NSW Education Standards Authority

NSW GOVERNMENT

NSW Syllabus for the Australian Curriculum

Industrial Technology

Years 7–10 Syllabus

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Contents

Introduction

The K–10 curriculum

The NSW Education Standards Authority (NESA) syllabuses are developed with respect to some overarching views about education. These include the NESA *K–10 Curriculum Framework* (March 2002) and *Statement of Equity Principles* and the *Melbourne Declaration on Educational Goals for Young Australians* (December 2008).

NESA syllabuses include agreed Australian Curriculum content and content that clarifies the scope, breadth and depth of learning. The Australian Curriculum achievement standards underpin the syllabus outcomes and the Stage statements for Early Stage 1 to Stage 5.

In accordance with the *NESA K–10 Curriculum Framework* and the *Statement of Equity Principles*, the syllabus takes into account the diverse needs of all students. It identifies essential knowledge, understanding, skills, values and attitudes. It outlines clear standards of what students are expected to know and be able to do in Years 7–10. It provides structures and processes by which teachers can provide continuity of study for all students.

The framework also provides a set of broad learning outcomes that summarise the knowledge, understanding, skills, values and attitudes essential for all students in all learning areas to succeed in and beyond their schooling.

The continued relevance of the *K–10 Curriculum Framework* is consistent with the intent of the *Melbourne Declaration on Educational Goals for Young Australians* (December 2008), which sets the direction for Australian schooling. There are two broad goals:

Goal 1: Australian schooling promotes equity and excellence
Goal 2: All young Australians become successful learners, confident and creative individuals, and active and informed citizens.

The way in which learning in the *Industrial Technology Years 7–10 Syllabus* contributes to the curriculum, and to students' achievement of the broad learning outcomes, is outlined in the syllabus rationale.

Diversity of learners

NSW syllabuses are inclusive of the learning needs of all students. Syllabuses accommodate teaching approaches that support student diversity, including students with disability, gifted and talented students, and students learning English as an additional language or dialect (EAL/D). Students may have more than one learning need.

Students with disability

All students are entitled to participate in and progress through the curriculum. Under the *Disability Standards for Education 2005*, schools are required to provide additional support or adjustments to teaching, learning and assessment activities for some students with disability. Adjustments are measures or actions taken in relation to teaching, learning and assessment that enable a student with disability to access syllabus outcomes and content and demonstrate achievement of outcomes.

Students with disability can access outcomes and content from Years 7–10 syllabuses in a range of ways. Students may engage with:

- syllabus outcomes and content from their age-appropriate Stage with adjustments to teaching, learning and/or assessment activities; or
- selected syllabus outcomes and content from their age-appropriate Stage, relevant to their learning needs; or
- syllabus outcomes from an earlier Stage, using age-appropriate content; or
- selected Years 7–10 Life Skills outcomes and content from one or more syllabuses for students in Stages 4 and 5.

Decisions regarding curriculum options, including adjustments, should be made in the context of collaborative curriculum planning with the student, parent/carer and other significant individuals to ensure that syllabus outcomes and content reflect the learning needs and priorities of individual students.

Further information can be found in support materials for:

- Technologies
- Special Education
- Life Skills.

Gifted and talented students

Gifted and talented students have specific learning needs that may require adjustments to the pace, level and content of the curriculum. Differentiated educational opportunities assist in meeting the needs of gifted and talented students.

Generally, gifted and talented students demonstrate the following characteristics:

- the capacity to learn at faster rates
- the capacity to find and solve problems
- the capacity to make connections and manipulate abstract ideas.

There are different kinds and levels of giftedness and talent. Gifted and talented students may also have learning disabilities and/or English as an additional language or dialect. These needs should be addressed when planning appropriate teaching, learning and assessment activities.

Curriculum strategies for gifted and talented students may include:

- differentiation: modifying the pace, level and content of teaching, learning and assessment activities
- acceleration: promoting a student to a level of study beyond their age group
- curriculum compacting: assessing a student's current level of learning and addressing aspects of the curriculum that have not yet been mastered.

School decisions about appropriate strategies are generally collaborative and involve teachers, parents/carers and students, with reference to documents and advice available from NESA and the education sectors.

Gifted and talented students may also benefit from individual planning to determine the curriculum options, as well as teaching, learning and assessment strategies, most suited to their needs and abilities.

Students learning English as an additional language or dialect (EAL/D)

Many students in Australian schools are learning English as an additional language or dialect (EAL/D). EAL/D students are those whose first language is a language or dialect other than Standard Australian English and who require additional support to assist them to develop English language proficiency.

EAL/D students come from diverse backgrounds and may include:

- overseas and Australian-born students whose first language is a language other than English, including creoles and related varieties
- Aboriginal and Torres Strait Islander students whose first language is Aboriginal English, including Kriol and related varieties.

EAL/D students enter Australian schools at different ages and stages of schooling and at different stages of English language learning. They have diverse talents and capabilities and a range of prior learning experiences and levels of literacy in their first language and in Standard Australian English. EAL/D students represent a significant and growing percentage of learners in NSW schools. For some, school is the only place they use Standard Australian English.

EAL/D students are simultaneously learning a new language and the knowledge, understanding and skills of a syllabus through that new language. They require additional time and support, along with informed teaching that explicitly addresses their language needs, and assessments that take into account their developing language proficiency.

The *ESL Scales* and the *English as an Additional Language or Dialect: Teacher Resource* provide information about the English language development phases of EAL/D students. These materials and other resources can be used to support the specific needs of EAL/D students and to assist students to access syllabus outcomes and content.

Industrial Technology Key

The following codes and icons are used in the *Industrial Technology Years 7–10 Syllabus*.

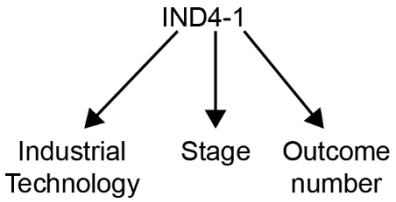
Outcome coding

Syllabus outcomes are coded in a consistent way. The code identifies the subject, Stage, outcome number and the way content is organised.

Stage 4, Stage 5 and Life Skills are represented by the following codes:

Stage	**Code**
Stage 4	4
Stage 5	5
Life Skills	LS

In the Industrial Technology syllabus, outcome codes indicate subject, Stage and outcome number. For example:

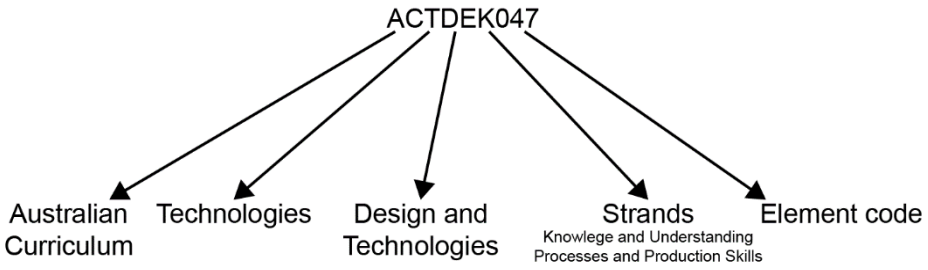


Outcome code	**Interpretation**
IND4-1	Industrial Technology, Stage 4 – Outcome number 1
INDLS-3	Industrial Technology, Life Skills – Outcome number 3

Coding of Australian Curriculum content

The syllabus includes Australian Curriculum content for Design and Technologies, with Australian Curriculum codes in brackets at the end of each content description, for example:

- Investigate and make judgments, within a range of technologies specialisations, on how technologies can be combined to create designed solutions (ACTDEK047)



Where a number of content descriptions are jointly represented, all description codes are included, eg (ACTDEK046, ACTDEP050)

For example:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available (ACTDEK046)

Learning across the curriculum icons

Learning across the curriculum content, including the cross-curriculum priorities, general capabilities and other areas identified as important learning for all students, is incorporated and identified by icons in the syllabus.

Cross-curriculum priorities

- Aboriginal and Torres Strait Islander histories and cultures
- Asia and Australia's engagement with Asia
- Sustainability

General capabilities

- Critical and creative thinking
- Ethical understanding
- Information and communication technology capability
- Intercultural understanding
- Literacy
- Numeracy
- Personal and social capability

Other learning across the curriculum areas

- Civics and citizenship
- Difference and diversity
- Work and enterprise

Rationale

The study of Industrial Technology provides students with opportunities to engage in a diverse range of creative and practical experiences using a variety of technologies widely available in industrial and domestic settings. This may include study in the areas of Automotive, Building and Construction, Electronics, Engineering, Farm Maintenance, Metal, Multimedia or Timber.

Industrial Technology develops knowledge and understanding of materials and processes. Related knowledge and skills are developed through a specialised approach to the tools, materials and techniques employed in the planning, development, construction and evaluation of quality practical projects and processes. Critical thinking skills are developed through engagement with creative practical problem-solving activities.

The *Industrial Technology Years 7–10 Syllabus* allows students to study technology in specific focus areas relevant to individual needs and interests. The syllabus has been designed to be inclusive of the needs, interests and aspirations of all students. Students are provided with opportunities to develop responsibility for their own learning through a range of student-centred learning experiences.

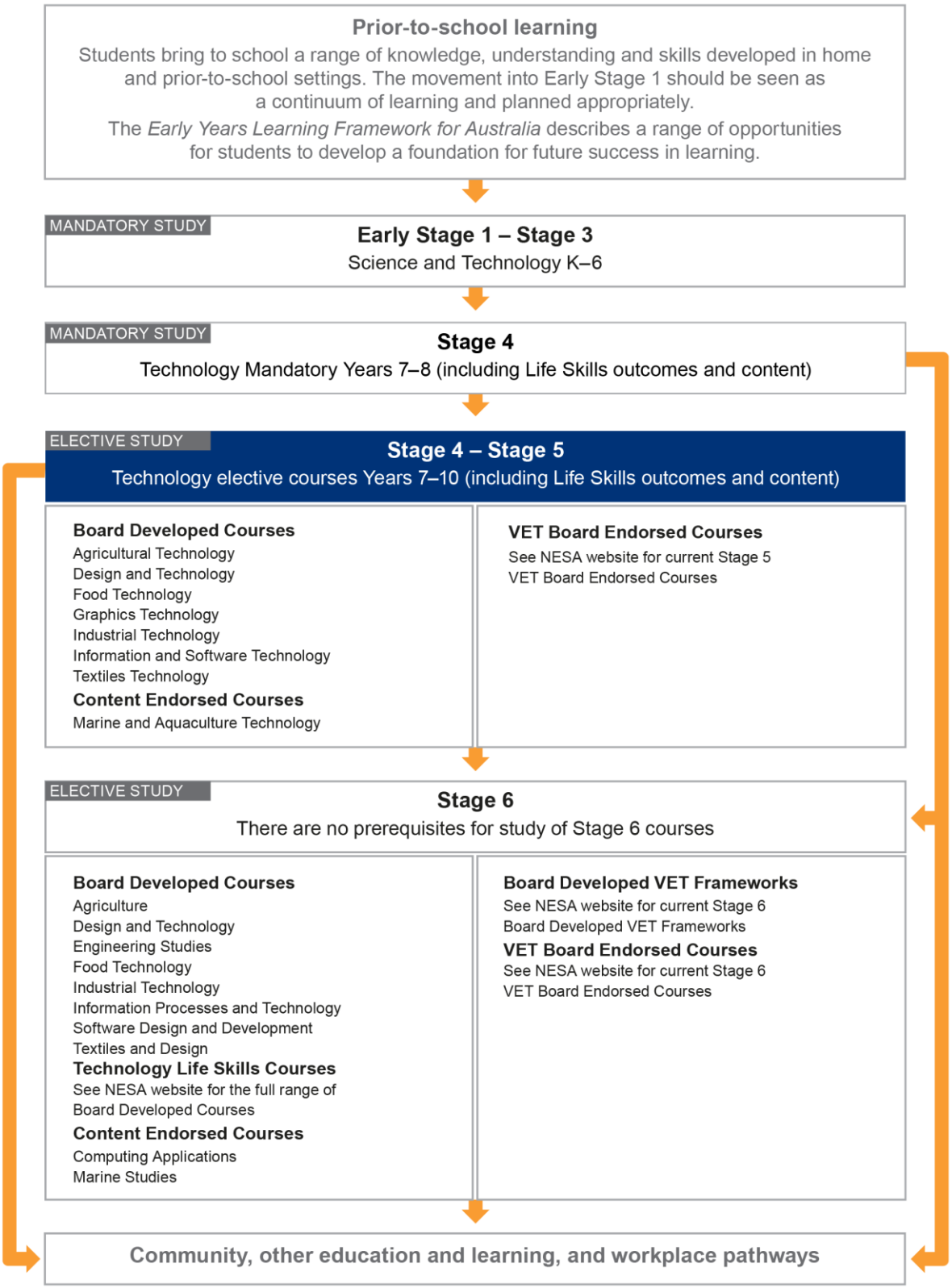
Through the study of Industrial Technology students develop knowledge relating to current and emerging technologies in industrial and domestic settings. Students study the interrelationship of technologies, equipment and materials used in a variety of settings. They develop skills through project-based learning in the design, planning, management and production of practical projects.

