Ontario

Manufacturing Engineering Technician Program Standard

The approved program standard for the Manufacturing Engineering Technician program of instruction leading to an Ontario College Diploma delivered by Ontario Colleges of Applied Arts and Technology. (MCU funding code 57000)

Ministry of Colleges and Universities
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Introduction

This document is the Program Standard for the Manufacturing Engineering Technician program of instruction leading to an Ontario College Diploma delivered by Ontario Colleges of Applied Arts and Technology (MCU funding code 57000).

Development of system-wide program standards

In 1993, the Government of Ontario initiated program standards development with the objectives of bringing a greater degree of consistency to college programming offered across the province, broadening the focus of college programs to ensure graduates have the skills to be flexible and to continue to learn and adapt, and providing public accountability for the quality and relevance of college programs.

The Program Standards Unit of the Ministry of Colleges and Universities has responsibility for the development, review and approval of system-wide standards for programs of instruction at Ontario Colleges of Applied Arts and Technology.

Program standards

Program standards apply to all similar programs of instruction offered by Colleges of Applied Arts and Technology across the province of Ontario. Each program standard for a postsecondary program includes the following elements:

- **Vocational standard** (the vocationally specific learning outcomes which apply to the program of instruction in question),
- **Essential employability skills** (the essential employability skills learning outcomes which apply to all programs of instruction); and
- **General education requirement** (the requirement for general education in postsecondary programs of instruction).

Collectively, these elements outline the essential skills and knowledge that a student must reliably demonstrate in order to graduate from the program.

Individual Colleges of Applied Arts and Technology offering the program of instruction determine the specific program structure, delivery methods and other curriculum matters to be used in assisting students to achieve the outcomes articulated in the standard. Individual colleges also determine whether additional local learning outcomes will be required to reflect specific local needs and/or interests.

The expression of program standards as vocational learning outcomes

Vocational learning outcomes represent culminating demonstrations of learning and achievement. They are not simply a listing of discrete skills, nor broad statements of knowledge and comprehension. In addition, vocational learning outcomes are interrelated and cannot be viewed in isolation from one another. As such, they should be viewed as a comprehensive whole. They describe performances that demonstrate that significant integrated learning by graduates of the program has been achieved and verified.

Expressing standards as vocational learning outcomes ensures consistency in the outcomes for program graduates, while leaving to the discretion of individual colleges, curriculum matters such as the specific program structure and delivery methods.

The presentation of the vocational learning outcomes

The vocational learning outcome statements set out the culminating demonstration of learning and achievement that the student must reliably demonstrate before graduation.

The elements of the performance for each outcome define and clarify the level and quality of performance necessary to meet the requirements of the vocational learning outcome. However, it is the performance of the vocational learning outcome itself on which students are evaluated. The elements of performance are indicators of the means by which the student may proceed to satisfactory performance of the vocational learning outcome. The elements of performance do not stand alone but rather in reference to the vocational learning outcome of which they form a part.

The development of a program standard

In establishing the standards development initiative, the Government of Ontario determined that all postsecondary programs of instruction should include vocational skills coupled with a broader set of essential skills. This combination is considered critical to ensuring that college graduates have the skills required to be successful both upon graduation from the college program and throughout their working and personal lives.

A program standard is developed through a broad consultation process involving a range of stakeholders with a direct interest in the program area, including employers, professional associations, universities, secondary schools and program graduates working in the field, in addition to students, faculty and administrators at the colleges themselves. It represents a consensus of participating stakeholders on the essential learning that all program graduates should have achieved.

Updating the program standard

The Ministry of Colleges and Universities will undertake regular reviews of the vocational learning outcomes for this program to ensure that the Manufacturing Engineering Technician Program Standard remains appropriate and relevant to the needs of students and employers across the Province of Ontario. To confirm that this document is the most up-to-date release, please contact the Ministry of Colleges and Universities.

Vocational standard

All graduates of the Manufacturing Engineering Technician program have achieved the eleven vocational learning outcomes (VLOs), in addition to achieving the essential employability outcomes and meeting the general education (GE) requirement.

Preamble

Graduates of Manufacturing Engineering Technician Programs carry out manufacturing engineering functions within an engineering environment. Graduates have demonstrated achievement of vocational learning outcomes which relate to engineering in general and manufacturing engineering in particular.

Graduates of the two-year Manufacturing Engineering Technician Programs are prepared to perform design and analysis functions to support d production in a manufacturing environment, as well as carry out manufacturing and quality control procedures. They are also able to apply communication, documentation, computer applications, information technology, and teamwork skills to support the engineering activities of an organization.

