scale, codification of materials, symbols, abbreviations, etc. • Tolerances, surface conditions, symbols, roughness index, etc. • Standards and conventions

Specifications	Performance Criteria	Suggested Related Content
4. Determine the function of the components of an assembly.	4.1 Thorough identification of the components of an assembly in an assembly drawing 4.2 Recognition of the characteristics of the components 4.3 Recognition of the function of each component of the assembly and its relationship with the other components	• Functions: permanent or temporary installation, fastening, transformation of motion, power transmission, leak tightness, stops, etc. • English and French terminology • Diagrammatic view • Parts • Fasteners • Seals • Bushings and bearings • Principles underlying assembly • Principles underlying motion and power

MODULE 3: SOLVING MATHEMATICAL PROBLEMS RELATED TO INDUSTRIAL MACHINERY OPERATION CODE: 869 534 60 hours		
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach
Solve mathematical problems related to industrial machinery operation.	• Given: - written instructions - problems representative of those encountered in the trade - technical drawings in metric and imperial units of measurement • Using: - tables and graphs - technical manuals - a calculator	• Provide students with individualized support. • Review the basic operations, the rule of three and the transformation of formulae. Then, have the students do calculations related to the manufacture of products and quality control. • Use a variety of problems to represent the reality of the trade.

Specifications	Performance Criteria	Suggested Related Content
1. Convert measurements from the metric to the imperial system and vice versa.	1.1 Proper use of conversion tables 1.2 Proper choice of formulae 1.3 Proper application of conversion formulae 1.4 Accurate calculations	• Decimals and fractions • Conversion of units of length, weight and volume • Conversion factors and tables in the metric and imperial systems of measurement • Use of a calculator
2. Calculate surfaces, volumes, flows, pressures and weights.	2.1 Accurate calculations 2.2 Use of appropriate mathematical formulae 2.3 Proper use of density tables	• Units of length, weight and volume

Specifications	Performance Criteria	Suggested Related Content
3. Calculate manufacturing parameters.	3.1 Accurate identification of information about manufacturing parameters in tables 3.2 Proper use of the appropriate tables and graphs 3.3 Proper choice of formulae 3.4 Correct application of formulae 3.5 Accurate calculations	• Method of consulting tables and graphs • Items to locate in reference tables and technical manuals: manufacturing parameters, values related to manufacturing and quality control • Parameters for processing or machining wood, metals and plastics: cutting speed, rpm, feed rate and depth of cut • Definition of elements of formulae • Basic formulae related to the calculation of machining parameters • Volume of material removed per minute • Method of calculating using the rule of three • Application and transformation of formulae • Method of calculating the speed of pulleys and gear systems in order to adjust certain parameters (enrichment activity) • Metric and imperial systems of measurement • Use of a calculator

Specifications	Performance Criteria	Suggested Related Content
4. Find missing dimensions.	4.1 Determination of calculations required for the job: - linear and circular dimensions - angles - polar and rectangular coordinates 4.2 Accurate identification, in drawings, of the information needed for the calculations 4.3 Proper application of: - formulae - Pythagorean theorem - trigonometric functions 4.4 Proper adaptation of mathematical formulae 4.5 Accurate results 4.6 Logical problem-solving approach	• Simple geometric analysis • Solution of right-angle triangles: Pythagorean theorem and trigonometric functions • Technique of solving a triangle by breaking it down into right-angle triangles • Application and transformation of formulae • Calculation of polar and rectangular coordinates • Conversion of polar coordinates into rectangular coordinates and vice versa • Solution of problems requiring analysis and reasoning • Metric and imperial systems of measurement

MODULE 4: RELATIONSHIPS BETWEEN THE PRODUCT TO BE MANUFACTURED AND THE PRODUCTION PROCESS			CODE: 869 543	45 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach		
Establish relationships between the product to be manufactured and the production process.	- Using: - relevant technical documentation in English and in French - samples of raw or processed materials - technical drawings - data sheets	- This module is designed to introduce students to raw or processed materials, as well as the processes and machinery used in the chosen sector(s) of activity. - It is strongly recommended that the instructor cover the three main sectors of economic activity in the region in order to ensure the students' versatility. The students should then focus on one of the three sectors in the workplace. - Provide the students with samples of the materials studied. - Use prospectuses, videos and materials provided by the industries in the region. - Refer to the visit to the workplace in Module 1, if applicable. - Arrange demonstrations on machinery in the school. - A few hours in the workplace should be devoted to learning about products, materials, and more specialized machinery used in the sector chosen by the student. - Help students develop the desire to remain informed about developments in the trade. - Provide the students with tools and techniques for learning and classifying information on their own.		

Specifications	Performance Criteria	Suggested Related Content
1. Recognize the properties of raw or processed materials needed to manufacture a product.	1.1 Recognition of products manufactured in the sector and, in particular, in the plant 1.2 Accurate identification of raw or processed materials used 1.3 Recognition of their properties 1.4 Accurate interpretation of identification codes 1.5 Proper identification of the risks associated with handling certain materials 1.6 Use of accurate English and French terminology	<i>Related content specific to the chosen sectors</i> <i>Metal and electrical products</i> • Types of ferrous and non-ferrous metals and composites • Commercial forms of materials • Electrical and electronic materials, etc. <i>Wood products</i> • Types of wood, commercial forms, etc. <i>Textiles</i> • Types of fibres (cotton, wool, silk, synthetic fibres, etc.) • Types of fabric, yarns and knits • Types of products, etc. <i>Food</i> • Raw materials: meats and meat substitutes, grains, fruits and vegetables, dairy products • Raw materials used to make beverages <i>Polymers</i> • Thermoplastic materials (linear or branched) • Thermosetting materials (amorphous and infusible) • Elastomers, etc.

