

Engineering Skills 2024 v1.2

Applied senior syllabus

January 2024

ISBN

Electronic version: 978-1-74378-262-0



© State of Queensland (QCAA) 2024

Licence: <https://creativecommons.org/licenses/by/4.0> | **Copyright notice:** www.qcaa.qld.edu.au/copyright — lists the full terms and conditions, which specify certain exceptions to the licence. |

Attribution (include the link): © State of Queensland (QCAA) 2024 www.qcaa.qld.edu.au/copyright.

Queensland Curriculum & Assessment Authority
PO Box 307 Spring Hill QLD 4004 Australia

Phone: (07) 3864 0299

Email: office@qcaa.qld.edu.au

Website: www.qcaa.qld.edu.au

Contents

Queensland syllabuses for senior subjects _____	1
Course overview _____	2
Rationale	2
Syllabus objectives	3
Designing a course of study in Engineering Skills	4
Reporting	8
Unit options _____	10
Unit option A: Fitting and machining	10
Unit option B: Welding and fabrication.....	15
Unit option C: Sheet metal working	20
Unit option D: Production in the structural engineering industry	25
Unit option E: Production in the transport engineering industry.....	30
Unit option F: Production in the manufacturing engineering industry.....	35
Assessment _____	40
Assessment A1: Practical demonstration — Fitting and machining.....	40
Assessment A2: Project — Fitting and machining	43
Assessment B1: Practical demonstration — Welding and fabrication	47
Assessment B2: Project — Welding and fabrication.....	50
Assessment C1: Practical demonstration — Sheet metal working	54
Assessment C2: Project — Sheet metal working	57
Assessment D1: Practical demonstration — Structural engineering.....	61
Assessment D2: Project — Structural engineering.....	64
Assessment E1: Practical demonstration — Transport engineering.....	68
Assessment E2: Project — Transport engineering	71
Assessment F1: Practical demonstration — Manufacturing engineering.....	75
Assessment F2: Project — Manufacturing engineering	78
Glossary _____	82
References _____	82
Version history _____	82

Queensland syllabuses for senior subjects

In Queensland, a syllabus for a senior subject is an official 'map' of a senior school subject. A syllabus's function is to support schools in delivering the Queensland Certificate of Education (QCE) system through high-quality and high-equity curriculum and assessment.

Syllabuses are based on design principles developed from independent international research about how excellence and equity are promoted in the documents teachers use to develop and enliven the curriculum.

Syllabuses for senior subjects build on student learning in the Prep to Year 10 Australian Curriculum and include General, General (Extension), Senior External Examination (SEE), Applied, Applied (Essential) and Short Course syllabuses.

More information about syllabuses for senior subjects is available at www.qcaa.qld.edu.au/senior/senior-subjects and in the 'Queensland curriculum' section of the *QCE and QCIA policy and procedures handbook*.

Teaching, learning and assessment resources will support the implementation of a syllabus for a senior subject. More information about professional resources for senior syllabuses is available on the QCAA website and via the QCAA Portal.

Course overview

Rationale

Technologies are an integral part of society as humans seek to create solutions to improve their own and others' quality of life. Technologies affect people and societies by transforming, restoring and sustaining the world in which we live. 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 the Australian manufacturing industry to produce products. The manufacturing industry transform raw materials into products wanted by society. This adds value for both enterprises and consumers. Australia has strong manufacturing industries that continue to provide employment opportunities.

Engineering Skills includes the study of the manufacturing and engineering industry's practices and production processes through students' application in, and through trade learning contexts. Industry practices are used by manufacturing enterprises to manage the manufacture of products from raw materials. Production processes combine the production skills and procedures required to produce products. Students engage in applied learning to demonstrate knowledge and skills in units that meet 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.

Applied learning supports students' development of transferable 21st century, literacy and numeracy skills relevant to future employment opportunities in the structural, transport and manufacturing engineering industrial sectors. Students learn to interpret drawings and technical information, and select and demonstrate safe practical production processes using hand and power tools, machinery and equipment. They communicate using oral, written and graphical modes, organise, calculate, plan, evaluate and adapt production processes and the products they produce. The majority of learning is done through manufacturing tasks that relate to business and industry. Students work with each other to solve problems and complete practical work.

Syllabus objectives

The syllabus objectives outline what students have the opportunity to learn.

1. Demonstrate practices, skills and procedures.

Students identify and reproduce fundamental industry skills in manufacturing tasks. These relate to enterprises, workplace health and safety, personal and interpersonal skills, product quality, drawings and technical information, tools and materials.

2. Interpret drawings and technical information.

Students use knowledge of industry practices and production processes to draw meaning from elements and critical features of drawings and technical information. They draw meaning through mathematical calculations, industry conventions, standards and task-specific information, such as schedules, data tables and operating procedures.

3. Select practices, skills and procedures.

Students choose knowledge and skills to complete engineering industry-specific manufacturing tasks. Knowledge and skills relate to enterprises, workplace health and safety, personal and interpersonal skills, product quality, drawings and technical information, tools and materials.

4. Sequence processes.

Students use knowledge and understanding of industry practices, including safety concepts and principles, waste minimisation, product quality expectations, teamwork and regulations. They decide on the combination and order of production processes, including preparing, marking-out, cutting, joining, machining, forming, assembling and finishing to produce products in manufacturing tasks.

5. Evaluate skills and procedures, and products.

Students determine the efficiency and effectiveness of production skills and procedures in relation to industry practices and specific manufacturing task requirements. They assess the strengths, implications and limitations of products, using drawings, technical information and expectations of quality.

6. Adapt plans, skills and procedures.

Students modify and improve production plans based on identified strengths, implications and limitations. They apply quality control measures to improve the alignment of products with drawings and technical information.

Designing a course of study in Engineering Skills

Syllabuses are designed for teachers to make professional decisions to tailor curriculum and assessment design and delivery to suit their school context and the goals, aspirations and abilities of their students within the parameters of Queensland's senior phase of learning.

The syllabus is used by teachers to develop curriculum for their school context. The term *course of study* describes the unique curriculum and assessment that students engage with in each school context. A course of study is the product of a series of decisions made by a school to select, organise and contextualise subject matter, integrate complementary and important learning, and create assessment tasks in accordance with syllabus specifications.

It is encouraged that, where possible, a course of study is designed such that teaching, learning and assessment activities are integrated and enlivened in an authentic setting.

Course structure

Engineering Skills is an Applied senior syllabus. It contains at least four QCAA-developed units from which schools develop their course of study.

Each unit has been developed with a notional time of 55 hours of teaching and learning, including assessment.

Schools select four units from the unit options provided. They decide the order in which the units will be delivered. Once these decisions have been made, the four units selected and their order of implementation determine which units are considered Units 1–4.

Students should complete Unit 1 and Unit 2 before beginning Units 3 and 4. Units 3 and 4 are studied as a pair.

More information about the requirements for administering senior syllabuses is available in the 'Queensland curriculum' section of the [QCE and QCIA policy and procedures handbook](#).

Curriculum

Senior syllabuses set out only what is essential while being flexible so teachers can make curriculum decisions to suit their students, school context, resources and expertise.

Within the requirements set out in this syllabus and the [QCE and QCIA policy and procedures handbook](#), schools have autonomy to decide:

- how and when subject matter is delivered
- how, when and why learning experiences are developed, and the context in which learning occurs
- how opportunities are provided in the course of study for explicit and integrated teaching and learning of complementary skills.

These decisions allow teachers to develop a course of study that is rich, engaging and relevant for their students.

Assessment

Senior syllabuses set out only what is essential while being flexible so teachers can make assessment decisions to suit their students, school context, resources and expertise.

Applied senior syllabuses contain assessment specifications and conditions for the assessment instruments that must be implemented with Units 3 and 4. These specifications and conditions ensure comparability, equity and validity in assessment.

Within the requirements set out in this syllabus and the [QCE and QCIA policy and procedures handbook](#), schools have autonomy to decide:

- specific assessment task details
- assessment contexts to suit available resources
- how the assessment task will be integrated with teaching and learning activities
- how authentic the task will be.

In Unit 1 and Unit 2, schools:

- develop at least two but no more than four assessments
- complete at least one assessment for each unit
- ensure that each unit objective is assessed at least once.

In Units 3 and 4, schools develop four assessments using the assessment specifications and conditions provided in the syllabus.

More information about assessment in senior syllabuses is available in 'The assessment system' section of the [QCE and QCIA policy and procedures handbook](#).

Subject matter

Each unit contains a unit description, unit objectives and subject matter. Subject matter is the body of information, mental procedures and psychomotor procedures (see Marzano & Kendall 2007, 2008) that are necessary for students' learning and engagement with the subject.

Subject matter itself is not the specification of learning experiences but provides the basis for the design of student learning experiences.

Subject matter has a direct relationship with the unit objectives and provides statements of learning that have been constructed in a similar way to objectives.

Aboriginal perspectives and Torres Strait Islander perspectives

The QCAA is committed to reconciliation. As part of its commitment, the QCAA affirms that:

- Aboriginal peoples and Torres Strait Islander peoples are the first Australians, and have the oldest living cultures in human history
- Aboriginal peoples and Torres Strait Islander peoples have strong cultural traditions and speak diverse languages and dialects, other than Standard Australian English
- teaching and learning in Queensland schools should provide opportunities for students to deepen their knowledge of Australia by engaging with the perspectives of Aboriginal peoples and Torres Strait Islander peoples
- positive outcomes for Aboriginal students and Torres Strait Islander students are supported by successfully embedding Aboriginal perspectives and Torres Strait Islander perspectives across planning, teaching and assessing student achievement.

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.

Where appropriate, Aboriginal perspectives and Torres Strait Islander perspectives have been embedded in the subject matter.

Complementary skills

Opportunities for the development of complementary skills have been embedded throughout subject matter. These skills, which overlap and interact with syllabus subject matter, are derived from current education, industry and community expectations and encompass the knowledge, skills, capabilities, behaviours and dispositions that will help students live and work successfully in the 21st century.

These complementary skills are:

- literacy — the knowledge, skills, behaviours and dispositions about language and texts essential for understanding and conveying English language content
- numeracy — the knowledge, skills, behaviours and dispositions that students need to use mathematics in a wide range of situations, to recognise and understand the role of mathematics in the world, and to develop the dispositions and capacities to use mathematical knowledge and skills purposefully
- 21st century skills — the attributes and skills students need to prepare them for higher education, work, and engagement in a complex and rapidly changing world. These skills include critical thinking, creative thinking, communication, collaboration and teamwork, personal and social skills, and digital literacy. The explanations of associated skills are available at www.qcaa.qld.edu.au/senior/senior-subjects/general-subjects/21st-century-skills.

It is expected that aspects of literacy, numeracy and 21st century skills will be developed by engaging in the learning outlined in this syllabus. Teachers may choose to create additional explicit and intentional opportunities for the development of these skills as they design the course of study.

Additional subject-specific information

Additional subject-specific information has been included to support and inform the development of a course of study.

Risk management

Schools will need to appropriately manage the risks associated with equipment 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 at <https://education.qld.gov.au/initiatives-and-strategies/health-and-wellbeing/workplaces>.

Support material to manage risks is available at <https://education.qld.gov.au/initiatives-and-strategies/health-and-wellbeing/workplaces/safety/managing/industrial-technology-design>.

Reporting

General information about determining and reporting results for senior syllabuses is provided in the 'Determining and reporting results' section of the [QCE and QCIA policy and procedures handbook](#).

Reporting standards

Reporting standards are summary statements that describe typical performance at each of the five levels (A–E).

A
The student shows proficient demonstration of manufacturing industry practices, and production skills and procedures when manufacturing products. They demonstrate insightful and justified interpretation of drawings and technical information. The student discerningly selects industry practices, and production skills and procedures. When manufacturing they strategically sequence production processes. They provide insightful and justified evaluations of production skills, procedures and products. The student's adaptation of production plans, skills and procedures is insightful and justified when manufacturing products.
B
The student shows efficient demonstration of manufacturing industry practices, and production skills and procedures when manufacturing products. They demonstrate detailed and supported interpretation of drawings and technical information. The student thoroughly selects industry practices, and production skills and procedures. When manufacturing they consider how to sequence production processes. They provide detailed and supported evaluations of production skills, procedures and products. The student's adaptation of production plans, skills and procedures is detailed and supported when manufacturing products.
C
The student shows demonstration of manufacturing industry practices, and production skills and procedures when manufacturing products. They demonstrate interpretation of drawings and technical information. The student selects industry practices, and production skills and procedures. When manufacturing they sequence production processes. They provide evaluations of production skills, procedures and products. The student adapts production plans, skills and procedures when manufacturing products.
D
The student shows rudimentary demonstration of practices, and production skills and procedures when manufacturing products. They demonstrate narrow and unsupported interpretation of drawings and technical information. The student inconsistently selects industry practices, and production skills and procedures. When manufacturing they inconsistently sequence production skills or procedures. They provide narrow and unsupported evaluations of production skills, procedures and products. The student's adaptation of skills or procedures is narrow and unsupported when manufacturing incomplete products.
E
The student shows incorrect demonstration of practices, and production skills and procedures when manufacturing products. They demonstrate superficial and unsubstantiated interpretation of drawings and technical information. The student incorrectly selects industry practices, and production skills and procedures. When manufacturing they incorrectly sequence production skills or procedures. They provide statements about production skills, procedures and products. The student changes skills or procedures when manufacturing aspects of products.

Determining and reporting results

Unit 1 and Unit 2

Schools make A–E judgments on individual assessment instruments implemented in Unit 1 and Unit 2 using reporting standards.