Graduates of Manufacturing Engineering Technician Programs work in a broad range of employment settings in a variety of sectors in the manufacturing engineering industry, in both large and small organizations. Their activities could range from basic tool and component design, to, or to production of components or quality control procedures. Graduates' learning is significantly enhanced by opportunities to gain and reflect on as much practical experience during their time in the program. While certain positions may require discrete knowledge or a higher level of a particular skill, there is a set of common skills, knowledge, and attitudes essential to all entry-level employees in the manufacturing engineering field. Individual programs may choose to build on this standard by offering some degree of specialization.

There are opportunities for graduates to pursue further educational or occupational qualifications; through articulation agreements between the colleges, universities, professional organizations, or the apprenticeship board, graduates may be granted credits towards a degree, certification, or a trade apprenticeship. Students should contact individual colleges for further details of a college's articulation agreements with other institutions or professional associations.

See Glossary

Note: The Ontario Council on Articulation and Transfer (ONCAT) maintains the provincial postsecondary credit transfer portal, ONTransfer.

Synopsis of the vocational learning outcomes
Manufacturing Engineering Technician (Ontario College Diploma)

The graduate has reliably demonstrated the ability to:

1. Analyze routine technical problems to provide solutions in manufacturing environments.
2. Conduct routine analysis of components, processes, systems to in the application of engineering principles and practices.
3. Interpret and prepare graphics and other technical documents according to engineering standards.
4. Use modern and emerging technologies to support the engineering environment and enhance processes according to current industry standards and needs.
5. Prepare and maintain documentation, inventory, and records to ensure the integrity of the information and workflow control.
6. Plan and test products, methods and equipment to support production systems and outputs.
7. Use machinery, tools and other equipment to manufacture and assemble components.
8. Conduct quality control and quality assurance procedures to support manufacturing processes.
9. Adhere to environmental, economic, legal, safety, and ethical standards and principles in manufacturing.
10. Support the planning and implementation of manufacturing engineering projects to meet specified timelines and deliverables.
11. Develop and apply strategies for professional development to enhance work performance and relationship building.

See Glossary

Note: The learning outcomes have been numbered as a point of reference; numbering does not imply prioritization, sequencing, nor weighting of significance.

The vocational learning outcomes

1. Analyze routine technical problems to provide solutions in manufacturing environments.

Elements of the performance

a. Calculate and convert correctly in Imperial and SI measurement units using both manual methods and electronic technology.
b. Use engineering terminology correctly and accurately in written and oral communication.
c. Identify the technical criteria necessary to design and construct components, processes, and systems.
d. Apply engineering principles to the analysis, design and implementation of manufacturing projects.
e. Carry out standard procedures involving the design and implementation, monitoring, and reporting of manufacturing processes.

See Glossary

2. Conduct routine **analysis** of components, processes, systems to in the application of **engineering principles** and **practices**.

Elements of the performance

a. Review the tolerances and materials specifications applicable to manufacturing processes.
b. Apply knowledge of conventional and electronic technologies to carry out routine **analysis** of components, manufacturing processes, and systems including automated methods.
c. Identify properties of materials and assess their responses in an engineering environment.
d. Apply **basic** principles of method analysis and work measurement, mechanics, pneumatics, fluid mechanics, and hydraulics to **analyze** and solve problems.
e. Apply **basic** principles of control systems.
f. Apply **basic** knowledge of electricity and electronics.
g. Identify ergonomic considerations.
h. Interpret technical drawings and other technical **documents** used in the design of components, processes, and systems.

See Glossary

3. Interpret and prepare **graphics** and other technical **documents** according to engineering standards.

Elements of the performance

a. Collect relevant information, data, and materials.
b. Organize and prepare documents in accordance with recognized standards (e.g., company standards ISO, CSA, ASTM, ASME etc.).
c. Employ freehand sketching techniques to produce graphics.
d. Employ computer-aided design (CAD) techniques to produce graphics for manufacturing projects utilizing traditional tolerancing and Geometric Dimensioning and Tolerancing (GD&T).
e. Interpret and prepare technical drawings and documents, including reports, used in the design of components, processes, and systems.

See Glossary

Use **modern** and **emerging technologies** to support the engineering environment and enhance processes according to current industry standards and needs.