Specifications	Performance Criteria	Suggested Related Content
2. Recognize the properties of the chemicals or additives used, as well as the associated risks.	2.1 Accurate differentiation among the types of chemicals and additives used in the manufacture and finishing of a product 2.2 Recognition of their properties and their effects on the product being manufactured 2.3 Accurate description of the precautions to take to ensure a quality product 2.4 Accurate association of risks with preventive measures for: - health and safety - environmental protection 2.5 Use of accurate English and French terminology	<i>Related content specific to the chosen sectors</i> <i>Metal and electrical products</i> • Lubricants, degreasers and plating products, etc. <i>Wood products</i> • Glues, finishing products, solvents, etc. <i>Textiles</i> • Dyes, glues, solvents, etc. <i>Food</i> • Colouring agents, chemical additives, etc. <i>Polymers</i> • Colorants, chemical additives, finishing products, etc. <i>Other suggested related content</i> • Knowledge of products related to manufacture, finishing and cleaning • Health, safety and environmental risks • Waste disposal • Finishing product contaminants

Specifications	Performance Criteria	Suggested Related Content
3. Find out what standards and requirements apply to the product to be manufactured.	3.1 Recognition of quality criteria or standards related to: - production - finishing - the work area 3.2 Accurate association of standards with the characteristics of the product that are required by the company	<i>Related content specific to the chosen sectors</i> <i>Metal and electrical products</i> • Surface finishes, tolerances, etc. <i>Wood products</i> • Surface finishes, tolerances, etc. <i>Textiles</i> • Thread tension, dye, glue, etc. <i>Food</i> • Hygiene standards <i>Polymers</i> • Colouring, density, etc.

Specifications	Performance Criteria	Suggested Related Content
4. Recognize the processes or treatments required.	4.1 Accurate differentiation among the processes or treatments used during production 4.2 Accurate association of processes and treatments with the stages of a manufacturing process 4.3 Appropriate associations between the characteristics of the processes or treatments and the operating limits of raw or processed materials 4.4 Use of accurate English and French terminology	<i>Related content specific to the chosen sectors</i> <i>Metal and electrical products</i> • Primary processing: lamination, roll bending, extrusion • Secondary processing: moulding, shaping, machining • Heat treatments • Surface treatments, etc. <i>Wood products</i> • Primary processing • Secondary processing: cutting, processing, sanding, assembling, finishing, upholstering, etc. <i>Textiles</i> • Primary processing: throwing, picking, carding, spinning • Secondary processing: dyeing, pasting, weaving, finishing, etc. <i>Food</i> • Cooking, fermentation, etc. <i>Polymers</i> • Injection, thermoforming, extrusion, extrusion blow moulding, rotational moulding, etc. <i>Other suggested related content</i> • Evolution of the industry • Processing operations: - preparation of raw materials - manufacturing - finishing - assembly - preparation for shipping • Awareness of production costs and the optimal use of raw and processed materials • Accountability of employee

Specifications	Performance Criteria	Suggested Related Content
5. Associate the machinery in the plant with the processes used.	5.1 Recognition of the main types of machines used for each process 5.2 Determination of the complexity of operating these machines 5.3 Recognition of the capacities and operating limits of the main machines	• Characteristics of the machines used in the chosen sector(s)

MODULE 5: USING A COMPUTERIZED WORKSTATION			CODE: 869 552	30 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach		
Use a computerized workstation.	• Using: - a computerized workstation - a word processing program - relevant technical documentation in English and in French	• This module is designed to introduce the students to computers. According to a study conducted by the school boards, employers would prefer that the operators they hire have a knowledge of computers. • Use this competency to introduce the formatting of a résumé. You might provide the students with a sample résumé in electronic form. They could then learn by reformatting the sample.		

Specifications	Performance Criteria	Suggested Related Content
1. Prepare a workstation.	1.1 Recognition of the components of the computer and its peripherals 1.2 Methodical inspection of connections 1.3 Functional and ergonomic organization of workstation 1.4 Proper preparation of printer	• The computer, its components and its peripherals • The importance of observing ergonomic rules • Distinction among the types of software programs • Distinction among the types of memory • Definition of terms related to microcomputers and their operation • Ways in which computer viruses are transmitted • Distinction between a standalone and a network workstation • Role of the mouse, keyboard, menus and memory management programs • Means of accessing different software programs and their menus • Display of the contents of a diskette or hard disk • Start-up and shutdown of a workstation • Replacement of printer paper and cartridge

Specifications	Performance Criteria	Suggested Related Content
2. Use the basic functions of an operating system.	2.1 Proper use of the main functions of a graphics environment, such as windows, dialog boxes, menu bars, tool bars and scroll bars 2.2 Observance of procedure for creating, saving and printing documents 2.3 Proper use of the main functions of the file manager for different storage media: hard disk, diskette, CD-ROM 2.4 Proper formatting of diskettes 2.5 Accurate association of types of files with the main types of software programs 2.6 Observance of procedure for ending a work session	• Opening an application • Selecting options from the menu bar using the keyboard and the mouse • Changing the size of a window • Closing a window • Making backup copies • Using the file manager: - creating a file - creating a directory - making a copy of a directory on the hard disk - deleting a file or directory • Formatting a diskette using the keyboard and the mouse • Procedure for turning off the computer
3. Use the help function.	3.1 Efficient search of help function and technical documentation 3.2 Proper interpretation and application of suggested solutions 3.3 Accurate interpretation of English and French terms	• Use of instruction manuals for: - the operating system - the computer's peripherals

Specifications	Performance Criteria	Suggested Related Content
4. Input and format a short text.	4.1 Proper use of the main functions on the formatting and standard tool bars 4.2 Use of the appropriate commands for: - formatting - making changes to a text - numbering pages - creating a table - using the calculate function in a table - using a dictionary - printing	• Opening a software program • Using the menu bars • Size and appearance of characters • Opening an existing document • Margins and alignment • Arrangement of text: - line - columns - page - document • Selecting, copying and moving blocks of text • Functions to create a table and do calculations • Print preview function and printing documents • Inserting dates in documents