The *Industrial Technology Years 7–10 Syllabus* leads students to an awareness of the relationship between technology, industry, society and the environment, and develops their ability to make value judgements about issues, decisions and consequences arising from this interaction. Students are challenged to develop an awareness of the importance of environmental sustainability in relation to the use of materials and technologies and their effects on people and society.

The study of Industrial Technology develops in students an understanding of related work environments and Work Health and Safety (WHS) matters, while developing a range of skills that equip them for future learning, potential vocational pathways and leisure and lifestyle activities involving technologies.

The knowledge, understanding, skills and attitudes developed through the study of Industrial Technology provides opportunities for students to make positive contributions to Australian industry and society, to express valued opinions and to make considered judgements as contributing members of society.

The Place of the Industrial Technology Years 7–10 Syllabus in the K–12 Curriculum



Aim

The aim of the *Industrial Technology Years 7–10 Syllabus* is to develop knowledge, understanding, skills and values related to a range of technologies through safe interaction with tools, materials and processes in the design, planning, management and production of quality projects. The syllabus aims to develop in students an understanding of the interrelationships between technology, the individual, society and the environment, and to develop their ability to think creatively to produce solutions to practical problems.

Objectives

Knowledge, understanding and skills

Students develop:

- knowledge of and capability in applying Work Health and Safety and risk-management procedures and practices
- knowledge and skills in the design and production of practical projects
- knowledge and understanding of the relationship between the properties of materials and their applications
- skills in communicating ideas, processes and technical information with a range of audiences
- understanding to transfer knowledge and skills to other experiences
- knowledge and understanding to critically evaluate manufactured products in order to become a discriminating consumer
- knowledge and understanding of the role of traditional, current, new and emerging technologies in industry and their impact on society and the environment.

Values and attitudes

Students:

- appreciate the contribution and impact of innovation and technologies on leisure, lifestyle, work and further learning
- appreciate the dynamic nature of design and production processes and how they are used to develop solutions to personal, social and global issues
- appreciate the finite nature of some resources and the impact of their use on the environment and society
- value the development of skills and gain satisfaction from their use to solve problems and create quality products.

Outcomes

Table of objectives and outcomes – continuum of learning

Knowledge, understanding and skills

Objective

Students develop:

- knowledge of and capability in applying Work Health and Safety and risk-management procedures and practices

Stage 4 outcome A student:	**Stage 5 outcome** A student:
IND4-1 identifies and applies fundamental WHS principles when working with tools, materials and machines	**IND5-1** identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies

Objective

Students develop:

- knowledge and skills in the design and production of practical projects

Stage 4 outcomes A student:	**Stage 5 outcomes** A student:
IND4-2 applies a design process in the modification of projects	**IND5-2** applies design principles in the modification, development and production of projects
IND4-3 identifies and uses a range of hand and machine tools to produce quality practical projects	**IND5-3** identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects

Objective

Students develop:

- knowledge and understanding of the relationship between the properties of materials and their applications

Stage 4 outcome A student:	**Stage 5 outcome** A student:
IND4-4 selects and uses a range of relevant materials for specific purposes	**IND5-4** selects, justifies and uses a range of relevant and associated materials for specific applications

Objective

Students develop:

- skills in communicating ideas, processes and technical information with a range of audiences

Stage 4 outcomes A student:	**Stage 5 outcomes** A student:
IND4-5 selects and uses communication techniques when designing, making and evaluating projects and ideas	**IND5-5** selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects
IND4-6 participates in collaborative work practices in the learning environment	**IND5-6** identifies and participates in collaborative work practices in the learning environment

Objective

Students develop:

- understanding to transfer knowledge and skills to other experiences

Stage 4 outcome A student:	**Stage 5 outcome** A student:
IND4-7 applies skills, processes and materials to a variety of contexts and projects	**IND5-7** applies and transfers skills, processes and materials to a variety of contexts and projects

Objective

Students develop:

- knowledge and understanding to critically evaluate manufactured products in order to become a discriminating consumer

Stage 4 outcome A student:	**Stage 5 outcome** A student:
IND4-8 evaluates products in terms of functional use and aesthetics	**IND5-8** evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction

Objective

Students develop:

- knowledge and understanding of the role of traditional, current, new and emerging technologies in industry and their impact on society and the environment

Stage 4 outcomes A student:	**Stage 5 outcomes** A student:
IND4-9 identifies a range of technologies and their intended uses	**IND5-9** describes, analyses and uses a range of current, new and emerging technologies and their various applications
IND4-10 describes the impact of technology on society, the environment and cultural issues locally and globally	**IND5-10** describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally

Stage 4 outcomes have been provided to assist the assessment and reporting of student achievement in those schools that choose to begin elective study before Year 9. Teachers are advised to select from the syllabus content to target the specific needs of students who commence study in Stage 4.

Stage Statements

Stage statements are summaries of the knowledge, understanding, skills, values and attitudes that have been developed by students as a result of achieving the outcomes for the relevant Stage of learning.

Stage 4 – Technology Mandatory

By the end of Stage 4, students explore problems and opportunities, considering functional, economic, environmental, social, technical and/or usability constraints. They investigate, select, justify and safely use a range of tools, materials, components, equipment and processes to develop, test and communicate design ideas using appropriate technical terms and technologies. Students plan, manage and evaluate the production of design solutions. They develop thinking skills to communicate the development of digital and non-digital solutions.

Students investigate how managed systems are used to sustainably produce food and fibre. They explain food selection and preparation, food safety, and make informed and healthy food choices. Students collect and interpret data from a range of sources to assist in making informed judgements. They explain how data is represented in digital systems, and transmitted and secured in networks.

Students explain how force, motion and energy can be used in systems, machines and structures. They investigate characteristics and properties of a range of materials, develop skills and techniques in the use of a broad range of tools and safely apply them in the production of projects.

Students are responsible users of technology, capable of designing and producing solutions to identified needs or opportunities. They develop an appreciation of the contribution of technologies on their lives now and the impact of innovations for creating preferred futures. They develop an appreciation of the dynamic nature of design and production processes and how thinking skills are used to develop solutions to personal, social and global issues.

Stage 4 – Industrial Technology

By the end of Stage 4, students undertaking the study of Industrial Technology build upon the experiences gained through Technology Mandatory Years 7–8. In particular, they focus more directly on the development of specific practical skills associated with the material being studied and the associated WHS issues arising through the use of these materials and related equipment.

Stage 5 – Industrial Technology

By the end of Stage 5, the knowledge, skills and attitudes developed in the *Technology Mandatory Years 7–8 Syllabus* are further enhanced through the study of Industrial Technology Years 7–10 through applied practical experiences in one or more focus areas.

Students at Stage 5 recognise and make an assessment of the risks and WHS issues that are associated with hand and machine tools and processes that they use in the development of their projects. They can identify and assess risks and apply appropriate WHS practices to all of the hand and machine tools, and materials that they use and follow appropriate procedures in completing processes.

Students apply a design process to modify, develop and produce original design solutions for a range of practical projects. They identify, select and apply appropriate hand and machine tools and processes to produce quality practical projects.

Students understand the relationship between the physical and mechanical properties of a range of relevant and associated materials and their functional applications. They select the most appropriate materials for the successful completion of their practical projects.

At Stage 5 students communicate technical ideas and information with others using a range of methods including graphical, digital, written and/or verbal. They can select the most appropriate way in which to communicate information.

Through experiences in a range of practical activities, students develop an appreciation of the value of working cooperatively in the achievement of common goals and gain personal satisfaction and enjoyment. These skills form a basis that enables students to continue their learning experiences in many lifestyle and leisure activities.

Students identify and critically evaluate products that have been well designed and well made, which fulfil their intended function. They apply design criteria to the planning and development of their own practical projects.

Students are aware of the nature and impact of current, new and emerging technologies on society and the environment. They describe the effect of these technologies on industry and the local and global environment. They envisage future directions and applications of technologies in their own and others lives.

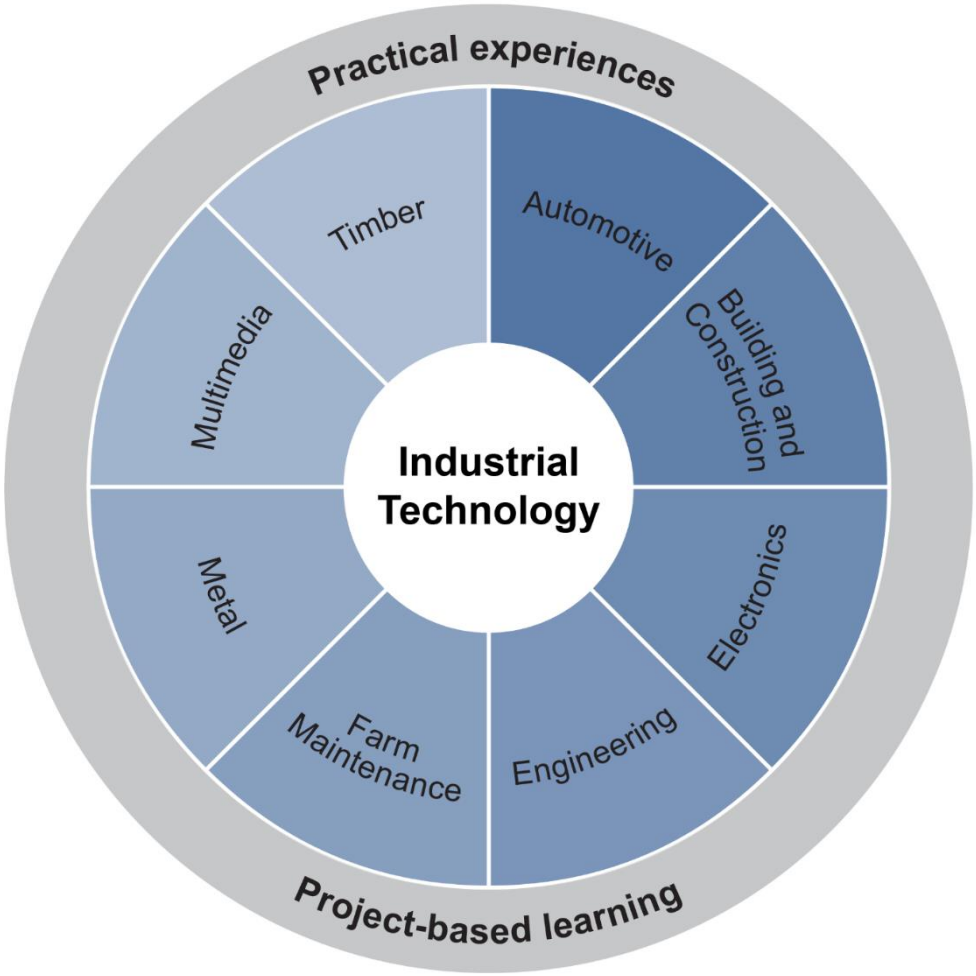
Content

For Kindergarten to Year 10, courses of study and educational programs are based on the outcomes of syllabuses. The content describes in more detail how the outcomes are to be interpreted and used, and the intended learning appropriate for the Stage. In considering the intended learning, teachers will make decisions about the sequence, the emphasis to be given to particular areas of content, and any adjustments required based on the needs, interests and abilities of their students.

The knowledge, understanding and skills described in the outcomes and content provide a sound basis for students to successfully move to the next stage of learning.

Organisation of content

The following diagram provides an illustrative representation of elements of the course and their relationship.



Course structure and requirements

This syllabus covers a number of focus areas in the field of Industrial Technology: Automotive, Building and Construction, Electronics, Engineering, Farm Maintenance, Metal, Multimedia and Timber.

Each focus area has a compulsory core module that leads to a specialised module with some focus areas having multiple specialised modules to choose from. The core module of each focus area develops understanding and skills through the design, production and evaluation of practical projects. Modules are structured in a sequential manner, with the knowledge and skills developed in one module applied and enhanced through subsequent module(s) within the focus area.

Schools may:

- deliver consecutive modules concurrently
- choose to deliver any two of the four specialised Engineering modules.

Focus areas and modules

<table>
<tr><th>Focus area</th><th>Core module
100 hours total</th><th colspan="2">Specialised module(s)
100 hours total</th></tr>
<tr><td>Automotive</td><td>Automotive 1</td><td colspan="2">Automotive 2</td></tr>
<tr><td>Building and Construction</td><td>Building and Construction 1</td><td colspan="2">Building and Construction 2</td></tr>
<tr><td>Electronics</td><td>Electronics 1</td><td colspan="2">Electronics 2</td></tr>
<tr><td rowspan="2">Engineering</td><td rowspan="2">Engineering 1
(Structures/Mechanisms)</td><td>Alternative Energy
(50 hours)</td><td>Control Systems
(50 hours)</td></tr>
<tr><td>School-Developed Engineering Module
(50 hours)</td><td>Transport
(50 hours)</td></tr>
<tr><td>Farm Maintenance</td><td>Farm Maintenance 1</td><td colspan="2">Farm Maintenance 2</td></tr>
<tr><td rowspan="3">Metal</td><td rowspan="2">Metal 1</td><td>Fabrication 2
(50 hours)</td><td>Fabrication 3
(50 hours)</td></tr>
<tr><td>Metal Machining 2
(50 hours)</td><td>Metal Machining 3
(50 hours)</td></tr>
<tr><td>Art Metal 1</td><td colspan="2">Art Metal 2</td></tr>
<tr><td>Multimedia</td><td>Multimedia 1
(Web Design/Video Production)</td><td colspan="2">Multimedia 2
(Apps and Interactivity/Games and Simulations)</td></tr>
<tr><td>Timber</td><td>Timber 1</td><td colspan="2">Timber 2</td></tr>
</table>

Requirements

Industrial Technology Years 7–10 is designed to build upon the Technology Mandatory Years 7–8 course. Outcomes for Stage 4 have been included to allow flexibility for those schools who wish to offer the course in Years 7 and 8.

