Engineering Skills 2019 v1.0

Applied Senior Syllabus

This syllabus is for implementation with Year 11 students in 2019.

Queensland Government
Queensland Curriculum & Assessment Authority

170217

For all Queensland schools

Contents

1 Course overview

1.1 Introduction

1.1.1 Rationale

Technology has been an integral part of society for as long as humans have had the desire to create products to improve their quality of life. In an increasingly technological and complex world, it is important to develop the knowledge, understanding and skills associated with traditional and contemporary tools and materials used by Australian manufacturing industries to create products.

The engineering manufacturing industry transforms raw materials into products wanted by society. This adds value for both enterprises and consumers. Australia, as one of the most developed economies in the world, has strong manufacturing industries that provide employment for many people.

The Engineering Skills subject focuses on the underpinning industry practices and production processes required to create, maintain and repair predominantly metal products in the engineering manufacturing industry. This subject provides a unique opportunity for students to experience the challenge and personal satisfaction of undertaking practical work while developing beneficial vocational and life skills.

The subject includes two core topics — 'Industry practices' and 'Production processes'. Industry practices are used by manufacturing enterprises to manage the manufacturing of products from raw materials. Production processes combine the production skills and procedures required to create products. Students explore the knowledge, understanding and skills of the core topics through selected industry-based electives in response to local needs, available resources and teacher expertise.

Through both individual and collaborative learning experiences, students learn to meet customer expectations of product quality at a specific price and time. The majority of learning is done through manufacturing tasks that relate to business and industry, and that promote adaptable, competent, self-motivated and safe individuals who can work with colleagues to solve problems and complete practical work.

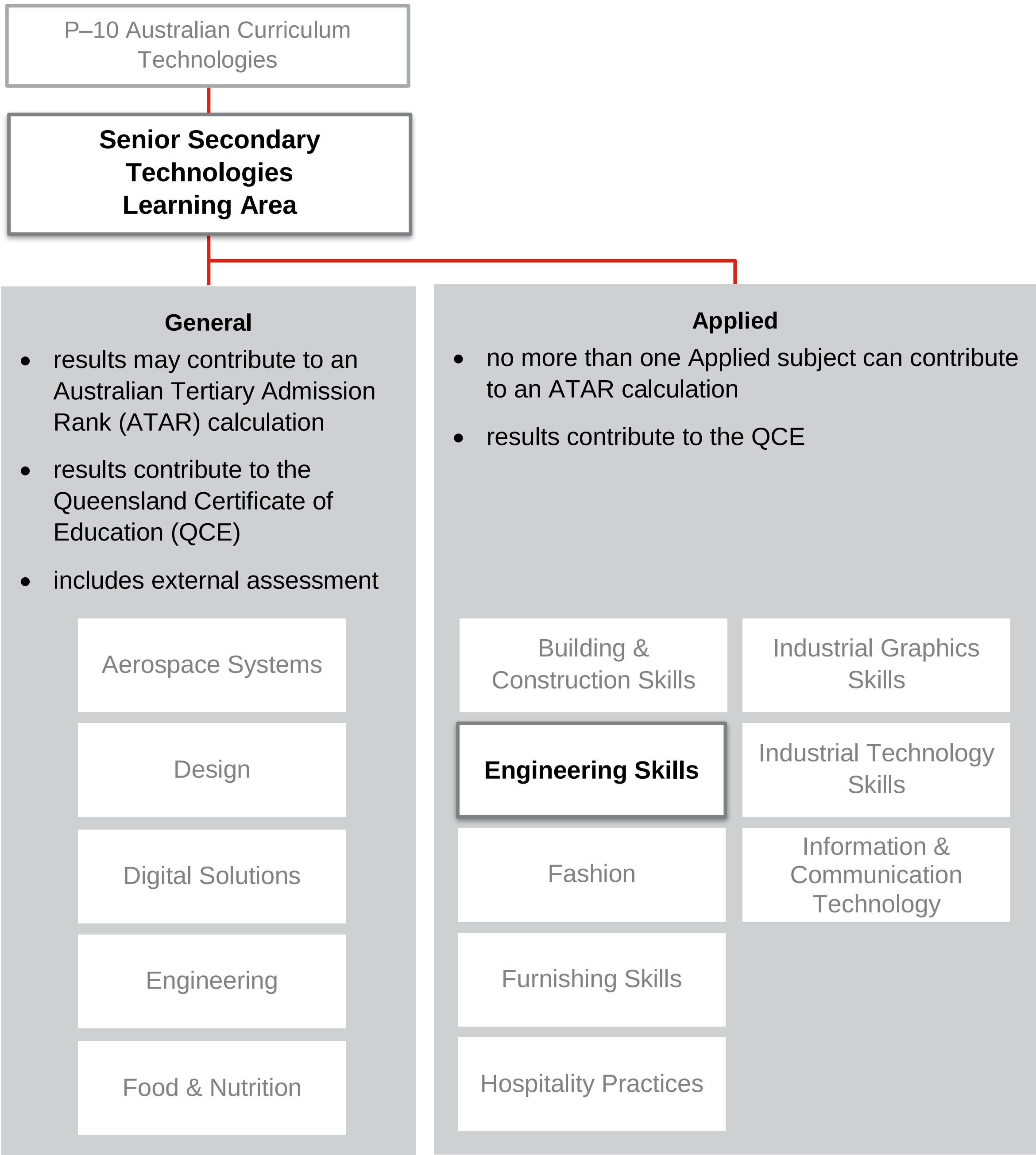
By doing manufacturing tasks, students develop transferable skills relevant to a range of industry-based electives and future employment opportunities. They understand industry practices, interpret specifications, including technical drawings, demonstrate and apply safe practical production processes with hand/power tools and machinery, communicate using oral, written and graphical modes, organise, calculate and plan production processes and evaluate the products they create using predefined specifications.

Pathways

A course of study in Engineering Skills can establish a basis for further education and employment. With additional training and experience, potential employment opportunities may be found in engineering trades as, for example, a sheet metal worker, metal fabricator, welder, maintenance fitter, metal machinist, locksmith, air-conditioning mechanic, refrigeration mechanic or automotive mechanic.

1.1.2 Learning area structure

Figure 1: Summary of subjects offered in the Technologies learning area



1.2 Teaching and learning

1.2.1 Dimensions and objectives

The dimensions are the salient properties or characteristics of distinctive learning for this subject. The objectives describe what students should know and be able to do by the end of the course of study.

Progress in a particular dimension may depend on the knowledge, understanding and skills developed in other dimensions. Learning through each of the dimensions increases in complexity to allow for greater independence for learners over a four-unit course of study.

The standards have a direct relationship with the objectives, and are described in the same dimensions as the objectives. Schools assess how well students have achieved all of the objectives using the standards.

The dimensions for a course of study in this subject are:

- Dimension 1: Knowing and understanding
- Dimension 2: Analysing and applying
- Dimension 3: Producing and evaluating.

Dimension 1: Knowing and understanding

Knowing and understanding refers to being familiar with the concepts and ideas used in manufacturing tasks within industry-based electives. This involves retrieving relevant knowledge and practical skills from memory, constructing meaning from instructional messages, and recognising, interpreting and demonstrating manufacturing tasks.

Objectives

By the conclusion of the course of study, students should:

- describe industry practices in manufacturing tasks
- demonstrate fundamental production skills
- interpret drawings and technical information.

When students describe, they use industry terminology and provide examples from manufacturing tasks to help clarify the meaning of industry practice concepts and ideas. These concepts and ideas include manufacturing enterprises and occupations, safety, personal and interpersonal skills in manufacturing workplaces, customer expectations of quality and impacts on production processes.