MODULE 6: QUALITY CONTROL		CODE: 869 564 60 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach
Carry out the quality control of products.	- Given: - assembly or detail drawings in metric or imperial units of measurement - the required quality standards - Using: - general measuring instruments and devices used in different sectors - tables and graphs - conversion tables - technical manuals - a calculator - measurement records - cleaning products and lubricants	- This module is designed to help the students develop the ability to use the most common measuring instruments to carry out the quality control of products. - A few hours in the workplace should be devoted to learning about instruments specific to the trade. - Review the concept of quality control in the modules entitled <i>Operating Conventional Machinery</i> and <i>Operating an Automated Production System</i>. - Demand serious, quality work. - Emphasize the importance of quality control. - Introduce the students to a quality control software program used in some companies. - Inform the students about their responsibilities with respect to quality assurance and the methods used (International Organization for Standardization [ISO], Hazard Analysis Critical Control Points [HACCP]).

Specifications	Performance Criteria	Suggested Related Content
1. Plan the work.	1.1 Thorough identification of information related to the manufacture of a product: - dimensions - tolerances - instructions 1.2 Appropriate choice of measuring instruments and devices 1.3 Proper positioning of part and appropriate choice of fastenings for part to be measured 1.4 Organized arrangement of instruments and devices	• Graduated measuring instruments: rulers, vernier callipers, micrometers, dial gauges, touch-sensing probes, protractors, bore gauges, torque wrenches, scales, voltmeters, etc. • Non-graduated measuring instruments: dividers, square, marking gauge, telescope gauge, etc. • Callipers, jigs and parallels: threads, angles, radii, diameter, taper, roughness index, etc. • Testing instruments and apparatus: - sine bar, sine plate, surface plates, angle plate, parallels, jack, V block, three-wire method, balls, etc. - optical comparator, hardness tester, roughness tester and numerical measuring instruments (overview)
2. Prepare the measuring instruments and devices, as well as the product to be tested.	2.1 Detailed inspection of instruments and devices 2.2 Accurate calibration and adjustment of common measuring instruments and devices 2.3 Proper preparation of part or product to be tested 2.4 Cleanliness of work area	• Detection of defects • Neatness • Calibration and adjustment techniques • Manufacturer's specifications • Cleaning, deburring, handling, mounting and fastening of part • Test temperature (thermal expansion)

Specifications	Performance Criteria	Suggested Related Content
3. Measure products of different shapes.	3.1 Accurate calculation of information needed for measurement 3.2 Proper use of measuring instruments and devices 3.3 Accurate reading of measurements 3.4 Accurate conversion of dimensions in the metric and imperial systems of measurement 3.5 Accurate interpretation of measurements 3.6 Accurate recording of results	• Calculations associated with measurement: offset dimensions, height of gauge blocks, coordinates and conversions • Methods of using instruments and devices: direct reading, statistical process control (SPC), transfer of measurements from one instrument to the other and go, no-go gauges • Interpretation of measurements • Measurement records
4. Check the physical characteristics of products.	4.1 Proper use of testing apparatus 4.2 Accurate readings 4.3 Observance of technique for converting scales 4.4 Accurate recording of results	• Techniques • Roughness and hardness testers, comparators, etc. • Hardness scales: Rockwell, Brinell, etc. • Conversion tables for hardness scales • Inches and centimetres • Measurement records

Specifications	Performance Criteria	Suggested Related Content
5. Compare the measurements recorded with the required standards.	5.1 Accurate detection of all errors 5.2 Recognition of the causes of the errors 5.3 Relevance of information recorded 5.4 Correct entry of data into the computer	• Definition of the different terms used in statistical control: mean, standard deviation, tolerance, etc. • Concepts of quality assurance: standards, requirements, effects on production, etc. • Developments in the field • Form, positioning and dimensional tolerances, etc. • Rockwell deviation • Verification cards • Use of quality control software • Concepts of sampling
6. Perform regular maintenance on measuring instruments and devices.	6.1 Careful cleaning of instruments and devices 6.2 Lubrication of instruments and devices at the appropriate points 6.3 Proper storage of instruments and devices	• Simple assembly and disassembly of components • Products and accessories • Cleaning method • Lubrication points • Frequency of lubrication • Types of lubricants • Cleanliness • Protection against rust, dust, products, shock, etc.

MODULE 7: HEALTH AND SAFETY		CODE: 869 571 15 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach
Avoid occupational health and safety risks.	• Working in a manufacturing industry • Given work situations presenting health and safety risks • Using relevant documentation	• This module is designed to provide students with general information on the risks involved in working in a manufacturing industry. The specific characteristics of each sector will be covered in the specific competencies. • This module is to be reviewed in the module entitled <i>Shopwork</i>, and in all the program's specific competencies. • Use video recordings. • It is important that the students understand that the same health and safety measures they follow at school apply in the workplace.

Specifications	Performance Criteria	Suggested Related Content
1. Gather information on the laws and regulations that apply to industrial machinery operation.	1.1 Accurate identification of information 1.2 Relevant associations made between sections of the laws and regulations and activities performed in the workplace 1.3 Recognition of the rights and obligations of the parties involved	• Regulation respecting industrial and commercial establishments • Regulation respecting the quality of the work environment • Regulation respecting information on controlled products • Rights and responsibilities of employers and workers
2. Recognize the potential risks and their effects on health and safety.	2.1 Recognition of the risks inherent in the trade 2.2 Accurate interpretation of Workplace Hazardous Materials Information System (WHMIS) data sheets 2.3 Accurate identification of effects on health and safety	• Resources: CSST, unions, Commission des normes du travail, joint committees, etc.
3. Recognize means of preventing accidents.	3.1 Recognition of relevant measures for: - setting up the shop and the workstation - performing trade-related operations - handling loads - using hazardous materials 3.2 Recognition of required personal safety gear	• Resources: CSST, unions, Commission des normes du travail, joint committees, etc. • Ergonomic principles