Students should be provided with a range of theoretical and practical experiences to develop knowledge and skills in a selected focus area. A design and production folio or engineering report is required for each practical project completed and will form part of the overall assessment of each module.

Students may study up to **two** focus areas based on the Industrial Technology syllabus that contribute to the award of their Record of School Achievement (RoSA). A student may undertake a focus area once only.

Each focus area of study includes:

- the study of 100 hours comprised of the core module only OR
- the study of 200 hours comprised of the core module plus specialised module(s).

Course combinations that contribute to the award of the RoSA in Industrial Technology Years 7–10 may include:

- 1 x 100-hour course
- 1 x 200-hour course
- 2 x 100-hour courses
- 2 x 200-hour courses
- 1 x 100-hour course and 1 x 200-hour course.

For example, a student may choose to study:

Engineering focus area

100-hour course:

- Core Module – Engineering 1 (Structures/Mechanisms)

or

200-hour course:

- Core Module – Engineering 1 (Structures/Mechanisms)
- Any two Specialised Modules from Alternative Energy, Control Systems, Transport, School-Developed Module

For example, a student may choose to study:

Metal focus area

100-hour course:

- Core Module – Metal 1

or

200-hour course:

- Core Module –Metal 1
- Specialised Module – Fabrication 2
- Specialised Module – Fabrication 3

or

200-hour course:

- Core Module – Metal 1
- Specialised Module – Metal Machining 2
- Specialised Module – Metal Machining 3

or

200-hour course:

- Core Module – Metal 1
- Specialised Module – Fabrication 2
- Specialised Module – Metal Machining 2

Practical experiences

To satisfy the requirements of the *Industrial Technology Years 7–10 Syllabus* students must undertake a range of practical experiences that occupy the majority of course time.

Practical experiences allow students to undertake project work to develop skills and confidence in the use of a range of equipment, tools, processes and technologies. Practical experiences should be used to develop knowledge and understanding of and skills in designing, producing and evaluating.

Student capability, confidence and expertise at their current stage of development are important considerations in determining the teaching and learning sequences in the course. Students with disability may require adjustments and/or additional support in order to engage in practical experiences.

Safety

Schools have a legal obligation in relation to safety. Teachers need to ensure that they comply with relevant legislation as well as system and school requirements in relation to safety and risk management when implementing their programs. This includes legislation and guidelines relating to Work Health and Safety, and the safe handling, use, storage and disposal of tools, equipment, materials and chemicals. Teachers need to be aware of activities such as working with electronic and electrical projects or components that may require notification, certification, permission, permits and licences.

Schools need to be aware of legal, ethical, cyber security and safety considerations of digital solutions, including copyright and intellectual property, cultural considerations, accessibility, privacy issues and digital footprints.

Teachers need to be aware that students may have allergies that can result in anaphylaxis, a severe and sometimes sudden allergic reaction which is potentially life-threatening and always requires an emergency response.

Animal welfare

Schools have a legal responsibility in relation to the welfare of animals. The keeping of animals and all practical activities involving animals must comply with relevant guidelines and legislation that are interpreted for schools on the *Animals in Schools* website.

Learning across the curriculum

Learning across the curriculum content, including the cross-curriculum priorities and general capabilities, assists students to achieve the broad learning outcomes defined in the NESA *K–10 Curriculum Framework* and *Statement of Equity Principles*, and in the *Melbourne Declaration on Educational Goals for Young Australians* (December 2008).

Cross-curriculum priorities enable students to develop understanding about and address the contemporary issues they face.

The cross-curriculum priorities are:

- Aboriginal and Torres Strait Islander histories and cultures
- Asia and Australia's engagement with Asia
- Sustainability

General capabilities encompass the knowledge, skills, attitudes and behaviours to assist students to live and work successfully in the 21st century.

The general capabilities are:

- Critical and creative thinking
- Ethical understanding
- Information and communication technology capability
- Intercultural understanding
- Literacy
- Numeracy
- Personal and social capability

NESA syllabuses include other areas identified as important learning for all students:

- Civics and citizenship
- Difference and diversity
- Work and enterprise

Learning across the curriculum content is incorporated, and identified by icons, in the content of the syllabus in the following ways.

Aboriginal and Torres Strait Islander histories and cultures

The syllabus provides students with opportunities to learn about how Aboriginal and Torres Strait Islander Peoples have developed and refined knowledge about the world through observation, making predictions, testing and responding to environmental factors within specific contexts. It emphasises the relationships people have with places and their interconnectedness with the environments in which they live. Students learn about Aboriginal and Torres Strait Islander Peoples' understanding of the environment and the ways that traditional knowledge and Western knowledge can be complementary. Students learn that there are different ways of interacting with the environment and how this can influence sustainability.

When planning and programming content relating to Aboriginal and Torres Strait Islander histories and cultures, teachers are encouraged to:

- involve local Aboriginal communities and/or appropriate knowledge holders in determining suitable resources, or to use Aboriginal or Torres Strait Islander authored or endorsed publications
- read the Principles and Protocols relating to teaching and learning about Aboriginal and Torres Strait Islander histories and cultures and the involvement of local Aboriginal communities.

Asia and Australia's engagement with Asia

Students have opportunities to explore the links that exist between Australia and Asia and appreciate how our interactions help to shape Australia's economy, areas of research and technological advancement. Students identify how the Asia region plays an important role in research and technological developments in areas such as medicine, natural resource management and natural disaster prediction and management.

Sustainability

Sustainability content is focused on renewable resources, the protection of the environment and sustainable patterns of living and requires consideration of environmental, social, cultural and economic systems and their interdependence. Students learn about the actions required to improve sustainability, helping them to take a more active role in shaping preferred futures. Students investigate the relationships between system components, consider how systems respond to change and develop an appreciation of the impact that design solutions can have on the Earth's resources.

All focus areas foster an awareness of the impact of industry on the environment and the importance of the use of alternative and sustainable resources. This enables students to make informed decisions in relation to the selection and use of materials and processes.

Critical and creative thinking

Critical thinking is at the core of most activities where students recognise or develop an argument, use evidence in support of an argument, draw reasoned conclusions, and use information to solve problems. Students are provided with opportunities to generate and apply new ideas in specific contexts, view existing situations in a new way, identify alternative explanations, and make links that generate a positive outcome. The skills and processes of design, planning, management and production provide critical and creative thinking opportunities as students pose questions, make predictions, engage in firsthand investigations, design projects, solve problems and make evidence-based decisions.

Ethical understanding

Students develop capacity to behave ethically as they identify and investigate ethical concepts, values and principles, and understand how reasoning can assist ethical judgement. The syllabus provides opportunities for students to form and make ethical judgements in relation to design solutions, codes of practice, use of digital technologies and online collaborative environments. They apply ethical guidelines as they design projects, particularly when considering the implications for others and the environment. They learn about intellectual property, including Indigenous cultural and intellectual property and the protection of cultural knowledge and designs. Students are encouraged to demonstrate ethical digital citizenship, follow social and ethical protocols and understand the need to protect data and intellectual property.

Information and communication technology capability

Students engage with information and communication technology (ICT) when they develop design ideas and solutions, solve problems, collaborate online and communicate information and ideas. ICT, through animations and simulations, provides opportunities to view phenomena, test predictions and visualise designs that cannot be investigated or produced through practical experiences in the classroom, and may enhance students' understanding and engagement with technology.

Intercultural understanding

Students develop intercultural understanding and value of their own culture and those of others as they engage with people from diverse cultural backgrounds in ways that recognise similarities and differences, create connections and cultivate respect. Students learn about intellectual property, including Indigenous cultural and intellectual property and the protection of cultural knowledge and designs. The syllabus provides opportunities for students to appreciate the contribution that diverse cultural perspectives have made to the development, breadth and diversity of technological knowledge and its applications.

Students learn about and engage with issues requiring cultural sensitivity and recognise that people in technology-related professions work in culturally diverse teams. They learn about the interactions between technologies and society, and are provided with opportunities to take responsibility for securing positive outcomes for members of all cultural groups.

Literacy

The syllabus provides students with opportunities to develop skills in literacy to effectively communicate and comprehend using a variety of modes and media. Being 'literate' is more than the acquisition of technical skills – it includes the ability to identify, understand, interpret, create and communicate effectively using written, visual and/or digital forms of expression. The language of industrial technology is often technical and includes specific terms for concepts, processes and features of the world. Students use subject-specific vocabulary to describe, develop and present design solutions.

They develop an understanding that technological information can be presented in a variety of forms including drawings, diagrams, infographics, flowcharts, models, tables and graphs. Project work and the associated documentation provides an authentic context for development of literacy skills, particularly technological literacy.

Numeracy

Real-world numeracy connections are formed when numerical data is collected and manipulated and numeracy concepts, such as size, proportion and measurement, are used by students as tools in the design and production process. An appreciation of the fundamental importance of numeracy in everyday life is fostered as students develop an understanding of how numeracy is essential to a variety of technologies, such as the importance of accurate measurement in the production of quality products. As they develop design projects and solutions, students are provided with opportunities to learn data-analysis skills, create technical drawings, work with digital models and use computational thinking.

Numeracy skills are integral to the development of all practical projects through measurement, quantities, costing, time management and the interpretation and production of a variety of drawings. The use of advanced manufacturing technologies provides further opportunities for students to develop and apply their numeracy skills.

Personal and social capability

Students develop personal and social capability as they learn to understand and manage themselves, their relationships and their lives more effectively. This provides students with opportunities to establish positive relationships, work effectively both individually and collaboratively, and resolve difficult situations. The syllabus encourages students to explore, question, solve problems and develop skills in communication, display initiative, set goals and make responsible decisions.

Civics and citizenship

The syllabus provides students with opportunities to become self-reliant and active members of a society driven by change, emerging technologies and increasingly sophisticated communication and information systems. Students broaden their understanding of civics and citizenship in relation to the application of technological advances and the development of environmental and sustainable practices. Students have opportunities to develop a sense of local responsibility and global citizenship as they improve and advance Australia through their investigations and future-focused solutions.

Students develop a sound knowledge of materials and manufacturing processes which enables them to become discriminating consumers and users of materials and processes. This encourages participation as active and informed citizens. Students also reflect on the environmental impacts of industries, leading to ethical considerations in technical practice.

Difference and diversity

Difference and diversity comprises gender, ethnicity, ability and socioeconomic circumstances. The syllabus provides students with opportunities to develop their awareness, understanding and appreciation of difference and diversity within their lives and the wider community. Students have opportunities to work collaboratively and develop an appreciation of the values and ideas of all group members. This also enables them to identify individual rights, challenge stereotypes and engage with opinions different to their own.

All students are encouraged to develop skills in a variety of areas in which they are interested. By participating in collaborative work practices they develop an appreciation of the various roles and contributions of people in society. Students learn the importance of respecting and valuing differences in others.

Work and enterprise

Students develop an understanding of careers associated with technology and learn skills relevant to work and leisure activities. Students are provided with opportunities to learn about careers in a broad range of fields related to technology occupations and study issues related to work and employment. Students are provided with opportunities to safely manage and produce projects, and to appreciate quality of work.

The application of design, planning, management and production processes can provide students with work-related skills including individual and collaborative work practices. Students are encouraged to develop initiative, and to become independent thinkers and confident communicators.

Automotive Content for Years 7–10

The Automotive focus area provides opportunities for students to develop knowledge, understanding and skills in relation to automotive and associated industries.

The Automotive 1 core module develops knowledge and skills in the use of tools, materials and techniques related to automotive maintenance and repair. These are enhanced and further developed through the study of the Automotive 2 specialist module.

Practical projects should reflect the nature of the Automotive focus area and provide opportunities for students to develop specific knowledge, understanding and skills related to automotive-related technologies. These may include:

- automotive restorations
- maintenance and repair of small engines
- making metal tools and parts
- repairing metal components
- rebuilding or restoring automotive components.

Projects should promote the sequential development of skills and reflect an increasing degree of student autonomy as they progress through the course.