When students demonstrate, they reproduce fundamental production skills safely and correctly. These skills may include the operation of hand/power tools and machinery, maintenance of tools and equipment, measuring techniques, safe work practices and general housekeeping

When students interpret, they determine the meaning and features of drawings and industry-specific technical information to complete manufacturing tasks. Drawings and technical information together are defined as specifications.

Dimension 2: Analysing and applying

Analysing refers to breaking down information into its constituent parts and determining how the parts relate to each other and to an overall structure or purpose within manufacturing tasks. This may involve differentiating, organising and/or attributing. Applying refers to carrying out or using a procedure in a given situation.

Objectives

By the conclusion of the course of study, students should:

- analyse manufacturing tasks to organise materials and resources
- select and apply production skills and procedures in manufacturing tasks
- use visual representations and language conventions and features to communicate for particular purposes.

When students analyse and organise, they ascertain and examine constituent parts of industry practices and production processes to establish the work roles and skills, quality, safety, materials, quantities, tools and other related resources required to complete manufacturing tasks. This may include calculating quantities and costs, and identifying materials, particular tools, fasteners and procedures required to manipulate the materials used in the manufacturing task.

When students apply, they demonstrate their understanding by selecting and using particular industry production skills and procedures in preference to others in manufacturing tasks. Examples include selecting and following safe operating procedures, selecting, setting up and using hand/power tools and machinery for a purpose, and selecting and using production procedures such as marking out, cutting, joining and finishing.

When students use visual representations and language conventions and features, they convey industry-specific knowledge and/or understanding for particular purposes. Visual representations include photographs, sketches, drawings, diagrams, graphs and symbols. Language conventions and features include industry-specific vocabulary, grammar, spelling, punctuation, text types and structures in spoken and written modes. Communicating for particular purposes may include pictorial sketches, working drawings, verbal descriptions of production procedures, material lists, risk assessments, job cards and forms.

Dimension 3: Producing and evaluating

Producing refers to planning production processes, then creating functional products that meet predefined specifications. Evaluating involves reflecting on industry practices, production process and products to consider ways to improve future manufacturing tasks.

Objectives

By the conclusion of the course of study, students should:

- plan and adapt production processes
- create products from specifications
- evaluate industry practices, production processes and products, and make recommendations.

When students plan, they devise a series of actions that allows them to manufacture a product. Students consider the predefined specifications, production skills, selection and sequence of procedures, materials, consumables, safety (including risk assessment), management of time and cost and expectations of quality. When students adapt, they consider the feasibility, efficiency and modification of proposed production skills and procedures.

When students create, they synthesise knowledge and skills in industry practice and production processes to manufacture a functional product to predefined specifications. These specifications may include working drawings, sketches, templates and technical information. They make decisions about how to combine a range of production skills and procedures and actively engage in monitoring and modifying procedures as a result of issues arising during the production process.

When students evaluate, they test and check industry practices, production processes and their own created products for effectiveness, usability, functionality and suitability for the intended purpose. They also assign merit according to criteria derived from specifications. When students make recommendations, they consider alternatives and suggest ways to improve production processes and products.

1.2.2 Underpinning factors

There are five factors that underpin and are essential for defining the distinctive nature of Applied syllabuses:

- applied learning
- community connections
- core skills for work
- literacy
- numeracy.

These factors, build on the general capabilities found in the P–10 Australian Curriculum. They overlap and interact, are derived from current education, industry and community expectations, and inform and shape Engineering Skills.

All Applied syllabuses cover all of the underpinning factors in some way, though coverage may vary from syllabus to syllabus. Students should be provided with a variety of opportunities to learn through and about the five underpinning factors across the four-unit course of study.

Applied learning and community connections emphasise the importance of applying learning in workplace and community situations. Applied learning is an approach to contextualised learning; community connections provide contexts for learning, acquiring and applying knowledge, understanding and skills. Core skills for work, literacy and numeracy, however, contain identifiable knowledge and skills which can be directly assessed. The relevant knowledge and skills for these three factors are contained in the course dimensions and objectives for Engineering Skills.

Applied learning

Applied learning is the acquisition and application of knowledge, understanding and skills in real-world or lifelike contexts. Contexts should be authentic and may encompass workplace, industry and community situations.

Applied learning values knowledge — including subject knowledge, skills, techniques and procedures — and emphasises learning through doing. It includes both theory and the application of theory, connecting subject knowledge and understanding with the development of practical skills.

Applied learning:

- links theory and practice
- integrates knowledge and skills in real-world and/or lifelike contexts

- encourages students to work individually and in teams to complete tasks and solve problems
- enables students to develop new learnings and transfer their knowledge, understanding and skills to a range of contexts
- uses assessment that is authentic and reflects the content and contexts.

Community connections

Community connections build students' awareness and understanding of life beyond school through authentic, real-world interactions. This understanding supports the transition from school to participation in, and contribution to, community, industry, work and not-for-profit organisations. 'Community' includes the school community and the wider community beyond the school, including virtual communities.

Valuing a sense of community encourages responsible citizenship. Connecting with community seeks to deepen students' knowledge and understanding of the world around them and provide them with the knowledge, understanding, skills and dispositions relevant to community, industry and workplace contexts. It is through these interactions that students develop as active and informed citizens.

Schools plan connections with community as part of their teaching and learning programs to connect classroom experience with the world outside the classroom. It is a mutual or reciprocal arrangement encompassing access to relevant experience and expertise. The learning can be based in community settings, including workplaces, and/or in the school setting, including the classroom.

Community connections can occur through formal arrangements or more informal interactions. Opportunities for community connections include:

- visiting a business or community organisation or agency
- organising an event for the school or local community
- working with community groups in a range of activities
- providing a service for the local community
- attending industry expos and career 'taster' days
- participating in mentoring programs and work shadowing
- gaining work experience in industry
- participating in community service projects or engaging in service learning
- interacting with visitors to the school, such as community representatives, industry experts, employers, employees and the self-employed
- internet, phone or video conferencing with other school communities.

Core skills for work

In August 2013, the Australian Government released the *Core Skills for Work Developmental Framework (CSfW).*[1] The *CSfW* describes a set of knowledge, understanding and non-technical skills that underpin successful participation in work.[2] These skills are often referred to as generic

[1] More information about the *Core Skills for Work Developmental Framework* is available at https://docs.education.gov.au/node/37095

[2] The term 'work' is used in the broadest sense: activity that is directed at a specific purpose, which may or may not be for remuneration or gain.

or employability skills. They contribute to work performance in combination with technical skills, discipline-specific skills, and core language, literacy and numeracy skills.

The *CSfW* describes performance in ten skill areas grouped under three skill clusters, shown in the table below. These skills can be embedded, taught and assessed across Engineering Skills. Relevant aspects of core skills for work are assessed, as described in the standards.

Table 1: Core skills for work skill clusters and skill areas

	Skill cluster 1: Navigate the world of work	Skill cluster 2: Interacting with others	Skill cluster 3: Getting the work done
Skill areas	• Manage career and work life • Work with roles, rights and protocols	• Communicate for work • Connect and work with others • Recognise and utilise diverse perspectives	• Plan and organise • Make decisions • Identify and solve problems • Create and innovate • Work in a digital world

Literacy in Engineering Skills

The information and ideas that make up Engineering Skills are communicated in language and texts. Literacy is the set of knowledge and skills about language and texts that is essential for understanding and conveying this content.

Each Applied syllabus has its own specific content and ways to convey and present this content. Ongoing systematic teaching and learning focused on the literacy knowledge and skills specific to Engineering Skills is essential for student achievement.