Specifications	Performance Criteria	Suggested Related Content
4. Determine what to do in an emergency situation.	4.1 Choice of appropriate strategy 4.2 Recognition of the seriousness of the situation on the basis of signs and symptoms 4.3 Judgment of the need to intervene or ask for help 4.4 Determination of the basic first aid required	• Things to be done or behaviour to be adopted in the case of malaise, injuries, burns, falls, poisoning, fumes, fire, etc. • Collection of information (symptoms, identification of victim, Medicalert bracelet, pregnancy, etc.) • Recognition of the seriousness of the situation • Recognition of and respect for their limits • Verification of: first-aid kit, blankets, tourniquets, stretcher, extinguishers, proximity of a telephone, access to important telephone numbers, etc. • Familiarization with basic first-aid techniques

MODULE 8: SHOPWORK		CODE: 869 586 90 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach
Do shopwork.	- Given: - simple technical drawings in metric or imperial units of measurement - instructions - different materials - Using: - electric or air hand or fixed tools - abrasives - drill jigs - testing and layout instruments and devices - products necessary for cutting and maintenance - a calculator - Using various reference materials, such as: - technical manuals - tool catalogues	- This module is designed to help students develop the manual dexterity required to practise the trade. They will learn to work with a variety of conventional, electric or air hand or fixed tools. - Although shopwork is uncommon in some sectors, it is important to develop students' versatility. - Encourage the use of recent types of tools. - At the beginning of the module, provide the students with simple process sheets to interpret. - Provide the students with drawings without fit tolerances, appropriate to their level of skill. - Limit the use of files to deburring or finishing operations.

Specifications	Performance Criteria	Suggested Related Content
1. Gather the information needed for the job.	1.1 Accurate interpretation of manufacturing standards 1.2 Accurate interpretation of: - symbols, dimensions, codes and abbreviations - English and French technical terminology - verbal and written instructions	• Detail drawings in metric and imperial units of measurement • Symbols • Codes • Information to be gathered: - dimensions - dimensional tolerances - characteristics of surface finishes - types of materials - sequence of operations - required tools and assembly methods - manufacturing parameters - reference surfaces
2. Lay out workpieces.	2.1 Proper inspection of: - the workpiece and its conformity with the drawing - the surface plate - the layout instruments - the mounting accessories 2.2 Appropriate corrections made 2.3 Careful preparation of surfaces 2.4 Proper positioning of workpiece 2.5 Layout techniques appropriate to the material used 2.6 Layout in conformity with drawing and operations to be performed	• Characteristics of castings • Deburring techniques • Layout instruments • Mounting and fastening accessories • Application of solutions • Mounting methods • Cleaning products and their use • Layout methods • Techniques for sharpening scribes and dividers

Specifications	Performance Criteria	Suggested Related Content
3. Mount the workpiece.	3.1 Visual and manual inspection of mounting equipment and accessories 3.2 Appropriate corrections made 3.3 Installation of accessories in accordance with mounting method 3.4 Proper positioning and alignment of workpiece 3.5 Safe installation of workpiece	• Characteristics of an appropriate installation • Method of handling workpiece and mounting accessories • Condition and maintenance of accessories • Alignment of workpiece • Method of mounting accessories: - vice - jig - jaw cover - angle plate - rotary table • Orientation of workpiece • Method of clamping and effect on workpiece
4. Prepare the workstation.	4.1 Visual and manual inspection of equipment, abrasives and accessories 4.2 Appropriate corrections made 4.3 Adjustments in conformity with instructions: - feed rate - rpm and direction of rotation - security device 4.4 Organized arrangement of instruments 4.5 Observance of health and safety rules	• Inspection of cut • Sharpening, replacement of tips, blades and abrasives, etc. • Adjustment of tool height • Orientation of tool • Proper mounting of tool • Verification of availability of testing, calibration and adjustment instruments

Specifications	Performance Criteria	Suggested Related Content
5. Perform the required manufacturing operations.	5.1 Observance of prescribed sequence of operations 5.2 Observance of roughing and finishing techniques in accordance with the type of operation performed 5.3 Safe use of tools and equipment 5.4 Detection of manufacturing problems 5.5 Appropriate corrections made 5.6 Product in conformity with manufacturing requirements 5.7 Careful deburring and cleaning of part 5.8 Observance of health and safety rules	• Start-up and operation of tools: saw, drill, buffer, sander, sandblaster, grinding wheel, riveting machine, broaching machine, etc. • Increments • Effects of cut on workpiece: thermal expansion and deformation • Method of using cutting fluids and coolants when necessary • Techniques for performing the different operations, including roughing and finishing: - deburring - sanding - buffing - sawing - drilling - sharpening - reaming - counterboring - chamfering - tapping - filing - broaching • Inspection during the manufacturing process: dimensions, form and positioning tolerances, and roughness index • Deburring techniques • Health and safety rules

Specifications	Performance Criteria	Suggested Related Content
6. Control the quality of their work.	6.1 Accurate identification of dimensions 6.2 Observance of dimensional tolerances or requirements 6.3 Precise control of surface finishes 6.4 Proper presentation of results in reports 6.5 Careful cleaning and storage of measuring instruments and devices	• Inspection of linear and angular dimensions, form and positioning tolerances, and surfaces • Direct and indirect measuring instruments • Other necessary instruments or devices • Calibration and adjustment • Roughness tester • Concepts of self-inspection
7. Perform regular maintenance on machines, devices, accessories and tools.	7.1 Proper cleaning and storage of devices, tools and accessories, and proper cleaning of work area 7.2 Careful inspection of equipment and oil levels 7.3 Appropriate corrections made 7.4 Lubrication by hand at the appropriate points 7.5 Appropriate reporting of abnormalities 7.6 Observance of health and safety rules 7.7 Disposal of hazardous and toxic waste in conformity with regulations	• Method of cleaning machines • Lubrication methods • Types of lubricants: soluble oils, lubricating oils, hydraulic oils and greases • Lubrication points • Treatment or replacement of unclean soluble oils • Health risks associated with contaminated coolants • Disposal of used oil • Detection of abnormal vibrations and noises • Criteria related to cleanliness

MODULE 9: HANDLING MATERIALS			CODE: 869 592	30 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach		
Handle materials.	• Given: - instructions - instruction manuals and handling and lifting equipment - tables of maximum loads • Using: - items to be moved - handling and lifting equipment such as simple levers, hoists, hand trucks, cables and slings - safety gear - inventory forms - a computerized inventory management system	• In many industries, operators are called upon to operate a forklift. Given the duration of this module, training should be limited to the safety aspects of operating a forklift. A video recording might be useful. • Emphasize the importance of observing occupational health and safety rules and of performing tasks and storing items with care.		

