



8669

APPLIED ENGINEERING
DESIGN DRAFTING (12D)

40S/40E/40M

A Design Drafting Course

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Course Description

Applied Engineering Design Drafting is intended for students transitioning to industry or post-secondary education from design drafting.

Curriculum content provides for the application of the design process for client-specific engineering and manufacturing projects. Communication with the client and engineering professionals will determine the project scope and proposed design solutions. Students will design and modify their proposal and create the required presentation and working drawings. Students will present their design solutions to others.

Students will apply safety procedures and employability skills independently. Students will demonstrate their knowledge, skills, and attitudes in the areas of career and portfolio development, sustainability, and new and emerging technologies in engineering design drafting.

Cross-curricular learning outcomes, which include those in design drafting math, science, and the interpretation of technical documents, are to be integrated into the course.

The learning outcomes are organized by Technology Fundamentals (F), Technology Skills (S), and Professional Practice (P) strands. For instructional purposes, the sequence of learning outcomes and the learning outcomes included in each unit of study can vary based on the projects within the course.

Goal 1: Solve problems using the **design process**.

GLO 1.1: Define design problems.

- SLO 12D.F.1.1.1 Collaborate with a client to define design problems.
 - SLO 12D.S.1.1.1 Use a structured model to solve, refine, and revise advanced engineering problems and to create buildable manufacturing drawings.
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GLO 1.2: Research and analyze information for design solutions.

- SLO 12D.F.1.2.1 Research and analyze the engineering principles (e.g., sustainability, universal design, aesthetics) and factors (e.g., client requirements, materials, cost, manufacturing process, availability) to solve engineering design problems.

- SLO 12D.S.1.2.1 Select and incorporate engineering principles (e.g., sustainability, universal design, aesthetic) and factors (e.g., client requirements, materials, manufacturing process, cost, availability) into design solutions.
 - SLO 12D.S.1.2.2 Create and revise sketches and notes based on engineering research and analysis.
 - SLO 12D.S.1.2.3 Research and reference information from various engineering and manufacturing sources.
 - SLO 12D.S.1.2.4 Analyze and predict consequences of design modifications.
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GLO 1.3: Synthesize information and ideas to create design solutions.

- SLO 12D.F.1.3.1 Identify the decision-making process required to arrive at the best (compromised) design solution for the client.
 - SLO 12D.S.1.3.1 Select design solutions based on engineering research and client requirements.
 - SLO 12D.S.1.3.2 Create freehand sketches using a variety of media to solve engineering design problems.
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Goal 2: Communicate design solutions.

GLO 2.1: Prepare **computer models** of design solutions.

- SLO 12D.F.2.1.1 Analyze research results and client requirements to select the process for modelling parts, sub-assemblies, and assemblies.
 - SLO 12D.S.2.1.1 Incorporate engineering features into computer model parts, sub-assemblies, and assemblies.
 - SLO 12D.S.2.1.2 Create and modify a computer model to visualize, analyze, and communicate design solutions.
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GLO 2.2: Prepare working and presentation drawings and documents.

- SLO 12D.F.2.2.1 Read and interpret drafting, engineering, and manufacturing standards.
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Goal 3: Use appropriate materials and processes of building/manufacturing.

GLO 3.1: Describe **materials** used in design solutions.

- SLO 12D.F.3.1.1 Analyze materials and standard parts based on research and client requirements.

SLO 12D.S.3.1.1 Select materials and standard parts based on research and client requirements.

GLO 3.2: Describe building/manufacturing processes used in design solutions.

SLO 12D.F.3.2.1 Analyze manufacturing processes based on research and client requirements.

SLO 12D.F.3.2.2 Describe project management and production practices (e.g., LEAN, TQM, TPS).

SLO 12D.S.3.2.1 Select manufacturing processes based on research and client requirements.

Goal 4: Present design solutions.

GLO 4.1: Plan and organize presentations of design solutions.

SLO 12D.F.4.1.1 Differentiate among the effectiveness of various presentation methods.

SLO 12D.S.4.1.1 Select presentation methods based on client requirements.

GLO 4.2: Use presentation production methods.

SLO 12D.F.4.2.1 Assess written and visual presentation methods based on project complexity, budget, available time, and client requirements.

SLO 12D.F.4.2.2 Identify the techniques to create 3-D engineering physical models.

SLO 12D.S.4.2.1 Choose written and visual presentation methods to communicate effectively with client.

SLO 12D.S.4.2.2 Communicate effectively using presentation software incorporating design elements (e.g., formatting, layout, font size).

SLO 12D.S.4.2.3 Create physical models.

GLO 4.3: Present/defend design solutions.

SLO 12D.F.4.3.1 Assess and adapt the presentation and communication techniques (e.g., appearance and dress, enunciation and volume, body language) for the client.

SLO 12D.F.4.3.2 Research out-of-school student competitions related to engineering design drafting.

SLO 12D.S.4.3.1 Present design solutions to clients and respond to questions and feedback.