Students need to learn and use the knowledge and skills of reading, viewing and listening to understand and learn the content of Engineering Skills. Students need to learn and use the knowledge and skills of writing, composing and speaking to convey the Engineering Skills content they have learnt.

In teaching and learning in Engineering Skills, students learn a variety of strategies to understand, use, analyse and evaluate ideas and information conveyed in language and texts.

To understand and use Engineering Skills content, teaching and learning strategies include:

- breaking the language code to make meaning of Engineering Skills language and texts
- comprehending language and texts to make literal and inferred meanings about Engineering Skills content
- using Engineering Skills ideas and information in classroom, real-world and/or lifelike contexts to progress their own learning.

To analyse and evaluate Engineering Skills content, teaching and learning strategies include:

- making conclusions about the purpose and audience of Engineering Skills language and texts
- analysing the ways language is used to convey ideas and information in Engineering Skills texts
- transforming language and texts to convey Engineering Skills ideas and information in particular ways to suit audience and purpose.

Relevant aspects of literacy knowledge and skills are assessed, as described in the standards.

Numeracy in Engineering Skills

Numeracy is about using mathematics to make sense of the world and applying mathematics in a context for a social purpose.

Numeracy encompasses the knowledge, skills, behaviours and dispositions that students need to use mathematics in a wide range of situations. Numeracy involves students recognising and understanding the role of mathematics in the world and having the dispositions and capacities to use mathematical knowledge and skills purposefully.[3]

Although much of the explicit teaching of numeracy skills occurs in Mathematics, being numerate involves using mathematical skills across the curriculum. Therefore, a commitment to numeracy development is an essential component of teaching and learning across the curriculum and a responsibility for all teachers.

To understand and use Engineering Skills content, teaching and learning strategies include:

- identifying the specific mathematical information
- providing learning experiences and opportunities that support the application of students' general mathematical knowledge and problem-solving processes
- communicating and representing the language of numeracy in teaching, as appropriate.

Relevant aspects of numeracy knowledge and skills are assessed, as described in the standards.

1.2.3 Planning a course of study

Engineering Skills is a four-unit course of study.

Units 1 and 2 of the course are designed to allow students to begin their engagement with the course content, i.e. the knowledge, understanding and skills of the subject. Course content, learning experiences and assessment increase in complexity across the four units as students develop greater independence as learners.

Units 3 and 4 consolidate student learning.

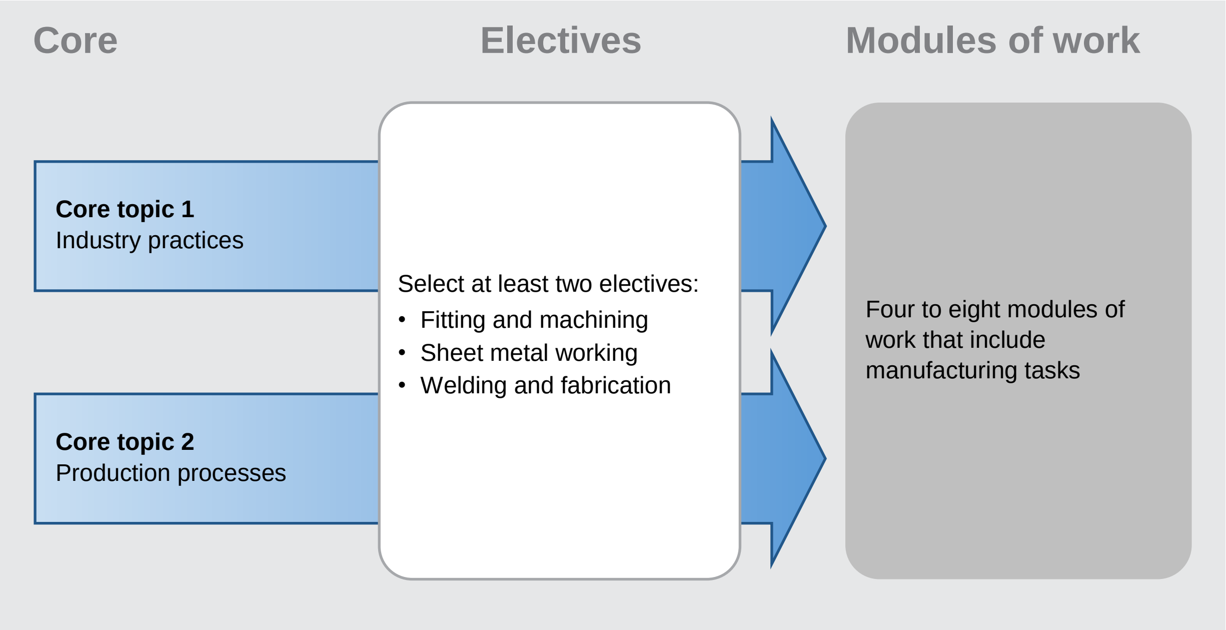
The minimum number of hours of timetabled school time, including assessment, for a course of study developed from this Applied syllabus is 55 hours per unit. A course of study will usually be completed over four units (220 hours).

A course of study for Engineering Skills includes:

- core topics — 'Industry practices' and 'Production processes' — and their associated concepts and ideas integrated into modules of work across Units 1 and 2, and further developed in Units 3 and 4
- electives — at least two electives. The electives included in Units 3 and 4 must have been introduced in Units 1 or 2.
- modules of work— four to eight modules of work across the four-unit course of study. Each module of work is based on one or more elective/s and related manufacturing tasks (see Section Manufacturing tasks).

[3] ACARA, General Capabilities, Numeracy, www.australiancurriculum.edu.au/GeneralCapabilities/Numeracy/Introduction/Introduction

Figure 2: A course of study: the relationship between core, electives and modules of work



1.2.4 Developing a module of work

A module of work is developed from the elective/s and outlines the knowledge, understanding and skills, learning experiences and assessment that will be effective in implementing the objectives of the syllabus.

A module of work in Engineering Skills consists of:

- one or more electives (multiple electives in a single module of work should be integrated)
- one or more manufacturing tasks related to the chosen elective/s
- in-depth coverage of both core topics (‘Industry practices’ and ‘Production processes’) and associated concepts and ideas (not all concepts and ideas need to be evident in each module of work)
- opportunities for teaching, learning and assessment of the objectives of Knowing and understanding, Analysing and applying, and Producing and evaluating.

1.2.5 Manufacturing tasks

Manufacturing tasks in this syllabus are defined as industry-related learning experiences through which students may demonstrate Knowing and understanding, Analysing and applying and Producing and evaluating. Manufacturing tasks range from skill exercises focused on specific production processes to the combination of ‘Industry practices’ and ‘Production processes’ needed to manufacture completed functional products to predefined specifications.

The manufacturing tasks are chosen from the electives, which are drawn from the common engineering trade qualifications. Examples of manufacturing tasks are provided in each of the electives to assist with module of work planning (see Electives).

1.2.6 Aboriginal perspectives and Torres Strait Islander perspectives

The Queensland Government has a vision that Aboriginal and Torres Strait Islander Queenslanders have their cultures affirmed, heritage sustained and the same prospects for health, prosperity and quality of life as other Queenslanders. The QCAA is committed to helping achieve this vision, and encourages teachers to include Aboriginal perspectives and Torres Strait Islander perspectives in the curriculum.

The QCAA recognises Aboriginal peoples and Torres Strait Islander peoples, their traditions, histories and experiences from before European settlement and colonisation to the present time. Opportunities exist in Engineering Skills to encourage engagement with Aboriginal peoples and Torres Strait Islander peoples and strengthen students' appreciation and understanding of:

- frameworks of knowledge and ways of learning
- contexts in which Aboriginal peoples and Torres Strait Islander peoples live
- contributions to Australian society and cultures.