Schools report results to the QCAA for students who complete Unit 1 and/or Unit 2. Results are reported as satisfactory (S) or unsatisfactory (U). Where appropriate, schools may also report a not rated (NR).

Units 3 and 4

Schools make A–E judgments on each of the four assessment instruments implemented in Units 3 and 4 using instrument-specific standards (ISS).

Schools report instrument results to the QCAA for students enrolled in Units 3 and 4 for each of the four assessments implemented. Where appropriate, schools may also report a not rated (NR).

Schools are also responsible for determining and reporting an A–E final subject result to the QCAA. The subject result is an on-balance judgment about how the pattern of evidence across the four assessments in Units 3 and 4 best matches the characteristics of the reporting standards at one of five levels (A–E).

Unit options

Unit option A: Fitting and machining

In this unit, students demonstrate fitting and machining fundamental ways of working. They use tools, machinery and equipment safely and recognise that products are manufactured, maintained and repaired using drawings and technical information that detail the expected quality standards of the final product, e.g. size, type and grade of metal, tolerances, fits, finish and joints. Students evaluate, make decisions about and adapt production plans, skills and procedures, and products with the knowledge that the quality of products depends on customer expectations of value, which affects industry production processes.

Unit objectives

1. Demonstrate fitting and machining industry practices, and production skills and procedures.
2. Interpret fitting and machining drawings and technical information.
3. Select fitting and machining industry practices, and production skills and procedures.
4. Sequence fitting and machining production processes.
5. Evaluate fitting and machining production skills and procedures, and products.
6. Adapt fitting and machining production plans, skills and procedures.

Subject matter

Pathways

- Recognise industry career pathways for fitting and machining workers in structural, transport, and manufacturing engineering enterprises, including fitter, fitter and turner, mechanical fitter, maintenance fitter, first-class metal machinist.

Drawings and technical information

- Recognise project requirements from a simple detailed drawing that includes
 - basic orthogonal projections
 - pictorial view
 - dimensions, symbols, annotations and scales
 - hole sizes, form and quality information
 - surface finish details.
- Recognise project requirements to identify potential hazards and apply control measures.
- Examine industry drawings to identify
 - the naming conventions for polymer (e.g. nylon, PVC, acetal), bright mild steel and aluminium standard sections, shapes and sizes, including solid bar (round, square and hexagon) and flat bar
 - basic drawing standards, including
 - dimensions, limits, fits and tolerances, including clearance, interference and transition fit
 - plain and solid shapes, including orthographic, sectional and isometric (pictorial view)
 - drawing details, including tapping hole sizes for various materials and thread forms; machine finish, including basic surface finish symbols, callouts, and standards; hole centres, e.g. PCD (pitch circle diameter).
- Interpret a
 - simple detailed drawing with technical information to manufacture a product from mild steel (M/S) 3 mm flat stock, e.g. drill gauge
 - detailed drawing with technical information of a machined product that consists of multiple interconnected components, e.g. tack hammer, meat mallet, soft faced hammer.

Production processes

- Demonstrate preparation skills and procedures using tools and machinery, including
 - use of safe work practices
 - setting up and positioning of machine guards and attachments
 - tool storage and maintenance
 - machine settings, e.g. tooling, blades, cutter, speed, feed selection
 - replacement and disposal
 - general housekeeping
- Demonstrate marking-out skills and procedures using relevant tools, including
 - skills using measuring/marking-out tools and equipment, e.g. steel rule, vernier callipers, micrometres, engineers square, scribe, vernier height gauge and divider
 - procedures used to measure, estimate and calculate materials, e.g. length, diameter, thickness, surface area and percentage.
- Demonstrate cutting skills and procedures using relevant tools and machinery, including
 - skills using hand tools, e.g. hacksaw, file, cold chisel, holding devices and thread cutting tools
 - skills using power tools, e.g. drill, die grinder and jigsaw
 - skills using machinery, e.g. bandsaw, cold saw, bench grinder and power hacksaw
 - procedures for and safe methods of cutting a range of materials, e.g. metals and polymers.
- Demonstrate joining skills and procedures using relevant tools and machinery, including
 - skills using hand tools, e.g. screwdriver, spanners and sockets
 - skills using power tools, e.g. power screwdriver and power ratchet
 - skills using equipment, e.g. hydraulic press, brazing and silver soldering equipment
 - procedures for and safe methods of joining a range of materials, e.g. metals and polymers.
- Demonstrate machining skills and procedures using relevant machinery, including
 - skills using machinery (manual and CNC), e.g. lathe, milling machine, pedestal drill
 - procedures for and safe methods of machining a range of materials, e.g. metals and polymers.
- Demonstrate forming skills and procedures using relevant tools and machinery, including
 - skills using hand tools, e.g. hammer, flaring tool, jigs and vices
 - skills using machinery, e.g. knurling
 - procedures for and safe methods of forming a range of materials, e.g. metals and polymers.
- Demonstrate assembling skills and procedures using relevant tools and machinery, including
 - skills using hand tools, e.g. screwdriver, spanners and sockets
 - skills using power tools, e.g. power screwdriver and power ratchet
 - procedures for and safe methods of assembling a range of components.

- Demonstrate finishing skills and procedures using relevant tools and machinery, including
 - skills using hand tools, e.g. file, brushes, sandpaper, holding device
 - skills using power tools, e.g. angle grinder and sander
 - skills using fixed machinery, e.g. drum/belt sander, compressor and buffer.
 - procedures for and safe methods of finishing a range of materials, e.g. metals and polymers.

Industry practices

- Demonstrate industry-related personal attributes for fitters and machinists, including
 - communication skills, including
 - use of technical language, including main components of a metal lathe, precise measuring tool names and uses, fitting and machining procedures and uses, consumables and types of materials
 - written skills, including producing textual and visual information, e.g. rough sketches to communicate technical information to others
 - oral skills, including speaking and listening to others, e.g. providing explanations, negotiating, asking clarifying questions and following instructions
 - teamwork, including individual responsibility and accountability
 - integrity, initiative, independence and work ethic.
- Recognise industry practices relevant to fitting and machining regarding customer expectations of product quality, including
 - accuracy, including limits fits and tolerances in drawings
 - finish, including R_a value (i.e. average roughness values for boring and turning manufacturing processes) and machine cutting speeds and feeds (i.e. roughing and finishing cuts)
 - cost, including minimising waste materials, working efficiently, working with others effectively
 - completion in agreed timeframes, e.g. working to a construction schedule.
- Select and demonstrate workplace health and safety practices in fitting and machining manufacturing tasks, including
 - manufacturing worker rights, responsibilities and obligations under the *Work Health and Safety Act 2011* (Qld)
 - industry-specific requirements, including codes of practice for workplace machinery and equipment, e.g. lathes, milling machines and drilling machines
 - safe operating procedures for workplace machinery and equipment, e.g. lathes, boring and drilling machines and equipment
 - risk assessments for fitting and machining workshop processes, including use of safety data sheets for consumables such as paints, solvents, sealant and adhesives
 - safe and appropriate use of personal protective equipment (PPE).
- Document production plans, including cutting list, costing, production sequence, safety (risk assessments), working with others, evaluation of production processes and the product, the adaptations made to improve the production plan, skills used, and procedures undertaken.

- Determine the sequence of production processes required to manufacture fitting and machining products, including acknowledgement of
 - available equipment, machinery and tools, e.g. lathe, drill press, taps and dies
 - working and communicating with others in the workplace
 - working to a production schedule
 - minimising waste, including time and materials.
- Evaluate production skills and procedures, and fitting and machining products, using knowledge of industry practices and drawing requirements, including
 - material cut and machine size errors, availability and storage
 - working with others, e.g. communication, cooperation
 - product accuracy and quality
 - production sequence issues, errors or constraints, e.g. time restrictions or holdups
 - equipment availability, suitability and performance
 - waste, including time and cost.
- Adapt production plans, skills and procedures, including
 - production sequence
 - tool and machine use
 - machining surface defects
 - component limits, fits and tolerance
 - out of tolerance errors, e.g. incorrect product size or finish
 - finishing product to drawing requirements and customer expectations of quality.

Unit option B: Welding and fabrication

In this unit, students demonstrate welding and fabrication fundamental ways of working. They use tools, machinery and equipment safely and recognise that products are manufactured, maintained and repaired using drawings and technical information that detail the expected quality standards of the final product, e.g. size, type and grade of metal, tolerances, fits, finish and joints. Students evaluate, make decisions about and adapt production plans, processes and products with the knowledge that the quality of products depends on customer expectations of value, which affects industry production processes.

Unit objectives

1. Demonstrate welding and fabrication industry practices, and production skills and procedures.
2. Interpret welding and fabrication drawings and technical information.
3. Select welding and fabrication industry practices, and production skills and procedures.
4. Sequence welding and fabrication production processes.
5. Evaluate welding and fabrication production skills and procedures, and products.
6. Adapt welding and fabrication production plans, skills and procedures.

Subject matter

Pathways

- Recognise industry career pathways for welding and fabrication workers in structural, transport and manufacturing engineering enterprises, including boilermaker, first-class welder, fabricator, steel erector.

Drawings and technical information

- Recognise project requirements from a simple detailed drawing that includes
 - basic orthogonal projections
 - pictorial view
 - dimensions, symbols, annotations and scales
 - weld size, form and quality information
 - surface finish details.
- Recognise project requirements to identify potential hazards and apply control measures.
- Examine industry drawings to identify
 - the naming conventions for various material standard sections, shapes and sizes, including
 - rectangular hollow section (RHS)
 - angle
 - solid bar (round and square)
 - flat bar
 - sheet (heavy, i.e. thickness greater than 3 mm)
 - basic drawing standards, including
 - dimensions and tolerances
 - plain and solid shapes, including orthographic and isometric (pictorial view)
 - drawing details, including weld requirements, hole sizes and finishes.
- Interpret a
 - simple detailed drawing with technical information of a mild steel fabricated product that requires multiple butt welds and fillet welds using MMAW or MIG, e.g. sand anchor, shed stool
 - detailed drawing with technical information of a mild steel fabricated product that contains MMAW or MIG generated butt welds, fillet welds, plug welds and stitch welds to manage distortion, e.g. camp BBQ and grill, BBQ brazier/fire pit.

Production processes

- Demonstrate preparation skills and procedures using tools and machinery, including
 - use of safe work practices
 - setting up and positioning of welding screens, machine guards and attachments
 - tool storage and maintenance
 - machine settings, e.g. amperage, gas flow rate, wire feed rate
 - replacement and disposal of consumables, e.g. cutting and grinding discs
 - general housekeeping.
- Demonstrate marking-out skills and procedures using relevant tools, including
 - skills using measuring/marketing-out tools and equipment, e.g. tape measure, steel rule, engineers square, scribe
 - procedures used to measure, estimate and calculate materials, e.g. length, diameter, thickness, surface area and percentage.
- Demonstrate cutting skills and procedures using relevant tools and machinery, including
 - skills using hand tools, e.g. hacksaw, file, cold chisel, ball peen hammer
 - skills using power tools, e.g. drill, angle grinder and jigsaw
 - skills using machinery, e.g. bandsaw, cold saw, bench grinder and power hacksaw
 - procedures for and safe methods of cutting a range of material sections, e.g. flat, round, angle, tube, RHS.
- Demonstrate joining skills and procedures using relevant tools and machinery, including
 - skills using hand tools, e.g. screwdriver, spanners and sockets
 - skills using power tools, e.g. power screwdriver and power ratchet
 - skills using equipment, e.g. welding equipment (MMAW, MIG, TIG)
 - procedures for and safe methods of joining a range of material sections, e.g. flat, round, angle, tube, RHS.
- Demonstrate machining skills and procedures using relevant machinery, including
 - skills using machinery, e.g. pedestal drill
 - procedures for and safe methods of machining a range of material sections, e.g. flat, round, angle, tube, RHS.
- Demonstrate forming skills and procedures using relevant tools and machinery, including
 - skills using hand tools, e.g. hammer, jigs and vices
 - skills using machinery, e.g. benders for plate, bar, pipe and tube
 - procedures for and safe methods of forming a range of material sections, e.g. flat, round, angle, tube, RHS.
- Demonstrate assembling skills and procedures using relevant tools and machinery, including
 - skills using hand tools, e.g. screwdriver, spanners and sockets
 - skills using power tools, e.g. power screwdriver and power ratchet
 - procedures for and safe methods of assembling a range of components.

- Demonstrate finishing skills and procedures using relevant tools and machinery, including
 - skills using hand tools, e.g. file, brushes, sandpaper, holding device
 - skills using power tools, e.g. angle grinder and sander
 - skills using fixed machinery, e.g. drum/belt sander, compressor and buffer.
 - procedures for and safe methods of finishing a range of material sections, e.g. flat, round, angle, tube, RHS.

Industry practices

- Demonstrate industry-related personal attributes for welders and fabricators, including
 - communication skills, including
 - use of technical language, including tool names and uses, cutting and welding procedures and uses, consumables, types of materials
 - written skills, including producing textual and visual information, e.g. rough sketches to communicate technical information to others
 - oral skills, including speaking and listening to others, e.g. providing explanations, negotiating, asking clarifying questions and following instructions
 - teamwork, including individual responsibility and accountability
 - integrity, initiative, independence and work ethic.
- Recognise industry practices relevant to welding and fabrication regarding customer expectations of product quality, including
 - accuracy, including tolerances or allowances in drawings
 - finish, including surface preparation, primer, undercoat and finish coat (colour)
 - cost, including minimising waste materials, working efficiently, working with others effectively
 - completion in agreed timeframes, e.g. working to a construction schedule.
- Select and demonstrate workplace health and safety practices in welding and fabricating manufacturing tasks, including
 - manufacturing worker rights, responsibilities and obligations under the *Work Health and Safety Act 2011* (Qld)
 - industry-specific requirements, including codes of practice for workplace machinery and equipment, including welding and cutting machines and equipment
 - safe operating procedures for welding, cutting and forming machines and equipment
 - completing risk assessments for welding and fabrication workshop processes
 - safe and appropriate use of personal protective equipment (PPE).