Elements of the performance

a. Use computer systems and application software to resolve technical problems.
b. Use computer applications to support design and analysis within an engineering environment.
c. Identify emerging technologies relevant to manufacturing processes.

See Glossary

4. Prepare and maintain documentation, inventory, and records to ensure the integrity of the information and workflow control.

Elements of the performance

a. Use and maintain a paper-based and electronic system to store and retrieve information and to plan activities.
b. Maintain current, clear, and accurate project-related documents in accordance with appropriate organizational **practices.**
c. Use project-related records and inventories to prepare reports.
d. Apply file management techniques to access and store data.
e. Access and exchange information using electronic technology.
f. Use computer hardware and applications to access and organize information and produce technical documents within an engineering environment.

See Glossary

5. Plan and test products, methods and equipment to support production systems and outputs.

Elements of the performance

a. Understand operations used in the production of components.
b. Use systematic approaches to identify and resolve technical problems in the manufacture of components.
c. Understand processes used to manufacture components.
d. Assist in sourcing material, tools, equipment, supplies, and services related to production of components.
e. Apply knowledge of computer-aided manufacturing techniques to support the production of components.

See Glossary

6. Use machinery, tools and other equipment to manufacture and assemble components.

Elements of the performance

a. Assess the performance characteristics, limitations, potential, and safety aspects of machinery, tools, and other equipment.
b. Use machinery, tools, and other equipment to manufacture **simple** components to required specifications.
c. Program computer-aided machinery to manufacture **simple** components to required specifications.
d. Apply fabrication, joining, welding, finishing, and assembly processes to support the manufacture of products from their components.
e. Complete work in accordance with appropriate health and safety standards and legislation.

See Glossary

7. Conduct quality control and quality assurance procedures to support manufacturing processes.

Elements of the performance

a. Review the specifications applicable to a manufacturing project.
b. Observe, record, and report compliance with appropriate quality assurance procedures and specifications.
c. Perform or arrange quality-assurance sampling and testing.
d. Implement the collection and reporting of statistical data.
e. Interpret and use the results of quality-assurance sampling and testing to make adjustments or changes to manufacturing processes.
f. Select and use appropriate measuring instruments to inspect components as required.

See Glossary

9. Adhere to environmental, economic, legal, safety, and ethical standards and principles in manufacturing.

Elements of the performance

a. Consider the interrelationships among technology, society, the environment, politics, the economy, and manufacturing projects contributing to the **sustainability** of the manufacturing process.
b. Support the provision of a healthy and safe workplace environment.
c. Apply ethical principles to own work.
d. Meet legal responsibilities to adhere to relevant legislation in the workplace.
e. Understand employer-employee contractual obligations within collective agreements.

See Glossary

10. Support the planning and implementation of manufacturing engineering projects to meet specified timelines and deliverables.

Elements of the performance

a. Identify the stages of a manufacturing project and their component activities.
b. Assist in scheduling, coordinating, and monitoring a manufacturing project.
c. Participate in long- and short-term planning.
d. Assist in preparing elements of estimates.
e. Participate in the manufacturing phase of projects.

See Glossary

11. Develop and apply strategies for professional development to enhance work performance and relationship building.

Elements of the performance

a. Solicit and adapt constructive feedback to one's own performance, strengths, and limitations.
b. Identify opportunities for ongoing professional development (e.g., professional associations, continuing education courses, and trade shows).
c. Take responsibility and accountability for own competence.
d. Contribute to equity and cooperation within the diverse manufacturing community.

See Glossary

Glossary

Analyze: to examine in detail through the application of principles of engineering theory and research.

Basic: of a fundamental nature, requiring a rudimentary knowledge of principles and practical skills.

Routine technical problems: difficulties affecting the project which may be encountered on a regular basis and resolved through the application of basic principles of engineering theory and research, such as mechanics, pneumatics, fluid mechanics, and hydraulics.

Documents: all project-related paperwork such as graphics, reports, estimates, specifications, and contracts.

Emerging Technologies: Still in the early stages of development or adoption.

Engineering principles: the knowledge, skills, and attitudes used in engineering that are based on applied theory and research.

Graphics: a pictorial representation of information such as designs, sketches, charts, schematics, and engineering drawings.

Modern Technologies: Widely adopted and in common use within the past few years (up to about a decade).

Practices: the knowledge, skills, and attitudes used in engineering that are based on professional and industry associations' practice standards and ethical guidelines.

Routine analysis: detailed examination which may be required on a regular basis and involve the application of basic principles of engineering theory and research.