Guidelines about Aboriginal perspectives and Torres Strait Islander perspectives and resources for teaching are available at www.qcaa.qld.edu.au/k-12-policies/aboriginal-torres-strait-islander-perspectives.

2 Subject matter

2.1 Core

The core is what all students who undertake a four-unit course of study in this subject will have the opportunity to learn. The core of this subject consists of two interrelated topics:

- industry practices
- production processes.

Both core topics include concepts and ideas that provide a focus for each topic and the minimum knowledge, understanding and skills that students would be expected to explore in the course of study.

The core topics are interrelated and are not intended to be treated in isolation. Concepts and ideas are progressively developed across the course of study through the associated knowledge, understanding and skills. Further knowledge, understanding and skills may arise in a module of work from engagement with electives and specific manufacturing tasks. The school decides the coverage and depth to which the knowledge, understanding and skills is explored in each module of work.

The core topics are presented in tables below.

2.1.1 Core topic 1: Industry practices

Focus	
Industry practices are used to effectively and efficiently manage manufacturing enterprises, workplace health and safety, employee personal and interpersonal skills and customer expectations to safely change raw materials into products wanted by society and which add value for both enterprises and consumers.	
Concepts and ideas	**Knowledge, understanding and skills**
Manufacturing enterprises Manufacturing enterprises are important to the economy of Australia and employ a broad range of people in many different occupations (C1.1).	• overview of engineering enterprises and their contribution to the economy, e.g. types of enterprises, successful businesses, technology use, cost structure and industry culture • organisational structure of engineering workplaces, e.g. human resources, safe and cooperative work environments, job descriptions, linking skills to employment options, receipt and storage of raw material, maintenance, design, quality and testing, transport, warehousing and marketing • career options and pathways, e.g. semi-skilled, trade and professional, and the differences in skill levels for modern manufacturing practices compared to traditional manufacturing
Workplace health and safety Workplace health and safety legislation, rules and procedures must be followed in manufacturing industry workplaces (C1.2).	• employer and employee responsibilities, rights and obligations under the *Work Health and Safety Act 2011* • industry-specific requirements, e.g. codes of practice/policies training, site induction and machine licensing • risk assessments to identify hazards, e.g: – hand/power tools, plant and fixed machinery – materials – manual handling • safe working practices and procedure, e.g: – hierarchy of hazard control pertaining to any workplace activity, which

	may include tool selection, personal protective equipment, manual handling techniques, dust, fumes, waste, noise, movement, barriers, signage, fire prevention and ongoing monitoring and review of practices
Personal and interpersonal skills Personal and interpersonal skills, including teamwork and communication skills, are essential for effective participation in engineering workplaces (C1.3).	• work-readiness skills, e.g. punctuality, ethical behaviour, diligence, respect for authority, demonstrating initiative (such as using time effectively and notifying unsafe practices) • teamwork in the workplace, e.g. clear expectations of work roles, working cooperatively with others, being involved in group discussions, working with people from diverse social, cultural and ethnic backgrounds and with varying physical and mental abilities • workplace communication using industry-specific terminology including written, graphical, verbal and non-verbal, e.g: – written, such as safety rules, work instructions, job cards, timesheets, forms, safe operating procedures and job applications – sketching, such as two-dimension and three-dimension graphical views – verbal and non-verbal instructions, such as practical demonstration of skills and processes, verbal task instructions and hand signals
Product quality The quality of products depends on customer expectations of value, which affects industry production processes (C1.4).	• quality standards of products are derived from customer expectations of value based on factors such as needs, trends, budget, product life and competition, e.g. the variation in price and quality of tools • products are manufactured to specifications that detail the expected quality standards of the final product, e.g. size, type and grade of metal, tolerances, fits, finish and joints • manufacturing enterprises make decisions about production processes that affect product quality based on a range of factors, e.g: – specifications (drawings and technical information) – customer expectations – business practices – wholesale and retail costs – available production time – available resources (human, materials, plant and equipment) – waste – recycling – government regulations

2.1.2 Core topic 2: Production processes

Focus	
Production processes combine production skills and procedures to safely manufacture products to specifications using tools and materials.	
Concepts and ideas	**Knowledge, understanding and skills**
Specifications Specifications are communicated through industry-specific drawings and technical information (C2.1).	• interpretation of sketches and technical drawings, e.g: − orthogonal projections − pictorial drawings (including exploded views) − sketches (thumbnail, diagram, detail) − developments − detail drawings − dimensions, symbols/annotation, scale and proportion • technical information accessed from charts, tables and books, e.g. set-up procedures, speeds and feeds, drill sizes for tapping and gas pressures
Tools Tools have specific functions and are selected and safely operated for particular procedures (C2.2). (See risk management)	• identification, safety and maintenance of tools and machinery, e.g: − tool names and purpose − safe work practices − guards and attachments − tool storage and maintenance − machine settings (tooling/blades/cutter/speed/feed selection) − replacement and disposal − general housekeeping • marking-out procedures and skills using relevant tools, e.g: − procedures used to measure, estimate and calculate materials, e.g. length, diameter, thickness, area, percentages and perimeters − skills using measuring/marking-out tools and equipment, e.g. tape measure, steel rule, vernier callipers, micrometres, engineers square, combination set, scriber, scratch gauge, vernier height gauge and divider • cutting procedures and skills using relevant tools and machinery, e.g: − purposes, limitations and safe methods of cutting a range of metals − skills using hand tools, e.g. hacksaw, file, punch, snips, shears, cold chisel, holding devices, pliers and thread cutting tools − skills using power tools, e.g. drill, nibblers, shears, grinder and jigsaw − skills using machinery, e.g. bandsaw, cold saw, guillotine and power hacksaw • joining procedures and skills using relevant tools and machinery, e.g: − purposes, limitations and safe methods of joining a range of metals − skills using hand tools, e.g. blind rivet gun, screwdriver, spanners and sockets − skills using power tools, e.g. portable spot welder and pneumatic riveter − skills using equipment, e.g. welding (MIG, Arc, TIG, spot), brazing and soldering equipment • machining procedures and skills using relevant machinery, e.g: − purposes, limitations and safe methods of machining a range of metals − skills using machinery (manual and CNC), e.g. lathe, milling machine and drill • forming procedures and skills using relevant tools and machinery, e.g:

	– purposes, limitations and safe methods of forming a range of metals – skills using hand tools, e.g. hammer, folding pliers, vice grips, mallet, holding devices, stakes, jigs and vices – skills using machinery, e.g. guillotine, pan brake, rollers, scrolling equipment and folder • finishing procedures and skills using relevant tools and machinery, e.g: – purposes, limitations and safe methods of finishing a range of metals – skills using hand tools, e.g. file, brushes, sandpaper, holding device and spray gun – skills using power tools, e.g. angle grinder and sander – skills using fixed machinery, e.g. drum/belt sander, scrolling equipment, compressor and buffer
Materials Materials are selected and safely manipulated based on industry-specific applications (C2.3).	• types of materials, e.g. metals, including aluminium, zinc, ferrous alloys (high and low carbon steel, stainless steel) and nonferrous alloys (brass, tin), polymers and composites • properties of materials, e.g. tensile strength, toughness, durability, ductility, malleability, lustre, hardness, work hardening, fatigue, corrosion, cast, rolled, extruded, forged, drawn, heat treatment and galvanizing • sections, shapes and sizes of metal products, e.g. pipe, tube, wire, solid sections, flat bar, angle bar, sheet and RHS • logistics, e.g. suppliers, ordering, storage, transportation, waste and management • industry applications and manipulation procedures, e.g. cutting, joining, machining, material optimisation, tool selection, surface preparation and clean-up • consumables, e.g. fixings and fasteners, paints, solvents, sealants and adhesives • safety data sheets

2.1.3 Risk management

Schools will need to appropriately manage the risks associated with tools and materials used in this course of study.