- Document production plans, including cutting list, costing, production sequence, safety (risk assessments), working with others, evaluation of production processes and the product, the adaptations made to improve the production plan, skills used, and procedures undertaken.
- Determine the sequence of production processes required to manufacture welding and fabrication products, including acknowledgement of
 - available equipment, machinery and tools, e.g. MIG welder, drill press, hand grinder, hand tools
 - working and communicating with others in the workplace
 - working to a production schedule
 - minimising waste, including time and materials.
- Evaluate production skills and procedures, and welding and fabrication products, using knowledge of industry practices and drawing requirements, including
 - material cut and machine size errors, availability and storage
 - working with others, e.g. communication, cooperation
 - product accuracy and quality
 - production sequence issues, errors or constraints, e.g. time restrictions or holdups
 - equipment availability, suitability and performance
 - waste, including time and cost.
- Adapt production plans, skills and procedures, including
 - production sequence
 - tool and machine use
 - weld defects, e.g. porosity and weld surface penetration
 - out of tolerance errors, e.g. incorrect product size or finish
 - finishing product to drawing requirements and customer expectations of quality.

Unit option C: Sheet metal working

In this unit, students demonstrate sheet metal working fundamental ways of working. They use tools, machinery and equipment safely and recognise that products are manufactured, maintained and repaired using drawings and technical information that detail the expected quality standards of the final product, e.g. size, type and grade of metal, tolerances, fits, finish and joints. Students evaluate, make decisions about and adapt production plans, processes and products with the knowledge that the quality of products depends on customer expectations of value, which affects industry production processes.

Unit objectives

1. Demonstrate sheet metal working industry practices, and production skills and procedures.
2. Interpret sheet metal working drawings and technical information.
3. Select sheet metal working industry practices, and production skills and procedures.
4. Sequence sheet metal working production processes.
5. Evaluate sheet metal working production skills and procedures, and products.
6. Adapt sheet metal working production plans, skills and procedures.

Subject matter

Pathways

- Recognise industry career pathways for sheet metal workers in structural, transport and manufacturing engineering enterprises, including
 - air-conditioning ducting manufacture and installation
 - aircraft repair, manufacture and assembly
 - stainless steel shop fitting manufacture and installation, e.g. benches, displays, industrial kitchen equipment
 - repair of industrial machinery, e.g. guarding, switch-boards
 - automotive panel repair.

Drawings and technical information

- Recognise project requirements from a simple detailed drawing that includes
 - basic orthogonal projections
 - pictorial view
 - dimensions, symbols, annotations and scales
 - fold size, form and quality information
 - surface finish details.
- Recognise project requirements to identify potential hazards and apply control measures.
- Examine industry drawings to identify
 - the naming conventions for mild steel (M/S), stainless steel (S/S) and aluminium standard sections, shapes and sizes, including
 - rectangular hollow section (RHS)
 - angle
 - flat bar
 - sheet (light, i.e. thickness less than 3 mm)
 - basic drawing standards, including
 - dimensions and tolerances for outside and inside sizes
 - plain and solid shapes, including orthographic and isometric (pictorial view)
 - drawing details, including joining methods, fold radius and finishes.
- Interpret a
 - simple detailed drawing with technical information of a sheet metal fabricated product that includes multiple components with allowances for fit, e.g. small cabinet with a shelf or drawer
 - detailed drawing with technical information of a sheet metal fabricated product that includes multiple interconnected and moving components and hardware (e.g. hinges, latches, locks, hasp and staple), e.g. toolbox with lid and lift out compartment/s, workshop cabinet including a door and drawer.

Production processes

- Demonstrate preparation skills and procedures using tools and machinery, including
 - use of safe work practices
 - setting up and positioning of machine guards and attachments
 - tool storage and maintenance
 - machine settings, e.g. amperage, fold radius allowance
 - replacement and disposal of consumables
 - general housekeeping.
- Demonstrate marking-out skills and procedures using relevant tools, including
 - skills using measuring/marketing-out tools and equipment, e.g. tape measure, steel rule, engineers square, scribe, engineers square, combination square, scratch gauge, dividers
 - procedures used to measure, estimate and calculate materials, e.g. length, diameter, thickness, surface area and percentage.
- Demonstrate cutting skills and procedures using relevant tools and machinery, including
 - skills using hand tools, e.g. hacksaw, file, tin snips, aviation snips
 - skills using power tools, e.g. drill, grinder, sander, jigsaw, shears and nibbler
 - skills using machinery, e.g. guillotine, bench plate shears
 - procedures for and safe methods of cutting a range of materials, e.g. metals and polymers.
- Demonstrate joining skills and procedures using relevant tools and machinery, including
 - skills using hand tools, e.g. pop rivet gun, screwdriver, spanners and sockets, soldering iron
 - skills using power tools, e.g. power screwdriver and power ratchet
 - skills using equipment, e.g. spot welder, welding equipment (MMAW, MIG, TIG), soldering and brazing equipment
 - procedures for and safe methods of joining a range of materials, e.g. metals and polymers.
- Demonstrate machining skills and procedures using relevant machinery, including
 - skills using machinery, e.g. pedestal drill
 - procedures for and safe methods of machining a range of materials, e.g. metals and polymers.
- Demonstrate forming skills and procedures using relevant tools and machinery, including
 - skills using hand tools, e.g. hammer, forming jigs and folding pliers
 - skills using machinery, e.g. pan break, magna bend, sheet metal roller
 - procedures for and safe methods of forming a range of materials, e.g. metals and polymers.
- Demonstrate assembling skills and procedures using relevant tools and machinery, including
 - skills using hand tools, e.g. screwdriver, spanners and sockets
 - skills using power tools, e.g. power screwdriver and power ratchet
 - procedures for and safe methods of assembling a range of components.

- Demonstrate finishing skills and procedures using relevant tools and machinery, including
 - skills using hand tools, e.g. file, brushes, sandpaper, holding device
 - skills using power tools, e.g. sander, polisher
 - skills using fixed machinery, e.g. drum/belt sander, compressor and buffer.
 - procedures for and safe methods of finishing a range of materials, e.g. metals and polymers.

Industry practices

- Demonstrate industry-related personal attributes for sheet metal workers, including
 - communication skills, including
 - use of technical language, including tool names and uses, cutting, welding and joining procedures and uses, consumables, types of materials
 - written skills, including producing textual and visual information, e.g. rough sketches to communicate technical information to others
 - oral skills, including speaking and listening to others, e.g. providing explanations, negotiating, asking clarifying questions and following instructions
 - teamwork, including individual responsibility and accountability
 - integrity, initiative, independence and work ethic.
- Recognise industry practices relevant to sheet metal working regarding customer expectations of product quality, including
 - accuracy, including tolerances or allowances in drawings
 - finish, including material preparation, sanding, polishing, primer, undercoat and finish coat (colour)
 - cost, including minimising waste materials, working efficiently, working with others effectively
 - completion in agreed timeframes, e.g. working to a construction schedule.
- Select and demonstrate workplace health and safety practices in sheet metal manufacturing tasks, including
 - manufacturing worker rights, responsibilities and obligations under the *Work Health and Safety Act 2011* (Qld)
 - industry-specific requirements including codes of practice for workplace machinery and equipment, including cutting, folding, rolling, welding and joining machines and equipment
 - safe operating procedures for cutting, folding, rolling, welding and joining machines and equipment
 - completing risk assessments for sheet metal workshop processes
 - safe and appropriate use of personal protective equipment (PPE).

- Document production plans, including cutting list, costing, production sequence, safety (risk assessments), working with others, evaluation of production processes and the product, the adaptations made to improve the production plan, skills used, and procedures undertaken.
- Determine the sequence of production processes required to manufacture sheet metal working products, including acknowledgement of
 - available cutting, forming and joining equipment, machinery and tools
 - working and communicating with others in the workplace
 - working to a production schedule
 - minimising waste, including time and materials.
- Evaluate production skills and procedures, and sheet metal working products, using knowledge of industry practices and drawing requirements, including
 - material cut and machine size errors, availability and storage
 - working with others, e.g. communication, cooperation
 - product accuracy and quality
 - production sequence issues, errors or constraints, e.g. time restrictions or holdups
 - equipment availability, suitability and performance
 - waste, including time and cost.
- Adapt production plans, skills and procedures, including
 - production sequence
 - tool and machine use
 - joint defects, e.g. accuracy, fit and strength
 - out of square, component size concerns or hardware alignment errors
 - out of tolerance errors, e.g. incorrect product size or finish
 - finishing product to drawing requirements and customer expectations of quality.

Unit option D: Production in the structural engineering industry

In this unit, students demonstrate the structural engineering industry's fundamental ways of working. They use tools, machinery and equipment safely and recognise that structural engineering industry products are manufactured, maintained and repaired to a specified quality using a combination of job, batch and mass manufacturing methods. Students demonstrate through practical learning experiences that the expected quality standards of the end product (e.g. size, type and grade of metal, tolerances, fits, finish and joints) are maintained by a range of quality assurance processes, including jigs and fixtures, gauges and production checks. Students evaluate, make decisions about and adapt batch and mass production plans, skills and procedures, and products with the knowledge that the quality of end products depends on customer expectations of value, which affects the structural engineering industry's application and use of particular production processes and manufacturing methods.

Unit objectives

1. Demonstrate structural engineering industry practices, and production skills and procedures.
2. Interpret structural engineering drawings and technical information.
3. Select structural engineering industry practices, and production skills and procedures.
4. Sequence structural engineering production processes.
5. Evaluate structural engineering production skills and procedures, and products.
6. Adapt structural engineering production plans, skills and procedures.

Subject matter

Pathways

- Recognise structural engineering enterprise career pathways, including structural steel fabricators, boilermaker, sheet metal worker, first-class metal machinist.
- Recognise roles in structural engineering enterprises, including
 - production management roles
 - area supervision roles, e.g. assembly supervisor, machine shop supervisor
 - materials management roles
 - safety management roles
 - quality assurance management roles.

Drawings and technical information

- Recognise project requirements from a simple detailed drawing that includes
 - basic orthogonal projections
 - pictorial view
 - dimensions, symbols, annotations and scales
 - fits, limits, tolerances and quality information
 - surface finish details.
- Recognise project requirements to identify potential hazards and apply control measures.
- Examine industry drawings to identify
 - the materials used in fabrication, including structural steel, including rectangular hollow section (RHS) and pipe; channel; angle; flat bar; I beam; solid round bar (precision structural pins); cold formed galvanised steel columns, purlins and girts; sheet metal roofing, flashing, brackets and gutters; structural steel connections, including riveted connections, bolted connections, welded connections, pinned connections
 - basic drawing standards, including
 - dimensions and tolerances
 - plain and solid shapes, including orthographic and isometric (pictorial view)
 - drawing technical information, including joining methods, e.g. weld, connection and material notes and details.
- Interpret a
 - simple detailed drawing with technical information of a fabricated product that includes multiple machined components with allowances for fit, e.g. swing gate adjustable bolt-on hinge with fixing plate
 - detailed drawing with technical information of a fabricated structural sheet metal product that includes multiple interconnected components, e.g. section of complex shaped industrial/commercial guttering with end caps and mounting brackets.

Production processes

- Demonstrate preparation skills and procedures using tools and machinery, including
 - use of safe work practices
 - setting up and positioning of machine guards and attachments
 - tool storage and maintenance
 - machine settings
 - replacement and disposal
 - general housekeeping.
- Demonstrate marking-out skills and procedures using relevant tools, including
 - skills using measuring/marketing-out tools and equipment
 - procedures used to measure, estimate and calculate materials.
- Demonstrate cutting skills and procedures using relevant tools and machinery, including
 - skills using hand tools
 - skills using power tools
 - skills using machinery
 - procedures for and safe methods of cutting a range of materials.
- Demonstrate joining skills and procedures using relevant tools and machinery, including
 - skills using hand tools
 - skills using power tools
 - skills using equipment
 - procedures for and safe methods of joining a range of materials.
- Demonstrate machining skills and procedures using relevant machinery, including
 - skills using machinery
 - procedures for and safe methods of machining a range of materials.
- Demonstrate forming skills and procedures using relevant tools and machinery, including
 - skills using hand tools
 - skills using machinery
 - procedures for and safe methods of forming a range of materials.
- Demonstrate assembling skills and procedures using relevant tools and machinery, including
 - skills using hand tools
 - skills using power tools
 - procedures for and safe methods of assembling a range of components.
- Demonstrate finishing skills and procedures using relevant tools and machinery, including
 - skills using hand tools
 - skills using power tools
 - skills using fixed machinery
 - procedures for and safe methods of finishing a range of materials.