Specifications	Performance Criteria	Suggested Related Content
1. Plan the move.	1.1 Accurate interpretation of instructions 1.2 Determination of centre of gravity 1.3 Estimate of weight 1.4 Proper choice of method and equipment in accordance with lifting capacity and resistance to friction and rust	- Excessive humidity and rust - Operation of handling and lifting devices and equipment - Geometric and experimental procedure - Formulae for the calculation of specific volume and weight - Visual estimate of weight in order to choose the appropriate equipment - Verification in the technical documentation of the maximum permissible load for cables and other pieces of lifting equipment
2. Inspect the equipment.	2.1 Detailed visual inspection of equipment and safety devices 2.2 Good judgment	- Worn cables, deformed strands, cut strands, lack of lubrication - Excessive humidity and rust - Points to inspect before every job in order to avoid serious accidents
3. Move items and loads on horizontal and inclined planes.	3.1 Proper use of standardized signals and gestures 3.2 Use of techniques in accordance with the type of move and the material or product to be moved 3.3 Observance of safety rules related to forklift operation	- Main signals used in rigging - Advantages of a good system of signals - Verification of path of load - Work method and precautions to be taken - Personal safety gear

Specifications	Performance Criteria	Suggested Related Content
4. Move hazardous materials.	4.1 Observance of technique 4.2 Observance of occupational health and safety rules 4.3 Recognition of precautions to be taken when handling and moving hazardous materials	• Verification of clearance of load path • Work method and precautions to be taken • WHMIS
5. Maintain handling equipment.	5.1 Cleaning and lubrication in accordance with instructions 5.2 Observance of storage methods	• Cleaning of equipment with chains • Regular lubrication • Storage of equipment in a dry place • Methods of storing cables: - in rolls - on spools
6. Input inventory management data.	6.1 Accurate data 6.2 Conventional forms correctly filled out 6.3 Correct inputting of data	• Method of recording data on conventional and electronic forms • Theory of inventory management in the workplace

MODULE 10: JOB SEARCH TECHNIQUES			CODE: 869 601	15 hours
Expected Outcome	Instructional Guidelines	Suggested Approach		
Use job search techniques. Specifications: • Plan a job search. • Prepare the necessary documents. • Examine the conditions for a successful selection interview.	• Plan learning activities of interest to the students. • Ensure that the students understand the importance of having the proper tools for a job search. • Make available to the students a variety of resource materials (reference works, brochures, pamphlets, telephone books, videotapes, etc.). • Invite resource people in the community to speak. • Provide the necessary support for students experiencing difficulty attaining their objectives. • Provide the students with a sample résumé and cover letter. • Identify resources in the school or the community for creating simulated interviews. • Allow the students to make their phone calls during office hours.	• This module can be taught concurrently with Phase 1, <i>Search for a Practicum Position</i>, of the module entitled <i>Entering the Workforce</i>, since they are complementary.		

Learning Context	Participation Criteria	Suggested Related Content
PHASE 1: Gathering of Information - Becoming familiar with various sources of information that can be used to prepare for a job search. PHASE 2: Preparation for the Job Search - Learning about the steps involved in finding a practicum position and a job.	- Gather information useful for the job search. - Produce the required documents.	- Employment centres - Weekend editions of newspapers - Professional corporations - Businesses - Acquaintances in the job market - Personal contacts - Placement and recruitment agencies - List of companies in the region - Internet, etc. - Determination of steps involved: - definition of their expectations and needs - search for potential employers - production and dispatch of a résumé and cover letter - interviews - Follow-up with employers

Learning Context	Participation Criteria	Suggested Related Content
• Writing a résumé and cover letter. • Learning about the attitudes and behaviours to adopt or avoid in a selection interview.		• Résumé: - definition and purpose - qualities (organized presentation, clarity, neatness, etc.) - parts (identification, education and work experience, personality traits, personal experience, activities, references, etc.) • Cover letter: - definition and purpose - qualities (clarity, neatness, concision, etc.) - parts (date, name and title of addressee, name of company, type of job applied for, reasons and justification for the application, request for an interview, address and telephone number, complimentary closing, signature) • Attitudes and behaviours demonstrating competency and main assets • Neat appearance • Appropriate language • Appropriate, coherent remarks • Interest and dynamic attitude • Attitudes and behaviours to avoid

PHASE 3:**Evaluation of Their Potential**

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| <ul style="list-style-type: none">• Recognizing their strengths and weaknesses with respect to a job search. | <ul style="list-style-type: none">• Make a list of:<ul style="list-style-type: none">- their strengths and weaknesses observed during the various steps involved in preparing the job search- the aspects of their personality to be emphasized or improved• State means of overcoming the observed weaknesses | <ul style="list-style-type: none">• Advantages of self-examination• Serious examination of their strengths and weaknesses• Determination of means of overcoming weaknesses• Importance of not being hard on themselves during the self-examination |
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MODULE 11: NEW TYPES OF WORK ORGANIZATION			CODE: 872 153	45 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach		
Adapt to new types of work organization.	• Working in a team • In a context of value-added output • Using the necessary technical documentation • In an atmosphere of respect and openness	• This module is designed to help students develop the ability to adapt to changes in production management: - new types of work organization - technological developments - employers' requirements with respect to accountability, teamwork and the participation of workers in the search for solutions • It would be interesting to introduce the students to work cells in the context of value-added output.		