Risk management processes will include safe operating procedures, record-keeping of maintenance and risk assessments for high-risk equipment.

Further information to assist schools with health and safety is available on the Queensland Government's Department of Education and Training website: http://education.qld.gov.au/health/safety/index.html.

The Department of Education and Training has developed support material to manage risks specific to Industrial Technology and Design (Manual Arts): http://education.qld.gov.au/health/safety/managing/industrial-technology-design.html.

2.2 Electives

The electives in this subject are based on engineering industry specialisations that require tradespeople with specific knowledge, understanding and skills when using tools and materials to create or maintain products. Each elective predominantly relates to a common current engineering trade qualification described in the industry training packages at: https://training.gov.au/Home/Tga.

The choice of the electives is dependent on:

- dimensions, objectives and core topics to be explored
- the interests of the student cohort
- the expertise of teachers
- available facilities and resources.

The following tables provide a description of the electives with examples of school-based manufacturing tasks to assist schools with module of work planning. The information provided is a guide for teachers and is not meant to be definitive. The examples are not meant to be exhaustive.

2.2.1 Fitting and machining

Description
Fitting and machining refers to the manufacture, maintenance and repair of mechanical plant machinery and equipment to operational standards. Machinery is predominantly used to cut material using a range of procedures such as turning, boring, grooving, thread cutting, milling, drilling and grinding to form a required shape. Precision measuring instruments are used to check parts for accuracy and fit. A range of tools and joining procedures is used to assemble components. Fitting and machining enterprises manufacture and maintain products such as food-processing equipment, pumps, instruments, vices, tools, bicycles, metal sculptures, hose fittings, stub axles, heavy vehicle components and jacks.
Possible manufacturing tasks
Students could be involved in manufacturing tasks such as: • disassembling, inspecting, adjusting, measuring and machining components on a human-powered vehicle such as a bush • producing a class set of picture frames from plate aluminium • turning and drilling aluminium round bar on a metal lathe to create a small aluminium vase • using fitting and machining equipment to mill, grind, turn and drill components for a metal sculpture such as a model motorbike • using a production line method to produce the screw mechanism of a G clamp • fitting wheels to a floor creeper or workshop trolley • fabricating a folding shovel from working drawings • disassembling, cleaning, identifying worn components, replacing components and reassembling a mechanical device such as a vice or small engine.

2.2.2 Sheet metal working

Description
Sheet metal working refers to the cutting, forming and joining of sheet metal to manufacture products. Sheet metal can be ferrous, e.g. steel, zinc -coated steel and stainless steel, and nonferrous, e.g. aluminium, copper and brass. Production procedures predominantly involve cutting, folding, bending, rolling, stretching, riveting and spot welding. Sheet metal working enterprises manufacture products such as ducting, hoods, framing, roofs, tanks, car bodies, airplane wings, internal fixtures, toolboxes, cabinets and storage units.
Possible manufacturing tasks
Students could be involved in manufacturing tasks such as: • measuring and marking dimensions and reference lines on sheet metal • producing a sheet metal toolbox from a working drawing • using a template to mark out, cut, fold and join zinc-coated steel to form a fish smoker • attaching hardware to finished products • marking out developments, cutting sheets, folding components and spot welding joints to produce a set of storage draws • using working drawings to mark out, cut and fold aluminium sheet to fabricate a mobile phone holder.

2.2.3 Welding and fabrication

Description
Welding and fabrication refers to the shaping, joining and repair of metal products and components using heat or electrical current. Different welding techniques and equipment such as manual arc welding, oxyacetylene welding, spot welding, MIG and TIG are used, depending on the application and the type and size of metal. Enterprises weld, fabricate and repair products such as machinery parts, metal sculptures, brackets, benches, anchors, boat hulls, trailers, agricultural equipment, fences, gates and structures.
Possible manufacturing tasks
Students could be involved in manufacturing tasks such as: • fabricating a jig from working drawings to enable the mass production of a product • using manual arc welding to assemble a mild steel brazier • cutting and joining plate steel and square bar to create a portable barbeque plate from working drawings • fabricating a sand anchor from plate steel using a MIG welder from a template • welding a table frame from square tube steel using a MIG welder • using a production line method to produce the frame of a G clamp to specifications • interpreting working drawings to fabricate a floor creeper or workshop trolley from tube steel.

3 Assessment

3.1 Assessment — general information

Assessment is an integral part of the teaching and learning process. It is the purposeful, systematic and ongoing collection of information about student learning outlined in the syllabus.

The major purposes of assessment are to:

- promote, assist and improve learning
- inform programs of teaching and learning
- advise students about their own progress to help them achieve as well as they are able
- give information to parents, carers and teachers about the progress and achievements of individual students to help them achieve as well as they are able
- provide comparable exit results in each Applied syllabus which may contribute credit towards a Queensland Certificate of Education (QCE); and may contribute towards Australian Tertiary Admission Rank (ATAR) calculations
- provide information about how well groups of students are achieving for school authorities and the State Minister responsible for Education.

Student responses to assessment opportunities provide a collection of evidence on which judgments about the quality of student learning are made. The quality of student responses is judged against the standards described in the syllabus.

In Applied syllabuses, assessment is standards-based. The standards are described for each objective in each of the three dimensions. The standards describe the quality and characteristics of student work across five levels from A to E.

3.1.1 Planning an assessment program

When planning an assessment program over a developmental four-unit course, schools should:

- administer assessment instruments at suitable intervals throughout the course
- provide students with opportunities in Units 1 and 2 to become familiar with the assessment techniques that will be used in Units 3 and 4
- assess all of the dimensions in each unit
- assess each objective at least twice by midway through the course (end of Unit 2) and again by the end of the course (end of Unit 4)
- assess only what the students have had the opportunity to learn, as prescribed in the syllabus and outlined in the study plan.

For a student who studies four units, only assessment evidence from Units 3 and 4 contributes towards decisions at exit.

Further guidance can be found in the QCE and QCIA policy and procedures handbook.

3.1.2 Authentication of student work

Schools and teachers must have strategies in place for ensuring that work submitted for internal summative assessment is the student's own.

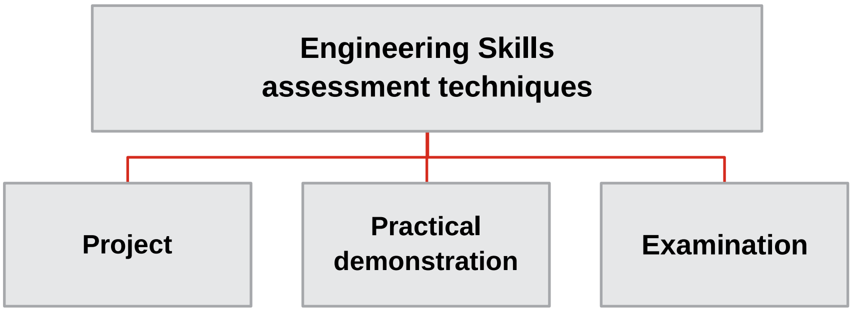
Judgments about student achievement are based on evidence of the demonstration of student knowledge, understanding and skills. Schools ensure responses are validly each student's own work.

Guidance about authentication strategies which includes guidance for drafting, scaffolding and teacher feedback can be found in the QCE and QCIA policy and procedures handbook.

3.2 Assessment techniques

The assessment techniques relevant to this syllabus are identified in the figure below and described in detail within the individual assessment techniques.

