

# Engineering Skills 2019 v1.0

Sample module of work

---

## Module 3: Welding and fabrication enterprise

### Overview

#### Module 3: Welding and fabrication enterprise

##### Module description

This module builds on prior learning of industry practices and production processes used in the safe creation of quality products. Products are created at a suitable quality using production processes that recognise industry costs, price, competition and customer expectations of value.

##### Time allocation

55 hours

Elective/s	Underpinning factors
<ul style="list-style-type: none"><li>• Sheet metal working</li><li>• Welding and fabrication</li></ul>	<ul style="list-style-type: none"><li><input checked="" type="checkbox"/> Applied learning</li><li><input checked="" type="checkbox"/> Community connections</li><li><input checked="" type="checkbox"/> Core skills for work</li><li><input checked="" type="checkbox"/> Literacy</li><li><input checked="" type="checkbox"/> Numeracy</li></ul>



## Assessment

Assessment number	Assessment description	Technique and mode	Assessment conditions	Dimensions and objectives
5	Manufacture braziers for clients from predefined detailed specifications.	Project <ul style="list-style-type: none"> <li>• Multimodal component — non-presentation               <ul style="list-style-type: none"> <li>– Individual digital portfolio (photographic production journal including sketches and annotations)</li> </ul> </li> <li>• Product               <ul style="list-style-type: none"> <li>– Braziers with sheet metal ash trays</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Product component               <ul style="list-style-type: none"> <li>– Schools provide students with a set period of in-class time (approx. 35 hrs) to develop the product component/s of their project.</li> </ul> </li> <li>• Multimodal component — non-presentation               <ul style="list-style-type: none"> <li>– maximum 8 A4 pages (or equivalent)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Knowing and understanding               <ul style="list-style-type: none"> <li>– describe industry practices in manufacturing tasks</li> <li>– demonstrate fundamental production skills</li> <li>– interpret drawings and technical information</li> </ul> </li> <li>• Analysing and applying               <ul style="list-style-type: none"> <li>– analyse manufacturing tasks to organise materials and resources</li> <li>– select and apply production skills and procedures in manufacturing tasks</li> <li>– use visual representations and language conventions and features to communicate for particular purposes</li> </ul> </li> <li>• Producing and evaluating               <ul style="list-style-type: none"> <li>– plan and adapt production processes</li> <li>– create products from specifications</li> <li>– evaluate industry practices, production processes and products, and make recommendations</li> </ul> </li> </ul>
6	Manufacture a wall bracket from specifications.	Practical demonstration <ul style="list-style-type: none"> <li>• Individual response</li> <li>• Visual evidence is collected through annotated photographs or teacher observations annotated on the instrument-specific standards.</li> </ul>	<ul style="list-style-type: none"> <li>• A set period of in-class time (approx. 5 hrs)</li> </ul>	<ul style="list-style-type: none"> <li>• Knowing and understanding               <ul style="list-style-type: none"> <li>– demonstrate fundamental production skills</li> <li>– interpret drawings and technical information</li> </ul> </li> <li>• Analysing and applying               <ul style="list-style-type: none"> <li>– select and apply production skills and procedures in manufacturing tasks</li> <li>– use visual representations and language conventions and features to communicate for particular purposes</li> </ul> </li> <li>• Producing and evaluating               <ul style="list-style-type: none"> <li>– plan and adapt production processes</li> <li>– create products from specifications</li> <li>– evaluate industry practices, production processes and products, and make recommendations</li> </ul> </li> </ul>