Goal 5: Describe and apply the common **tools and equipment** used in design drafting.

GLO 5.1: Describe and use **drawing and modelling tools and equipment**.

- SLO 12D.F.5.1.1 Identify specialized sketching tools and media (e.g., charcoal, paint, felt pen, pen and ink).
 - SLO 12D.F.5.1.2 Select the drawing, modelling, and measuring tools and equipment based on own assessment of the project.
 - SLO 12D.S.5.1.1 Use specialized sketching tools and media (e.g., charcoal, paint, felt pen, pen and ink).
 - SLO 12D.S.5.1.2 Use the drawing, modelling, and measuring tools and equipment based on own assessment of the project.
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GLO 5.2: Describe and use **computer hardware and equipment**.

- SLO 12D.F.5.2.1 Select the computer hardware and equipment based on own assessment of the project.
 - SLO 12D.S.5.2.1 Use communication devices to interact with clients, industry experts, manufacturers, and suppliers.
 - SLO 12D.S.5.2.2 Operate input devices (e.g., digital camera, scanner).
 - SLO 12D.S.5.2.3 Operate output devices (e.g., printers, plotters).
 - SLO 12D.S.5.2.4 Troubleshoot computer and printer/plotter problems.
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GLO 5.3: Describe and use **software**.

- SLO 12D.F.5.3.1 Select software based on own assessment of the project.
- SLO 12D.F.5.3.2 Discuss advanced features of office software in the design and presentation process.
- SLO 12D.F.5.3.3 Identify information communication technologies (e.g., RSS feeds, blogs, technical websites, discussion boards) related to design drafting.
- SLO 12D.S.5.3.1 Analyze and select software and tools necessary to complete the engineering project.
- SLO 12D.S.5.3.2 Demonstrate use of electronic communications technology.
- SLO 12D.S.5.3.3 Manage project data using the file sharing and management features of CADD software.
- SLO 12D.S.5.3.4 Manage, organize, and share project files in a networked environment.
- SLO 12D.S.5.3.5 Use and manipulate digital images, at an advanced level, to obtain and record information (e.g., portfolio collection, research).

SLO 12D.S.5.3.6 Use information communication technologies (e.g., RSS feeds, blogs, technical websites, discussion boards) related to engineering design drafting.

Goal 6: Describe and apply transferable **cross-curricular knowledge and skills** that relate to design drafting.

GLO 6.1: Describe and apply **mathematical concepts** as they relate to design drafting.

SLO 12D.F.6.1.1 Select mathematical methods to solve engineering design problems.

SLO 12D.S.6.1.1 Perform mathematical calculations, conversions, and measurements as required for client project.

GLO 6.2: Read, interpret, and communicate information.

SLO 12D.F.6.2.1 Compare sources of design and technical information.

SLO 12D.S.6.2.1 Synthesize design and technical information from oral, visual, material, print, or electronic sources.

SLO 12D.S.6.2.2 Read, interpret, and apply design and technical information from text, tables, charts, and graphs.

SLO 12D.S.6.2.3 Communicate using the language and terminology of engineering design drafting.

GLO 6.3: Understand **scientific concepts** as they apply to design drafting.

SLO 12D.S.6.3.1 Use materials and engineering processes based on aesthetic and scientific properties.

Goal 7: Demonstrate an awareness of **sustainability** as it pertains to design drafting.

GLO 7.1: Understand the impact of architectural/engineering design on the **environment**.

SLO 12D.F.7.1.1 Analyze sustainable factors, materials, and manufacturing processes that affect engineering design solutions.

SLO 12D.F.7.1.2 Differentiate between the effects of various manufacturing processes on the environment.

SLO 12D.S.7.1.1 Select and incorporate sustainable factors, materials, and manufacturing processes that affect engineering design solutions.

GLO 7.2: Describe the impact of architectural/engineering design on **human health and well-being.**

- SLO 12D.F.7.2.1 Analyze sustainable factors, materials, and manufacturing processes that affect human health and well-being.
 - SLO 12D.F.7.2.2 Analyze the effect of manufacturing processes on human health and well-being.
 - SLO 12D.S.7.2.1 Select and incorporate human health and well-being sustainable factors, materials, and manufacturing processes in engineering design solutions.
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GLO 7.3: Recognize the **economic impact** of sustainable practices in architectural/engineering design.

- SLO 12D.F.7.3.1 Analyze economic sustainability factors that affect the selection of materials and manufacturing processes.
 - SLO 12D.F.7.3.2 Analyze the economic impact of sustainable factors, materials, and manufacturing processes on engineering design solutions.
 - SLO 12D.S.7.3.1 Select economic sustainable factors, materials, and manufacturing processes that affect engineering design solutions.
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Goal 8: Understand the **evolution** of design drafting, including its **technological progression and emerging trends.**

GLO 8.1: Describe the **evolution of design drafting, including its technological progression and emerging trends.**

- SLO 12D.F.8.1.1 Demonstrate an appreciation of the changing role of the draftsman based on emerging trends and technologies.
 - SLO 12D.F.8.1.2 Describe emerging styles and trends and their impact on the selection of materials, manufacturing processes, and engineering design.
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Goal 9: Follow the **ethical and legal standards** in design drafting.

