Engineering Drawing and Design

8493 18 weeks

8436 36 weeks

Table of Contents

Acknowledgments

The components of this instructional framework were developed by the following business panel team members:

Donnie Land, Design Associate, Kimley-Horn and Associates
Derek McCalla, Architectural Designer, Moseley Architects
Billy Wooten, Drafting Technician, Richmond, VA

The following teachers served on the curriculum development team:

Jacob Leonard, Page County High School, Page County Public Schools
Emily Loving, Chesterfield Technical Center, Chesterfield County Public Schools
Steven Raileanu, Louisa County High School, Louisa County Public Schools

Jennifer Renne, Landstown High School, Virginia Beach City Schools
Walter Thomasser, Colonial Forge High School, Stafford County Public Schools

Correlations to the Virginia Standards of Learning were reviewed and completed by:

Vickie L. Inge, Mathematics Committee Member, Virginia Mathematics and Science Coalition
Anne F. Markwith, New Teacher Mentor, Gloucester County Public Schools
Cathy Nichols-Cocke, PhD, Fairfax High School, Fairfax County Public Schools
Caroline C. Wheeler, M.T., Secondary English

The framework was edited and produced by the CTE Resource Center:

Robin A. Jedlicka, Writer/Editor
Kevin P. Reilly, Administrative Coordinator

Dr. Lynn Basham, Specialist for Technology Education
Office of Career, Technical, and Adult Education
Virginia Department of Education

Dr. Tricia S. Jacobs, CTE Coordinator of Curriculum and Instruction
Office of Career, Technical, and Adult Education Services
Virginia Department of Education

Course Description

Suggested Grade Level: 10 or 11 or 12
Prerequisites: 8434 or 8435 or 8439

Students use a graphic language for product design, technical illustration, evaluation of designs, and engineering drawings. They increase their understanding of drawing techniques learned in the prerequisite course. Students use computers, calculators, and descriptive geometry and adhere to established standards to solve design problems. They work in teams to design solutions for an identified need.

Task Essentials Table

- Tasks/competencies designated by plus icons (⊕) in the left-hand column(s) are essential
- Tasks/competencies designated by empty-circle icons (○) are optional
- Tasks/competencies designated by minus icons (⊖) are omitted

- Tasks marked with an asterisk (*) are sensitive.

Task Number	8436	8493	Tasks/Competencies
Introducing the Design Process			
39	⊕	⊕	Define *engineering drawing*.
40	⊕	⊕	Describe the engineering design process.
41	⊕	⊕	Apply the engineering design process.
Exploring Engineering Design Foundations			
42	⊕	⊕	Investigate engineering-related careers.
43	⊕	⊕	Acquire specification information, using a reference library of technical data.
44	⊕	⊕	Use English and metric measuring devices and systems.
45	⊕	⊕	Create objects, using solid modeling.
46	⊕	⊕	Apply mathematical formulas to engineering drawings.
Producing Illustrations			
47	⊕	○	Prepare drawings of parts that transfer energy or motion in mechanical systems.
48	⊕	○	Draw a thread detail.
49	⊕	⊕	Prepare freehand technical sketches.
50	⊕	⊕	Apply principles of dimensioning and annotation.
51	⊕	⊕	Develop design ideas using freehand multi-view and pictorial sketches.
52	⊕	⊕	Design an assembly and prepare working drawings as part of a design team.
53	⊕	⊕	Create parts of the assembly using a 3-D printer
54	⊕	⊕	Use descriptive geometry to solve problems.

55	⊕	⊕	Create auxiliary views and revolutions.
56	⊕	⊕	Create development drawings.
57	⊕	⊕	Construct models from various geometric shapes created from development drawings.
58	⊕	○	Create examples of mechanical, fluid, and/or electrical/electronic drawings.
59	⊕	⊕	Deliver a presentation to explain an engineered system.

Legend: ⊕Essential ○Non-essential ⊖Omitted

Curriculum Framework

Introducing the Design Process

Task Number 39

Define *engineering drawing*.

Definition

Definition should include the fact that engineering drawing is the primary method of communication relating to the design and conveyance/understanding of ideas. It is used to fully and clearly define requirements for engineered items.