## Teaching and learning sequence

Notional hours	Core topics		Learning experiences
	Core concepts and ideas	Knowledge, understanding and skills	
2 hours	<p><b>Core topic 1 — Manufacturing enterprises</b> Manufacturing enterprises are important to the economy of Australia and employ a broad range of people in many different occupations (C1.1).</p>	<ul style="list-style-type: none"> <li>• overview of engineering enterprises and their contribution to the economy</li> <li>• organisational structure of engineering workplaces</li> <li>• career options and pathways</li> </ul>	<p><b>Module orientation</b> Introduce the module, outline learning goals and success criteria, and link the module to prior learning. Organise an excursion/guest speaker to present information about a manufacturing enterprise, including engineering products, production processes and practices used, health and safety procedures, costings and quality expectations of customers. Emphasise the importance of teamwork in an engineering enterprise and the range of skills required to manufacture a product. Demonstrate samples of engineering products and lead a discussion highlighting career options and pathways in manufacturing enterprises. Students:</p> <ul style="list-style-type: none"> <li>• use appropriate industry terminology when engaging in classroom discussions</li> <li>• discuss class protocols and relate them to industry workplace health and safety procedures, maintenance of tools and storage of stock and product</li> <li>• identify and describe the               <ul style="list-style-type: none"> <li>– machinery used in production in terms of function, reasons for use, required safety and maintenance</li> <li>– roles and responsibilities when in the work environment, including demonstrating safety procedures, effective workplace communication, and the need for shared workspaces</li> </ul> </li> <li>• compare product quality of welded and sheet metal products and discuss the needs of customers</li> <li>• describe materials used in manufacturing industries, discussing suitability, availability and cost</li> <li>• analyse and evaluate production processes and consider the advantages and disadvantages of manufacturing products in an engineering enterprise.</li> </ul>

Notional hours	Core topics		Learning experiences
	Core concepts and ideas	Knowledge, understanding and skills	
5 hours	<p><b>Core topic 1 — Workplace health and safety</b> Workplace health and safety legislation, rules and procedures must be followed in manufacturing industry workplaces (C1.2).</p>	<ul style="list-style-type: none"> <li>• employer and employee responsibilities, rights and obligations under the <i>Work Health and Safety Act 2011</i></li> <li>• industry-specific requirements</li> <li>• risk assessments to identify hazards</li> <li>• safe working practices and procedures</li> </ul>	<p><b>Welding revision and risk assessment</b> Revise relevant welding and fabrication skills and procedures. Describe, explain and demonstrate safe operating procedures for tools and machinery, including:</p> <ul style="list-style-type: none"> <li>• class workplace health and safety procedures</li> <li>• set-up, storage and maintenance of welders</li> <li>• risk assessment for welders</li> <li>• safe operating procedures for the set-up and use of welders (arc, MIG and spot welders)</li> <li>• personal protective equipment (PPE) discussion and demonstration</li> <li>• requirements for machine licences.</li> </ul> <p>Students:</p> <ul style="list-style-type: none"> <li>• identify and apply tools and procedures appropriate for cutting and welding</li> <li>• apply and demonstrate standard operating procedures (SOP) for each machine, analysing the risks associated with each machine by considering the hierarchy of hazard control and the safety of working with the machines</li> <li>• watch a welding video and complete a worksheet</li> <li>• complete a group risk assessment on one of the welders</li> <li>• demonstrate and practise refining production skills and procedures by completing a series of skill exercises using different welding techniques</li> <li>• analyse efficient cutting techniques when using an oxyacetylene cutting torch.</li> </ul>
	<p><b>Core topic 2 — Tools</b> Tools have specific functions and are selected and safely operated for particular procedures (C2.2).</p>	<ul style="list-style-type: none"> <li>• identification, safety and maintenance of tools and machinery</li> <li>• marking-out procedures and skills using relevant tools</li> <li>• cutting procedures and skills using relevant tools and machinery</li> <li>• joining procedures and skills using relevant tools and machinery</li> <li>• finishing procedures and skills using relevant tools and machinery</li> </ul>	
1 hour	<p><b>Core topic 2 — Specifications</b> Specifications are communicated through industry-specific drawings and technical information (C2.1).</p>	<ul style="list-style-type: none"> <li>• interpretation of sketches and technical drawings</li> <li>• technical information accessed from charts, tables and books</li> </ul>	<p><b>Revision of technical drawings</b> Explain and demonstrate:</p> <ul style="list-style-type: none"> <li>• analysing elements of technical drawings, e.g. dimensions, labels, symbols, views and text</li> <li>• creating a cutting list and production template</li> <li>• converting metric measurements.</li> </ul> <p>Provide feedback to students about the quality of their interpretation of</p>