Industry practices

- Demonstrate manufacturing methods used in structural engineering enterprises, including job, batch and mass production.
- Recognise structural engineering industry practices relevant to staff who work as members of a team to manufacture metal products, considering customer expectations of quality, including
 - accuracy, including knowledge of drawing and technical information, e.g. connection hole tolerances and size allowances in drawings
 - cost, including minimising waste materials, working efficiently and cooperatively as a member of a manufacturing team
 - completion in agreed timeframes, e.g. working to a production schedule
 - team communication skills, including
 - use of technical language, including tool names and uses, cutting, machining, welding and joining procedures and uses, consumables, types of materials
 - written skills, including producing textual and visual information, e.g. rough sketches of components and products to communicate technical information to team members
 - oral skills, including speaking and listening to team members, e.g. providing explanations, negotiating, asking clarifying questions and following instructions
 - integrity, initiative, independence, responsibility and work ethic as a team member.
- Select and demonstrate workplace health and safety practices in structural engineering industry manufacturing tasks, ensuring these practices are maintained and followed, including
 - manufacturing worker rights, responsibilities and obligations under the *Work Health and Safety Act 2011* (Qld)
 - industry-specific requirements, including codes of practice for workplace machinery and equipment, including cutting, forming and welding machines and equipment
 - safe operating procedures for cutting, forming and welding machines and equipment
 - risk assessments for workshop processes
 - safe and appropriate use of personal protective equipment (PPE).

- Document production plans, including cutting list, costing, production sequence, safety (risk assessments), working with others, evaluation of production processes and the product, the adaptations made to improve the production plan, skills used, and procedures undertaken.
- Determine the sequence of production processes required to job, batch or mass manufacture structural engineering products, including acknowledgement of
 - available cutting, forming and joining equipment, machinery and tools
 - working and communicating with others in the workplace
 - working to a production schedule
 - minimising waste, including time and materials
 - quality assurance processes, including templates, jigs, gauges and inspection points.
- Evaluate production skills and procedures, and structural engineering products, using knowledge of job, batch or mass manufacturing industry practices and drawing requirements, including
 - material cut and machine size errors, availability and storage
 - template, jig, gauge, or production checking errors or inconsistencies
 - working with others, e.g. communication, cooperation
 - product accuracy and quality
 - production sequence issues, errors or constraints, e.g. time restrictions or holdups
 - equipment availability, suitability and performance
 - waste, including time and cost.
- Adapt production plans, skills and procedures, including
 - production sequence
 - tool and machine use
 - jigs, templates, gauges and production checks
 - joint defects, e.g. accuracy, fit and strength
 - out of square, component size concerns or component alignment or fit errors
 - out of tolerance errors, e.g. incorrect product size or finish
 - finishing products to drawing requirements and customer expectations of quality.

Unit option E: Production in the transport engineering industry

In this unit, students demonstrate the transport engineering industry's fundamental ways of working. They use tools, machinery and equipment safely and recognise that transport engineering industry products are manufactured, maintained and repaired to a specified quality using a combination of job, batch and mass manufacturing methods. Students demonstrate through practical learning experiences that the expected quality standards of the end product (e.g. size, type and grade of metal and polymer, tolerances, fits, finish and joints) are maintained by a range of quality assurance processes, including jigs and fixtures, gauges and production checks. Students evaluate, make decisions about and adapt batch and mass production plans, processes and products with the knowledge that the quality of end products depends on customer expectations of value, which affects the transport engineering industry's application and use of particular production processes and manufacturing methods.

Unit objectives

1. Demonstrate transport engineering industry practices, and production skills and procedures.
2. Interpret transport engineering drawings and technical information.
3. Select transport engineering industry practices, and production skills and procedures.
4. Sequence transport engineering production processes.
5. Evaluate transport engineering production skills and procedures, and products.
6. Adapt transport engineering production plans, skills and procedures.

Subject matter

Pathways

- Recognise transport engineering enterprise career pathways, including
 - ship/boat building
 - aircraft manufacture, maintenance and repair
 - vehicle body section manufacture and repair, including trains, trucks and buses
 - boilermaker
 - sheet metal worker
 - fitter and turner.
- Recognise roles in transport engineering enterprises, including
 - production management roles
 - area supervision roles, e.g. assembly supervisor, machine shop supervisor
 - materials management roles
 - safety management roles
 - quality assurance management roles.

Drawings and technical information

- Recognise project requirements from a simple detailed drawing that includes
 - basic orthogonal projections
 - pictorial and sectional views
 - dimensions, symbols, annotations and scales
 - fits, limits, tolerances and quality information
 - surface finish requirements.
- Recognise project requirements to identify potential hazards and apply control measures.
- Examine transport engineering industry drawings to identify
 - the materials used in fabrication, including steel, polymers and aluminium, including
 - rectangular hollow section (RHS) and pipe
 - angle
 - flat bar
 - solid round, square and hexagonal bar
 - cold formed sheet metal panels and components
 - basic drawing standards, including
 - dimensions, including limits, fits and tolerances
 - plain and solid shapes, including orthographic, isometric (pictorial view) and sectional views
 - drawing technical information, including joining methods, e.g. weld (spot, MMAW, MIG, TIG), bolt, mechanical fastener (metal thread).

- Interpret a
 - simple detailed drawing with technical information of a fabricated product that includes multiple machined components with allowances for fit, e.g. basic train suspension swing link and mounting plate with pivot pin (proof of concept manufactured from M/S using a smaller scale)
 - detailed drawing with technical information of a fabricated transport sheet metal product that includes multiple interconnected components and hardware such as hinges and locking mechanism, e.g. boat glove box for safe storage of keys, phone, wallet.

Production processes

- Demonstrate preparation skills and procedures using tools and machinery, including
 - use of safe work practices
 - setting up and positioning of machine guards and attachments
 - tool storage and maintenance
 - machine settings
 - replacement and disposal
 - general housekeeping.
- Demonstrate marking-out skills and procedures using relevant tools, including
 - skills using measuring/marking-out tools and equipment
 - procedures used to measure, estimate and calculate materials.
- Demonstrate cutting skills and procedures using relevant tools and machinery, including
 - skills using hand tools
 - skills using power tools
 - skills using machinery
 - procedures for and safe methods of cutting a range of materials.
- Demonstrate joining skills and procedures using relevant tools and machinery, including
 - skills using hand tools
 - skills using power tools
 - skills using equipment
 - procedures for and safe methods of joining a range of materials.
- Demonstrate machining skills and procedures using relevant machinery, including
 - skills using machinery
 - procedures for and safe methods of machining a range of materials.
- Demonstrate forming skills and procedures using relevant tools and machinery, including
 - skills using hand tools
 - skills using machinery
 - procedures for and safe methods of forming a range of materials.

- Demonstrate assembling skills and procedures using relevant tools and machinery, including
 - skills using hand tools
 - skills using power tools
 - procedures for and safe methods of assembling a range of components.
- Demonstrate finishing skills and procedures using relevant tools and machinery, including
 - skills using hand tools
 - skills using power tools
 - skills using fixed machinery
 - procedures for and safe methods of finishing a range of materials.

Industry practices

- Demonstrate manufacturing methods used in transport engineering enterprises, including job, batch and mass production.
- Demonstrate transport engineering industry practices relevant to staff who work as members of a team to manufacture metal products, considering customer expectations of quality, including
 - accuracy, including knowledge of drawing and technical information, e.g. limits, fits, tolerances and size allowances in drawings
 - cost, including minimising waste materials, working efficiently and cooperatively as a member of a manufacturing team
 - completion in agreed timeframes, e.g. working to a production schedule
 - team communication skills, including
 - use of technical language, including tool names and uses, cutting, machining, welding and joining procedures and uses, consumables, types of materials
 - written skills, including producing textual and visual information, e.g. rough sketches of components and products to communicate technical information to team members
 - oral skills, including speaking and listening to team members, e.g. providing explanations, negotiating, asking clarifying questions and following instructions
 - integrity, initiative, independence, responsibility and work ethic as a team member.
- Select and demonstrate workplace health and safety practices in structural engineering industry manufacturing tasks, ensuring these practices are maintained and followed, including
 - manufacturing worker rights, responsibilities and obligations under the *Work Health and Safety Act 2011* (Qld)
 - industry-specific requirements, including codes of practice for workplace machinery and equipment, including cutting, forming and welding machines and equipment
 - safe operating procedures for cutting, forming and welding machines and equipment
 - risk assessments for workshop processes
 - safe and appropriate use of personal protective equipment (PPE).
- Document production plans, including cutting list, costing, production sequence, safety (risk assessments), working with others, evaluation of production processes and the product, the adaptations made to improve the production plan, skills used, and procedures undertaken.

- Determine the sequence of production processes required to job, batch or mass manufacture transport engineering products, including acknowledgement of
 - available cutting, forming and joining equipment, machinery and tools
 - working and communicating with others in the workplace
 - working to a production schedule
 - minimising waste, including time and materials
 - quality assurance processes, including templates, jigs, gauges and inspection points.
- Evaluate production skills and procedures, and transport engineering products, using knowledge of job, batch or mass manufacturing industry practices and drawing requirements, including
 - material cut and machine size errors, availability and storage
 - template, jig, gauge, or production checking errors or inconsistencies
 - working with others, e.g. communication, cooperation
 - product accuracy and quality
 - production sequence issues, errors or constraints, e.g. time restrictions or holdups
 - equipment availability, suitability and performance
 - waste, including time and cost.
- Adapt production plans, skills and procedures, including
 - production sequence
 - tool and machine use
 - jigs, templates, gauges and production checks
 - joint defects, e.g. accuracy, fit and strength
 - out of square, component size concerns or component alignment or fit errors
 - out of tolerance errors, e.g. incorrect product size or finish
 - finishing products to drawing requirements and customer expectations of quality.

Unit option F: Production in the manufacturing engineering industry

In this unit, students demonstrate the manufacturing engineering industry's fundamental ways of working. They use tools, machinery and equipment safely and recognise that manufacturing engineering industry products are manufactured, maintained and repaired to a specified quality using a combination of job, batch and mass manufacturing methods. Students demonstrate through practical learning experiences that the expected quality standards of the end product (e.g. size, type and grade of metal and polymer, tolerances, fits, finish and joints) are maintained by a range of quality assurance processes, including jigs and fixtures, gauges and production checks. Students evaluate, make decisions about and adapt batch and mass production plans, processes and products with the knowledge that the quality of end products depends on customer expectations of value, which affects the manufacturing engineering industry's application and use of particular production processes and manufacturing methods.

Unit objectives

1. Demonstrate manufacturing engineering industry practices, and production skills and procedures.
2. Interpret manufacturing engineering drawings and technical information.
3. Select manufacturing engineering industry practices, and production skills and procedures.
4. Sequence manufacturing engineering production processes.
5. Evaluate manufacturing engineering production skills and procedures, and products.
6. Adapt manufacturing engineering production plans, skills and procedures.

Subject matter

Pathways

- Recognise manufacturing engineering enterprise career pathways, including
 - mining machinery and equipment
 - agricultural machinery and equipment
 - first-class welder
 - sheet metal worker
 - metal fitter and machinist.
- Recognise roles in manufacturing engineering enterprises, including
 - production management roles
 - area supervision roles, e.g. assembly supervisor, machine shop supervisor
 - materials management roles
 - safety management roles
 - quality assurance management roles.

Drawings and technical information

- Recognise project requirements from a simple detailed drawing that includes
 - basic orthogonal projections
 - pictorial views
 - dimensions, symbols, annotations and scales
 - tolerances and quality information
 - surface finish requirements.
- Recognise project requirements to identify potential hazards and apply control measures.
- Examine manufacturing engineering industry drawings to identify
 - the materials used in fabrication, including steel, polymers, and aluminium
 - rectangular hollow section (RHS) and pipe/tube
 - angle
 - flat bar
 - solid round, square and hexagonal bar
 - cold formed sheet metal panels and components
 - basic drawing standards, including
 - dimensions, including limits, fits and tolerances
 - plain and solid shapes, including orthographic, isometric (pictorial view) and sectional views
 - drawing technical information, including basic weld symbols (spot, plug, fillet, butt), and joints bolted, mechanical fastener (metal thread and pop rivets).

- Interpret a
 - simple detailed drawing with technical information of a fabricated product that includes multiple machined components with allowances for fit, e.g. ride-on lawn mower tool tray and mounting bracket
 - detailed drawing with technical information of a fabricated metal product that includes multiple interconnected components, e.g. tractor/tray mounted machine or pipe vice.

Production processes

- Demonstrate preparation skills and procedures using tools and machinery, including
 - use of safe work practices
 - setting up and positioning of machine guards and attachments
 - tool storage and maintenance
 - machine settings
 - replacement and disposal
 - general housekeeping.
- Demonstrate marking-out skills and procedures using relevant tools, including
 - skills using measuring/marking-out tools and equipment
 - procedures used to measure, estimate and calculate materials
- Demonstrate cutting skills and procedures using relevant tools and machinery, including
 - skills using hand tools
 - skills using power tools
 - skills using machinery
 - procedures for and safe methods of cutting a range of materials.
- Demonstrate joining skills and procedures using relevant tools and machinery, including
 - skills using hand tools
 - skills using power tools
 - skills using equipment
 - procedures for and safe methods of joining a range of materials.
- Demonstrate machining skills and procedures using relevant machinery, including
 - skills using machinery
 - procedures for and safe methods of machining a range of materials.
- Demonstrate forming skills and procedures using relevant tools and machinery, including
 - skills using hand tools
 - skills using machinery
 - procedures for and safe methods of forming a range of materials.

- Demonstrate assembling skills and procedures using relevant tools and machinery, including
 - skills using hand tools
 - skills using power tools
 - procedures for and safe methods of assembling a range of components.
- Demonstrate finishing skills and procedures using relevant tools and machinery, including
 - skills using hand tools
 - skills using power tools
 - skills using fixed machinery
 - procedures for and safe methods of finishing a range of materials.