Specifications	Performance Criteria	Suggested Related Content
1. Recognize the production management approaches of the company and their effects on the type of work organization. 2. Recognize the means used to promote the continual improvement of productivity.	1.1 Recognition of the company's management philosophies, such as Taylorism and value-added output 1.2 Proper description of preferred type of structural organization: - hierarchical organization - semi-autonomous teams - autonomous teams 1.3 Recognition of the company's production process 1.4 Appreciation of the effects on production and on the evolution of tasks in the company 2.1 Accurate differentiation among the instruments or techniques used in the company 2.2 Relevant associations between the means used and the company's ability to meet the requirements of the new economy, such as: - improvement of the time required to respond to market needs - economies of scale - elimination of waste 2.3 Recognition of the contribution of personnel to the improvement of productivity	

Specifications	Performance Criteria	Suggested Related Content
3. Communicate verbally with colleagues and superiors.	3.1 Choice of types of questions required to obtain relevant information 3.2 Proper reformulation and reflection of message 3.3 Constructive and accurate feedback to: - encourage improvement in behaviour - recognize and encourage the contribution of colleagues 3.4 Relevant and persuasive expression of their point of view 3.5 Use of an effective approach to deal with emotional behaviour	• Communication process • Obstacles to communication • Role of perception and defence mechanisms • Productive and counter-productive attitudes • Types of questions • Reformulation • Summary of discussions • Specific feedback based on personal experience • Reaction to emotional behaviour • Arguments supporting an opinion
4. Solve problems.	4.1 Accurate differentiation of problem-solving techniques 4.2 Clear description of the problem 4.3 Determination of the causes and consequences of the problem 4.4 Choice of best solution in accordance with established criteria	• Advantages of using a problem-solving process • Simple process • Modern tools and techniques
5. Work in a team.	5.1 Understanding of the goals of the team and the results to be attained in accordance with the company's mission and values 5.2 Consensus on team rules 5.3 Determination of the responsibilities of each team member 5.4 Consensus decision making 5.5 Description of factors favourable and unfavourable to the success of a work team	• Bases of an effective work team • Cooperation as opposed to competition • Roles within the team • Team rules • Styles of participation • Planning stages • Consensus decision-making process • Stages in the growth of a work team

MODULE 12: OPERATING CONVENTIONAL MACHINERY			CODE: 869 617	105 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach		
Operate conventional machinery.	• Given: - instructions - the appropriate raw materials - technical information appropriate to the sectors involved (i.e. work orders, recipes, patterns, technical drawings in metric and imperial units of measurement) • Using: - manufacturing, assembly, finishing, packaging or labelling equipment - measuring instruments and testing apparatus - procedures manuals - a calculator - forms	• This module is designed to develop the students' versatility, that is, their ability to work with a variety of machines. To this end, emphasis should be placed on interpreting procedures manuals and following instructions. • It is recommended that students undergo practical training in the workplace in a work-study approach. For instructional organization purposes, it is suggested that this module be combined with the following one. Students will then have the opportunity to work with a variety of machines, both conventional and automated, in a single plant. This will ensure a better understanding of the production process and increased versatility. • Ensure that the students learn to operate a variety of machines and that the complexity of the machines used increases progressively. • When they arrive at the plant, the students should be made aware of the type of work organization favoured by management.		

Specifications	Performance Criteria	Suggested Related Content
1. Interpret procedures manuals and instructions.	1.1 Accurate interpretation of information about the job and the procedure 1.2 Thorough identification of information in sketches, diagrams, organizational charts, drawings, patterns or recipes 1.3 Thorough identification of monitoring phases in the production process	<i>Related content specific to the chosen sectors</i> <i>Metal and electrical products</i> • Technical drawings <i>Wood products</i> • Technical drawings <i>Textiles</i> • Patterns, dye recipes <i>Food</i> • Recipes <i>Polymers</i> • Recipes and technical drawings
2. Plan the work.	2.1 Verification of availability of necessary tools and materials 2.2 Preparation of raw materials in conformity with instructions and standards	• Codification of raw materials • Raw or processed materials used • Temperature • Weights, calculations, measurements • Rules of hygiene or other rules specific to the sectors chosen • Awareness of production costs and the concept of responsibility

Specifications	Performance Criteria	Suggested Related Content
3. Prepare machines.	3.1 Proper preparation of machines and mounting accessories 3.2 Proper mounting of workpieces 3.3 Accurate adjustment of parameters in accordance with instructions 3.4 Observance of rules of health, safety and hygiene	• Fastening techniques • Calculations to verify parameters • Method of adjusting basic parameters
4. Use the equipment necessary for manufacturing, assembly or finishing.	4.1 Observance of technique for: - starting up machines - feeding machines - operating machines - maintaining machines 4.2 Observance of rules of health, safety and hygiene 4.3 Appropriate corrections made to parameters following the detection of abnormalities	• Operating mode of machines and most common problems • Sequence of operations • Safety rules - personal safety gear - use of safety devices • Importance of keeping a safe pace • Use of the senses to detect abnormalities: odours, colours, noises • Measurements specific to each sector

Specifications	Performance Criteria	Suggested Related Content
5. Control the quality of the product.	5.1 Conformity of product with standards 5.2 Observance of inspection and measuring techniques 5.3 Appropriate decision made regarding substandard products 5.4 Verification card properly filled out	- Finishing of product: - deburring - removal of excess material - cleaning, etc. - Inspection method: - consultation of reference documents or drawings - use of appropriate measurement techniques and instruments - decision making - compilation of rejects - Conventional and electronic verification cards
6. Prepare products for shipping or handling.	6.1 Proper and safe use of packaging and labelling materials and machines 6.2 Conformity with instructions regarding the packaging and labelling of products 6.3 Form properly filled out 6.4 Accurate information recorded	- Handling and positioning procedure - Precautions to be taken during transportation (fragility, leak tightness, etc.)
7. Tidy up the workstation.	7.1 Equipment cleaned in conformity with instructions 7.2 Clean and well-organized workstation 7.3 Clear communication of relevant information to appropriate parties 7.4 Observance of procedure for shutting down machines and the workstation	- Observance of safe cleaning procedure - Draining and decontamination of appropriate sectors - Different methods of conveying information used in industry - Shutdown sequence