Figure 3: Engineering Skills assessment techniques



Schools design assessment instruments from the assessment techniques relevant to this syllabus. The assessment instruments students respond to in Units 1 and 2 should support those techniques included in Units 3 and 4.

For each assessment instrument, schools develop an instrument-specific standards matrix by selecting the syllabus standards descriptors relevant to the task and the dimension/s being assessed (see Standards matrix).

The matrix is used as a tool for making judgments about the quality of students' responses to the instrument and is developed using the syllabus standards descriptors. Assessment is designed to allow students to demonstrate the range of standards (see Determining an exit result). Teachers give students an instrument-specific standards matrix for each assessment instrument.

Evidence

Evidence includes the student's responses to assessment instruments and the teacher's annotated instrument-specific standards matrixes. Evidence may be direct or indirect. Examples of direct evidence include student responses to assessment instruments or digital recordings of student performances. Examples of indirect evidence include student notes, teacher observation recording sheets or photographic evidence of the process.

Further guidance can be found in the QCE and QCIA policy and procedures handbook.

Conditions of assessment

Over a four-unit course of study, students are required to complete assessment under a range of conditions (see Planning an assessment program).

Conditions may vary according to assessment. They should be stated clearly on assessment instruments and reflect the conditions stated for each technique.

Where support materials or particular equipment, tools or technologies are used under supervised conditions, schools must ensure that the purpose of supervised conditions (i.e. to authenticate student work) is maintained.

Assessment of group work

When students undertake assessment in a group or team, instruments must be designed so that teachers can validly assess the work of individual students and not apply a judgment of the group product and processes to all individuals.

3.2.1 Project

Purpose
This technique assesses a response to a single task, situation and/or scenario in a module of work that provides students with authentic opportunities to demonstrate their learning in both 'Industry practices' and 'Production processes'. The student response will consist of a collection of **at least two** assessable components, demonstrated in different circumstances, places and times, and may be presented to different audiences and through different modes.
Dimensions to be assessed
This assessment technique is to be used to determine student achievement in objectives from all of the following dimensions: • Knowing and understanding • Analysing and applying • Producing and evaluating. All objectives from each dimension must be assessed.
Types of projects

A project occurs over a set period of time. Students may use class time and their own time to develop a response.
A project involves students demonstrating and documenting 'Industry practices' and 'Production processes' when creating a product to predefined specifications.
A project consists of **a product component** and at least one of the following components:
• written
• spoken
• multimodal.
The selected assessable components must contribute significantly to the task and to the overall result for the project. A variety of technologies may be used in the creation or presentation of the response.
Note: Spoken delivery of a written component, or a transcript of a spoken component (whether written, electronic or digital), constitutes one component, not two.
Examples of projects in Engineering Skills include:
• plan using 'Industry practices' and 'Production processes' to produce a sheet metal toolbox to technical drawing specifications:
  – product component: toolbox
  – multimodal component: individual digital portfolio documenting industry practices and production processes that may include selection and sequence of production procedures, materials, tools, management of time, safety, cost and expectations of quality
  – spoken component: oral presentation evaluating the practices, processes and finished toolbox
• organise and manage the manufacturing of a clamping device:
  – product component: clamping device
  – multimodal component: workbook describing the production process (sketches, photographs, annotations, evaluation)
• work in a team to plan and implement a production line to manufacture anchors:
  – product component: anchors
  – written component: documentation of industry practices and production processes used, e.g. logbook, e-journal or diary.

Product component
This component refers to the creation of a product that meets predefined specifications. Students apply a range of cognitive, technical and physical skills to demonstrate knowledge, understanding and skills in 'Industry practices' and 'Production processes'. Students are given specifications (working drawings and technical information) and may use class time and their own time to complete a functional product that meets the specifications.
Written component
This component requires students to use written language to communicate ideas and information to readers for a particular purpose. A written component may be supported by references or, where appropriate, data, tables, flowcharts or diagrams.
Spoken component
This component requires students to use spoken language to communicate ideas and information to a live or virtual audience (i.e. through the use of technology) for a particular purpose.
Multimodal component
This component requires students to use a combination of at least two modes delivered at the same time to communicate ideas and information to a live or virtual audience for a particular purpose. The selected modes are integrated to allow both modes to contribute significantly to the multimodal component. Modes include: • written • spoken/signed • nonverbal, e.g. physical, visual or auditory. The multimodal component can be a presentation or non-presentation. Examples of presentations include delivery of a slide show, short video clip or webinar. Examples of non-presentations include a webpage with embedded media (graphics, images, audio or video) or a digital portfolio documenting the planning, organising and implementation of a production process with text, sketches and photographs. A variety of technologies may be used in the creation or presentation of the component. Replication of a written document into an electronic or digital format does not constitute a multimodal component.

Assessment conditions	Units 1–2	Units 3–4
Written component	400–700 words	500–900 words
Spoken component	1½ – 3½ minutes	2½ – 3½ minutes
Multimodal component • non-presentation • presentation	 6 A4 pages max (or equivalent) 2–4 minutes	 8 A4 pages max (or equivalent) 3–6 minutes
Product component	Schools give students a set period of in-class time to develop the product component/s of their project.	

Further guidance
• It is the responsibility of teachers and students to present the evidence to support the standard awarded. • When students undertake assessment in a team, instruments must be designed so that teachers can validly assess the work of individual students and not apply a judgment of the group product and processes to all individuals. • Supporting evidence may include: – annotated instrument-specific standards – visual evidence of the product – documentation. • Allow class time for the student to effectively undertake each component of the project assessment. Independent student time will be required to complete the task. • The required length of student responses should be considered in the context of the tasks. • Implement strategies to promote the authenticity of student work. Strategies may include note-taking, drafting and/or teacher observation sheets. • Scaffolding is part of the teaching and learning that supports student development of the knowledge, understanding and skills needed to complete an assessment task and demonstrate what the assessment requires. Scaffolding should be reduced in Units 3 and 4 as students develop greater independence as learners. • Clearly indicate the dimensions and objectives that will be assessed and explain to students the requirements of the task, including instrument-specific standards. • Give students learning experiences in the use of appropriate communication strategies. • Teach the requirements for each component of the project, e.g. sketches, diagrams, journals, digital equipment use and referencing.

3.2.2 Practical demonstration

Purpose

This technique assesses the practical application of a specific set of teacher-identified production skills and procedures. Responses are completed individually in a set timeframe.

Dimensions to be assessed

This assessment technique is to be used to determine student achievement in objectives from all of the following dimensions:

- Knowing and understanding
- Analysing and applying
- Producing and evaluating.

Not every objective from each dimension needs to be assessed.

Types of practical demonstration

A practical demonstration involves students demonstrating production skills and procedures over a set period of time. Students are given specifications (such as a drawing, template or written instructions) and use class time under teacher supervision.

Examples of practical demonstrations in Engineering Skills include:

- welding exercises to produce a bracket
- machining a hose nozzle
- using a template to prepare components and assemble a carryall.

Assessment conditions	Units 1–2	Units 3–4
Practical demonstration	A set period of in-class time	

Further guidance

- Schools provide students with continuous class time to develop and practise production skills and procedures.
- Practical demonstrations should increase in complexity and variety over the course of study.
- Practical demonstration evidence could include:
  - visual evidence of practical demonstration, e.g. annotated photographs
  - student work books
  - teacher observations annotated on instrument-specific standards matrix.

There should be evidence of student work to support the standards awarded.

3.2.3 Examination

Purpose
This technique assesses the application of a range of cognition to provided questions, scenarios and/or problems. Responses are completed individually, under supervised conditions and in a set timeframe.