Industry practices

- Demonstrate manufacturing methods in manufacturing engineering enterprises, including job, batch and mass production.
- Demonstrate manufacturing engineering industry practices relevant to staff who work as members of a team to manufacture products, considering customer expectations of quality, including
 - accuracy, including knowledge of drawing and technical information, e.g. limits, fits, tolerances and size allowances in drawings
 - cost, including minimising waste materials, working efficiently and cooperatively as a member of a manufacturing team
 - completion in agreed timeframes, e.g. working to a production schedule
 - team communication skills, including
 - use of technical language, including tool names and uses, cutting, machining, welding and joining procedures and uses, consumables, types of materials
 - written skills, including producing textual and visual information, e.g. rough sketches of components and products to communicate technical information to team members
 - oral skills, including speaking and listening to team members, e.g. providing explanations, negotiating, asking clarifying questions and following instructions
 - integrity, initiative, independence, responsibility and work ethic as a team member.
- Select and demonstrate workplace health and safety practices in manufacturing engineering industry manufacturing tasks, ensuring these practices are maintained and followed, including
 - manufacturing worker rights, responsibilities and obligations under the *Work Health and Safety Act 2011* (Qld)
 - industry-specific requirements, including codes of practice for workplace machinery and equipment, including cutting, forming and welding machines and equipment
 - safe operating procedures for cutting, forming and welding machines and equipment
 - risk assessments for workshop processes
 - safe and appropriate use of personal protective equipment (PPE).
- Document a production plan, including cutting list, costing, production sequence, safety (risk assessments), working with others, evaluation of production processes and the product, the adaptations made to improve the production plan, skills used, and procedures undertaken.

- Determine the sequence of production processes required to job, batch or mass manufacture manufacturing engineering products, including acknowledgement of
 - available cutting, forming and joining equipment, machinery and tools
 - working and communicating with others in the workplace
 - working to a production schedule
 - minimising waste, including time and materials
 - quality assurance processes, including templates, jigs, gauges and inspection points.
- Evaluate production skills and procedures, and manufacturing engineering products, using knowledge of job, batch or mass manufacturing industry practices and drawing requirements, including
 - material cut and machine size errors, availability and storage
 - template, jig, gauge, or production checking errors or inconsistencies
 - working with others, e.g. communication, cooperation
 - product accuracy and quality
 - production sequence issues, errors or constraints, e.g. time restrictions or holdups
 - equipment availability, suitability and performance
 - waste, including time and cost
- Adapt production plans, skills and procedures, including
 - production sequence
 - tool and machine use
 - jigs, templates, gauges and production checks
 - joint defects, e.g. accuracy, fit and strength
 - out of square, component size concerns or component alignment or fit errors
 - out of tolerance errors, e.g. incorrect product size or finish
 - finishing products to drawing requirements and customer expectations of quality.

Assessment

Assessment A1: Practical demonstration — Fitting and machining

Students perform a practical demonstration when manufacturing a fitting and machining product and reflect on industry practices, and production skills and procedures.

Assessment objectives

1. Demonstrate fitting and machining industry practices, and production skills and procedures.
2. Interpret fitting and machining drawings and technical information.
3. Select fitting and machining industry practices, and production skills and procedures.
5. Evaluate fitting and machining production skills and procedures, and products.

Specifications

This task requires students to:

- interpret a provided drawing with technical information
- identify the skills required to manufacture a fitting and machining product
- select industry practices, production skills and procedures
- annotate sketches, photographs and/or video footage to capture decision-making
- demonstrate production skills and procedures used in 3–5 production processes
- reflect on the industry practices, and production skills and procedures used to manufacture the fitting and machining product.

It is recommended that this task is designed so that students can develop a response in approximately 10 hours of class time.

Stimulus specifications

Schools must provide suitably developed drawings and technical information to support students' demonstration of the assessment objectives across the full range of A–E instrument-specific standards.

Conditions

- Students can develop their responses in class time and their own time.
- This is an individual task.
- Students have access to materials, tools and equipment as required to complete the assessment.
- Products constructed for Assessment A1 must be separate from the product component of Assessment A2.

Response requirements

Practical demonstration of fitting and machining

Practical demonstration: the skills and procedures used in 3–5 production processes

Documentation

Multimodal (at least two modes delivered at the same time): up to 3 minutes, 6 A4 pages, or equivalent digital media

Instrument-specific standards

Demonstrate	Interpret	Select	Evaluate	Grade
The student response has the following characteristics:				
<ul style="list-style-type: none"> proficient demonstration of fitting and machining industry practices, and production skills and procedures when manufacturing a fitting and machining product 	<ul style="list-style-type: none"> insightful and justified interpretation of fitting and machining drawings and technical information when manufacturing a fitting and machining product 	<ul style="list-style-type: none"> discerning selection of fitting and machining industry practices, and production skills and procedures when manufacturing a fitting and machining product 	<ul style="list-style-type: none"> insightful and justified evaluation of fitting and machining production skills, procedures and a fitting and machining product 	A
<ul style="list-style-type: none"> efficient demonstration of fitting and machining industry practices, and production skills and procedures when manufacturing a fitting and machining product 	<ul style="list-style-type: none"> detailed and supported interpretation of fitting and machining drawings and technical information when manufacturing a fitting and machining product 	<ul style="list-style-type: none"> thorough selection of fitting and machining industry practices, and production skills and procedures when manufacturing a fitting and machining product 	<ul style="list-style-type: none"> detailed and supported evaluation of fitting and machining production skills, procedures and a fitting and machining product 	B
<ul style="list-style-type: none"> demonstration of fitting and machining industry practices, and production skills and procedures when manufacturing a fitting and machining product 	<ul style="list-style-type: none"> interpretation of fitting and machining drawings and technical information when manufacturing a fitting and machining product 	<ul style="list-style-type: none"> selection of fitting and machining industry practices, and production skills and procedures when manufacturing a fitting and machining product 	<ul style="list-style-type: none"> evaluation of fitting and machining production skills, procedures and a fitting and machining product 	C
<ul style="list-style-type: none"> rudimentary demonstration of production skills and procedures when manufacturing an incomplete fitting and machining product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported reference to drawings when manufacturing an incomplete fitting and machining product with obvious inaccuracies. 	<ul style="list-style-type: none"> inconsistent selection of production skills and procedures when manufacturing an incomplete fitting and machining product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported evaluation of production skills and procedures and an incomplete fitting and machining product with obvious inaccuracies. 	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

Assessment A2: Project — Fitting and machining

Students manufacture a fitting and machining product that consists of multiple interconnected components and document the manufacturing process.

Assessment objectives

1. Demonstrate fitting and machining industry practices, and production skills and procedures.
2. Interpret fitting and machining drawings and technical information.
3. Select fitting and machining industry practices, and production skills and procedures.
4. Sequence fitting and machining production processes.
5. Evaluate fitting and machining production skills and procedures, and products.
6. Adapt fitting and machining production plans, skills and procedures.

Specifications

This task requires students to:

- manufacture a fitting and machining product by
 - demonstrating fitting and machining production skills and procedures used in 5–7 production processes
 - select industry practices, production skills and procedures
 - adapting skills and procedures during production to meet the requirements in the drawings and technical information
- document the manufacturing process by
 - interpreting fitting and machining drawings and technical information for the manufacture of a fitting and machining product
 - deciding on the industry practices, and production skills and procedures required to manufacture the product
 - determining the sequence in which the production processes will be implemented
 - annotating sketches, photographs and/or video footage to capture decision-making
 - reflecting on the quality of the completed product, industry practices, and production skills and procedures used.

It is recommended that this task is designed so that students can develop a response in approximately 20 hours of class time.

Stimulus specifications

Schools must provide suitably developed drawings and technical information to support students' demonstration of the assessment objectives across the full range of A–E instrument-specific standards.

Conditions

- Students can develop their responses in class time and their own time.
- The product manufacturing can be completed individually or in groups. Students must be assessed individually.
- Students have access to materials, tools and equipment as required to complete the assessment.

Response requirements

Fitting and machining product

Product: 1 fitting and machining product manufactured using the skills and procedures in 5–7 production processes

Manufacturing process

Multimodal (at least two modes delivered at the same time): up to 5 minutes, 8 A4 pages, or equivalent digital media

Instrument-specific standards

Demonstrate	Interpret	Select	Sequence	Evaluate	Adapt	Grade
The student response has the following characteristics:						
<ul style="list-style-type: none"> proficient demonstration of fitting and machining industry practices, and production skills and procedures when manufacturing a fitting and machining product 	<ul style="list-style-type: none"> insightful and justified interpretation of fitting and machining drawings and technical information when manufacturing a fitting and machining product 	<ul style="list-style-type: none"> discerning selection of fitting and machining industry practices, and production skills and procedures when manufacturing a fitting and machining product 	<ul style="list-style-type: none"> strategic sequencing of fitting and machining production processes when manufacturing a fitting and machining product 	<ul style="list-style-type: none"> insightful and justified evaluation of fitting and machining production skills, procedures and a fitting and machining product 	<ul style="list-style-type: none"> insightful and justified adaptation of fitting and machining production plans, skills and procedures when manufacturing a fitting and machining product 	A
<ul style="list-style-type: none"> efficient demonstration of fitting and machining industry practices, and production skills and procedures when manufacturing a fitting and machining product 	<ul style="list-style-type: none"> detailed and supported interpretation of fitting and machining drawings and technical information when manufacturing a fitting and machining product 	<ul style="list-style-type: none"> thorough selection of fitting and machining industry practices, and production skills and procedures when manufacturing a fitting and machining product 	<ul style="list-style-type: none"> considered sequencing of fitting and machining production processes when manufacturing a fitting and machining product 	<ul style="list-style-type: none"> detailed and supported evaluation of fitting and machining production skills, procedures and a fitting and machining product 	<ul style="list-style-type: none"> detailed and supported adaptation of fitting and machining production plans, skills and procedures when manufacturing a fitting and machining product 	B
<ul style="list-style-type: none"> demonstration of fitting and machining industry practices, and production skills and procedures when manufacturing a fitting and machining product 	<ul style="list-style-type: none"> interpretation of fitting and machining drawings and technical information when manufacturing a fitting and machining product 	<ul style="list-style-type: none"> selection of fitting and machining industry practices, and production skills and procedures when manufacturing a fitting and machining product 	<ul style="list-style-type: none"> sequencing of fitting and machining industry production processes when manufacturing a fitting and machining product 	<ul style="list-style-type: none"> evaluation of fitting and machining production skills, procedures and a fitting and machining product 	<ul style="list-style-type: none"> adaptation of fitting and machining production plans, skills and procedures when manufacturing a fitting and machining product 	C

Demonstrate	Interpret	Select	Sequence	Evaluate	Adapt	Grade
<ul style="list-style-type: none"> rudimentary demonstration of production skills and procedures when manufacturing an incomplete fitting and machining product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported reference to drawings when manufacturing an incomplete fitting and machining product with obvious inaccuracies. 	<ul style="list-style-type: none"> inconsistent selection of production skills and procedures when manufacturing an incomplete fitting and machining product with obvious inaccuracies. 	<ul style="list-style-type: none"> inconsistent sequencing of production skills or procedures when manufacturing an incomplete fitting and machining product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported evaluation of production skills, procedures, or an incomplete fitting and machining product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported adaptations to production skills or procedures when manufacturing an incomplete fitting and machining product with obvious inaccuracies. 	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

Assessment B1: Practical demonstration — Welding and fabrication

Students perform a practical demonstration when manufacturing a welding and fabrication product and reflect on industry practices, and production skills and procedures.

Assessment objectives

1. Demonstrate welding and fabrication industry practices, and production skills and procedures.
2. Interpret welding and fabrication drawings and technical information.
3. Select welding and fabrication industry practices, and production skills and procedures.
5. Evaluate welding and fabrication production skills and procedures, and products.

Specifications

This task requires students to:

- interpret a provided drawing with technical information
- identify the skills required to manufacture a welding and fabrication product
- select industry practices, production skills and procedures
- annotate sketches, photographs and/or video footage to capture decision-making
- demonstrate production skills and procedures used in 3–5 production processes
- reflect on the industry practices, and production skills and procedures used to manufacture the welding and fabrication product.

It is recommended that this task is designed so that students can develop a response in approximately 10 hours of class time.

Stimulus specifications

Schools must provide suitably developed drawings and technical information to support students' demonstration of the assessment objectives across the full range of A–E instrument-specific standards.

Conditions

- Students can develop their responses in class time and their own time.
- This is an individual task.
- Students have access to materials, tools and equipment as required to complete the assessment.
- Products constructed for Assessment B1 must be separate from the product component of Assessment B2.