Notional hours	Core topics		Learning experiences
	Core concepts and ideas	Knowledge, understanding and skills	
			<p>drawings and prepared cutting list and templates.</p> <p>Students:</p> <ul style="list-style-type: none"> <li>analyse provided technical drawings to establish a cutting list and production template</li> <li>complete a group evaluation with recommendations to improve the cutting list and production template.</li> </ul>
5 hours	<p><b>Core topic 2 — Materials</b></p> <p>Materials are selected and safely manipulated based on industry-specific applications (C2.3).</p>	<ul style="list-style-type: none"> <li>types of materials</li> <li>properties of materials</li> <li>sections, shapes and sizes of metal products</li> <li>logistics</li> <li>industry applications and manipulation procedures</li> <li>consumables</li> <li>safety data sheets</li> </ul>	<p><b>Assessment 6: Wall bracket from specifications</b></p> <p><b>Practical demonstration — Welding and fabrication electives</b></p> <p>Introduce the assessment task and provide a completed working drawing of the wall bracket. Lead a discussion of the assessment standards and where evidence of individual student achievement will be found in the product. Provide class time for the creation of the product.</p> <p>Describe, explain and demonstrate safe operating procedures for tools and machinery, and monitor student use of tools and machinery. Give feedback to students on the product, including proposed use of tools, machinery, materials and production procedures.</p> <p>Students:</p> <ul style="list-style-type: none"> <li>interpret drawings to determine the product requirements</li> <li>demonstrate <ul style="list-style-type: none"> <li>marking-out procedures and skills using relevant tools</li> <li>cutting procedures and skills using relevant tools and machinery</li> <li>machining procedures and skills using relevant machinery</li> <li>finishing procedures and skills using relevant tools and machinery</li> </ul> </li> <li>select and apply production skills and procedures through the creation of the wall bracket</li> <li>use industry terminology and language to communicate the skills used to manufacture the wall bracket</li> <li>plan and adapt production processes to ensure the product is manufactured to a quality standard</li> </ul>
	<p><b>Core topic 2 — Tools</b></p> <p>Tools have specific functions and are selected and safely operated for particular procedures (C2.2).</p>	<ul style="list-style-type: none"> <li>identification, safety and maintenance of tools and machinery</li> <li>marking-out procedures and skills using relevant tools</li> <li>cutting procedures and skills using relevant tools and machinery</li> <li>joining procedures and skills using relevant tools and machinery</li> <li>finishing procedures and skills using relevant tools and machinery</li> </ul>	

Notional hours	Core topics		Learning experiences
	Core concepts and ideas	Knowledge, understanding and skills	
	<p><b>Core topic 1 — Product quality</b> The quality of products depends on customer expectations of value, which affects industry production processes (C1.4).</p>	<ul style="list-style-type: none"> <li>quality standards of products are derived from customer expectations of value based on factors such as needs, trends, budget, product life and competition</li> <li>products are manufactured to specifications that detail the expected quality standards of the final product</li> <li>manufacturing enterprises make decisions about production processes that affect product quality based on a range of factors</li> </ul>	<ul style="list-style-type: none"> <li>create a wall bracket to specifications</li> <li>evaluate industry practices and production processes used to create the wall bracket</li> <li>recommend possible improvements for the wall bracket.</li> </ul>
4hours	<p><b>Core topic 2 — Materials</b> Materials are selected and safely manipulated based on industry-specific applications (C2.3).</p>	<ul style="list-style-type: none"> <li>types of materials</li> <li>properties of materials</li> <li>industry applications and manipulation procedures</li> <li>consumables</li> <li>safety data sheets</li> </ul>	<p><b>Skill exercise — Sheet metal tray</b> Set up a mock class enterprise. Allocate students to work teams and set a practice manufacturing task. Describe the workplace-related learning goals for the task. Revise and demonstrate:</p> <ul style="list-style-type: none"> <li>marking out the sheet metal development</li> <li>cutting and folding procedures.</li> </ul> <p>In groups of four, students:</p> <ul style="list-style-type: none"> <li>interpret a development plan</li> <li>measure and mark out a sheet metal tray</li> <li>cut out and fold up the tray</li> <li>list work roles and skills used by the group</li> <li>discuss and reflect on learning, answering questions such as</li> </ul>
	<p><b>Core topic 2 — Tools</b> Tools have specific functions and are selected and safely operated for particular procedures (C2.2).</p>	<ul style="list-style-type: none"> <li>identification, safety and maintenance of tools and machinery</li> <li>finishing procedures and skills using relevant tools and machinery</li> </ul>	