Simple: easily understood, done, or solved; consisting of only one part.

Sustainability: aims to balance environmental, social, and economic considerations to create value for both present and future generations while minimizing adverse impacts on the planet and society.

Essential employability skills

All graduates of Manufacturing Engineering Technician programs of instruction must have reliably demonstrated the essential employability skills learning outcomes listed below, in addition to achieving the vocational learning outcomes and meeting the general education requirement.

Context

Essential Employability Skills (EES) are skills that, regardless of a student's program or discipline, are critical for success in the workplace, in day-to-day living and for lifelong learning.

The teaching and attainment of these EES for students in, and graduates from, Ontario's Colleges of Applied Arts and Technology are anchored in a set of three fundamental assumptions:

- these skills are important for every adult to function successfully in society today
- our colleges are well equipped and well positioned to prepare graduates with these skills
- these skills are equally valuable for all graduates, regardless of the level of their credential, whether they pursue a career path, or they pursue further education

Skill categories

To capture these skills, the following six categories define the essential areas where graduates must demonstrate skills and knowledge.

- Communication
- Numeracy
- Critical thinking and problem solving
- Information management
- Interpersonal
- Personal

Application and implementation

In each of the six skill categories, there are a number of defining skills, or sub skills, identified to further articulate the requisite skills identified in the main skill categories. The following chart illustrates the relationship between the skill categories, the defining skills within the categories and learning outcomes to be achieved by graduates from all postsecondary programs of instruction that lead to an Ontario College credential.

EES may be embedded in General Education or vocational courses or developed through discrete courses. However, these skills are developed, all graduates with Ontario College credentials must be able to reliably demonstrate the essential skills required in each of the six categories.

Skill category: communication

Defining skills

Skill areas to be demonstrated by graduates:

- reading
- writing
- speaking
- listening
- presenting
- visual literacy

Learning outcomes

The graduate has reliably demonstrated the ability to:

1. Communicate clearly, concisely and correctly in the written, spoken and visual form that fulfills the purpose and meets the needs of the audience.
2. Respond to written, spoken or visual messages in a manner that ensures effective communication.

Skill category: numeracy

Defining skills

Skill areas to be demonstrated by graduates:

- understanding and applying mathematical concepts and reasoning
- analyzing and using numerical data
- conceptualizing

Learning outcomes

The graduate has reliably demonstrated the ability to:

1. execute mathematical operations accurately

Skill category: critical thinking and problem solving

Defining skills

Skill areas to be demonstrated by graduates:

- analyzing
- synthesizing
- evaluating
- decision making
- creative and innovative thinking

Learning outcomes

The graduate has reliably demonstrated the ability to:

1. Apply a systematic approach to solve problems.
2. Use a variety of thinking skills to anticipate and solve problems.

Skill category: information management

Defining skills

Skill areas to be demonstrated by graduates:

- gathering and managing information
- selecting and using appropriate tools and technology for a task or a project
- computer literacy
- Internet skills

Learning outcomes

The graduate has reliably demonstrated the ability to:

1. Locate, select, organize and document information using appropriate technology and information systems.
2. Analyze, evaluate and apply relevant information from a variety of sources.

Skill category: interpersonal

Defining skills

Skill areas to be demonstrated by graduates:

- teamwork
- relationship management
- conflict resolution
- leadership
- networking

Learning outcomes

The graduate has reliably demonstrated the ability to:

1. Show respect for the diverse opinions, values, belief systems and contributions of others.
2. Interact with others in groups or teams in ways that contribute to effective working relationships and the achievement of goals.

Skill category: personal

Defining skills

Skill areas to be demonstrated by graduates:

- managing self
- managing change and being flexible and adaptable
- engaging in reflective practices
- demonstrating personal responsibility

Learning outcomes

The graduate has reliably demonstrated the ability to:

1. Manage the use of time and other resources to complete projects.
2. Take responsibility for one's own actions, decisions and their consequences.

General education requirement

All graduates of the Manufacturing Engineering Technician program must have met the general education requirement described below, in addition to achieving the vocational and essential employability skills learning outcomes.

Requirement

The General Education Requirement for programs of instruction is stipulated in the Credentials Framework in the Minister's Binding Policy Directive Framework for Programs of Instruction.

In programs of instruction leading to either an Ontario College Diploma or an Ontario College Advanced Diploma, it is required that graduates have been engaged in learning that exposes them to at least one discipline outside their main field of study and increases their awareness of the society and culture in which they live and work. This will typically be accomplished by students taking 3 to 5 courses (or the equivalent) designed discretely and separately from vocational learning opportunities.