Response requirements

Practical demonstration of welding and fabrication

Practical demonstration: the skills and procedures used in 3–5 production processes

Documentation

Multimodal (at least two modes delivered at the same time): up to 3 minutes, 6 A4 pages, or equivalent digital media

Instrument-specific standards

Demonstrate	Interpret	Select	Evaluate	Grade
The student response has the following characteristics:				
<ul style="list-style-type: none"> proficient demonstration of welding and fabrication industry practices, and production skills and procedures when manufacturing a welding and fabrication product 	<ul style="list-style-type: none"> insightful and justified interpretation of welding and fabrication drawings and technical information when manufacturing a welding and fabrication product 	<ul style="list-style-type: none"> discerning selection of welding and fabrication industry practices, and production skills and procedures when manufacturing a welding and fabrication product 	<ul style="list-style-type: none"> insightful and justified evaluation of welding and fabrication production skills, procedures and a welding and fabrication product 	A
<ul style="list-style-type: none"> efficient demonstration of welding and fabrication industry practices, and production skills and procedures when manufacturing a welding and fabrication product 	<ul style="list-style-type: none"> detailed and supported interpretation of welding and fabrication drawings and technical information when manufacturing a welding and fabrication product 	<ul style="list-style-type: none"> thorough selection of welding and fabrication industry practices, and production skills and procedures when manufacturing a welding and fabrication product 	<ul style="list-style-type: none"> detailed and supported evaluation of welding and fabrication production skills, procedures and a welding and fabrication product 	B
<ul style="list-style-type: none"> demonstration of welding and fabrication industry practices, and production skills and procedures when manufacturing a welding and fabrication product 	<ul style="list-style-type: none"> interpretation of welding and fabrication drawings and technical information when manufacturing a welding and fabrication product 	<ul style="list-style-type: none"> selection of welding and fabrication industry practices, and production skills and procedures when manufacturing a welding and fabrication product 	<ul style="list-style-type: none"> evaluation of welding and fabrication production skills, procedures and a welding and fabrication product 	C
<ul style="list-style-type: none"> rudimentary demonstration of production skills and procedures when manufacturing an incomplete welding and fabrication product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported reference to drawings when manufacturing an incomplete welding and fabrication product with obvious inaccuracies. 	<ul style="list-style-type: none"> inconsistent selection of production skills and procedures when manufacturing an incomplete welding and fabrication product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported evaluation of production skills, procedures and an incomplete welding and fabrication product with obvious inaccuracies. 	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

Assessment B2: Project — Welding and fabrication

Students manufacture a welding and fabrication product that consists of multiple interconnected components and document the manufacturing process.

Assessment objectives

1. Demonstrate welding and fabrication industry practices, and production skills and procedures.
2. Interpret welding and fabrication drawings and technical information.
3. Select welding and fabrication industry practices, and production skills and procedures.
4. Sequence welding and fabrication production processes.
5. Evaluate welding and fabrication production skills and procedures, and products.
6. Adapt welding and fabrication production plans, skills and procedures.

Specifications

This task requires students to:

- manufacture a welding and fabrication product by
 - demonstrating welding and fabrication production skills and procedures used in 5–7 production processes
 - select industry practices, production skills and procedures
 - adapting skills and procedures during production to meet the requirements in the drawings and technical information
- document the manufacturing process by
 - interpreting welding and fabrication drawings and technical information for the manufacture of a welding and fabrication product
 - deciding on the industry practices, and production skills and procedures required to manufacture the product
 - determining the sequence in which the production processes will be implemented
 - annotating sketches, photographs and/or video footage to capture decision-making
 - reflecting on the quality of the completed product, industry practices, and production skills and procedures used.

It is recommended that this task is designed so that students can develop a response in approximately 20 hours of class time.

Stimulus specifications

Schools must provide suitably developed drawings and technical information to support students' demonstration of the assessment objectives across the full range of A–E instrument-specific standards.

Conditions

- Students can develop their responses in class time and their own time.
- The product manufacturing can be completed individually or in groups. Students must be assessed individually.
- Students have access to materials, tools and equipment as required to complete the assessment.

Response requirements

Welding and fabrication product

Product: 1 welding and fabrication product manufactured using the skills and procedures in 5–7 production processes

Manufacturing process

Multimodal (at least two modes delivered at the same time): up to 5 minutes, 8 A4 pages, or equivalent digital media

Instrument-specific standards

Demonstrate	Interpret	Select	Sequence	Evaluate	Adapt	Grade
The student response has the following characteristics:						
<ul style="list-style-type: none"> proficient demonstration of welding and fabrication industry practices, and production skills and procedures when manufacturing a welding and fabrication product 	<ul style="list-style-type: none"> insightful and justified interpretation of welding and fabrication drawings and technical information when manufacturing a welding and fabrication product 	<ul style="list-style-type: none"> discerning selection of welding and fabrication industry practices, and production skills and procedures when manufacturing a welding and fabrication product 	<ul style="list-style-type: none"> strategic sequencing of welding and fabrication production processes when manufacturing a welding and fabrication product 	<ul style="list-style-type: none"> insightful and justified evaluation of welding and fabrication production skills, procedures and a welding and fabrication product 	<ul style="list-style-type: none"> insightful and justified adaptation of welding and fabrication production plans, skills and procedures when manufacturing a welding and fabrication product 	A
<ul style="list-style-type: none"> efficient demonstration of welding and fabrication industry practices, and production skills and procedures when manufacturing a welding and fabrication product 	<ul style="list-style-type: none"> detailed and supported interpretation of welding and fabrication drawings and technical information when manufacturing a welding and fabrication product 	<ul style="list-style-type: none"> thorough selection of welding and fabrication industry practices, and production skills and procedures when manufacturing a welding and fabrication product 	<ul style="list-style-type: none"> considered sequencing of welding and fabrication production processes when manufacturing a welding and fabrication product 	<ul style="list-style-type: none"> detailed and supported evaluation of welding and fabrication production skills, procedures and a welding and fabrication product 	<ul style="list-style-type: none"> detailed and supported adaptation of welding and fabrication production plans, skills and procedures when manufacturing a welding and fabrication product 	B
<ul style="list-style-type: none"> demonstration of welding and fabrication industry practices, and production skills and procedures when manufacturing a welding and fabrication product 	<ul style="list-style-type: none"> interpretation of welding and fabrication drawings and technical information when manufacturing a welding and fabrication product 	<ul style="list-style-type: none"> selection of welding and fabrication industry practices, and production skills and procedures when manufacturing a welding and fabrication product 	<ul style="list-style-type: none"> sequencing of welding and fabrication industry production processes when manufacturing a welding and fabrication product 	<ul style="list-style-type: none"> evaluation of welding and fabrication production skills, procedures and a welding and fabrication product 	<ul style="list-style-type: none"> adaptation of welding and fabrication production plans, skills and procedures when manufacturing a welding and fabrication product 	C

Demonstrate	Interpret	Select	Sequence	Evaluate	Adapt	Grade
<ul style="list-style-type: none"> rudimentary demonstration of production skills and procedures when manufacturing an incomplete welding and fabrication product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported reference to drawings when manufacturing an incomplete welding and fabrication product with obvious inaccuracies. 	<ul style="list-style-type: none"> inconsistent selection of production skills and procedures when manufacturing an incomplete welding and fabrication product with obvious inaccuracies. 	<ul style="list-style-type: none"> inconsistent sequencing of production skills or procedures when manufacturing an incomplete welding and fabrication product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported evaluation of production skills, procedures, or an incomplete welding and fabrication product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported adaptations to production skills or procedures when manufacturing an incomplete welding and fabrication product with obvious inaccuracies. 	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

Assessment C1: Practical demonstration — Sheet metal working

Students perform a practical demonstration when manufacturing a sheet metal product and reflect on industry practices, and production skills and procedures.

Assessment objectives

1. Demonstrate sheet metal working industry practices, and production skills and procedures.
2. Interpret sheet metal working drawings and technical information.
3. Select sheet metal working industry practices, and production skills and procedures.
5. Evaluate sheet metal working production skills and procedures, and products.

Specifications

This task requires students to:

- interpret a provided drawing with technical information
- identify the skills required to manufacture a sheet metal product
- select industry practices, production skills and procedures
- annotate sketches, photographs and/or video footage to capture decision-making
- demonstrate production skills and procedures used in 3–5 production processes
- reflect on the industry practices, and production skills and procedures used to manufacture the sheet metal product.

It is recommended that this task is designed so that students can develop a response in approximately 10 hours of class time.

Stimulus specifications

Schools must provide suitably developed drawings and technical information to support students' demonstration of the assessment objectives across the full range of A–E instrument-specific standards.

Conditions

- Students can develop their responses in class time and their own time.
- This is an individual task.
- Students have access to materials, tools and equipment as required to complete the assessment.
- Products constructed for Assessment C1 must be separate from the product component of Assessment C2.

Response requirements

Practical demonstration of sheet metal working

Practical demonstration: the skills and procedures used in 3–5 production processes

Documentation

Multimodal (at least two modes delivered at the same time): up to 3 minutes, 6 A4 pages, or equivalent digital media

Instrument-specific standards

Demonstrate	Interpret	Select	Evaluate	Grade
The student response has the following characteristics:				
<ul style="list-style-type: none"> proficient demonstration of sheet metal working industry practices, and production skills and procedures when manufacturing a sheet metal product 	<ul style="list-style-type: none"> insightful and justified interpretation of sheet metal working drawings and technical information when manufacturing a sheet metal product 	<ul style="list-style-type: none"> discerning selection of sheet metal working industry practices, and production skills and procedures when manufacturing a sheet metal product 	<ul style="list-style-type: none"> insightful and justified evaluation of sheet metal working production skills, procedures and a sheet metal product 	A
<ul style="list-style-type: none"> efficient demonstration of sheet metal working industry practices, and production skills and procedures when manufacturing a sheet metal product 	<ul style="list-style-type: none"> detailed and supported interpretation of sheet metal working drawings and technical information when manufacturing a sheet metal product 	<ul style="list-style-type: none"> thorough selection of sheet metal working industry practices, and production skills and procedures when manufacturing a sheet metal product 	<ul style="list-style-type: none"> detailed and supported evaluation of sheet metal working production skills, procedures and a sheet metal product 	B
<ul style="list-style-type: none"> demonstration of sheet metal working industry practices, and production skills and procedures when manufacturing a sheet metal product 	<ul style="list-style-type: none"> interpretation of sheet metal working drawings and technical information when manufacturing a sheet metal product 	<ul style="list-style-type: none"> selection of sheet metal working industry practices, and production skills and procedures when manufacturing a sheet metal product 	<ul style="list-style-type: none"> evaluation of sheet metal working production skills, procedures and a sheet metal product 	C
<ul style="list-style-type: none"> rudimentary demonstration of production skills and procedures when manufacturing an incomplete sheet metal product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported reference to drawings when manufacturing an incomplete sheet metal product with obvious inaccuracies. 	<ul style="list-style-type: none"> inconsistent selection of production skills and procedures when manufacturing an incomplete sheet metal product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported evaluation of production skills, procedures and an incomplete sheet metal product with obvious inaccuracies. 	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

Assessment C2: Project — Sheet metal working

Students manufacture a sheet metal product that consists of multiple interconnected components and document the manufacturing process.

Assessment objectives

1. Demonstrate sheet metal working industry practices, and production skills and procedures.
2. Interpret sheet metal working drawings and technical information.
3. Select sheet metal working industry practices, and production skills and procedures.
4. Sequence sheet metal working production processes.
5. Evaluate sheet metal working production skills and procedures, and products.
6. Adapt sheet metal working production plans, skills and procedures.

Specifications

This task requires students to:

- manufacture a sheet metal product by
 - demonstrating sheet metal working production skills and procedures used in 5–7 production processes
 - select industry practices, production skills and procedures
 - adapting skills and procedures during production to meet the requirements in the drawings and technical information
- document the manufacturing process by
 - interpreting sheet metal drawings and technical information for the manufacture of a sheet metal product
 - deciding on the industry practices, and production skills and procedures required to manufacture the product
 - determining the sequence in which the production processes will be implemented
 - annotating sketches, photographs and/or video footage to capture decision-making
 - reflecting on the quality of the completed product, industry practices, and production skills and procedures used.

It is recommended that this task is designed so that students can develop a response in approximately 20 hours of class time.

Stimulus specifications

Schools must provide suitably developed drawings and technical information to support students' demonstration of the assessment objectives across the full range of A–E instrument-specific standards.

Conditions

- Students can develop their responses in class time and their own time.
- The product manufacturing can be completed individually or in groups. Students must be assessed individually.
- Students have access to materials, tools and equipment as required to complete the assessment.

Response requirements

Sheet metal product

Product: 1 sheet metal product manufactured using the skills and procedures in 5–7 production processes

Manufacturing process

Multimodal (at least two modes delivered at the same time): up to 5 minutes, 8 A4 pages, or equivalent digital media

Instrument-specific standards

Demonstrate	Interpret	Select	Sequence	Evaluate	Adapt	Grade
The student response has the following characteristics:						
<ul style="list-style-type: none"> • proficient demonstration of sheet metal working industry practices, and production skills and procedures when manufacturing a sheet metal product 	<ul style="list-style-type: none"> • insightful and justified interpretation of sheet metal working drawings and technical information when manufacturing a sheet metal product 	<ul style="list-style-type: none"> • discerning selection of sheet metal working industry practices, and production skills and procedures when manufacturing a sheet metal product 	<ul style="list-style-type: none"> • strategic sequencing of sheet metal working production processes when manufacturing a sheet metal product 	<ul style="list-style-type: none"> • insightful and justified evaluation of sheet metal working production skills, procedures and a sheet metal product 	<ul style="list-style-type: none"> • insightful and justified adaptation of sheet metal working production plans, skills and procedures when manufacturing a sheet metal product 	A
<ul style="list-style-type: none"> • efficient demonstration of sheet metal working industry practices, and production skills and procedures when manufacturing a sheet metal product 	<ul style="list-style-type: none"> • detailed and supported interpretation of sheet metal working drawings and technical information when manufacturing a sheet metal product 	<ul style="list-style-type: none"> • thorough selection of sheet metal working industry practices, and production skills and procedures when manufacturing a sheet metal product 	<ul style="list-style-type: none"> • considered sequencing of sheet metal working production processes when manufacturing a sheet metal product 	<ul style="list-style-type: none"> • detailed and supported evaluation of sheet metal working production skills, procedures and a sheet metal product 	<ul style="list-style-type: none"> • detailed and supported adaptation of sheet metal working production plans, skills and procedures when manufacturing a sheet metal product 	B
<ul style="list-style-type: none"> • demonstration of sheet metal working industry practices, and production skills and procedures when manufacturing a sheet metal product 	<ul style="list-style-type: none"> • interpretation of sheet metal working drawings and technical information when manufacturing a sheet metal product 	<ul style="list-style-type: none"> • selection of sheet metal working industry practices, and production skills and procedures when manufacturing a sheet metal product 	<ul style="list-style-type: none"> • sequencing of sheet metal working industry production processes when manufacturing a sheet metal product 	<ul style="list-style-type: none"> • evaluation of sheet metal working production skills, procedures and a sheet metal product 	<ul style="list-style-type: none"> • adaptation of sheet metal working production plans, skills and procedures when manufacturing a sheet metal product 	C

Demonstrate	Interpret	Select	Sequence	Evaluate	Adapt	Grade
<ul style="list-style-type: none"> rudimentary demonstration of production skills and procedures when manufacturing an incomplete sheet metal product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported reference to drawings when manufacturing an incomplete sheet metal product with obvious inaccuracies. 	<ul style="list-style-type: none"> inconsistent selection of production skills and procedures when manufacturing an incomplete sheet metal product with obvious inaccuracies. 	<ul style="list-style-type: none"> inconsistent sequencing of production skills or procedures when manufacturing an incomplete sheet metal product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported evaluation of production skills, procedures, or an incomplete sheet metal product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported adaptations to production skills or procedures when manufacturing an incomplete sheet metal product with obvious inaccuracies. 	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

Assessment D1: Practical demonstration — Structural engineering

Students perform a practical demonstration when manufacturing a structural engineering product and reflect on industry practices, and production skills and procedures.