Process/Skill Questions

- What is engineering drawing and design?
- How has engineering drawing and design affected our society in the areas of transportation and manufacturing?
- What is the role of engineering drawing and design in our society today?

ITEEA National Standards

Engineering Design

Relationships Among Technologies and the Connections Between Technology and Other Fields

The Characteristics and Scope of Technology

The Core Concepts of Technology

TSA Competitive Events

Animatronics

Computer-Aided Design (CAD), Engineering

Dragster Design

Flight Endurance

Structural Design and Engineering

Transportation Modeling

Task Number 40

Describe the engineering design process.

Definition

Description should include the concept that the engineering design process is a systematic, creative process for solving problems concerning real objects, products, systems, and environments. The steps of the process include

- identification of a design problem
- identification of criteria and constraints
- refinement of the design
- evaluation of the design
- development of a product or system using quality control
- reevaluation of final solutions.

See also "Engineering Design Process" (TeachEngineering):
https://www.teachengineering.org/k12engineering/designprocess

Process/Skill Questions

- How can design problems be identified?
- Why should you research a problem?
- What are the types of problems that concern engineers?
- Why is it important to identify criteria and constraints?
- What techniques are used to refine a design?
- How can a design be evaluated?
- What is quality control?
- Why should final solutions be reevaluated? How is this done?

ITEEA National Standards

Apply Design Processes

Engineering Design

The Attributes of Design

The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

TSA Competitive Events

Computer-Aided Design (CAD), Engineering

Dragster Design

Engineering Design

Extemporaneous Speech

Task Number 41

Apply the engineering design process.

Definition

Application should include

- identifying a design problem
- identifying criteria and constraints
- refining the design
- considering optimization and trade-offs

- evaluating the design
- developing a product or system using quality control
- reevaluating solution(s).

Application should also include

- using analysis features of computer-aided design and drafting (CADD) software to improve a digital prototype (simulation, stress analysis)
- designing parts using mathematical parameters
- modifying parameters to update designs of parts or systems
- creating physical models or prototypes from digital designs.

Process/Skill Questions

- What are the steps in the engineering design process?
- Why should the design be tested throughout the engineering process?
- What problems did you find with the model while reevaluating it?

ITEEA National Standards

Apply Design Processes

The Attributes of Design

The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

TSA Competitive Events

Animatronics

Architectural Design

Biotechnology Design

Computer Integrated Manufacturing (CIM)

Computer-Aided Design (CAD), Engineering

Dragster Design

Engineering Design

Software Development

Technology Problem Solving

Video Game Design

Exploring Engineering Design Foundations

Task Number 42

Investigate engineering-related careers.

Definition

Investigation should include a variety of methods, which may include interviews, Internet searches, mentorships, internships, and documentation research.

Process/Skill Questions

- How is civil engineering drawing different from mechanical engineering drawing?
- What are the educational requirements to become a naval engineer?
- What are the educational requirements to become a mechanical engineer?

ITEEA National Standards

Assess the Impact of Products and Systems

Engineering Design

Information and Communication Technologies

The Characteristics and Scope of Technology

The Cultural, Social, Economic, and Political Effects of Technology

The Influence of Technology on History

The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

Use and Maintain Technological Products and Systems

TSA Competitive Events

Computer-Aided Design (CAD), Architecture

Computer-Aided Design (CAD), Engineering

Dragster Design

Engineering Design

Structural Design and Engineering

Task Number 43

Acquire specification information, using a reference library of technical data.

Definition

Acquisition of technical information should use various sources, which may include

- instructor handouts
- machinist handbook
- reference tables from text(s)
- online data libraries.

Students will organize data through the use of drawing files, spreadsheets, and other technical data. They may use notebooks, electronic storage devices, and manuals.

Process/Skill Questions

- What may be included in a reference library?
- What is technical data?
- What are the steps for copying, moving, and deleting drawing files?
- How do you create and delete folders?
- How do you merge files?

ITEEA National Standards

Assess the Impact of Products and Systems

Engineering Design

Information and Communication Technologies

The Characteristics and Scope of Technology

The Cultural, Social, Economic, and Political Effects of Technology

The Influence of Technology on History

The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

Use and Maintain Technological Products and Systems

TSA Competitive Events

Computer-Aided Design (CAD), Engineering

Dragster Design

Engineering Design

Structural Design and Engineering

Task Number 44

Use English and metric measuring devices and systems.