Dimensions to be assessed
This assessment technique may be used to determine student achievement in objectives from the following dimensions: • Knowing and understanding • Analysing and applying • Producing and evaluating. Not every objective from each dimension needs to be assessed.

Type of examination
Short response test
• Short response tests typically consist of a number of items that may include students responding to some or all of the following activities: – drawing, labelling or interpreting equipment, graphs, tables or diagrams – calculating using algorithms – responding to seen or unseen stimulus materials – interpreting ideas and information. • Short response tests occur under supervised conditions as students produce work individually and in a set time to ensure authenticity. • Questions, scenarios and problems are typically unseen. If seen, teachers must ensure the purpose of this technique is not compromised. • Stimulus materials may also be used and may be seen or unseen. • Unseen questions, statements or stimulus materials should not be copied from information or texts that students have previously been exposed to or have directly used in class.

Assessment conditions	Units 1–2	Units 3–4
Recommended duration	60–90 minutes	60–90 minutes
Short response test	50–150 words per item (diagrams and workings not included in word count)	50–250 words per item (diagrams and workings not included in word count)

Further guidance
• Format the assessment to allow for ease of reading and responding. • Consider the language needs of the students and avoid ambiguity. • Ensure questions allow the full range of standards to be demonstrated. • Consider the instrument conditions in relation to the requirements of the question/stimulus. • Outline any permitted material in the instrument conditions, e.g. one page of handwritten notes. • Determine appropriate use of stimulus materials and student notes. Ensure stimulus materials are succinct enough to allow students to engage with them in the time provided; if they are lengthy, consider giving students access to them before the assessment. • Provide students with learning experiences that support the types of items, including opportunities to respond to unseen tasks using appropriate communication strategies. • Indicate on the assessment the dimensions and objectives that will be assessed, and explain the instrument-specific standards.

3.3 Exiting a course of study

3.3.1 Folio requirements

A folio is a collection of one student's responses to the assessment instruments on which exit results are based. The folio is updated when earlier assessment responses are replaced with later evidence that is more representative of student achievement.

3.3.2 Exit folios

The exit folio is the collection of evidence of student work from Units 3 and 4 that is used to determine the student's exit result. Each folio must include:

- four assessment instruments, and the student responses
- evidence of student work from Units 3 and 4 only
- at least two projects
- at least one practical demonstration (separate to the assessable component of a project).
- a student profile completed to date.

3.3.3 Exit standards

Exit standards are used to make judgments about students' exit result from a course of study. The standards are described in the same dimensions as the objectives of the syllabus. The standards describe how well students have achieved the objectives and are stated in the standards matrix.

The following dimensions must be used:

- Dimension 1: Knowing and understanding
- Dimension 2: Analysing and applying
- Dimension 3: Producing and evaluating.

Each dimension must be assessed in each unit, and each dimension is to make an equal contribution to the determination of an exit result.

3.3.4 Determining an exit result

When students exit the course of study, the school is required to award each student an A–E exit result.

Exit results are summative judgments made when students exit the course of study. For most students, this will be after four units. For these students, judgments are based on exit folios providing evidence of achievement in relation to all objectives of the syllabus and standards.

For students who exit before completing four units, judgments are made based on the evidence of achievement to that stage of the course of study.

Determining a standard

The standard awarded is an on-balance judgment about how the qualities of the student's responses match the standards descriptors in each dimension. This means that it is not necessary for the student's responses to have been matched to every descriptor for a particular standard in each dimension.

Awarding an exit result

When standards have been determined in each of the dimensions for this subject, Table 2 below is used to award an exit result, where A represents the highest standard and E the lowest. The table indicates the minimum combination of standards across the dimensions for each result.

Table 2: Awarding exit result

Exit result	Minimum combination of standards
A	Standard A in any two dimensions and no less than a B in the remaining dimension
B	Standard B in any two dimensions and no less than a C in the remaining dimension
C	Standard C in any two dimensions and no less than a D in the remaining dimension
D	At least Standard D in any two dimensions and an E in the remaining dimension
E	Standard E in the three dimensions

Further guidance can be found in the QCE and QCIA policy and procedures handbook.

3.3.5 Standards matrix

	Standard A	Standard B	Standard C	Standard D	Standard E
Knowing and understanding	The student work has the following characteristics:	The student work has the following characteristics:	The student work has the following characteristics:	The student work has the following characteristics:	The student work has the following characteristics:
	• comprehensive description of industry practices in manufacturing tasks	• detailed description of industry practices in manufacturing tasks	• description of industry practices in manufacturing tasks	• statements about industry practices in manufacturing tasks	• inconsistent statements of industry practices
	• consistent and proficient demonstration of fundamental production skills	• effective demonstration of fundamental production skills	• demonstration of fundamental production skills	• partial demonstration of aspects of fundamental production skills	• minimal demonstration of aspects of fundamental production skills
	• informed and accurate interpretation of drawings and technical information.	• effective interpretation of drawings and technical information.	• interpretation of drawings and technical information.	• statements about drawings and technical information.	• inconsistent statements about drawings and technical information.
Analysing and applying	The student work has the following characteristics:	The student work has the following characteristics:	The student work has the following characteristics:	The student work has the following characteristics:	The student work has the following characteristics:
	• thorough analysis of manufacturing tasks to proficiently organise materials and resources	• effective analysis of manufacturing tasks to organise materials and resources	• analysis of manufacturing tasks to organise materials and resources	• partial analysis of manufacturing tasks to organise some materials and resources	• minimal organisation of some materials or resources
	• discerning selection and proficient application of production skills and procedures in manufacturing tasks	• relevant selection and purposeful application of production skills and procedures in manufacturing tasks	• selection and application of production skills and procedures in manufacturing tasks	• partial application of aspects of production skills and procedures in manufacturing tasks	• minimal application of aspects of some production skills and procedures in manufacturing tasks
	• coherent and succinct use of visual representations, language conventions and features to communicate for particular purposes.	• effective use of visual representations, language conventions and features to communicate for particular purposes.	• use of visual representations, language conventions and features to communicate for particular purposes.	• vague use of visual representations, language conventions and features to somewhat communicate.	• unclear use of visual representations, language conventions and features that impedes communication.

Producing and evaluating	The student work has the following characteristics: • thorough planning and discerning adaptation of production processes • proficient creation of products that meet specifications • discerning evaluation of practices, processes and products, and valid recommendations made.	The student work has the following characteristics: • effective planning and adaptation of production processes • methodical creation of products that meet specification with minor variations • effective evaluation of practices, processes and products, and plausible recommendations made.	The student work has the following characteristics: • planning and adaptation of production processes • creation of products from specifications • evaluation of practices, processes and products, and recommendations made.	The student work has the following characteristics: • partial planning of production processes • creation of incomplete products with obvious variation from specifications • superficial evaluation of practices, processes and products, and simple recommendations made.	The student work has the following characteristics: • minimal planning of some production processes • creation of aspects of products • statements about practices, processes or products.