Core Module: Automotive 1

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Content

WHS and risk management

Students:

- demonstrate safe workshop practices and procedures, for example:
  - clean up oil spills
  - safely support vehicles
  - store fuels in well-ventilated areas
  - work collaboratively
- safely use and maintain hand, power and machine tools
- select and use personal protective equipment (PPE) when working with tools, materials and machines, for example:
  - wear appropriate footwear
  - wear eye protection, eg safety glasses when machining
  - wear protective clothing
- apply the principles of risk management, for example:
  - hierarchies of control
  - identify a particular risk and implement risk-reduction procedures
- describe elementary first aid procedures, for example:
  - outline the procedure to follow after a particular incident, eg burns, cuts

Design

Students:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available, for example: (ACTDEK046)
  - dismantle and reassemble a single-cylinder engine
- use and/or modify existing designs when completing projects
- identify and investigate factors influencing design in automotive technologies, for example:
  - ease of serviceability
  - fuel efficiency
  - pedestrian safety
- identify the major systems of 2-stroke reciprocating engines and describe their operation
- identify the major systems of four-stroke reciprocating engines and describe their operation
- identify the major parts of and understand basic automotive electrical systems, for example:
  - 6-volt, 12-volt and 24-volt systems
  - electrical circuits, eg wiring, fuses, relays
  - energy generation, eg battery, alternator
- identify internal combustion power sources, for example:
  - rotary piston
  - turbine
  - Wankel
- explore the major types of ignition systems, for example:
  - breaker points ignition
  - electronic ignition
  - magneto
- examine the major parts related to power trains and transmission systems, for example:
  - automatic, manual and constant velocity transmissions
  - front, rear and all-wheel drive vehicles
  - transmissions and differentials
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - use spreadsheets to calculate material quantities and monitor project costs
- follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects

Materials

Students:

- identify and describe a range of materials used in automotive contexts, for example:
  - metals and alloys
  - polymers and composites
  - sheet, cast and forged materials
- identify the major parts related to chassis and body systems, and describe their construction and repair, for example:
  - body on chassis construction
  - unitary construction
- identify and select chemicals used in automotive contexts, for example:
  - cleaning solutions
  - oils, greases and other lubricants
  - paints, lacquers and solvents

Tools, equipment and techniques

Students:

- develop skills in using automotive hand tools, for example: (ACTDEK046)
  - automotive body repair
  - changing a tyre
  - remove and replace components
  - remake threaded components
- select and use appropriate measuring tools for accuracy needed in automotive tasks, for example:
  - feeler gauge
  - micrometer
  - use a dial indicator when setting up irregular lathe work
  - use vernier calipers to measure drill bits
- select, use and maintain appropriate hand tools for automotive tasks, for example:
  - ensure file handles are fitted securely
  - grind the tip of a centre punch
  - use spanners and socket wrenches to remove and replace components
  - use a stock and die to make threaded components or fasteners
- select, use and maintain appropriate machine and power tools for automotive tasks, for example:
  - use an angle grinder to grind metal
  - use a pneumatic sander to repair bodywork
  - use a lathe to manufacture components
- investigate advanced manufacturing techniques to assist in the production of projects, for example:
  - CNC equipment, eg laser cutters, CNC milling machines
  - plasma/water cutters
  - rapid prototyping

Workplace communication skills

Students:

- recognise and comply with WHS signage, for example:
  - identify the colours and shapes associated with types of WHS signage
- select and use specialist terminology in context, for example:
  - glossary
  - procedure/storyboard
  - record of production
- read and interpret plans and/or materials lists to prepare materials for the completion of projects, for example:
  - produce freehand sketches
- produce freehand sketches of project components and/or projects
- develop design and production folios using appropriate ICT, for example:
  - CAD
  - spreadsheets
- prepare design and production folios to describe the management and processes undertaken in the production of practical projects, for example:
  - procedure, eg dismantling engine parts
  - recount

Societal and environmental impact

Students:

- identify renewable and non-renewable resources in the automotive industry
- recognise the impact of automotive manufacturing, repair and recycling on the environment, for example:
  - obtaining resources for vehicle production such as mining, fabric/leather and plastics
  - recycling of metal parts
- recognise the importance of conservation of materials and recycling in the modern automotive industry, for example:
  - reclaiming of lubricants and oils
  - reusing parts dismantled from unroadworthy vehicles
- understand ethical responsibilities of sourcing materials, including Indigenous cultural and intellectual property, for example:
  - collaboration and benefit sharing
  - consulting with communities
  - the use of cultural designs and art on painted bodywork
- investigate issues related to the environmental impact of the automotive industry, for example:
  - reduced vehicle emissions, eg hybrid vehicles
  - modified manufacturing techniques, eg recycling of plastics at end of life
- explore the links between societal expectation, government regulation and environmental impact on design change, for example:
  - the increased use of ethanol in fuel, eg government legislation
  - the introduction of electric vehicles
  - the use of lead-free fuels
  - 4-stroke lawn mowers replacing 2-stroke

Links to industry

Students:

- compare industrial production processes to those used in the classroom, for example:
  - assembly line production
  - computer diagnosis and fault-finding
  - using a baking oven to cure automotive paints
- identify alternative historical technologies appropriate to the task and the material being used, for example:
  - adjusting a carburettor
  - setting contact points in a distributor
  - using a timing light
- investigate a range of career paths in the automotive industry, for example:
  - auto electrician
  - mechanic
  - panel beater

Specialised Module: Automotive 2

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Content

WHS and risk management

Students:

- demonstrate safe workshop practices and procedures, for example:
  - lift and carry equipment and materials safely
  - raise, lower and support automotive components safely
  - store fuels in flameproof cabinets
  - test engines in a well-ventilated area
- safely use and maintain hand, power and machine tools
- select and use personal protective equipment (PPE) when working with tools, materials and machines, for example:
  - wear appropriate footwear
  - wear eye protection, eg welding helmets when MIG welding
  - wear protective clothing
- describe the WHS Act and WHS Regulations, and the role of SafeWork NSW in maintaining a safe workplace
- identify and apply the principles of risk management, for example:
  - identify a particular risk and implement risk-reduction procedures
- identify and apply the principles of first aid, for example:
  - outline the procedure to follow after a particular incident, eg burns, cuts

Design

Students:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available, for example: (ACTDEK046)
- identify and investigate factors influencing design in automotive technologies, for example:
  - motor vehicle standards
  - use of hybrid engines in passenger cars
- explain the operating principles of alternate energy systems in automotive technologies, for example:
  - electric
  - fuel cell
  - hybrid
  - hydrogen
- compare the power output of different types of engines
- identify materials commonly used in automotive bodies, for example:
  - aluminium
  - polymers
  - steel
- identify the functional and aesthetic aspects of design in automotive technologies, for example:
  - daytime running lights
  - front and rear wings for downforce and stability
- identify the major components of body and/or chassis systems, how they function and are maintained
- identify the major components of braking systems, how they function and are maintained
- identify the major components of steering and suspension systems, how they function and are maintained
- identify the major components of engine management systems, how they function and are maintained
- use and/or modify designs when completing projects (ACTDEP049)
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - use spreadsheets to calculate material quantities and monitor project costs
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects

Materials

Students:

- describe the properties of materials used in automotive contexts, for example:
  - metals and alloys
  - polymers and other composites
  - sheet, cast and manufactured materials
- select chemicals used in automotive contexts, for example:
  - fillers and adhesives
  - oils, greases and other lubricants
  - paints, lacquers and solvents
- identify and describe the properties of chemicals used in automotive contexts, for example:
  - paints, lacquers and solvents

Tools, equipment and techniques

Students:

- select and maintain appropriate hand tools for automotive tasks, for example:
  - body repair tools
  - socket wrenches and spanners to remove and replace components
- develop skills in using metalworking hand tools (ACTDEK046)
- develop skills in using automotive hand and power tools in the refurbishment of automotive projects, for example: (ACTDEK046)
  - dismantling a carburettor
  - preparing and finishing automotive parts
  - rebuilding a 4-stroke single-cylinder engine
  - rebuilding a 2-stroke engine
- select and maintain appropriate measuring tools for accuracy needed for tasks, for example:
  - compression testing of engine cylinders
  - load-testing of batteries
  - use a hydrometer to test a battery
- select and maintain appropriate machine and power tools for automotive tasks, for example:
  - check air fittings, eg pneumatic tools
  - ensure guards are in position, eg bench grinders
  - lubricate and adjust machinery, eg metal lathe
- investigate advanced manufacturing techniques to assist in the production of projects, for example:
  - CNC equipment, eg robotic welding, CNC milling machines
  - laser/plasma/water cutters
  - rapid prototyping
- develop skills in using metalwork and automotive hand, power and machine tools in the construction of a student negotiated project (ACTDEK046)

Workplace communication skills

Students:

- recognise and comply with WHS signage
- select and use specialist terminology in context, for example:
  - procedure/storyboard
- read and interpret plans and/or materials lists to prepare materials for the completion of projects
- produce annotated freehand sketches of project components and/or projects to visualise, communicate, understand and record ideas
- modify and/or apply workshop drawings in the completion of projects, for example:
  - use CAD applications in the production of workshop drawings
- develop design and production folios using appropriate ICT, for example:
  - CAD
  - project management tools
- prepare design and production folios to describe the management and processes undertaken in the production of practical projects

Societal and environmental impact

Students:

- investigate the environmental and societal impact of resources used in the development and production of practical projects
- discuss different fuels used to power engines in the past and present, for example:
  - diesel
  - ethanol
  - liquid petroleum gas (LPG)
  - petrol
- explain how fuels and lubricants are sourced and refined and investigate their impact on society and the environment
- describe the importance of alternative fuels to the automotive industry and how these affect the environment and society, for example:
  - biofuels
  - electricity, eg electric vehicles, hybrid vehicles
- explain the impact different automotive power sources have on the environment and society

Links to industry

Students:

- compare and contrast contemporary industrial manufacturing techniques, materials and equipment with classroom experiences
- identify relevant technologies and contrast with those used in the past
- investigate basic automotive systems used to design small-scale manufacturing and repair industries
- investigate Australia's role in global supply chains, for example:
  - design, eg locally produced power trains for imported vehicles
  - engineering
  - innovation
- compare and contrast careers and professions in the automotive industry, for example:
  - a mechanic compared to an engine reconditioner
  - auto electrician and mobile battery replacement service
  - panel beater and mobile dent/body repairer

Building and Construction Content for Years 7–10

The Building and Construction focus area provides opportunities for students to develop knowledge, understanding and skills in relation to the building and associated industries.

The Building and Construction 1 core module develops knowledge and skills in the use of tools, materials and techniques related to building and construction. These are enhanced and further developed through the study of the Building and Construction 2 specialist module.

Projects should reflect the practical nature of the Building and Construction focus area and provide opportunities for students to develop specific knowledge, understanding and skills related to building and construction technologies. These may include:

- construction of small structures
- scale models
- elementary repairs and renovations
- development of garden and recreational areas
- work undertaken on isolated building models and mock-ups.

Projects should promote the sequential development of skills, use a range of appropriate materials and reflect an increasing degree of student autonomy as they progress through the course.

Core Module: Building and Construction 1

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Content

WHS and risk management

Students:

- demonstrate safe workshop practices and procedures, for example:
  - work collaboratively
  - lift and carry materials safely
  - use appropriate sun protection when working outdoors
  - follow workshop signage instructions
- safely use and maintain hand, power and machine tools
- select and use personal protective equipment (PPE) when working with tools, materials and machines, for example:
  - wear eye protection, eg safety glasses when nailing
  - wear protective clothing, eg high visibility clothing
  - wear appropriate footwear
- apply the principles of risk management, for example:
  - hierarchies of control
  - identify a particular risk and implement risk-reduction procedures
- describe elementary first aid procedures, for example
  - outline the procedure to follow after a particular incident, eg burns, cuts

Design

Students:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available, for example: (ACTDEK046)
  - combining metal, timber and composites into single projects
  - interior and exterior lining material choices
  - structural sizes required
  - sustainability, eg renewably sourced materials
- identify and investigate factors influencing design in building and construction, for example:
  - availability and cost of materials
- use and/or modify existing designs when completing projects, for example:
  - paint colours to meet council requirements
  - window location, aspect and type
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - use spreadsheets to calculate material quantities and monitor project costs
- follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects, for example:
  - specialist trades managed on single/multiple projects
  - the effectiveness of teamwork

Materials

Students:

- investigate a range of materials used for footings, framing, flooring, roofing, cladding and internal linings
- investigate local council building codes and specifications
- identify materials specified by council for building in the local area
- explore the properties, applications and working characteristics of a range of materials commonly used in the building and construction industry, for example: (ACTDEK046)
  - fire ratings of external cladding and windows
  - laminated beams for long spans
  - reinforced concrete for increased strength
  - treatment of timber for termite protection
- identify the different applications of hardwoods, softwoods and metals and how, where and why they are used in the building industry
- explore the impact of defects in metal and timber materials on structural integrity in building and construction contexts
- identify and compare a range of fixtures and fittings used in building and construction, for example:
  - fascias
  - masonry fixings
  - skirtings and architraves
  - windows and doors

Tools, equipment and techniques

Students:

- use and adjust a range of hand tools in the production of practical projects, for example:
  - chiselling through a housing joint using a bevelled edge chisel
  - cutting framing timber using a handsaw
  - planing a door to fit a frame
  - skew nailing using a claw hammer
  - using a builders square to construct formwork
- maintain hand and power tools, for example:
  - sharpening a chisel
- apply correct measuring standards and methods to mark out and prepare materials from a workshop drawing
- accurately cut and prepare materials to size using a variety of tools and power tools, for example:
  - cutting a scribed joint using a coping saw
  - cutting plywood using a jigsaw
- develop and produce practical projects using a range of power tools and machines, for example:
  - installing a passage or lock set
  - machining a trench using a router
  - preparing a metal frame for riveting
- investigate a range of processes to prepare surfaces and apply finishes to metal and timber, for example:
  - abrading the surface of metal for some finishes, eg keying the surfaces
  - protecting timber for exterior applications
- apply appropriate detailing to a building and construction project to enhance its appearance and/or function, for example:
  - calculating mixes when adding colouring to concrete pavers
  - laying pavers in geometric patterns
- prepare and construct formwork for a simple concrete project, for example:
  - footings for a post stirrup/support
  - garden border
  - pavers
- identify and use a variety of joining and finishing techniques used on a range of construction materials to complete practical projects, for example:
  - connecting guttering and downpipes
  - constructing elementary brickwork
  - constructing small-scale timber frame
  - fixing plasterboard
- develop a simple floor plan using ICT as appropriate
- investigate residential building construction techniques in Australia over time, including those of Aboriginal and Torres Strait Islander builders/designers in the past and present
- investigate advanced manufacturing techniques to assist in the production of projects, for example:
  - CNC equipment, eg laser cutters, CNC milling machines
  - plasma/water cutters
  - precast concrete

Workplace communication skills

Students:

- recognise and comply with WHS signage, for example:
  - identify the colours and shapes associated with types of WHS signage
- select and use specialist terminology in context, for example:
  - glossary
  - exposition
  - procedure/storyboard
  - record of production
- read and interpret plans and/or materials lists to prepare materials for the completion of projects, for example:
  - architectural drawings and plans
  - identifying architectural symbols
  - pictorial drawings
- produce freehand sketches of project components and/or projects, for example:
  - sketch simple floor plans and elevations
- develop design and production folios using appropriate ICT, for example:
  - CAD
  - spreadsheets
- prepare design and production folios to describe the management and processes undertaken in the production of practical projects

Societal and environmental impact

Students:

- identify renewable and non-renewable resources in building and construction
- investigate and recognise issues relating to the sustainability and recyclability of resources in the building and construction industry
- understand ethical responsibilities surrounding Indigenous cultural and intellectual property, for example:
  - protocols associated with Aboriginal and/or Torres Strait Islander cultural expression in contemporary architecture
- discuss the impact of renewable resources in the building and construction industry on society and the environment, for example:
  - plantation timbers
- investigate and identify alternate materials used in modern building and construction, for example: (ACTDEK046)
  - melamine coated and laminated boards
  - engineered I-joists
  - composite products, eg eco decking
- describe Australia's environmental building rating systems, for example:
  - green star rating
- identify the impact of a range of cultures on the building and construction industry, for example:
  - Aboriginal and/or Torres Strait Islander Peoples' designs such as housing, cultural centres and keeping places
  - Japanese construction methods, eg the relationship between indoor and outdoor

Links to industry

Students:

- compare industrial production processes to those used in the classroom, for example:
  - commercial concrete walls being formed and poured on-site
  - frames being produced off-site
  - laser measuring and levelling equipment
  - using a nail gun to assemble house frames
- identify alternative historical technologies appropriate to the task and the material being used, for example:
  - using a water level
  - fixing weatherboards for cladding
- investigate a range of career paths in the building industry, for example:
  - a kitchen cabinetmaker compared to a builder
  - a concreter compared to a project manager

Specialised Module: Building and Construction 2

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Content

WHS and risk management

Students:

- demonstrate safe workshop practices and procedures, for example:
  - safe handling and storage of chemicals and materials
  - safety fencing around outdoor projects
  - work collaboratively
- safely use and maintain hand, power and machine tools
- select and use personal protective equipment (PPE) when working with tools, materials and machines, for example:
  - wear appropriate footwear
  - wear eye protection, eg safety glasses when using power tools
  - wear protective clothing
- describe the WHS Act and WHS Regulations, and the role of SafeWork NSW in maintaining a safe workplace, for example:
  - complete SafeWork NSW Whitecard Training
- identify and apply the principles of risk management, for example:
  - identify a particular risk and implement risk-reduction procedures
- identify and apply the principles of first aid, for example:
  - outline the procedure to follow after a particular incident, eg burns, cuts

Design

Students:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available, for example: (ACTDEK046)
  - combining metal, timber and composites into single projects
- identify and investigate factors influencing design in building and construction, for example:
  - material selection for architectural designs
  - site aspect and topography
- identify the functional and aesthetic aspects of design in building and construction, for example:
  - select plant types most suited to individual locations and incorporate these plants into a landscape design
- use and/or modify designs when completing projects (ACTDEP049)
- calculate and manage quantities and costs of materials and components used in the completion of projects, for example:
  - determine processes for the efficient use of materials
  - use spreadsheets to calculate material quantities and monitor project costs
- explore building and construction projects using a range of sources, for example:
  - books
  - internet
  - magazines
  - photographic images
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects

Materials

Students:

- select and use materials most suitable for completing a construction, renovation or landscaping project
- investigate the advantages and disadvantages of different materials, for example:
  - steel structural beams and laminated timber beams
  - treated and untreated timber
- identify defects in solid timber, timber products and allied materials
- describe the effect of defects on structural properties of construction, renovation or landscaping materials and apply techniques to overcome such defects where possible
- describe the properties and applications of a range of materials associated with construction, renovation or landscaping projects, for example: (ACTDEK046)
  - decorative blocks (keystones)
  - irrigation systems
  - plumbing systems
  - tiles
- compare the properties and applications of a range of materials associated with construction, renovation or landscaping projects, for example: (ACTDEK046)
  - bricks, blocks and pavers
  - roofing materials
  - sand, soil and gravel, crusher dust (recycled)
  - solid timbers and manufactured boards

Tools, equipment and techniques

Students:

- use and adjust hand and power tools in the development and production of projects
- identify and use a range of equipment and technologies used in construction, renovation or landscaping projects, for example:
  - for cutting and joining a range of materials
  - for elementary demolition and stripping out
  - for levelling, eg laser level, rotary level
  - for site marking out, preparation and excavation
- identify, select and use a range of hand and power tools for cutting, shaping and joining exercises associated with construction, renovation or landscaping projects, for example: (ACTDEK047)
  - using a hacksaw to complete plumbing or garden irrigation project
  - using a sheet metal bender to fold galvanised mesh to create a planter box
- adjust and maintain appropriate hand and power tools, for example:
  - changing blades on a jigsaw
  - changing discs on an angle grinder
- apply a range of specialist tools for specific purposes, for example:
  - a pallet trolley for moving materials
  - a reciprocating saw for demolition
  - an automatic level for setting heights for formwork
- set out and prepare sites for building projects, for example:
  - ensuring an earth leakage power supply exists when necessary
  - erecting temporary fencing around a project
  - using a water level to determine fall
- apply a range of processes and techniques related to the construction of projects, for example:
  - decks or paved areas
  - foundations, concrete slabs and footings
  - retaining walls and garden areas
  - simple framed structures with piers, bearers and joists
- use jigs and replica construction teaching aids to assist in the production or minor maintenance of projects, for example:
  - non-structural repairs to buildings
  - prepare and fix tiles to either walls or floors
  - simple garden furniture, garden edging or garden structures
- identify, evaluate, select and use suitable processes and techniques for the marking out, setting out and production of construction-specific projects, for example: (ACTDEK047)
  - drainage, ponds and irrigation systems
  - driveways or walkways
  - fences, solid block or brick walls
  - framework suitable for a cubby house, gazebo, pergola, room, shed or small extension that may be fitted with a window, roof, door and/or cladding
- investigate advanced manufacturing techniques to assist in the production of projects, for example:
  - CNC equipment, eg laser cutters
  - plasma/water cutters
  - precast concrete

Workplace communication skills

Students:

- recognise and comply with WHS signage
- select and use specialist terminology in context, for example:
  - procedure/storyboard
  - use specialist terms in context
- read and interpret plans, working/layout drawings, building plans and/or materials lists to prepare materials for the completion of projects, for example:
  - elevations and cross-sections
  - site plans
- produce annotated freehand sketches of project components and/or projects to visualise, communicate, understand and record ideas
- modify and/or apply workshop drawings in the completion of projects, for example:
  - use CAD applications in the production of workshop drawings
- develop planning and production details to assist in the production of projects, for example:
  - materials lists
  - specifications
- develop design and production folios using appropriate ICT, for example:
  - CAD to visualise projects prior to production of 2D plans/workshop drawings
  - project management tools
- prepare design and production folios to describe the management and processes undertaken in the production of practical projects

Societal and environmental impact

Students:

- investigate the effects of the building and construction industry on society and the physical environment, for example:
  - impact of water run-off on local waterways
  - impact on native flora and fauna
  - local government codes and regulations about aesthetics
- analyse the use of plantation timbers and old-growth forest timbers in construction or renovation
- describe the use of recycled materials in construction, renovation or landscaping projects and their impact on landfill and society
- describe the environmental and societal impact of resources used in the development and production of projects

Links to industry

Students:

- compare and contrast contemporary industrial manufacturing techniques, materials and equipment with classroom experiences
- describe the effects of new and emerging technologies on careers and professions in construction, renovation or landscaping
- investigate industrial/commercial techniques in building and construction, for example: (ACTDEP052)
  - computer-aided design (CAD) and computer-aided manufacturing (CAM) in these industries
  - prefabrication
- compare and contrast careers and professions in the building industry, for example:
  - carpenter compared to a builder

Electronics Content for Years 7–10

The Electronics focus area provides opportunities for students to develop knowledge, understanding and skills in relation to the electronics and associated industries.

The Electronics 1 core module develops knowledge and skills in the use of tools, materials and techniques related to electronics technologies. These are enhanced and further developed through the study of the Electronics 2 specialist module.

Practical projects should reflect the nature of the Electronics focus area and provide opportunities for students to develop specific knowledge, understanding and skills related to electronics-related technologies. These may include:

- electronic circuits and kits
- electronic-controlled devices
- robotic projects

Projects should promote the sequential development of skills and reflect an increasing degree of student autonomy as they progress through the course.

Core Module: Electronics 1

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Content

WHS and risk management

Students:

- demonstrate safe workshop practices and procedures, for example:
  - clamp materials securely when cutting or drilling with tools and equipment
  - follow workshop signage instructions
  - solder in well-ventilated areas
  - work collaboratively
- safely use and maintain hand, power and machine tools, for example:
  - check cables are in good working order
- ensure all main electrical products are safety tested and tagged
- select and use personal protective equipment (PPE) when working with tools, materials and machines, for example:
  - wear appropriate footwear
  - wear eye protection, eg safety glasses when soldering
  - wear protective clothing
- apply the principles of risk management, for example:
  - hierarchies of control
  - identify a particular risk and implement risk-reduction procedures
- describe elementary first aid procedures, for example:
  - outline the procedure to follow after a particular incident, eg burns, cuts

Design

Students:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available (ACTDEK046)
- identify and investigate factors influencing design in electronics, for example:
  - allow for component function, value and layout
  - carry out simple modifications to existing circuit designs
- identify methods of prototyping designs before manufacture, for example:
  - breadboard a circuit
  - use circuit simulation software
- apply a range of techniques and skills to enhance the appearance and/or function of electronics projects, for example:
  - adding components, eg switches, light-emitting diodes (LEDs)
  - applying finishes, eg spray painting
  - constructing cases
  - project packaging
- investigate printed circuit board (PCB) pattern design, for example:
  - software to design, modify and simulate PCBs
- use and/or modify existing designs when completing projects
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - use spreadsheets to calculate material quantities and monitor project costs
- follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects

Materials

Students:

- investigate components used in elementary electronics, for example:
  - capacitors
  - resistors
  - transistors
- identify, understand and use a range of electrical components in the production of practical projects
- interpret codes and units of measurement for electronic components
- identify and use a variety of semiconductors and components, for example:
  - diodes
  - special purpose resistors, eg light-dependent resistors
  - transistors
- identify and use different types of wires
- identify a variety of component mounting methods, for example:
  - single- and double-sided printed circuit boards (PCBs)
  - surface mount
  - veroboard
- investigate solder applications, for example:
  - common solder compositions
  - lead-free solder
  - resin core solder
- apply elementary PCB construction methods, for example:
  - CNC milling of PCBs
  - etching of PCBs

- design and produce project housings
- investigate the characteristics and working properties of a range of materials, for example:
  - acrylic
  - plywood
  - sheet metal
  - solder
- construct a circuit housing using a range of suitable materials, for example:
  - acrylic
  - sheet metals
  - timber and timber products

Electronic concepts

Students:

- explore fundamental electricity principles, for example:
  - electrical units
  - the flow of electricity
- explain the operation of simple circuits
- calculate voltage, current and resistance using Ohm's law
- calculate values for capacitors in series and in parallel
- calculate values for resistors in series and in parallel
- calculate values for components in series and in parallel
- calculate elementary circuit values, for example:
  - resistance between two points in a circuit
- perform calculations using Kirchhoff's law in simple circuits
- convert orders of magnitude in electronic units of measurement
- describe the elementary concept of electrical current, for example:
  - drawing a graph that represents Direct Current (DC)
  - drawing a graph that represents Alternating Current (AC)
- describe electronic systems, for example:
  - using block diagrams to represent input, processing and output
- investigate applications of coil winding, for example:
  - inductance
- describe basic Amplitude Modulation (AM) transmission
- explain modulation and rectification in AM reception
- describe basic Frequency Modulation (FM) transmission
- identify and describe a range of sources of power, for example:
  - batteries
- investigate power generation, for example:
  - coal fired
  - gas
  - solar
  - tidal
  - wind
- investigate electrical power distribution, for example:
  - distribution transformers
  - power stations and grids

Tools, equipment and techniques

Students:

- use a range of hand tools and equipment in the construction of electronic circuits and circuit housings, for example:
  - circuit construction
  - marking out, cutting and shaping
  - soldering and desoldering
  - testing and measuring components
- apply a range of appropriate equipment to create and assemble circuits, for example:
  - a range of pliers
  - desoldering pump/desoldering braid
  - etchant tanks and related equipment to produce PCBs
  - wire strippers
- construct circuits using a soldering iron
- develop skills in the use of soldering equipment, for example:
  - soldering components together to form a simple circuit
  - mounting components on a PCB
- apply a range of machines and power tools, for example:
  - portable power tools and machines used for drilling and cutting
- construct project housings using appropriate techniques, for example:
  - advanced manufacturing technologies, eg 3D printer
  - sawing, drilling, bending and gluing
- read and measure values for circuit components, for example:
  - identifying component values
  - identifying resistor values from the coloured bands
  - measuring components, eg using a multimeter
- test circuits when producing practical projects, for example:
  - multimeters
- diagnose and rectify faults in circuits using fault-finding practices, for example:
  - continuity test
  - visual inspection
- select an appropriate power supply for a circuit, for example:
  - 9V battery
  - supply from a USB port on a computer
- investigate advanced manufacturing techniques to assist in the production of projects, for example:
  - CNC equipment, eg laser cutters, CNC milling machines
  - rapid prototyping

Workplace communication skills

Students:

- recognise and comply with WHS signage, for example:
  - identify the colours and shapes associated with types of WHS signage
- select and use specialist terminology in context, for example:
  - glossary
  - procedure/storyboard
  - record of production
- read and interpret plans and/or materials lists to prepare materials for the completion of projects, for example:
  - component codes for resistors, capacitors, transistors, LEDs and specialised components

- interpret and follow technical and safety data relating to components and chemicals
- produce freehand sketches of project components and/or projects, for example:
  - project housing plans
- produce circuit schematic diagrams, workshop and pictorial drawings, for example:
  - CAD to design project housings
  - CAD to prepare schematic circuit diagrams
  - freehand diagrams and sketches
  - software to prepare and print PCB layouts
- develop design and production folios using appropriate ICT, for example:
  - CAD
  - simulations
  - spreadsheets
- prepare design and production folios to describe the management and processes undertaken in the production of practical projects

Societal and environmental impact

Students:

- recognise the importance of conservation of materials including renewable and non-renewable resources in the electronics industry, explaining the impact of these on society and the physical environment, for example:
  - reclaiming of materials from decommissioned computer circuit boards
  - using local council chemical drop-off points
  - disposal of chemical etchants
  - recycling of electronic devices, eg mobile phone batteries
- investigate issues relating to the sustainability of resources in the electronics industry, for example:
  - compare battery types and the environmental impacts of each
  - rechargeable batteries
  - the introduction of small and lightweight batteries
- describe a range of power-generation techniques and their relative impacts on the environment
- explore the impact of the electronics industry on society and the environment, for example:
  - mobile communication devices
  - social media

Links to industry

Students:

- compare industrial production processes to those used in the classroom, for example:
  - commercial PCB production
  - industrial soldering process, eg wave soldering compared to manual soldering
- identify alternative historical technologies appropriate to the task and the material being used
- investigate a range of career paths in the electronics industry, for example:
  - auto electrician
  - electrical engineer
  - electrician
  - repair technician

Specialised Module: Electronics 2

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Content

WHS and risk management

Students:

- demonstrate safe workshop practices and procedures, for example:
  - apply safe procedures when handling etching agents
  - clamp materials securely when cutting or drilling
  - solder in well-ventilated areas
  - work collaboratively
- safely use and maintain hand, power and machine tools
- select and use personal protective equipment (PPE) when working with tools, materials and machines, for example:
  - wear appropriate footwear
  - wear eye protection, eg safety glasses when using power tools
  - wear protective clothing
- describe the WHS Act and WHS Regulations, and the role of SafeWork NSW in maintaining a safe workplace
- identify and apply the principles of risk management, for example:
  - identify a particular risk and implement risk-reduction procedures
- identify and apply the principles of first aid, for example:
  - outline the procedure to follow after a particular incident, eg burns, cuts

Design

Students:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available (ACTDEK046)
- identify and investigate factors influencing design in electronics, for example:
  - allow for component function, size and value
- identify the functional and aesthetic aspects of design in electronics, for example:
  - project housings that are safe for end users
  - resource and component selection
- use and/or modify designs when completing projects (ACTDEP049)
  - allow for component function, value and layout
  - carry out simple modifications to existing circuit designs
  - reverse-engineering project kits to enable modification
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - determine processes for the efficient use of materials
  - use spreadsheets to calculate material quantities and monitor project costs
- justify choice of materials, components, processes and equipment, for example:
  - ABS premade jiffy boxes
  - aluminium panels for mounting switchgear
  - breadboards for prototyping
  - solder composition
- produce schematic and working drawings of circuits, housings and projects, for example:
  - sketches of schematic drawings
  - use CAD for PCB layout and production
  - use CAD for project and housing design
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects

Materials

Students:

- compare the advantages and disadvantages of different wire types in the development and production of practical projects, for example:
  - electronic and LAN cable
  - hook-up, jumper and lead wire
  - paired and non-paired
  - ribbon cable
- investigate the use of transmission media, for example:
  - data cabling
  - fibre-optic
  - wire types
- select and use a range of components and allied hardware in the development and production of practical projects, for example:
  - heat shrink
  - heat sinks
  - integrated circuit (IC) sockets
  - mountings/stand-offs
  - switches

- explore input/output devices, for example:
  - free-running motor
  - piezo devices
  - relays
  - solenoid
- create a PCB using appropriate materials and processes, for example:
  - advanced manufacturing technologies, eg CNC milling machine
  - use of solvents, etchants and photo-etching chemicals
- design and produce project housings
- describe the function of and use of dual in-line (DIL) series of integrated circuits (ICs), for example:
  - 4000 series
  - 555 timers
  - 7400 series
  - operational amps
- identify and use control technologies in circuit design and production, for example:
  - microcontrollers
  - relays
  - transistors
- use control technologies components and accessories in practical projects
- identify and use sensing devices in the production of practical projects, for example:
  - infra-red sensors
  - light-dependent resistors (LDR)
  - temperature sensors
  - ultrasonic sensors
- select and justify appropriate materials for project housings

Electronic concepts

Students:

- calculate voltage, current and resistance using Ohm's law in circuits
- perform calculations using Kirchhoff's law in circuits
- explore the concept of electrical current, for example:
  - drawing a graph that represents Direct Current (DC)
  - drawing a graph that represents Alternating Current (AC)
- describe electronic systems, for example:
  - using block diagrams to represent input, processing and output
- explain the principles of electromagnetism and induced currents
- explain inductance process and transformation of power
- identify AC/DC motors and generators, for example:
  - dynamo
  - servo motor
  - stepper motors
- describe types of transformers
- examine the function of sensing devices, for example:
  - distance
  - light
  - movement
  - temperature
- program and debug control technologies in practical projects
- read and interpret logic diagrams using AND, OR, NAND and/or NOR gates
- recognise counting and decision components, for example:

  - interpreting a basic logic gate circuit (AND, OR, NAND and/or NOR gates)
- explain the operation of amplifiers
- explain the use of fibre-optics
- describe the use of optical infra-red components
- explore a variety of wireless transmission technologies, for example:
  - Bluetooth
  - infra-red
  - radio
  - wi-fi

Tools, equipment and techniques

Students:

- select and use a range of power and machine tools in the production of practical projects, for example:
  - portable power tools and machines used for drilling and cutting
  - soldering irons in circuit construction
- use diagnostic and measurement equipment, for example:
  - use a multimeter to measure current and voltage
  - use an oscilloscope to diagnose components
- apply diagnostic, fault-finding, measuring and testing methods, for example:
  - logic probes
  - measuring a range of circuit outputs
  - oscilloscope
  - signal generators
- design and construct PCBs, for example:
  - use of software to develop PCB pattern design for third-party manufacture
- select a variety of sensors for use in control devices
- select DIL integrated circuits in the development and production of practical projects
- investigate advanced manufacturing techniques to assist in the production of projects, for example:
  - CNC equipment, eg laser cutters, CNC milling machines
  - rapid prototyping

Workplace communication skills

Students:

- recognise and comply with WHS signage
- select and use specialist terminology in context, for example:
  - glossary
  - procedure/storyboard
  - record of production
- read and interpret plans and/or materials lists to prepare materials for the completion of projects, for example:
  - component codes for resistors, capacitors, transistors, LEDs and specialised components
- read and interpret circuit schematic diagrams and technical data sheets
- interpret and follow technical and safety data relating to components and chemicals
- produce annotated freehand sketches of project components and/or projects to visualise, communicate, understand and record ideas
- modify and/or apply workshop drawings in the completion of projects, for example:
  - use CAD applications in the production of workshop drawings

- produce circuit schematic diagrams, workshop and pictorial drawings, for example:
  - CAD to design project housings
  - CAD to prepare schematic circuit diagrams
  - freehand diagrams and sketches
  - software to prepare and print PCB layouts
- develop design and production folios using appropriate ICT, for example:
  - CAD
  - project management tools
  - simulations
- prepare design and production folios to describe the management and processes undertaken in the production of practical projects, for example:
  - detailing the design, production and evaluation of projects
  - justifying design decisions and the selection of materials, components and processes
  - prepare and use component lists
  - producing schematic diagrams

Societal and environmental impact

Students:

- explain the impact of electronics on society, for example:
  - impact on employment
  - safer workplaces
- investigate the use of recycling in the electronics industry, for example:
  - disposal of printer cartridges
- investigate the impact of power transmission on society and the environment, for example:
  - electromagnetic fields associated with electronic devices
- explain the environmental impact of the resources used in the development and production of projects, for example:
  - use of non-renewable resources, eg gold contacts in mobile phones
- explore the societal impact of the development and production of electronic projects, for example:
  - accessible transport devices for people with disability, eg motorised mobility scooter
  - impact of mobile phones on the productivity of workers
  - installation of surveillance cameras in public places
  - use of mobile phones to contact children
- discuss an example of an ethical issue in the electronics industry, for example:
  - built-in product redundancy

Links to industry

Students:

- compare and contrast contemporary industrial manufacturing techniques, materials and equipment with classroom experiences, for example:
  - surface mount process of circuit construction
- identify new and emerging technologies and contrast with those used in the past
- describe the impact of robotics/mechatronics on industry
- compare and contrast careers and professions in the electronics industry, for example:
  - an electrician compared to an auto electrician

Engineering Content for Years 7–10

The Engineering focus area provides opportunities for students to develop knowledge, understanding and skills in relation to engineering and its associated industries.

The Engineering 1 core module includes common content and topic content that develops knowledge and skills in the use of tools, materials and techniques related to Engineered Structures and Engineered Mechanisms.

These are enhanced and further developed through the study of specialist modules in:

- Alternative Energy
- Control Systems
- School-Developed Module
- Transport

Practical projects should reflect the nature of the Engineering focus area and provide opportunities for students to develop specific knowledge, understanding and skills related to engineering. These may include:

- a range of devices and appliances
- electronic and mechanical control systems
- programmable microcontrollers
- robotics projects
- small structures
- small vehicles

Projects should promote the sequential development of skills and reflect an increasing degree of student autonomy as they progress through the course.

Core Module: Engineering 1

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Common Content for Topics 1 and 2

Common content must be integrated with either Topic 1 and/or Topic 2 content.