Definition

Use should include engineer's scale, metric scale, decimal measurement, and fractional measurement.

Process/Skill Questions

- What measurement system is used in Europe?
- What is the purpose of scale?

- What are some of the common scales used in engineering?
- What are some of the common scales used in architecture?
- What is the scale of this drawing, and what units are being used?

ITEEA National Standards

Engineering Design

Relationships Among Technologies and the Connections Between Technology and Other Fields

The Attributes of Design

The Core Concepts of Technology

The Influence of Technology on History

The Role of Society in the Development and Use of Technology

TSA Competitive Events

Computer-Aided Design (CAD), Engineering

Dragster Design

Engineering Design

Flight Endurance

Structural Design and Engineering

Task Number 45

Create objects, using solid modeling.

Definition

Solid modeling is most often used to visualize concepts, parts, and designs in such a way as to allow clear understanding. Solid modeling may include

- extruding a model
- revolving a model

- intersecting a model
- subtracting a model
- slicing a model
- sweeping a model
- constructing 3-D faces
- arraying a 3-D feature
- mirroring a 3-D feature.

Process/Skill Questions

- What is solid modeling?
- What is an advantage of parametric software?
- What is the difference between a surface model and a solid model?
- How is an orthographic projection created from a solid model?
- What are the types of tests we can perform on solid models?
- What information is available from a solid model?
- How are patterns and arrays used in engineering design?
- What is the difference between a sketch and a feature?
- What is the difference between surfaces and solids?

ITEEA National Standards

Apply Design Processes

Assess the Impact of Products and Systems

Engineering Design

The Attributes of Design

The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

Use and Maintain Technological Products and Systems

TSA Competitive Events

Computer-Aided Design (CAD), Engineering

Dragster Design

Engineering Design

Flight Endurance

Structural Design and Engineering

Technology Problem Solving

Transportation Modeling

Task Number 46

Apply mathematical formulas to engineering drawings.

Definition

Application of formulas may be used to determine the size and shape of objects and features and to control the relative positions of components within assemblies. Algebra and geometry may be used to find missing dimensions. Mathematical formulas for engineering drawings may include

- determining the scale of a drawing
- converting unit systems
- determining the depth of threads of a fastener and the pitch of a threaded fastener
- calculating true length and width of an inclined or oblique plane
- calculating gear ratios and the number of teeth on a gear.

Process/Skill Questions

- What is the definition of *parameter*?
- How might a spreadsheet be used to link parameters to an engineered part drawing?
- What are the factors to consider when choosing a scale of a drawing?
- How are auxiliary views and revolutions used to show the true length and width of inclined and oblique planes?
- How is the number of teeth on a gear related to the gear ratio?
- How can you solve to find a missing angle?
- How can you find the hypotenuse of a triangle?

ITEEA National Standards

Apply Design Processes

Engineering Design

TSA Competitive Events

Computer-Aided Design (CAD), Engineering

Dragster Design

Engineering Design

Structural Design and Engineering

Producing Illustrations

Task Number 47

Prepare drawings of parts that transfer energy or motion in mechanical systems.

Definition

Preparation should include calculating formulas. Parts that transfer energy or motion may include

- cams
- gears
- belts
- linkages
- shafts.

Process/Skill Questions

- What is a *cam*?
- What are the various types of cams?
- What are the types of motions that can be produced by cams?
- What are the various types of gears?
- How do engineers apply gear formulas to solve problems and transfer motion between mechanical parts?
- What are the commands and options in computer-assisted design (CAD) software that help to illustrate the path of a cam or the teeth of a gear?
- What is a cam displacement diagram, and for what is it used?
- How is the curve on a spur gear tooth developed?

ITEEA National Standards

Apply Design Processes

Energy and Power Technologies

Engineering Design

Manufacturing Technologies

Transportation Technologies

TSA Competitive Events

Animatronics

Computer-Aided Design (CAD), Engineering

Task Number 48

Draw a thread detail.