GLO 9.1: Incorporate the local and national **building codes and standards as well as manufacturing and engineering standards** into designs.

- SLO 12D.P.9.1.1 Select the appropriate standard for engineering drafting projects.
- SLO 12D.P.9.1.2 Produce technical drawings to CAN/CSA, ISO, and ANSI standards.

- SLO 12D.P.9.1.3 Interpret criteria from different government regulatory bodies.
 - SLO 12D.P.9.1.4 Select and use CADD standards (e.g., discipline specific, trade specific, organization) based on client requirements.
 - SLO 12D.P.9.1.5 Produce engineering drawings to legal and manufacturable standards.
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GLO 9.2: Describe the **ethical expectations** of designers.

- SLO 12D.P.9.2.1 Apply ethical practices in producing contract documents.
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Goal 10: Demonstrate a knowledge of and ability to recognize and apply appropriate **health and safety** requirements and practices to maintain a safe workplace.

GLO 10.1: Demonstrate an awareness of **rights, responsibilities, and safety procedures** for specific tools, equipment, and working environments.

- SLO 12D.P.10.1.1 Demonstrate and value safe work practices and procedures.
 - SLO 12D.P.10.1.2 Demonstrate ergonomically correct procedures to avoid injury (e.g., stress, strain).
 - SLO 12D.P.10.1.3 Demonstrate personal responsibility for health and safety.
 - SLO 12D.P.10.1.4 Demonstrate the safety features of tools and equipment.
 - SLO 12D.P.10.1.5 Follow emergency evacuation procedures.
 - SLO 12D.P.10.1.6 Use appropriate aids to minimize risk of injury.
 - SLO 12D.P.10.1.7 Use appropriate personal protective equipment.
 - SLO 12D.P.10.1.8 Locate first aid stations and fire extinguishers.
 - SLO 12D.P.10.1.9 Demonstrate an awareness of external health and safety programs and certifications.
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GLO 10.2: Describe **health and safety laws and regulations**.

- SLO 12D.P.10.2.1 Describe the reporting process for injuries.
- SLO 12D.P.10.2.2 Identify WHMIS symbols and terminology, and follow WHMIS guidelines, including the location of MSDS sheets.
- SLO 12D.P.10.2.3 Comply with health and safety legislation and practices.

Goal 11: Demonstrate **employability skills** required in design drafting.

GLO 11.1: Demonstrate fundamental **employability skills**.

- SLO 12D.P.11.1.1 Describe the importance of employability skills in school, work, and daily life.
 - SLO 12D.P.11.1.2 Listen and ask questions to clarify problems and instructions.
 - SLO 12D.P.11.1.3 Locate, gather, and organize design drafting information using appropriate technology and information systems.
 - SLO 12D.P.11.1.4 Assess situations and identify problems and possible solutions.
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GLO 11.2: Demonstrate **personal management** skills.

- SLO 12D.P.11.2.1 Demonstrate interest, initiative, and effort.
 - SLO 12D.P.11.2.2 Manage time to complete tasks/projects within stated time frames.
 - SLO 12D.P.11.2.3 Demonstrate accountability for own actions and for the actions of one's team.
 - SLO 12D.P.11.2.4 Respond constructively to changes.
 - SLO 12D.P.11.2.5 Demonstrate a willingness to learn continuously.
 - SLO 12D.P.11.2.6 Appreciate the need for continuous learning in technologically dependent occupations.
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GLO 11.3: Demonstrate **teamwork** skills.

- SLO 12D.P.11.3.1 Be respectful toward, open to, and supportive of the thoughts, opinions, and contributions of others in a group.
- SLO 12D.P.11.3.2 Contribute information and skills to achieve the goals of a group.
- SLO 12D.P.11.3.3 Contribute willingly to classroom/shop learning activities.
- SLO 12D.P.11.3.4 Accept assistance from and offer it to others.
- SLO 12D.P.11.3.5 Collaborate with peers and industry professionals.

Goal 12: Describe **career opportunities** in design drafting.

GLO 12.1: Describe **post-secondary opportunities** related to design drafting.

SLO 12D.P.12.1.1 Discuss the post-secondary application process (e.g., deadlines, forms, applications, scholarships).

GLO 12.2: Describe **career opportunities** available in design drafting across industries.

SLO 12D.P.12.2.1 Explore engineering careers.

SLO 12D.P.12.2.2 Identify information needed for transition from school to work.

GLO 12.3: Create, maintain, and present a **portfolio**.

SLO 12D.P.12.3.1 Reflect on and include a complete set of engineering documents for a project in a design drafting portfolio.

SLO 12D.P.12.3.2 Present a design drafting portfolio.