WHS and risk management

Students:

- demonstrate safe workshop practices and procedures, for example:
  - clamp materials securely when cutting or drilling
  - follow electrical safety procedures
  - follow workshop signage instructions
  - work collaboratively
- safely use and maintain hand, power and machine tools
- select and use personal protective equipment (PPE) when working with tools, materials and machines, for example:
  - wear appropriate footwear
  - wear eye protection, eg safety glasses when cutting materials
  - wear protective clothing
- apply the principles of risk management, for example:
  - hierarchies of control
  - identify a particular risk and implement risk-reduction procedures
- describe elementary first aid procedures, for example:
  - outline the procedure to follow after a particular incident, eg burns, cuts

Materials

Students:

- classify engineering materials into groups, for example:
  - ceramics, eg building ceramics, engineering ceramics
  - metals and alloys, eg ferrous, non-ferrous metals
  - polymers, eg thermosetting, thermoplastic
- investigate the properties, structure and applications of typical materials used in engineered projects, for example: (ACTDEK043)
  - metals and alloys, eg steel, aluminium, brass and copper
  - non-metals, eg polymers, ceramics, composites and smart materials
- conduct experiments and tests to explore the properties of materials, for example:
  - environmental properties, eg corrosion resistance, embodied energy
  - mechanical properties, eg tensile strength, hardness, toughness, elasticity, ductility
- investigate the concept of material corrosion and degradation, for example:
  - conduct experiments to investigate factors that influence the corrosion of a steel component
  - outline a range of processes and techniques for protecting materials when in service
- investigate the modification of materials to improve their mechanical and chemical properties, for example:
  - cladding, eg tinplate
  - heat treatment, eg case hardening
  - reinforcement, eg glass reinforced polymers
- compare engineering joining methods, for example:
  - adhesives, eg laminated timber beams
  - rivets, bolts and welding
- apply materials in the design and production of engineering projects based on an understanding of their properties, for example:
  - corrosion resistance
  - malleability
  - torsional and shear strength
  - toughness

Tools, equipment and techniques

Students:

- construct engineering projects, for example:
  - paper/balsa towers and beams
  - plaster arches and roller-coasters
  - slot car with geared drive line
- apply measuring standards and methods, for example:
  - accurately cut and prepare materials to size
  - measure and mark out project details from a technical drawing
- use and adjust a wide range of hand tools in the production of practical projects, for example:
  - assembly tools, eg screwdriver, rivet gun
  - holding tools, eg pliers, engineers vice
  - sawing tools, eg hacksaw, tenon saw
- conduct experiments, produce prototypes and practical projects using appropriate tools, equipment, machinery, for example:
  - marking-out tools, eg ruler, try square, scriber, dividers
  - sawing tools, eg hacksaw, tenon saw
  - shaping tools, eg file, disc sander
  - using power tools to drill, cut, sand, shape and join components of practical projects

- investigate advanced manufacturing techniques to assist in the production of projects, for example:
  - CNC equipment
  - laser/plasma/water cutters
  - rapid prototyping
- explore design construction sequencing and collaborative processes, for example:
  - teamwork in pasta bridge construction
- examine work practices and apply these to quality practical projects, for example:
  - comparing performance using different construction methods
- evaluate work practices and practical projects in terms of quality, for example:
  - the efficient use of materials

Workplace communication skills

Students:

- recognise and comply with WHS signage, for example:
  - identify the colours and shapes associated with types of WHS signage
- select and use specialist terminology in context, for example:
  - describe the manufacturing process of a particular part
  - develop a glossary related to mechanisms or structures
  - create a record of production
- read and interpret plans and/or materials lists to prepare materials for the completion of projects, for example:
  - orthogonal drawings containing projected top and front views
  - pictorial drawing showing relationships between component parts
- produce freehand sketches of project components and/or projects, for example:
  - position of members in various truss designs
  - shape options for a component, eg a cam or a ratchet
- complete graphics applying Australian Standards for drawing, for example:
  - orthogonal top and front views of a gear or other component of a mechanism
  - pictorial drawing showing relationships between component parts
  - use correct standards for representing threaded components
- develop engineering reports using appropriate ICT, for example:
  - CAD
  - graphing results
  - simulations
  - spreadsheets
- prepare engineering reports to describe the management and processes undertaken in the production of practical projects, for example:
  - identifying the materials, processes and equipment used

Societal and environmental impact

Students:

- recognise the importance of the conservation of materials and recycling in engineering, for example:
  - recycling of concrete, eg aggregate, steel
  - design of members to reduce excess material usage
- outline the impact of engineering on society and the environment, for example: (ACTDEK041)
  - street-sweeper vehicles
  - wind turbines
  - lifting of wheelchairs onto vehicles

- explore ethical, social and legal issues that apply to engineered solutions, for example:
  - damage to water courses during construction of infrastructure projects
  - increase in accessible architecture
  - introduction of mechanisms that reduce the number of workers in a manufacturing sector
  - mobile phone communication towers
- compare and contrast renewable and non-renewable resources, for example:
  - steel production, eg iron ore extraction compared to recycling

Links to industry

Students:

- compare industrial production processes to those used in the classroom, for example:
  - computer numerically controlled (CNC) machinery compared to traditional mechanically controlled machinery
  - material cutting technologies
- describe recent and emerging technologies in engineering, for example:
  - computer simulation and testing
  - tilt slab construction
- investigate a range of career paths in engineering, for example:
  - aeronautical engineer
  - mechanical engineer
  - project manager
  - structural engineer

Topic 1: Engineered Structures

Content

Design

Students:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available (ACTDEK046)
- identify and investigate factors influencing design in engineered structures, for example:
  - Aboriginal Health College at Little Bay, NSW
  - Sydney Harbour Bridge
  - Sydney metro rail projects
  - Sydney Opera House
  - wooden truss bridges in NSW road/rail systems
- apply elementary engineering principles and processes in the design and production of structures, for example: (ACTDEK043)
  - cantilevers
  - strength to weight ratios
  - the use of triangles in frames
- investigate innovative design solutions appropriate to engineered structures, for example: (ACTDEK043)
  - the design and construction of landmark structures, eg Olympic stadia around the world
  - the London Eye
- select correct International System of Units (SI) and Australian Standards for design, for example:
  - correct units for length, area and volume
- use and/or modify existing designs when completing projects
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - use spreadsheets to calculate material quantities and monitor project costs
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects, for example:
  - develop criteria to evaluate engineering design choices

Engineering principles and processes

Students:

- investigate the reasons for engineered structures, for example:
  - access, eg bridges, roads
  - resources, eg dams, wind farms
  - shelter, eg houses, unit blocks
- explore the elements and design of structures, for example:
  - bridges, eg arch, beam, cantilever
  - truss components, eg joints, members, supports, struts, ties
- identify fundamental quantities, derived quantities and their units, for example:
  - force, mass, acceleration
- identify the forces that act on structures, for example:
  - wind loads, live loads, weight

- explore the effects of forces on structures, for example:
  - calculate reactions for a simply supported beam
  - destructive testing
  - non-destructive testing, eg online simulations
- design and construct simple structures for specific purposes

Topic 2: Engineered Mechanisms

Content

Design

Students:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available (ACTDEK046)
- identify and investigate factors influencing design in engineered mechanisms, for example:
  - energy sources
  - intended application
  - material choices
- describe past, present and future challenges in the application of engineered mechanisms, for example:
  - assistive technologies, eg prosthetic limbs
  - development of the bicycle
- apply correct International System of Units (SI) and Australian Standards relevant to engineering design
- use and/or modify existing designs when completing projects
- apply Australian Drawing Standards in the development of engineered mechanisms
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - use spreadsheets to calculate material quantities and monitor project costs
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects, for example:
  - develop criteria to evaluate engineering design choices

Engineering principles and processes

Students:

- analyse and describe the function and operation of mechanisms, for example:
  - dismantle and reassemble mechanisms to understand how they work
  - gears, belts and pulleys, levers, chains, cam and follower, linkages
- conduct experiments to demonstrate an understanding of engineering principles
  - components that make up mechanisms
  - the nature and purpose of mechanisms
- investigate mechanical advantage (MA), velocity ratio (VR) and efficiency in mechanisms, for example:
  - calculate MA of a lever system, eg increasing the length of a lever arm or moving the fulcrum position
  - calculate VR of a pulley system
- investigate friction and its significance to the operation of mechanisms, for example:
  - how friction can be both an advantage and disadvantage in a mechanism
  - investigating the effect of contact surface area on static friction

- investigate energy sources that may be used in mechanisms, for example:
  - batteries and motors
  - gravity
  - rubber bands
  - springs
- investigate the relationship between components in complex mechanisms, for example:
  - develop projects using combinations of mechanisms
- design and construct mechanisms for specific purposes

Specialised Module: Alternative Energy

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Content

WHS and risk management

Students:

- demonstrate safe workshop practices and procedures, for example:
  - clamp materials securely when cutting or drilling
  - follow electrical safety procedures
  - follow workshop signage instructions
  - work collaboratively
- safely use and maintain hand, power and machine tools
- select and use personal protective equipment (PPE) when working with tools, materials and machines, for example:
  - wear appropriate footwear
  - wear eye protection, eg safety glasses when using power tools
  - wear protective clothing
- describe the WHS Act and WHS Regulations, and the role of SafeWork NSW in maintaining a safe workplace
- identify and apply the principles of risk management, for example:
  - identify a particular risk and implement risk-reduction procedures
- identify and apply the principles of first aid, for example:
  - outline the procedure to follow after a particular incident, eg burns, cuts

Design

Students:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available (ACTDEK046)
- examine the relationships between structure, properties and the application of materials in engineered projects
- identify and investigate factors influencing design in alternate energy, for example:
  - efficient energy use
  - efficient use of materials
  - reliability of the system
- investigate past, present and future challenges and achievements in the design of traditional and/or alternative energy systems, for example:
  - coal-fired power stations
  - hydro-electric power generation
  - steam engines
  - water wheels
- identify the functional and aesthetic aspects of design in alternate energy, for example:
  - appropriate geographic location of solar farms and wind turbines
  - calculate the number of solar cells required to produce the energy needs of a system
  - impact of wind farms on the visual amenity of the landscape
- apply International System of Units (SI) and Australian Standards relevant to engineering design
- use and/or modify designs when completing projects (ACTDEP049)
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - determine processes for the efficient use of materials
  - use spreadsheets to calculate material quantities and monitor project costs
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects, for example:
  - develop criteria to evaluate engineering design choices

Engineering principles and processes

Students:

- examine the components of an alternative energy system
- explore the need for alternative energy systems, for example:
  - diminishing non-renewable resources
  - reduced pollution
- investigate alternative energy options, for example:
  - research emerging technologies
  - types of systems, eg wind, solar, wave, human, geothermal
- compare the advantages and disadvantages of alternative energy systems
- evaluate applications and alternatives of current energy systems, for example:
  - coal-fired power station
  - internal combustion engine
  - solar panel collection
- represent alternative energy systems using suitable CAD or 3D modelling programs
- identify electrical units and values of voltage, power, current and energy in relation to alternative energy systems

- investigate batteries, for example:
  - compare outputs from several battery types
  - justify battery choice for various applications
  - recycling and recyclability
- modify system components to enhance characteristics and properties, for example:
  - measuring the effect of aiming a solar cell towards a light source
  - plan and construct a working model
  - prototype of an alternative energy system

Materials

Students:

- apply materials in the design and construction of projects based on an understanding and analysis of their properties, for example:
  - corrosion resistance/protection
  - durability
  - manufacturing properties
  - service life
  - yield strength
- investigate the properties, structures and applications of materials in alternative energy systems, for example:
  - metals and alloys, eg ferrous and non-ferrous metals
  - non-metals, eg polymers, ceramics, composites and smart materials

Tools, equipment and techniques

Students:

- use a range of equipment, hand and power tools, and machines to carry out experiments and construct projects/working models/prototypes, for example:
  - holding and joining tools
  - marking-out and cutting tools
  - using power tools to drill, cut, shape and assemble components
  - wind-powered generator, solar-powered vehicle and/or lighting systems
- develop skills in measuring the efficiency of alternative energy sources, for example:
  - measuring output from a solar panel under various conditions
- plan and construct or simulate a working model, prototype or full-scale alternative energy system, for example:
  - power a small robotic device using a solar panel
- develop or use a testing jig or apparatus to analyse properties of materials
- investigate advanced manufacturing techniques to assist in the production of projects, for example:
  - CNC equipment
  - laser/plasma/water cutters
  - rapid prototyping

Workplace communication skills

Students:

- recognise and comply with WHS signage

- select and use specialist terminology in context, for example:
  - glossary
  - labelled drawings
  - procedure/storyboard
  - record of production
- read and interpret plans and/or materials lists to prepare materials for the completion of projects
- produce annotated freehand sketches of project components and/or projects to visualise, communicate, understand and record ideas
- modify and/or apply workshop drawings in the completion of projects, for example:
  - use CAD applications in the production of workshop drawings
- sketch and draw engineering solutions using International System of Units (SI) and Australian Standards, for example:
  - apply correct standards to projection between views
  - show components of a system using pictorial sketches
  - use CAD software
- develop engineering reports using appropriate ICT, for example:
  - CAD
  - graph results
  - project management tools
  - spreadsheets
- prepare engineering reports to describe the management and processes undertaken in the production of practical projects, for example:
  - identifying the materials, processes and equipment used

Societal and environmental impact

Students:

- analyse the impact of alternative energy sources on society and the environment, for example:
  - energy costs
  - land use
  - pollution reduction
- compare and contrast renewable and non-renewable energy resources used by engineers, for example:
  - energy from fossil fuels
  - solar power
  - wind farms

Links to industry

Students:

- compare and contrast contemporary industrial manufacturing techniques, materials and equipment with classroom experiences
- analyse emerging technologies in engineering, for example:
  - storage systems, eg fuel cells, lithium-air batteries
  - smart electrical distribution grids
  - smart meters
- identify and discuss various career opportunities in engineering that are involved in alternative energy, for example:
  - chemical engineering, eg hydrogen fuel cell development and manufacture
  - electrical engineering, eg solar cell manufacture