MODULE 13: OPERATING AN AUTOMATED PRODUCTION SYSTEM		CODE: 869 627 105 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach
Operate an automated production system.	- Given: - instructions - the appropriate raw materials - technical information appropriate to the sectors involved (i.e. work orders, recipes, patterns, technical drawings in metric and imperial units of measurement) - Using: - automated machines or a continuous process production line - tools - measuring instruments and testing apparatus - procedures manuals - a calculator - forms - labelling materials	- This module is designed to develop the students' versatility, that is, their ability to work with a variety of machines. To this end, emphasis should be placed on interpreting procedures manuals and following instructions. - It is recommended that students undergo practical training in the workplace in a work-study approach. For instructional organization purposes, it is suggested that this module be combined with the previous one. Students will then have the opportunity to work with a variety of machines, both conventional and automated, in a single plant. This will ensure a better understanding of the production process and increased versatility. - Ensure that the students learn to operate a variety of machines and that the complexity of the machines used increases progressively. - When they arrive at the plant, the students should be made aware of the type of work organization favoured by management.

Specifications	Performance Criteria	Suggested Related Content
1. Interpret procedures manuals and instructions.	1.1 Accurate interpretation of information about the job and the procedure 1.2 Thorough identification of information in sketches, diagrams, organizational charts, drawings, patterns or recipes 1.3 Thorough identification of monitoring phases in the production process	<i>Related content specific to the chosen sectors</i> Depending on the sector chosen, cover the following related content: <i>Metal and electrical products</i> • Technical drawings <i>Wood products</i> • Technical drawings <i>Textiles</i> • Patterns, dye recipes <i>Food</i> • Recipes <i>Polymers</i> • Recipes and technical drawings
2. Plan the work.	2.1 Verification of availability of necessary tools and materials 2.2 Preparation of raw materials in conformity with instructions and standards	• Codification of raw materials • Raw or processed materials used • Temperature • Weights, calculations, measurements • Standards of hygiene or other standards specific to the sectors chosen • Awareness of production costs and the concept of accountability

Specifications	Performance Criteria	Suggested Related Content
3. Control the sequence of an automated procedure.	3.1 Proper preparation of machinery 3.2 Observance of technique for loading the program 3.3 Inputting of relevant data in accordance with instructions 3.4 Observance of technique for: - starting up machines - feeding machines - operating machines - handling materials 3.5 Observance of rules of health, safety and hygiene 3.6 Appropriate corrections made to control panel or computer following the detection of abnormalities	• Quick-change mount technique (hydraulic chuck) • Temperature, weight, etc. • Inputting of data from specifications into machine • Safety rules: - personal safety gear - use of safety devices • Importance of keeping a safe pace • Control panel • Measurements using instruments specific to each sector
4. Control the quality of the product.	4.1 Conformity of product with standards 4.2 Observance of inspection and measuring techniques 4.3 Appropriate decision made regarding substandard products 4.4 Verification card properly filled out	• Finishing of product: - deburring - removal of excess material - cleaning, etc. • Inspection methods specific to each sector: - consultation of reference documents or drawings - use of control apparatus specific to the chosen sector - measurement of density - decision making - compilation of rejects

Specifications	Performance Criteria	Suggested Related Content
5. Prepare products for shipping or handling.	5.1 Proper and safe use of packaging and labelling materials and machines 5.2 Form properly filled out 5.3 Accurate information recorded 5.4 Conformity with instructions regarding the packaging and labelling of products	• Positioning and labelling procedure • Importance of accurate information • Precautions to be taken during transportation (fragility, leak tightness, etc.)
6. Tidy up the workstation.	6.1 Equipment cleaned in conformity with instructions 6.2 Clean and well-organized workstation 6.3 Clear communication of relevant information to appropriate parties 6.4 Observance of procedure for shutting down machines and the workstation	• Observance of safe cleaning procedure • Draining and decontamination if applicable • Storage methods • Shutdown sequence

MODULE 14: MAINTAINING MACHINERY			CODE: 869 636	90 hours
Expected Behaviour	Conditions for Performance Evaluation	Suggested Approach		
Maintain machinery.	• Given: - assembly drawings of machines - instructions • Using: - various reference sources such as technical manuals - the appropriate tools and measuring instruments - preventive maintenance software - WHMIS data sheets	• This module is intended to help students develop a sense of mechanics and the ability to detect operational abnormalities and perform preventive maintenance. • First, explore mechanical maintenance in general. • Then, cover the maintenance of the machines specific to the sectors chosen. • Demand serious, quality work. • Provide the students with individualized support. • Inform the students about new trends in maintenance performed by operators. Explain the differences between preventive, corrective and predictive maintenance. • Emphasize the variety of possible orientations in companies. Some require operators to perform maintenance tasks, others do not. • Explain the consequences for production costs of shutting down machines.		