Assessment objectives

1. Demonstrate structural engineering industry practices, and production skills and procedures.
2. Interpret structural engineering drawings and technical information.
3. Select structural engineering industry practices, and production skills and procedures.
5. Evaluate structural engineering production skills and procedures, and products.

Specifications

This task requires students to:

- interpret a provided drawing with technical information
- identify the skills required to manufacture a structural engineering product
- select industry practices, production skills and procedures
- annotate sketches, photographs and/or video footage to capture decision-making
- demonstrate production skills and procedures used in 3–5 production processes
- reflect on the industry practices, and production skills and procedures used to manufacture the structural engineering product.

It is recommended that this task is designed so that students can develop a response in approximately 10 hours of class time.

Stimulus specifications

Schools must provide suitably developed drawings and technical information to support students' demonstration of the assessment objectives across the full range of A–E instrument-specific standards.

Conditions

- Students can develop their responses in class time and their own time.
- Students must be assessed individually.
- Students have access to materials, tools and equipment as required to complete the assessment.
- Products constructed for Assessment D1 must be separate from the product component of Assessment D2.

Response requirements

Practical demonstration of structural engineering

Practical demonstration: the skills and procedures used in 3–5 production processes

Documentation

Multimodal (at least two modes delivered at the same time): up to 3 minutes, 6 A4 pages, or equivalent digital media

Instrument-specific standards

Demonstrate	Interpret	Select	Evaluate	Grade
The student response has the following characteristics:				
<ul style="list-style-type: none"> proficient demonstration of structural engineering industry practices, and production skills and procedures when manufacturing a structural engineering product 	<ul style="list-style-type: none"> insightful and justified interpretation of structural engineering drawings and technical information when manufacturing a structural engineering product 	<ul style="list-style-type: none"> discerning selection of structural engineering industry practices, and production skills and procedures when manufacturing a structural engineering product 	<ul style="list-style-type: none"> insightful and justified evaluation of structural engineering production skills, procedures and a structural engineering product 	A
<ul style="list-style-type: none"> efficient demonstration of structural engineering industry practices, and production skills and procedures when manufacturing a structural engineering product 	<ul style="list-style-type: none"> detailed and supported interpretation of structural engineering drawings and technical information when manufacturing a structural engineering product 	<ul style="list-style-type: none"> thorough selection of structural engineering industry practices, and production skills and procedures when manufacturing a structural engineering product 	<ul style="list-style-type: none"> detailed and supported evaluation of structural engineering production skills, procedures and a structural engineering product 	B
<ul style="list-style-type: none"> demonstration of structural engineering industry practices, and production skills and procedures when manufacturing a structural engineering product 	<ul style="list-style-type: none"> interpretation of structural engineering drawings and technical information when manufacturing a structural engineering product 	<ul style="list-style-type: none"> selection of structural engineering industry practices, and production skills and procedures when manufacturing a structural engineering product 	<ul style="list-style-type: none"> evaluation of structural engineering production skills, procedures and a structural engineering product 	C
<ul style="list-style-type: none"> rudimentary demonstration of production skills and procedures when manufacturing an incomplete structural engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported reference to drawings when manufacturing an incomplete structural engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> inconsistent selection of production skills and procedures when manufacturing an incomplete structural engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported evaluation of production skills, procedures and an incomplete structural engineering product with obvious inaccuracies. 	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

Assessment D2: Project — Structural engineering

Students manufacture a structural engineering product that consists of multiple interconnected components and document the manufacturing process.

Assessment objectives

1. Demonstrate structural engineering industry practices, and production skills and procedures.
2. Interpret structural engineering drawings and technical information.
3. Select structural engineering industry practices, and production skills and procedures.
4. Sequence structural engineering production processes.
5. Evaluate structural engineering production skills and procedures, and products.
6. Adapt structural engineering production plans, skills and procedures.

Specifications

This task requires students to:

- manufacture a structural engineering product by
 - demonstrating structural engineering production skills and procedures used in 5–7 production processes
 - select industry practices, production skills and procedures
 - adapting skills and procedures during production to meet the requirements in the drawings and technical information
- document the manufacturing process by
 - interpreting structural engineering drawings and technical information for the manufacture of a structural engineering product
 - deciding on the industry practices, and production skills and procedures required to manufacture the product
 - determining the sequence in which the production processes will be implemented
 - annotating sketches, photographs and/or video footage to capture decision-making
 - reflecting on the quality of the completed product, industry practices, and production skills and procedures used.

It is recommended that this task is designed so that students can develop a response in approximately 20 hours of class time.

Stimulus specifications

Schools must provide suitably developed drawings and technical information to support students' demonstration of the assessment objectives across the full range of A–E instrument-specific standards.

Conditions

- Students can develop their responses in class time and their own time.
- The product fabrication can be completed individually or in groups. Students must be assessed individually.
- Students have access to materials, tools and equipment as required to complete the assessment.

Response requirements

Structural engineering product

Product: 1 structural engineering product manufactured using the skills and procedures in 5–7 production processes

Manufacturing process

Multimodal (at least two modes delivered at the same time): up to 5 minutes, 8 A4 pages, or equivalent digital media

Instrument-specific standards

Demonstrate	Interpret	Select	Sequence	Evaluate	Adapt	Grade
The student response has the following characteristics:						
<ul style="list-style-type: none"> proficient demonstration of structural engineering industry practices, and production skills and procedures when manufacturing a structural engineering product 	<ul style="list-style-type: none"> insightful and justified interpretation of structural engineering drawings and technical information when manufacturing a structural engineering product 	<ul style="list-style-type: none"> discerning selection of structural engineering industry practices, and production skills and procedures when manufacturing a structural engineering product 	<ul style="list-style-type: none"> strategic sequencing of structural engineering production processes when manufacturing a structural engineering product 	<ul style="list-style-type: none"> insightful and justified evaluation of structural engineering production skills, procedures and a structural engineering product 	<ul style="list-style-type: none"> insightful and justified adaptation of structural engineering production plans, skills and procedures when manufacturing a structural engineering product 	A
<ul style="list-style-type: none"> efficient demonstration of structural engineering industry practices, and production skills and procedures when manufacturing a structural engineering product 	<ul style="list-style-type: none"> detailed and supported interpretation of structural engineering drawings and technical information when manufacturing a structural engineering product 	<ul style="list-style-type: none"> thorough selection of structural engineering industry practices, and production skills and procedures when manufacturing a structural engineering product 	<ul style="list-style-type: none"> considered sequencing of structural engineering production processes when manufacturing a structural engineering product 	<ul style="list-style-type: none"> detailed and supported evaluation of structural engineering production skills, procedures and a structural engineering product 	<ul style="list-style-type: none"> detailed and supported adaptation of structural engineering production plans, skills and procedures when manufacturing a structural engineering product 	B

Demonstrate	Interpret	Select	Sequence	Evaluate	Adapt	Grade
<ul style="list-style-type: none"> demonstration of structural engineering industry practices, and production skills and procedures when manufacturing a structural engineering product 	<ul style="list-style-type: none"> interpretation of structural engineering drawings and technical information when manufacturing a structural engineering product 	<ul style="list-style-type: none"> selection of structural engineering industry practices, and production skills and procedures when manufacturing a structural engineering product 	<ul style="list-style-type: none"> sequencing of structural engineering industry production processes when manufacturing a structural engineering product 	<ul style="list-style-type: none"> evaluation of structural engineering production skills, procedures and a structural engineering product 	<ul style="list-style-type: none"> adaptation of structural engineering production plans, skills and procedures when manufacturing a structural engineering product 	C
<ul style="list-style-type: none"> rudimentary demonstration of production skills and procedures when manufacturing an incomplete structural engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported reference to drawings when manufacturing an incomplete structural engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> inconsistent selection of production skills and procedures when manufacturing an incomplete structural engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> inconsistent sequencing of production skills or procedures when manufacturing an incomplete structural engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported evaluation of production skills, procedures, or an incomplete structural engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported adaptations to production skills or procedures when manufacturing an incomplete structural engineering product with obvious inaccuracies. 	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

Assessment E1: Practical demonstration — Transport engineering

Students perform a practical demonstration when manufacturing a transport engineering product and reflect on industry practices, and production skills and procedures.

Assessment objectives

1. Demonstrate transport engineering industry practices, and production skills and procedures.
2. Interpret transport engineering drawings and technical information.
3. Select transport engineering industry practices, and production skills and procedures.
5. Evaluate transport engineering production skills and procedures, and products.

Specifications

This task requires students to:

- interpret a provided drawing with technical information
- identify the skills required to manufacture a transport engineering product
- select industry practices, production skills and procedures
- annotate sketches, photographs and/or video footage to capture decision-making
- demonstrate production skills and procedures used in 3–5 production processes
- reflect on the industry practices, and production skills and procedures used to manufacture the transport engineering product.

It is recommended that this task is designed so that students can develop a response in approximately 10 hours of class time.

Stimulus specifications

Schools must provide suitably developed drawings and technical information to support students' demonstration of the assessment objectives across the full range of A–E instrument-specific standards.

Conditions

- Students can develop their responses in class time and their own time.
- Students must be assessed individually.
- Students have access to materials, tools and equipment as required to complete the assessment.
- Products constructed for Assessment E1 must be separate from the product component of Assessment E2.

Response requirements

Practical demonstration of transport engineering

Practical demonstration: the skills and procedures used in 3–5 production processes

Documentation

Multimodal (at least two modes delivered at the same time): up to 3 minutes, 6 A4 pages, or equivalent digital media

Instrument-specific standards

Demonstrate	Interpret	Select	Evaluate	Grade
The student response has the following characteristics:				
<ul style="list-style-type: none"> proficient demonstration of transport engineering industry practices, and production skills and procedures when manufacturing a transport engineering product 	<ul style="list-style-type: none"> insightful and justified interpretation of transport engineering drawings and technical information when manufacturing a transport engineering product 	<ul style="list-style-type: none"> discerning selection of transport engineering industry practices, and production skills and procedures when manufacturing a transport engineering product 	<ul style="list-style-type: none"> insightful and justified evaluation of transport engineering production skills, procedures and a transport engineering product 	A
<ul style="list-style-type: none"> efficient demonstration of transport engineering industry practices, and production skills and procedures when manufacturing a transport engineering product 	<ul style="list-style-type: none"> detailed and supported interpretation of transport engineering drawings and technical information when manufacturing a transport engineering product 	<ul style="list-style-type: none"> thorough selection of transport engineering industry practices, and production skills and procedures when manufacturing a transport engineering product 	<ul style="list-style-type: none"> detailed and supported evaluation of transport engineering production skills, procedures and a transport engineering product 	B
<ul style="list-style-type: none"> demonstration of transport engineering industry practices, and production skills and procedures when manufacturing a transport engineering product 	<ul style="list-style-type: none"> interpretation of transport engineering drawings and technical information when manufacturing a transport engineering product 	<ul style="list-style-type: none"> selection of transport engineering industry practices, and production skills and procedures when manufacturing a transport engineering product 	<ul style="list-style-type: none"> evaluation of transport engineering production skills, procedures and a transport engineering product 	C
<ul style="list-style-type: none"> rudimentary demonstration of production skills and procedures when manufacturing an incomplete transport engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported reference to drawings when manufacturing an incomplete transport engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> inconsistent selection of production skills and procedures when manufacturing an incomplete transport engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported evaluation of production skills, procedures and an incomplete transport engineering product with obvious inaccuracies. 	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

Assessment E2: Project — Transport engineering

Students fabricate a transport engineering product that consists of multiple interconnected components and document the manufacturing process.

Assessment objectives

1. Demonstrate transport engineering industry practices, and production skills and procedures.
2. Interpret transport engineering drawings and technical information.
3. Select transport engineering industry practices, and production skills and procedures.
4. Sequence transport engineering production processes.
5. Evaluate transport engineering industry production skills and procedures, and products.
6. Adapt transport engineering production plans, skills and procedures.