This general education learning would normally be delivered using a combination of required and elective processes.

Purpose

The purpose of General Education in the Ontario college system is to contribute to the development of citizens who are conscious of the diversity, complexity and richness of the human experience; who are able to establish meaning through this consciousness; and who, as a result, are able to contribute thoughtfully, creatively and positively to the society in which they live and work.

General Education strengthens students' essential employability skills, such as critical analysis, problem solving and communication, in the context of an exploration of topics with broad-based personal and/or societal importance.

Themes

The themes listed below will be used to provide direction to Ontario Colleges in the development and identification of courses that are designed to fulfil the General Education Requirement for programs of instructions.

Each theme provides a statement of Rationale and offers suggestions related to more specific topic areas that could be explored within each area. These suggestions are neither prescriptive nor exhaustive. They are included to provide guidance regarding the

nature and scope of content that would be judged as meeting the intent and overall goals of General Education.

Arts in society:

Rationale:

The capacity of a person to recognize and evaluate artistic and creative achievements is useful in many aspects of his/her life. Since artistic expression is a fundamentally human activity, which both reflects and anticipates developments in the larger culture, its study will enhance the student's cultural and self-awareness.

Content:

Courses in this area should provide students with an understanding of the importance of visual and creative arts in human affairs, of the artist's and writer's perceptions of the world and the means by which those perceptions are translated into the language of literature and artistic expression. They will also provide an appreciation of the aesthetic values used in examining works of art and possibly, a direct experience in expressing perceptions in an artistic medium.

Civic Life:

Rationale:

In order for individuals to live responsibly and to reach their potential as individuals and as citizens of society, they need to understand the patterns of human relationships that underlie the orderly interactions of a society's various structural units. Informed people will have knowledge of the meaning of civic life in relation to diverse communities at the local, national and global level and an awareness of international issues and the effects of these on Canada, as well as Canada's place in the international community.

Content:

Courses in this area should provide students with an understanding of the meaning of freedoms, rights and participation in community and public life, in addition to a working knowledge of the structure and function of various levels of government (municipal, provincial, national) in a Canadian and/or in an international context. They may also provide an historical understanding of major political issues affecting relations between the various levels of government in Canada and their constituents.

Social and cultural understanding:

Rationale:

Knowledge of the patterns and precedents of the past provide the means for a person

to gain an awareness of his or her place in contemporary culture and society. In addition to this awareness, students will acquire a sense of the main currents of their culture and that of other cultures over an extended period of time in order to link personal history to the broader study of culture.

Content:

Courses in this area are those that deal broadly with major social and cultural themes. These courses may also stress the nature and validity of historical evidence and the variety of historical interpretation of events. Courses will provide the students with a view and understanding of the impact of cultural, social, ethnic or linguistic characteristics.

Personal understanding:

Rationale:

Educated people are equipped for life-long understanding and development of themselves as integrated physiological and psychological entities. They are aware of the ideal need to be fully functioning persons: mentally, physically, emotionally, socially, spiritually and vocationally.

Content:

Courses in this area will focus on understanding the individual: his or her evolution; situation; relationship with others; place in the environment and universe; achievements and problems; and his or her meaning and purpose. They will also allow students the opportunity to study institutionalized human social behaviour in a systematic way. Courses fulfilling this requirement may be oriented to the study of the individual within a variety of contexts.

Science and technology:

Rationale:

Matter and energy are universal concepts in science, forming a basis for understanding the interactions that occur in living and non-living systems in our universe. Study in this area provides an understanding of the behaviour of matter that provides a foundation for further scientific study and the creation of broader understanding about natural phenomena.

Similarly, the various applications and developments in the area of technology have an increasing impact on all aspects of human endeavour and have numerous social, economic and philosophical implications. For example, the operation of computers to process data at high speed has invoked an interaction between machines and the

human mind that is unique in human history. This and other technological developments have a powerful impact on how we deal with many of the complex questions in our society.

Content:

Courses in this area should stress scientific inquiry and deal with basic or fundamental questions of science rather than applied ones. They may be formulated from traditional basic courses in such areas of study as biology, chemistry, physics, astronomy, geology or agriculture. As well, courses related to understanding the role and functions of computers (e.g., data management and information processing) and assorted computer-related technologies should be offered in a non-applied manner to provide students with an opportunity to explore the impact of these concepts and practices on their lives.

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