Definition

Drawing should include

- calculating thread details
- creating a thread profile
- modeling a thread profile.

Thread representations communicate different graphic forms of thread patterns. This may include simplified, detailed, and schematic.

Process/Skill Questions

- What is a *detailed thread representation*?
- What are the differences among schematic, detailed, and simplified thread representations?
- How can a symbols library be used to illustrate drawings with threaded fasteners?
- How can you create a solid model of a screw thread using 3-D software?

ITEEA National Standards

Apply Design Processes

Assess the Impact of Products and Systems

Engineering Design

Information and Communication Technologies

The Attributes of Design

The Role of Society in the Development and Use of Technology

The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

TSA Competitive Events

Computer-Aided Design (CAD), Engineering

Task Number 49

Prepare freehand technical sketches.

Definition

Technical sketching is the recording of multiple views of preliminary ideas to solve a given design problem. Sketches may include

- pictorial
- multi-view
- sections
- auxiliary
- patterns
- geometric constructions.

Process/Skill Questions

- What are four types of sketches?
- What are the steps in sketching circles and arcs?

- How much emphasis should be placed on accuracy/detail when dealing with freehand drawings?

ITEEA National Standards

Apply Design Processes

Engineering Design

Information and Communication Technologies

The Attributes of Design

TSA Competitive Events

Animatronics

Dragster Design

Engineering Design

Flight Endurance

Structural Design and Engineering

Technology Problem Solving

Transportation Modeling

Task Number 50

Apply principles of dimensioning and annotation.

Definition

Advanced dimensions give information about sizes and locations. These may include

- height
- width
- depth
- angles
- fillets and rounds

- datums
- surface texture
- tolerances
- associative
- welding.

Process/Skill Questions

- What basic information is given by dimensions?
- What are the consequences of incorrect dimensioning?
- What is a size dimension?
- What is a location dimension?
- What is a *datum*?
- What is *tolerancing*?

ITEEA National Standards

Apply Design Processes

Engineering Design

Information and Communication Technologies

Relationships Among Technologies and the Connections Between Technology and Other Fields

The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

TSA Competitive Events

Animatronics

Computer-Aided Design (CAD), Engineering

Dragster Design

Engineering Design

Structural Design and Engineering

Task Number 51

Develop design ideas using freehand multi-view and pictorial sketches.

Definition

Development should include sketching parts of a device the students will assemble from each person's work, or parts of an assembly to be prepared.

Process/Skill Questions

- Why does a design team work with sketches before starting formal drawings of things?
- How can parts of something fit together if they are manufactured in different countries?
- What role does tolerance dimensioning play in a successful product design?
- What role does knowledge of material play in design?

ITEEA National Standards

Apply Design Processes

Engineering Design

Information and Communication Technologies

The Attributes of Design

The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

Use and Maintain Technological Products and Systems

TSA Competitive Events

Animatronics

Computer-Aided Design (CAD), Engineering

Dragster Design

Engineering Design

Flight Endurance

Structural Design and Engineering

Task Number 52

Design an assembly and prepare working drawings as part of a design team.

Definition

Assembly and working drawings are often necessary to help visualize the relationship between parts. Assembly and working drawings may include

- design assembly
- installation assembly
- detail drawings
- item lists (bills of materials)
- notes and specifications
- exploded assemblies
- machining information and manufacturing processes
- sub-assembly.

Process/Skill Questions

- Define the following terms: *design assembly drawings*, *design assembly*, and *installation assembly*.
- What is an identification part number, and what is its function?
- What manufacturing processes will be used to create the product?
- What does the bill of materials display?
- What types of views should be created to fully describe this product or system?

ITEEA National Standards

Apply Design Processes

Engineering Design

Information and Communication Technologies

Manufacturing Technologies

The Attributes of Design

The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

Use and Maintain Technological Products and Systems

TSA Competitive Events

Animatronics

Computer-Aided Design (CAD), Engineering

Dragster Design

Engineering Design

Flight Endurance

Structural Design and Engineering

Transportation Modeling

Task Number 53

Create parts of the assembly using a 3-D printer

Definition

Creation should include individual parts of the assembly prepared by team members. Parts should fit together as a complete assembly.