4 Glossary

Term	Explanation
A	
accurate	precise and exact; consistent with a standard, rule, convention or known facts
analyse; analysis	consider in detail for the purpose of finding meaning or relationships, and identifying patterns, similarities and differences
apply; application	use, utilise or employ in a particular situation
aspects	components, elements
C	
clear	easy to understand; explicit; without ambiguity
coherent	well-structured and logical; internally consistent relation of parts
communicate; communication	convey knowledge and/or understandings to others
components	parts or elements that make up a whole object and perform specific functions
composite materials	materials made from two or more constituent materials with significantly different physical or chemical properties that, when combined, produce a material with characteristics different from the individual components; the individual components remain separate and distinct within the finished structure The new material may be preferred for many reasons: common examples include materials which are stronger, lighter or less expensive when compared to traditional materials. Typical engineered composite materials include: • composite building materials such as cements and concrete • reinforced plastics such as fibre-reinforced polymer • metal composites • ceramic composites (composite ceramic and metal matrices). (Also called ‘composition materials’ or shortened to ‘composites’.)
comprehensive	thorough, including all that is relevant
computer-aided drafting	software used by drafters, architects and engineers to help them create lines, shapes and planes that can be combined, moved, rotated, adjusted and rendered; measurements and calculations can be included; computer-aided drafting can be used to create 2D and 3D models and drawings such as floor plans and rendered pictorial views of objects and structures; also known as computer-assisted design, computer-aided drawing or CAD
considered	formed after careful (deliberate) thought
consistent	agreeing or accordant; compatible; not self-opposed or self-contradictory; constantly adhering to the same principles
create	put elements together to form a coherent or functional whole; the synthesis of knowledge and skills in industry practices and production processes to manufacture a functional product to predefined specifications

Term	Explanation
D	
describe; description	giving an account of characteristics or features
detailed	meticulous; including many of the parts
diaries	documents that record the stages of manufacture when completing a functional product
digital portfolio	an engaging and effective way for students to showcase their work and reflect on the learning process; a digital portfolio can be either offline or online, or a combination of both; in the classroom, a digital portfolio is usually used to showcase learning and reflections over a period of time, and may provide evidence towards assessment; students' digital portfolios or digital banks of evidence of learning can include products, assessment comments and rubrics, strategies and plans
discerning	showing good judgment to make thoughtful choices
drawings	a range of graphical representations used to communicate information to particular audiences; produced manually or with CAD software systems; there are two main types of drawings used in Engineering Skills — sketches and technical drawings
E	
effective	meeting the assigned purpose
e-journals	electronic journals are able to be accessed via electronic transmission; may follow the format for production plans, logbooks or diaries; completed by students and able to show construction processes completed
equipment	items needed for carrying out specific jobs, activities, functions or procedures that area not usually identified in industry as a tool or machine, e.g. portable bench, saw stool, tool bag
evaluate; evaluation	assign merit according to criteria; examine and judge the merit, significance or value of something
F	
functional	complete and ready for use or service; functional products have been manufactured to specifications and are ready for sale or use by the customer/consumer
fundamental	essential foundation or basis on which other aspects are built
I	
identify; identification	distinguish, isolate; locate and recognise
J	
jigs	custom-made tools or pieces of equipment used to control the positioning and/or motion of another tool to go into a work piece; jigs are used when manufacturing products to ensure accuracy, alignment, repeatability and interchangeability; some jigs are also called templates or guides; examples are machining jigs, woodworking jigs such as a dowelling jig, jewellers' jigs and welders' jigs

Term	Explanation
joining	methods of bringing together and permanently holding materials or components, e.g. a dowel joint to join legs and rails for a table frame, fasteners such as nails, rivets, bolts and screws, glues or adhesives, welding
L	
limited	confined within limits; restricted, circumscribed, or narrow
logbook	the systemic daily record of activities, events and/or occurrences; it is a method of keeping track of the production processes completed by students
M	
manufacturing enterprise	a business entity set up to generate profit by making and selling products to wholesalers, retailers or consumers
manufacturing industry	organised economic activity connected with the manufacture or construction of a particular product or range of products; manufacturing industries employ people, tools and equipment to processes raw materials into products
methodical	carried out systematically; orderly
module of work	a module of work provides effective teaching strategies and learning experiences that facilitate students' demonstration of the dimensions and objectives as described in the syllabus A module of work: • draws from relevant aspects of the underpinning factors • identifies relevant concepts and ideas, and associated subject matter from the core topics • provides an alignment between core subject matter, learning experiences and assessment.
O	
obvious	clearly perceptible or evident; easily recognised; open to view
orthogonal drawings	scaled, multi-view drawings of a 3D object to show each view separately in a series of 2D drawings, e.g. top or bottom, front, back and sides; in Australia, orthogonal drawings use third-angle projection for layout of the views; orthogonal drawings may also include the measurements on each view and are used to develop lists of material requirements; in these drawings each edge is represented by a connected line, each segment of which is parallel to a coordinate axis
P	
partial	attempted, with evidence provided, but incomplete
personal protective equipment (PPE)	equipment used or worn by a person to minimise risk to the person's health or safety, e.g. goggles, ear muffs, face shield, hard hat, apron, gloves
plausible	credible and possible
product	a tangible end result of manufacturing that could be offered for sale; created by the practical application of knowledge and skills in 'Industry practices' and 'Production processes'
production procedure	established step-by-step ways of using materials, tools and machinery to achieve a purpose; production procedures include safely setting up and using hand/power tools and machinery to mark out, cut, join, form, fabricate and finish materials

Term	Explanation
production process	a system of combining production skills and procedures to safely manufacture products to specifications using tools and materials
production skill	know-how (practical knowledge) and manual dexterity required to use materials, tools and machinery; production skills include safe and correct operation of hand/power tools and machinery, maintenance of tools and equipment, measuring techniques, safe work practices and general housekeeping
proficient	skilled and adept; well advanced or expert
purposeful	having an intended or desired result
Q	
quality	the standard or grade of something; quality standards of products are derived from costumer expectations of value
R	
recommend; recommendation	make a suggestion or proposal as to the best course of action
relevant	applicable and pertinent; has direct bearing on
S	
scale	the relationship between the actual size of an object and its representation on a drawing, map or model; a scale may be a reduction or enlargement of the actual size of an object, often so it will fit on a page or be more manageable to draw or represent, e.g. house plans usually use a scale of 1:100 to represent the floor plan on A3 paper
simple	involving few elements, components or steps; obvious data or outcomes
sketch	a drawing completed freehand, often instantly capturing an idea for later use and therefore lacking in presentation quality; sketches are usually produced manually but may be software-assisted; they may include annotations, e.g. dimensions and materials
skill exercise	a practical activity typically completed using a narrow range of production skills and procedures; skill exercises allow students safe opportunities to develop know-how and manual dexterity with materials and tools; examples include turning a plumb bob on a metal lathe, arc welding a bracket
specifications	sketches, technical drawings and other technical information used to manufacture a product to customer expectations
statement	a sentence or assertion
superficial	apparent and sometimes trivial
succinct	brief, concise and clear
T	
technical drawing	orthographic and pictorial graphical representations (based on underlying mathematical frameworks) used to communicate how something functions or is to be manufactured; technical drawings are drafted to industry conventions that specify common symbols, units of measurement, notation, visual style and page layout; they are usually produced using computer-aided drafting (CAD) software

Term	Explanation
technical information	industry-specific information required to manufacture a product that is not available on a technical drawing but is crucial to the successful production process; technical information can be accessed from charts, templates, tables, manuals and schedules, e.g. set-up procedures, speeds and feeds, drill sizes for tapping, gas pressures, span distances and standard operating procedures (SOP)
thorough	attentive to detail; carried out through, or applied to, the whole of something
thumbnail sketch	small sketch usually done quickly by tradespeople, designers, architects and engineers to indicate roughly what an object, system or environment could look like; thumbnail sketches are a method of visualising thinking and show main features rather than minor details; they may include annotations
U	
unit	a unit is a minimum of 55 hours of timetabled school time, including assessment. A course of study will usually be completed over four units (220 hours).
V	
vague	couched in general or indefinite terms; not definitely or precisely expressed; deficient in details or particulars
valid	applicable, legitimate and defensible; able to be supported
virtual	representation of an object in a digital form, e.g. CAD model of a machine part

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