Specifications	Performance Criteria	Suggested Related Content
1. Perform tasks included in the maintenance schedule.	1.1 Proper planning of tasks included in the schedule 1.2 Proper verification of specified checkpoints 1.3 Adjustment of components in conformity with instructions 1.4 Observance of recommended lubrication 1.5 Careful cleaning of components 1.6 Observance of health and safety measures	• Preventive maintenance software • Observance of schedule • Machine parts • Observance of safety rules • Alignment • Oil level • Choice of appropriate lubricants • Filter and ventilation
2. Detect operating abnormalities.	2.1 Detection of unusual noises, odours or vibrations 2.2 Accurate location of defective component 2.3 Observance of health and safety measures 2.4 Repair work order properly filled out	• Power train system • Detection of significant noises, odours or vibrations • Pneumatic and hydraulic circuits and basic components • Main components of electric and electronic circuits • Measurement using a manometer: air pressure, oil pressure • Identification of equipment
3. Replace simple components.	3.1 Conformity with instructions in maintenance manual 3.2 Replacement component in conformity with original part 3.3 Component correctly installed 3.4 Observance of health and safety measures	• Procedure indicated in the maintenance manual • Choice of appropriate tools and measuring instruments • Codification of components • Selection criteria for components • Techniques for installation of components • Technical characteristics of components

Specifications	Performance Criteria	Suggested Related Content
4. Tidy up the work area.	4.1 Cleanliness of machines and work area 4.2 Handling and disposal of hazardous materials in conformity with instructions	• Handling and disposal of hazardous materials • Cleaning products
5. Fill out the maintenance record card.	5.1 Maintenance record card accurately filled out 5.2 Relevant comments	• Analysis of malfunctions • Source of potential problems • Follow-up • Suggested changes to the maintenance schedule • Routing of record card

MODULE 15: ENTERING THE WORKFORCE		CODE: 869 647 105 hours
Expected Outcome	Instructional Guidelines	Suggested Approach
Enter the workforce. Specifications: Find a practicum position. Observe and perform trade-related tasks in the workplace. Communicate with the work team. Evaluate their training with respect to their observations during the practicum.	• Provide the students with the necessary means and assistance to find a practicum position. • Maintain close ties between the school and the company. • Make sure that the trainees receive the support and supervision of a responsible person in the company. • Ensure the regular support and supervision of students in case of difficulty. • Make sure that the company respects the conditions required for the students to attain the objectives of the practicum. • Encourage the students to engage in discussions and express themselves. • Provide the students with an outline for the report.	• Phase 1 of this module is directly related to the module entitled <i>Job Search Techniques</i>. The process of finding a practicum position is similar to that of finding a job; therefore the activities of this phase may be included in the module on job search techniques. • In an approach other than work-study, the duration of the practicum should be divided into two periods. The first practicum may take place after the <i>Job Search Techniques</i> module. At that time, the students may perform mainly handling and like tasks. They may also observe the type of work organization in the company. During the second practicum, at the end of the program, they may practise mainly production-related tasks. • In the work-study approach, the duration of the practicum may be combined with the modules on operating machinery and an automated production system. • In the apprenticeship scheme, students must return to school for two weeks after their practicum. This requirement may also be applied to any other scheme.

Learning Context	Participation Criteria	Suggested Related Content
PHASE 1: Search for a Practicum Position • Learning about the practicum and the related procedures. • Defining their expectations and needs with respect to the practicum.	• List, in order of priority, possible practicum positions that meet their selection criteria. • Meet with a representative of the company in order to obtain a practicum position.	• Objectives of the practicum • Duration • Instructional guidelines • Participation criteria • Personal and occupational goals • Criteria for selecting the company, such as: - size and location - type of production - structure - quality of working relations - possibility of attaining the objectives of the practicum, etc. • Criteria meeting expectations

Learning Context	Participation Criteria	Suggested Related Content
- Finding companies likely to meet their expectations and needs. - Obtaining a practicum position. - Ensuring that the practicum procedure is within regulations. PHASE 2: Performance of Activities in the Workplace - Identifying the types of work organization in the company.	- Follow company rules regarding activities, work schedules and professional ethics - Write a practicum report on the activities performed - Demonstrate interest throughout the practicum	- Various sources: - banks of companies - telephone book - employment centres - classified ads - lists of companies who have accepted trainees in the past - instructor's assistance, etc. - Classification of companies by type of product or process - Obtaining of a practicum position - Elements to confirm: - insurance - registration of trainee with CSST - agreements with unions - responsibilities of parties, etc. - Agreements on supervision (by the company and the instructor) - Observance of types of work organization, values conveyed by the company and management of personnel

Learning Context	Participation Criteria	Suggested Related Content
- Observing industrial machinery operators at work in the company. - Performing various manufacturing tasks using different machines. - Communicating with members of the work team and those responsible for the practicum.		- Observation of industrial machinery operators at work - Observation of production process - Knowledge of rights and responsibilities of employer and trainee - Mastery of specific procedure for each of the machines used - Active participation in tasks - Observation of health and safety rules - Observance of company rules and regulations: order, schedules, attendance, movements in the shop and clothing. - Behaviour: attentiveness, respect, tact, discretion, concern for excellence, demonstration of interest in all new work experiences, etc. - Knowledge of the importance of professional ethics and dedication - Search for information (desire to learn) - Transmission of information - Positive, receptive attitude - Acceptance of advice and comments - Feedback - Verification of satisfaction of the person responsible for the practicum, etc.

Learning Context	Participation Criteria	Suggested Related Content
- Producing a report on the tasks and operations performed during the practicum. PHASE 3: Evaluation of the Practicum and of the Training Received - Presenting a report on the tasks and operations performed during the practicum.	- Give a presentation on the tasks and operations performed during the practicum. - Emphasize the strong and weak points of the training received.	- Daily log - Content of the practicum report: - general information on the location and date of the practicum and on those responsible in the company and the school - description of tasks performed - types of equipment used - new technologies and tools used - problems that occurred and solutions that were applied - comments on the practicum procedure - appreciation of tasks - elements different from those presented at school, etc. - Presentation

Learning Context	Participation Criteria	Suggested Related Content
- Assessing the relevance of their training with respect to the requirements of the workplace. - Stating the specific and complementary training needs in industrial machinery operation.		- List of aspects of the trade that correspond to the training received and those that do not - Comparison of their perception of the trade before and after the practicum: - workplace - occupational practices - equipment, etc. - Extension courses - Specialization courses - Further training

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