Process/Skill Questions

- Why is it important to consider manufacturing techniques when designing?
- If parts of an assembly do not fit, what part of the design process must be revisited?
- What role does tolerance play in designing?

ITEEA National Standards

Apply Design Processes

Engineering Design

Task Number 54

Use descriptive geometry to solve problems.

Definition

Descriptive geometry is primarily used to graphically illustrate mathematical problems and may include revolutions, multi-auxiliary, and secondary auxiliary.

Process/Skill Questions

- What is *descriptive geometry*?
- Define the terms *referenced planes*, *reference line*, and *axis of revolution*.
- What type of an auxiliary view would be needed to show the true shape of an oblique surface?

ITEEA National Standards

Apply Design Processes

Engineering Design

Information and Communication Technologies

Relationships Among Technologies and the Connections Between Technology and Other Fields

The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

TSA Competitive Events

Computer-Aided Design (CAD), Engineering

Dragster Design

Engineering Design

Flight Endurance

Structural Design and Engineering

Technology Problem Solving

Transportation Modeling

Task Number 55

Create auxiliary views and revolutions.

Definition

Auxiliary views and revolutions are used to describe the true shape of inclined and oblique planes. Creation should include

- choosing the primary orthographic view from which the auxiliary view is projected
- demonstrating that the edge view of the inclined surface is perpendicular to one of the three principal planes
- establishing a projection plane parallel to the inclined surface
- portraying the true length, depth, or height in the primary (orthographic) view
- illustrating the true shape of the auxiliary view.

Process/Skill Questions

- How are detail views helpful in illustrating complex locations?
- What is an auxiliary view, and for what is it used?
- What are the steps in drawing auxiliary views?
- Why should you not dimension an inclined plane when it is displayed on an orthographic projection?
- Why would secondary auxiliary views be needed?

TSA Competitive Events

Animatronics

Computer-Aided Design (CAD), Engineering

Dragster Design

Engineering Design

Flight Endurance

Structural Design and Engineering

Task Number 56

Create development drawings.

Definition

Developments are constructed to show the complete surface or surfaces laid out on a flat plane. These may include

- products made of different materials (e.g., sheet metal, plastic)
- parallel-line development
- cylindrical surfaces
- conical surfaces
- radial-line development
- development of curved surfaces through triangulation
- spheres
- intersecting prisms
- tabs and fold lines.

Process/Skill Questions

- What is the purpose of a surface development?
- What is a *line of intersection*?
- What is the best method of development for this pattern?
- What tools and options in CAD can enable us to more easily create the pattern for a cylinder or a rectangular pyramid?

ITEEA National Standards

Apply Design Processes

Engineering Design

Information and Communication Technologies

The Attributes of Design

The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

Use and Maintain Technological Products and Systems

TSA Competitive Events

Animatronics

Computer-Aided Design (CAD), Engineering

Engineering Design

Fashion Design and Technology

Flight Endurance

Task Number 57

Construct models from various geometric shapes created from development drawings.

Definition

Construction should include the intersection of shapes such as cylinders, spheres, and prisms at varied angles.

Process/Skill Questions

- How do parts with different geometric shapes intersect each other?
- How does the intersection of shapes affect the development of systems?
- What other manufacturing factors may affect design of parts and systems?

ITEEA National Standards

Apply Design Processes

Assess the Impact of Products and Systems

Engineering Design

The Attributes of Design

The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

Use and Maintain Technological Products and Systems

TSA Competitive Events

Computer-Aided Design (CAD), Engineering

Dragster Design

Flight Endurance

Structural Design and Engineering

Technology Problem Solving

Transportation Modeling

Task Number 58

Create examples of mechanical, fluid, and/or electrical/electronic drawings.

Definition

Examples of engineering drawings include welding processes, structural drawings, fluid drawings such as pipes, HVAC layouts, and electrical or electronic schematics.

Process/Skill Questions

- What is the purpose of schematic drawings?
- How are these drawing types interrelated?
- How are symbols portrayed in different types of drawings?

ITEEA National Standards

Apply Design Processes

Engineering Design

Information and Communication Technologies

The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

Use and Maintain Technological Products and Systems

TSA Competitive Events

Animatronics

Computer-Aided Design (CAD), Engineering

Dragster Design

Engineering Design

Flight Endurance

Structural Design and Engineering

Transportation Modeling

Task Number 59

Deliver a presentation to explain an engineered system.