Notional hours	Core topics		Learning experiences
	Core concepts and ideas	Knowledge, understanding and skills	
	<p><b>Core topic 1 — Product quality</b> The quality of products depends on customer expectations of value, which affects industry production processes (C1.4).</p>	<ul style="list-style-type: none"> <li>products are manufactured to specifications that detail the expected quality standards of the final product</li> </ul>	<ul style="list-style-type: none"> <li>What was successful in our group?</li> <li>How would this task be managed in a workplace?</li> <li>What improvements could be made to the product?</li> </ul>
2 hours	<p><b>Core topic 1 — Personal and interpersonal skills</b> Personal and interpersonal skills, including teamwork and communication skills, are essential for effective participation in engineering workplaces (C1.3).</p>	<ul style="list-style-type: none"> <li>workplace communication using industry-specific terminology including written, graphical, verbal and non-verbal, e.g. <ul style="list-style-type: none"> <li>written, such as safety rules, work instructions, timesheets, forms, safe operating procedures and job applications</li> </ul> </li> </ul>	<p><b>Using ICT to prepare a digital folio for the project</b> Lead a class discussion about what should be included in a production plan. Provide feedback to students about the quality of their proposed production plan, e.g. pictures taken and annotations made when describing production processes. Revise ICT skills used to prepare a digital folio, as well as workplace communication and industry-specific terminology. Students:</p> <ul style="list-style-type: none"> <li>identify and describe key stages of the production process and plan the manufacturing sequence</li> <li>take photographs of key stages of the production process using supplied devices</li> <li>annotate selected photographs of key stages to describe production processes</li> <li>evaluate photographs and annotations.</li> </ul>
	<p><b>Core topic 2 — Tools</b> Tools have specific functions and are selected and safely operated for particular procedures (C2.2).</p>	<ul style="list-style-type: none"> <li>identification, safety and maintenance of tools and machinery, e.g. <ul style="list-style-type: none"> <li>tool names and purpose</li> <li>safe work practices</li> <li>tool storage and maintenance</li> <li>general housekeeping</li> </ul> </li> </ul>	

Notional hours	Core topics		Learning experiences
	Core concepts and ideas	Knowledge, understanding and skills	
35 hours	<p><b>Core topic 2 — Materials</b> Materials are selected and safely manipulated based on industry-specific applications (C2.3).</p>	<ul style="list-style-type: none"> <li>• types of materials</li> <li>• properties of materials</li> <li>• sections, shapes and sizes of metal products</li> <li>• logistics</li> <li>• industry applications and manipulation procedures</li> <li>• consumables</li> <li>• safety data sheets</li> </ul>	<p><b>Assessment 5: Braziers from specifications</b> <b>Project — Welding and fabrication and Sheet metal working electives</b> Introduce the assessment task and assign roles to individual students within each team. Provide a completed working drawing of the braziers. Lead a discussion of the assessment standards, including where evidence of individual student achievement will be found in the product. Provide class time for the creation of the product. Describe, explain and demonstrate safe operating procedures for tools and machinery, and monitor student use of tools and machinery. Provide feedback to students on the product, including proposed use of tools, machinery, materials and production procedures. In groups of four, students:</p> <ul style="list-style-type: none"> <li>• design a manufacturing enterprise and production line to manufacture braziers for clients from specifications</li> <li>• interpret drawings to determine the product's requirements</li> <li>• demonstrate <ul style="list-style-type: none"> <li>– marking-out procedures and skills using relevant tools</li> <li>– cutting procedures and skills using relevant tools</li> <li>– machining procedures and skills using relevant machinery</li> <li>– finishing procedures and skills using relevant tools and machinery</li> </ul> </li> <li>• select and apply production skills and procedures through the creation of the braziers for clients</li> <li>• use industry terminology and language to communicate skills used to manufacture the braziers</li> <li>• plan and adapt production processes to ensure the product is manufactured to a quality standard</li> <li>• create a brazier for clients from specifications</li> </ul>
	<p><b>Core topic 2 — Tools</b> Tools have specific functions and are selected and safely operated for particular procedures (C2.2).</p>	<ul style="list-style-type: none"> <li>• identification, safety and maintenance of tools and machinery</li> <li>• marking-out procedures and skills using relevant tools</li> <li>• cutting procedures and skills using relevant tools</li> <li>• joining procedures and skills using relevant tools and machinery</li> <li>• machining procedures and skills using relevant machinery</li> <li>• forming procedures and skills using relevant tools and machinery</li> <li>• finishing procedures and skills using relevant tools and machinery</li> </ul>	