Specifications

This task requires students to:

- manufacture a transport engineering product by
 - demonstrating transport engineering production skills and procedures used in 5–7 production processes
 - select industry practices, production skills and procedures
 - adapting skills and procedures during production to meet the requirements in the drawings and technical information
- document the manufacturing process by
 - interpreting transport engineering drawings and technical information for the manufacture of a transport engineering product
 - deciding on the industry practices, and production skills and procedures required to manufacture the product
 - determining the sequence in which the production processes will be implemented
 - annotating sketches, photographs and/or video footage to capture decision-making
 - reflecting on the quality of the completed product, industry practices, and production skills and procedures used.

It is recommended that this task is designed so that students can develop a response in approximately 20 hours of class time.

Stimulus specifications

Schools must provide suitably developed drawings and technical information to support students' demonstration of the assessment objectives across the full range of A–E instrument-specific standards.

Conditions

- Students can develop their responses in class time and their own time.
- The product fabrication can be completed individually or in groups. Students must be assessed individually.
- Students have access to materials, tools and equipment as required to complete the assessment.

Response requirements

Transport engineering product

Product: 1 transport engineering product manufactured using the skills and procedures in 5–7 production processes

Manufacturing process

Multimodal (at least two modes delivered at the same time): up to 5 minutes, 8 A4 pages, or equivalent digital media

Instrument-specific standards

Demonstrate	Interpret	Select	Sequence	Evaluate	Adapt	Grade
The student response has the following characteristics:						
<ul style="list-style-type: none"> proficient demonstration of transport engineering industry practices, and production skills and procedures when manufacturing a transport engineering product 	<ul style="list-style-type: none"> insightful and justified interpretation of transport engineering drawings and technical information when manufacturing a transport engineering product 	<ul style="list-style-type: none"> discerning selection of transport engineering industry practices, and production skills and procedures when manufacturing a transport engineering product 	<ul style="list-style-type: none"> strategic sequencing of transport engineering production processes when manufacturing a transport engineering product 	<ul style="list-style-type: none"> insightful and justified evaluation of transport engineering production skills, procedures and a transport engineering product 	<ul style="list-style-type: none"> insightful and justified adaptation of transport engineering production plans, skills and procedures when manufacturing a transport engineering product 	A
<ul style="list-style-type: none"> efficient demonstration of transport engineering industry practices, and production skills and procedures when manufacturing a transport engineering product 	<ul style="list-style-type: none"> detailed and supported interpretation of transport engineering drawings and technical information when manufacturing a transport engineering product 	<ul style="list-style-type: none"> thorough selection of transport engineering industry practices, and production skills and procedures when manufacturing a transport engineering product 	<ul style="list-style-type: none"> considered sequencing of transport engineering production processes when manufacturing a transport engineering product 	<ul style="list-style-type: none"> detailed and supported evaluation of transport engineering production skills, procedures and a transport engineering product 	<ul style="list-style-type: none"> detailed and supported adaptation of transport engineering production plans, skills and procedures when manufacturing a transport engineering product 	B
<ul style="list-style-type: none"> demonstration of transport engineering industry practices, and production skills and procedures when manufacturing a transport engineering product 	<ul style="list-style-type: none"> interpretation of transport engineering drawings and technical information when manufacturing a transport engineering product 	<ul style="list-style-type: none"> selection of transport engineering industry practices, and production skills and procedures when manufacturing a transport engineering product 	<ul style="list-style-type: none"> sequencing of transport engineering industry production processes when manufacturing a transport engineering product 	<ul style="list-style-type: none"> evaluation of transport engineering production skills, procedures and a transport engineering product 	<ul style="list-style-type: none"> adaptation of transport engineering production plans, skills and procedures when manufacturing a transport engineering product 	C

Demonstrate	Interpret	Select	Sequence	Evaluate	Adapt	Grade
<ul style="list-style-type: none"> rudimentary demonstration of production skills and procedures when manufacturing an incomplete transport engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported reference to drawings when manufacturing an incomplete transport engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> inconsistent selection of production skills and procedures when manufacturing an incomplete transport engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> inconsistent sequencing of production skills or procedures when manufacturing an incomplete transport engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported evaluation of production skills, procedures, or an incomplete transport engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported adaptations to production skills or procedures when manufacturing an incomplete transport engineering product with obvious inaccuracies. 	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

Assessment F1: Practical demonstration — Manufacturing engineering

Students perform a practical demonstration when manufacturing a manufacturing engineering product and reflect on industry practices, and production skills and procedures.

Assessment objectives

1. Demonstrate manufacturing engineering industry practices, and production skills and procedures.
2. Interpret manufacturing engineering drawings and technical information.
3. Select manufacturing engineering industry practices, and production skills and procedures.
5. Evaluate manufacturing engineering production skills and procedures, and products.

Specifications

This task requires students to:

- interpret a provided drawing with technical information
- identify the skills required to manufacture a manufacturing engineering product
- select industry practices, production skills and procedures
- annotate sketches, photographs and/or video footage to capture decision-making
- demonstrate production skills and procedures used in 3–5 production processes
- reflect on the industry practices, and production skills and procedures used to manufacture the manufacturing engineering product.

It is recommended that this task is designed so that students can develop a response in approximately 10 hours of class time.

Stimulus specifications

Schools must provide suitably developed drawings and technical information to support students' demonstration of the assessment objectives across the full range of A–E instrument-specific standards.

Conditions

- Students can develop their responses in class time and their own time.
- Students must be assessed individually.
- Students have access to materials, tools and equipment as required to complete the assessment.
- Products constructed for Assessment F1 must be separate from the product component of Assessment F2.

Response requirements

Practical demonstration of manufacturing engineering

Practical demonstration: the skills and procedures used in 3–5 production processes

Documentation

Multimodal (at least two modes delivered at the same time): up to 3 minutes, 6 A4 pages, or equivalent digital media

Instrument-specific standards

Demonstrate	Interpret	Select	Evaluate	Grade
The student response has the following characteristics:				
<ul style="list-style-type: none"> proficient demonstration of manufacturing engineering industry practices, and production skills and procedures when manufacturing a manufacturing engineering product 	<ul style="list-style-type: none"> insightful and justified interpretation of manufacturing engineering drawings and technical information when manufacturing a manufacturing engineering product 	<ul style="list-style-type: none"> discerning selection of manufacturing engineering industry practices, and production skills and procedures when manufacturing a manufacturing engineering product 	<ul style="list-style-type: none"> insightful and justified evaluation of manufacturing engineering production skills, procedures and a manufacturing engineering product 	A
<ul style="list-style-type: none"> efficient demonstration of manufacturing engineering industry practices, and production skills and procedures when manufacturing a manufacturing engineering product 	<ul style="list-style-type: none"> detailed and supported interpretation of manufacturing engineering drawings and technical information when manufacturing a manufacturing engineering product 	<ul style="list-style-type: none"> thorough selection of manufacturing engineering industry practices, and production skills and procedures when manufacturing a manufacturing engineering product 	<ul style="list-style-type: none"> detailed and supported evaluation of manufacturing engineering production skills, procedures and a manufacturing engineering product 	B
<ul style="list-style-type: none"> demonstration of manufacturing engineering industry practices, and production skills and procedures when manufacturing a manufacturing engineering product 	<ul style="list-style-type: none"> interpretation of manufacturing engineering drawings and technical information when manufacturing a manufacturing engineering product 	<ul style="list-style-type: none"> selection of manufacturing engineering industry practices, and production skills and procedures when manufacturing a manufacturing engineering product 	<ul style="list-style-type: none"> evaluation of manufacturing engineering production skills, procedures and a manufacturing engineering product 	C
<ul style="list-style-type: none"> rudimentary demonstration of production skills and procedures when manufacturing an incomplete manufacturing engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported reference to drawings when manufacturing an incomplete manufacturing engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> inconsistent selection of production skills and procedures when manufacturing an incomplete manufacturing engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported evaluation of production skills, procedures and an incomplete manufacturing engineering product with obvious inaccuracies. 	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

Assessment F2: Project — Manufacturing engineering

Students manufacture a manufacturing engineering product that consists of multiple interconnected components and document the manufacturing process.

Assessment objectives

1. Demonstrate manufacturing engineering industry practices, and production skills and procedures.
2. Interpret manufacturing engineering drawings and technical information.
3. Select manufacturing engineering industry practices, and production skills and procedures.
4. Sequence manufacturing engineering production processes.
5. Evaluate manufacturing engineering production skills and procedures and products.
6. Adapt manufacturing engineering production plans, skills and procedures.

Specifications

This task requires students to:

- manufacture a manufacturing engineering product by
 - demonstrating manufacturing engineering production skills and procedures used in 5–7 production processes
 - select industry practices, production skills and procedures
 - adapting skills and procedures during production to meet the requirements in the drawings and technical information
- document the manufacturing process by
 - interpreting manufacturing engineering drawings and technical information for the manufacture of a manufacturing engineering product
 - deciding on the industry practices, and production skills and procedures required to manufacture the product
 - determining the sequence in which the production processes will be implemented
 - annotating sketches, photographs and/or video footage to capture decision-making
 - reflecting on the quality of the completed product, industry practices, and production skills and procedures used.

It is recommended that this task is designed so that students can develop a response in approximately 20 hours of class time.

Stimulus specifications

Schools must provide suitably developed drawings and technical information to support students' demonstration of the assessment objectives across the full range of A–E instrument-specific standards.

Conditions

- Students can develop their responses in class time and their own time.
- The product manufacturing can be completed individually or in groups. Students must be assessed individually.
- Students have access to materials, tools and equipment as required to complete the assessment.

Response requirements

Manufacturing engineering product

Product: 1 manufacturing engineering product manufactured using the skills and procedures in 5–7 production processes

Manufacturing process

Multimodal (at least two modes delivered at the same time): up to 5 minutes, 8 A4 pages, or equivalent digital media

Instrument-specific standards

Demonstrate	Interpret	Select	Sequence	Evaluate	Adapt	Grade
The student response has the following characteristics:						
<ul style="list-style-type: none"> proficient demonstration of manufacturing engineering industry practices, and production skills and procedures when manufacturing a manufacturing engineering product 	<ul style="list-style-type: none"> insightful and justified interpretation of manufacturing engineering drawings and technical information when manufacturing a manufacturing engineering product 	<ul style="list-style-type: none"> discerning selection of manufacturing engineering industry practices, and production skills and procedures when manufacturing a manufacturing engineering product 	<ul style="list-style-type: none"> strategic sequencing of manufacturing engineering production processes when manufacturing a manufacturing engineering product 	<ul style="list-style-type: none"> insightful and justified evaluation of manufacturing engineering production skills, procedures and a manufacturing engineering product 	<ul style="list-style-type: none"> insightful and justified adaptation of manufacturing engineering production plans, skills and procedures when manufacturing a manufacturing engineering product 	A
<ul style="list-style-type: none"> efficient demonstration of manufacturing engineering industry practices, and production skills and procedures when manufacturing a manufacturing engineering product 	<ul style="list-style-type: none"> detailed and supported interpretation of manufacturing engineering drawings and technical information when manufacturing a manufacturing engineering product 	<ul style="list-style-type: none"> thorough selection of manufacturing engineering industry practices, and production skills and procedures when manufacturing a manufacturing engineering product 	<ul style="list-style-type: none"> considered sequencing of manufacturing engineering production processes when manufacturing a manufacturing engineering product 	<ul style="list-style-type: none"> detailed and supported evaluation of manufacturing engineering production skills, procedures and a manufacturing engineering product 	<ul style="list-style-type: none"> detailed and supported adaptation of manufacturing engineering production plans, skills and procedures when manufacturing a manufacturing engineering product 	B
<ul style="list-style-type: none"> demonstration of manufacturing engineering industry practices, and production skills and procedures when manufacturing a manufacturing engineering product 	<ul style="list-style-type: none"> interpretation of manufacturing engineering drawings and technical information when manufacturing a manufacturing engineering product 	<ul style="list-style-type: none"> selection of manufacturing engineering industry practices, and production skills and procedures when manufacturing a manufacturing engineering product 	<ul style="list-style-type: none"> sequencing of manufacturing engineering industry production processes when manufacturing a manufacturing engineering product 	<ul style="list-style-type: none"> evaluation of manufacturing engineering production skills, procedures and a manufacturing engineering product 	<ul style="list-style-type: none"> adaptation of manufacturing engineering production plans, skills and procedures when manufacturing a manufacturing engineering product 	C

Demonstrate	Interpret	Select	Sequence	Evaluate	Adapt	Grade
<ul style="list-style-type: none"> rudimentary demonstration of production skills and procedures when manufacturing an incomplete manufacturing engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported reference to drawings when manufacturing an incomplete manufacturing engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> inconsistent selection of production skills and procedures when manufacturing an incomplete manufacturing engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> inconsistent sequencing of production skills or procedures when manufacturing an incomplete manufacturing engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported evaluation of production skills, procedures, or an incomplete manufacturing engineering product with obvious inaccuracies. 	<ul style="list-style-type: none"> narrow and unsupported adaptations to production skills or procedures when manufacturing an incomplete manufacturing engineering product with obvious inaccuracies. 	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

Glossary

The syllabus glossary is available at www.qcaa.qld.edu.au/downloads/senior-qce/common/snr_glossary_cognitive_verbs.pdf.

References

Marzano, RJ & Kendall, JS 2007, *The New Taxonomy of Educational Objectives*, 2nd edition, Corwin Press, USA.

—2008, *Designing and Assessing Educational Objectives: Applying the new taxonomy*, Corwin Press, USA.

Version history

Version	Date of change	Information
1.0	January 2023	Released for familiarisation and planning
1.1	August 2023	Released for implementation with minor updates
1.2	January 2024	Reporting standards: change from 'structures' to 'products' in all achievement levels