Definition

Presentation may include

- graphic representations of the engineered system
- discussion of the system
- problems encountered during the construction of the system
- historical background of the system
- examples of related systems
- details about the parts of the system and how they are interrelated.

Process/Skill Questions

- What are some engineered systems in history that developed into this system?
- How does the system work?
- What are the constraints of the system?
- What are some engineered systems that are similar to this one?

ITEEA National Standards

Assess the Impact of Products and Systems

Engineering Design

The Core Concepts of Technology

The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

TSA Competitive Events

Animatronics

Engineering Design

Prepared Presentation

Technology Bowl

SOL Correlation by Task

39	Define *engineering drawing*.	English: 10.3, 11.3, 12.3
40	Describe the engineering design process.	English: 10.5, 11.5, 12.5
41	Apply the engineering design process.	History and Social Science: GOVT.1
42	Investigate engineering-related careers.	English: 10.5, 10.8, 11.5, 11.8, 12.5, 12.8
43	Acquire specification information, using a reference library of technical data.	English: 10.5, 11.5, 12.5
44	Use English and metric measuring devices and systems.	Science: PH.1
45	Create objects, using solid modeling.	History and Social Science: WHII.1 Science: PH.1, PH.2
46	Apply mathematical formulas to engineering drawings.	
47	Prepare drawings of parts that transfer energy or motion in mechanical systems.	
48	Draw a thread detail.	
49	Prepare freehand technical sketches.	
50	Apply principles of dimensioning and annotation.	

51	Develop design ideas using freehand multi-view and pictorial sketches.	
52	Design an assembly and prepare working drawings as part of a design team.	
53	Create parts of the assembly using a 3-D printer	
54	Use descriptive geometry to solve problems.	
55	Create auxiliary views and revolutions.	
56	Create development drawings.	
57	Construct models from various geometric shapes created from development drawings.	
58	Create examples of mechanical, fluid, and/or electrical/electronic drawings.	
59	Deliver a presentation to explain an engineered system.	English: 10.1, 11.1, 12.1

Entrepreneurship Infusion Units

Entrepreneurship Infusion Units may be used to help students achieve additional, focused competencies and enhance the validated tasks/competencies related to identifying and starting a new business venture. Because the unit is a complement to certain designated courses and is not mandatory, all tasks/competencies are marked “optional.”

Appendix: Credentials, Course Sequences, and Career Cluster Information

Industry Credentials: Only apply to 36-week courses

- Autodesk Certified Professional Examinations
- Autodesk Certified User Examinations
- Certified SOLIDWORKS Associate (CSWA) Examination
- College and Work Readiness Assessment (CWRA+)
- Mechanical Drafting and Design Assessment
- National Career Readiness Certificate Assessment
- Technical Drafting Examination
- Workplace Readiness Skills for the Commonwealth Examination

Concentration sequences: *A combination of this course and those below, equivalent to two 36-week courses, is a concentration sequence. Students wishing to complete a specialization may take additional courses based on their career pathways. A program completer is a student who has met the requirements for a CTE concentration sequence and all other requirements for high school graduation or an approved alternative education program.*

- Advanced Drawing and Design (8438/36 weeks)
- Architectural Drawing and Design (8437/36 weeks)
- Architectural Drawing and Design (8492/18 weeks)
- Digital Visualization (8459/36 weeks)
- Technical Drawing and Design (8434/18 weeks)
- Technical Drawing and Design (8435/36 weeks)

Career Cluster: Science, Technology, Engineering and Mathematics	
Pathway	**Occupations**
Engineering and Technology	**Aeronautical Drafter** **Aerospace Engineering Technician** **Commercial and Industrial Designer** **Electrical Drafter** **Electrical Engineering Technician** **Electro-Mechanical Technician** **Electronic Drafter** **Engineer** **Engineering Technician** **Industrial Engineer** **Industrial Engineering Technician** **Mechanical Drafter** **Mechanical Engineer** **Mechanical Engineering Technician** **Pipeline Drafter**