Notional hours	Core topics		Learning experiences
	Core concepts and ideas	Knowledge, understanding and skills	
	<p><b>Core topic 1 — Product quality</b> The quality of products depends on customer expectations of value, which affects industry production processes (C1.4).</p>	<ul style="list-style-type: none"> <li>• quality standards of products are derived from customer expectations of value based on factors such as needs, trends, budget, product life and competition</li> <li>• products are manufactured to specifications that detail the expected quality standards of the final product</li> <li>• manufacturing enterprises make decisions about production processes that affect product quality based on a range of factors</li> </ul>	<ul style="list-style-type: none"> <li>• evaluate industry practices and production processes used to create the braziers for clients</li> <li>• recommend possible improvements for the braziers</li> <li>• compile an individual digital portfolio that includes               <ul style="list-style-type: none"> <li>– a risk assessment for one of the tools or machines used to manufacture the braziers</li> <li>– a description of the industry-related practices used</li> <li>– a materials list and calculation of cost for the manufacture of the braziers including materials and labour</li> <li>– a step-by-step plan of proposed production processes that analyses the manufacturing tasks</li> <li>– annotated photographs and sketches of the production sequence that clearly show the selected production procedures used to create the braziers</li> <li>– evaluation of industry practices and production processes, as well as the finished braziers in relation to the working drawings</li> <li>– recommendations for improvements to the braziers.</li> </ul> </li> </ul>
	<p><b>Core topic 1 — Personal and interpersonal skills</b> Personal and interpersonal skills, including teamwork and communication skills, are essential for effective participation in engineering workplaces (C1.3).</p>	<ul style="list-style-type: none"> <li>• work-readiness skills</li> <li>• teamwork in the workplace</li> <li>• workplace communication using industry-specific terminology including written, graphical, verbal and non-verbal</li> </ul>	

Notional hours	Core topics		Learning experiences
	Core concepts and ideas	Knowledge, understanding and skills	
1 hour	<p><b>Core topic 1 — Manufacturing enterprises</b> Manufacturing enterprises are important to the economy of Australia and employ a broad range of people in many different occupations (C1.1).</p>	<ul style="list-style-type: none"> <li>overview of engineering industries and their contribution to the economy</li> <li>organisational structure of engineering workplaces</li> <li>career options and pathways</li> </ul>	<p><b>Reflection</b> Lead a discussion revisiting learning goals and success criteria and linking the module to future learning. Display all completed braziers around the room and invite students to inspect the products as potential customers. Demonstrate the expected quality standards of the final product and revisit the predefined specifications. Students:</p> <ul style="list-style-type: none"> <li>use appropriate industry terminology when inspecting products</li> <li>discuss class protocols and relate to industry workplace health and safety procedures, maintenance of tools and storage of stock and product</li> <li>identify and describe machinery used in a manufacturing enterprise in terms of function, reasons for use, required safety and maintenance</li> <li>compare product quality of the braziers and discuss the needs of customers</li> <li>discuss the materials used including suitability, availability and cost</li> <li>analyse and evaluate production line processes and consider the advantages and disadvantages of manufacturing products in a mass-production environment.</li> </ul>
	<p><b>Core topic 1 — Personal and interpersonal skills</b> Personal and interpersonal skills, including teamwork and communication skills, are essential for effective participation in engineering workplaces (C1.3).</p>	<ul style="list-style-type: none"> <li>work-readiness skills</li> <li>teamwork in the workplace</li> <li>workplace communication using industry-specific terminology including written, graphical, verbal and non-verbal</li> </ul>	