Specialised Module: Control Systems

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Content

WHS and risk management

Students:

- demonstrate safe workshop practices and procedures, for example:
  - clamp materials securely when cutting or drilling
  - follow electrical safety procedures
  - follow workshop signage instructions
  - work collaboratively
- safely use and maintain hand, power and machine tools
- select and use personal protective equipment (PPE) when working with tools, materials and machines, for example:
  - wear appropriate footwear
  - wear eye protection, eg safety glasses when using power tools
  - wear protective clothing
- describe the WHS Act and WHS Regulations, and the role of SafeWork NSW in maintaining a safe workplace
- identify and apply the principles of risk management, for example:
  - identify a particular risk and implement risk-reduction procedures
- identify and apply the principles of first aid, for example:
  - outline the procedure to follow after a particular incident, eg burns, cuts

Design

Students:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available (ACTDEK046)
- identify and investigate factors influencing design in control systems, for example:
  - efficiency of energy use
  - efficient use of materials
  - reliability of systems
- identify the functional and aesthetic aspects of design in control systems**,** for example:
  - intuitive user interface
  - labelled control panel
  - water-level systems in cisterns
- select standard International System of Units (SI) and Australian Standards for design, for example:
  - correct units used for electrical quantities
- use and/or modify designs when completing projects (ACTDEP049)
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - determine processes for the efficient use of materials
  - use spreadsheets to calculate material quantities and monitor project costs
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects, for example:
  - develop criteria to evaluate engineering design choices
  - designing with block diagrams to clarify relationships between components

Engineering principles and processes

Students:

- investigate control system purposes, for example:
  - applications for remote control
  - applications for mechanical or wired control
  - evaluate past and present control systems
  - use of actuators, sensors and controllers
- identify and describe control system types, for example:
  - electronic
  - hydraulic
  - mechanical
  - pneumatic
- evaluate the principles of control systems, for example:
  - accuracy, eg automated production lines
  - reduced worker fatigue
- conduct experiments with a range of control devices and systems, for example:
  - calculate the efficiency of a system
  - determine the effect of moisture on a system
  - record the effect of vibration on a system
- investigate the function of feedback in a control system
- follow a planned construction sequence, for example:
  - constructing projects within a prescribed timeframe

- examine work practices and apply these to quality of practical projects, for example:
  - using collaborative process to achieve efficiencies
- modify component parts of a control system, for example:
  - adjusting tolerance
  - changing lever length

Materials

Students:

- explore engineering properties of materials suitable for control systems, for example:
  - electronic properties
  - insulating properties
  - strength, toughness and durability
- apply an understanding of material properties in the design and production of control systems
- recognise the basic structure of metals, alloys, polymers, ceramics
- investigate the properties and applications of materials, for example:
  - conductivity test of various wire types
  - copper as a conductor
  - polylactic acid (PLA) in 3D printing

Tools, equipment and techniques

Students:

- use a range of equipment, hand and power tools, and machines to carry out experiments and construct projects/working models/prototypes in control systems, for example:
  - holding and joining tools
  - marking-out and cutting tools
  - using power tools to drill, cut, shape and assemble components
- apply a range of measuring tools and methods, for example:
  - allowing for tolerance on parts
  - micrometer
  - vernier caliper
- investigate input and output components, for example:
  - stepper motors
  - book press
  - light, temperature, moisture and voltage sensors
  - using a smartphone to control home lighting
- investigate advanced manufacturing techniques to assist in the production of projects, for example:
  - CNC equipment
  - laser/plasma/water cutters
  - rapid prototyping

Workplace communication skills

Students:

- recognise and comply with WHS signage
- select and use specialist terminology in context, for example:
  - glossary
  - procedure/storyboard
  - record of production
- read and interpret plans and/or materials lists to prepare materials for the completion of projects

- represent control systems using freehand sketching, for example:
  - the components of an oven temperature control system
- produce annotated freehand sketches of project components and/or projects to visualise, communicate, understand and record ideas
- modify and/or apply workshop drawings in the completion of projects, for example:
  - use CAD applications in the production of workshop drawings
- complete drawings applying relevant Australian Standards, for example:
  - orthogonal top and front views of a component in a system
  - pictorial sketch showing relationships between system component parts
  - correct standards applied to projection of views
- develop engineering reports using appropriate ICT, for example:
  - CAD
  - graphing results
  - project management tools
  - spreadsheets
- prepare engineering reports to describe the management and processes undertaken in the production of practical projects

Societal and environmental impact

Students:

- describe the impact of engineered control systems on society and the environment, for example:
  - driver assistance systems in motor vehicles, eg lane departure warning systems
  - traffic management systems, eg Sydney Coordinated Adaptive Traffic Control System (SCATS)
- examine ethical and legal issues that apply to engineered control systems, for example:
  - the ethical responsibilities of system designers
  - the legal responsibility should a control system fail

Links to industry

Students:

- compare and contrast contemporary industrial manufacturing techniques, materials and equipment with classroom experiences
- compare technologies used in control systems engineering, for example:
  - autonomous transport compared to human driven transport
  - traffic control systems
  - wired compared to wireless sensors
- identify and discuss various career opportunities in engineering that are involved in control system design, for example:
  - electrical engineer
  - software engineer

Specialised Module: School-Developed Engineering Module

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Content

WHS and risk management

Students:

- demonstrate safe workshop practices and procedures, for example:
  - clamp materials securely when cutting or drilling
  - follow electrical safety procedures
  - follow workshop signage instructions
  - work collaboratively
- safely use and maintain hand, power and machine tools
- select and use personal protective equipment (PPE) when working with tools, materials and machines, for example:
  - wear appropriate footwear
  - wear eye protection, eg safety glasses when using power tools
  - wear protective clothing
- describe the WHS Act and WHS Regulations, and the role of SafeWork NSW in maintaining a safe workplace
- identify and apply the principles of risk management, for example:
  - identify a particular risk and implement risk-reduction procedures

- identify and apply the principles of first aid, for example:
  - outline the procedure to follow after a particular incident, eg burns, cuts

Design

Students:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available (ACTDEK046)
- identify and investigate factors influencing design in engineered projects, for example:
  - cloud computing and storage
  - resource availability
- identify the functional and aesthetic aspects of design in engineered projects, for example:
  - efficient energy use
  - efficient use of materials
  - reliability of the system
- examine the relationships between structure, properties and the application of materials in engineered projects (ACTDEK046)
- apply relevant Australian Standards to engineering designs, for example:
  - standard International System of Units (SI)
- use and/or modify designs when completing projects (ACTDEP049)
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - determine processes for the efficient use of materials
  - use spreadsheets to calculate material quantities and monitor project costs
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects, for example:
  - develop criteria to evaluate engineering design choices

Engineering principles and processes

Students:

- investigate principles or processes related to the school-based project, for example:
  - analyse power source options
  - analyse the mechanics of the school-based project
  - assess manufacturing options
  - assess the future trends in systems related to the school-based project
  - investigate material properties and options
- investigate obsolete technologies used in the engineering industry, for example:
  - distributor in an automotive ignition system
  - leaded petrol

Materials

Students:

- explore properties of materials suitable for inclusion in engineered systems
- justify the selection of material for engineered environments, for example: (ACTDEK046)
  - assess the in-service properties of materials
  - properties testing
  - suitability for cutting, drilling, forming, joining and shaping
- investigate properties and performance of ferrous, non-ferrous and composite materials

Tools, equipment and techniques

Students:

- use and adjust a wide range of hand tools in the production of practical projects, for example:
  - holding and sawing tools
  - marking-out and cutting tools
  - shaping and drilling tools
- develop practical projects using machines and portable power tools, for example:
  - drill, cut, shape and assemble components
  - manufacture model vehicles
- examine work practices and apply these to produce quality practical projects, for example:
  - using collaborative process to achieve efficiencies
- investigate advanced manufacturing techniques to assist in the production of projects, for example:
  - CNC equipment, eg laser cutters, CNC milling machines
  - laser/plasma/water cutters
  - rapid prototyping

Workplace communication skills

Students:

- recognise and comply with WHS signage
- select and use specialist terminology in context, for example:
  - glossary
  - procedure/storyboard
  - record of production
- read and interpret plans and/or materials lists to prepare materials for the completion of projects
- produce annotated freehand sketches of project components and/or projects to visualise, communicate, understand and record ideas
- modify and/or apply workshop drawings in the completion of projects, for example:
  - use CAD applications in the production of workshop drawings
- complete drawings applying relevant Australian Standards, for example:
  - orthogonal top and front views of a component
  - pictorial sketch showing relationships between system components
- develop engineering reports using appropriate ICT, for example:
  - CAD
  - graphing results
  - project management tools
  - spreadsheets
- prepare engineering reports to describe the management and processes undertaken in the production of practical projects

Societal and environmental impact

Students:

- examine the impact of the project on the environment
- analyse impact of the project in terms of its effect on society, for example:
  - the use of connected devices to automate lifestyles
- compare and contrast renewable and non-renewable energy resources used by engineers, for example:
  - products specifically engineered to be recycled or reused

Links to industry

Students:

- compare and contrast contemporary industrial manufacturing techniques, materials and equipment with classroom experiences ✸
- investigate an emerging technology being developed in the engineering industry, for example:
  - autonomous transport
  - communication systems
- identify and discuss a range of engineering careers that are related to the school-based project, for example: ✸
  - aeronautical engineer
  - environmental engineer
  - materials engineer
  - mechatronic engineer

Specialised Module: Transport

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Content

WHS and risk management

Students:

- demonstrate safe workshop practices and procedures, for example:
  - clamp materials securely when cutting or drilling
  - follow electrical safety procedures
  - follow workshop signage instructions
  - work collaboratively
- safely use and maintain hand, power and machine tools
- select and use personal protective equipment (PPE) when working with tools, materials and machines, for example:
  - wear appropriate footwear
  - wear eye protection, eg safety glasses when using power tools
  - wear protective clothing
- describe the WHS Act and WHS Regulations, and the role of SafeWork NSW in maintaining a safe workplace
- identify and apply the principles of risk management, for example:
  - identify a particular risk and implement risk-reduction procedures
- identify and apply the principles of first aid, for example:
  - outline the procedure to follow after a particular incident, eg burns, cuts

Design

Students:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available (ACTDEK046)
- identify and investigate factors influencing design in engineered transport, for example:
  - availability of materials
  - cultural preferences
  - reliability of the system
  - safety improvements
- use and/or modify designs when completing projects (ACTDEP049)
- apply standard International System of Units (SI) and Australian Standards for design, for example:
  - correct use of velocity and power units
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - determine processes for the efficient use of materials
  - use spreadsheets to calculate material quantities and monitor project costs
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects, for example:
  - develop criteria to evaluate engineering design choices

Engineering principles and processes

Students:

- analyse the nature and purpose of transport systems, for example:
  - future trends in mass transport, eg driverless trains/trams
  - private transport, eg bicycle, motor vehicle
  - public transport, eg trains, buses
- investigate power sources for transport, for example:
  - batteries for electric cars
  - emerging power technologies in transport
  - fuel for aircraft
  - piston engines
- calculate values for work and energy, for example:
  - the work required to move a vehicle

Materials

Students:

- explore engineering properties of materials suitable for inclusion in transport systems, for example:
  - impact resistance
  - in-service properties of materials, eg corrosion resistance, UV stability
  - suitability for cutting, drilling, forming, joining and shaping
- justify the selection of materials for environments, for example:
  - aircraft
  - automotive
  - rail
  - shipping

- investigate properties and performance of ferrous and non-ferrous metals, for example:
  - aluminium alloys
  - copper
  - steel

Tools, equipment and techniques

Students:

- use and adjust a wide range of hand tools in the production of practical projects, for example:
  - holding and sawing tools
  - marking-out and cutting tools
  - shaping and drilling tools
- develop practical projects using machines and portable power tools, for example:
  - drill, cut, shape and assemble components
  - manufacture model vehicles
- apply measuring standards and methods, for example:
  - determining average velocity during multiple test runs
- investigate advanced manufacturing techniques to assist in the production of projects, for example:
  - CNC equipment, eg laser cutters, CNC milling machines
  - plasma/water cutters
  - rapid prototyping

Workplace communication skills

Students:

- recognise and comply with WHS signage
- select and use specialist terminology in context, for example:
  - glossary
  - labelled drawings
  - procedure/storyboard
  - record of production
- explore engineering data, for example:
  - comparing passenger capacity of modes of transport
- read and interpret plans and/or materials lists to prepare materials for the completion of projects
- produce annotated freehand sketches of project components and/or projects to visualise, communicate, understand and record ideas, for example:
  - components of a transport system
- modify and/or apply workshop drawings in the completion of projects, for example:
  - use CAD applications in the production of workshop drawings
- complete drawings applying relevant Australian Standards, for example:
  - orthogonal top and front views of a component
  - pictorial sketch showing relationships between component parts
- develop engineering reports using appropriate ICT, for example:
  - CAD
  - graphing results
  - project management tools
  - spreadsheets
- prepare engineering reports to describe the management and processes undertaken in the production of practical projects

Societal and environmental impact

Students:

- examine the impact of transport systems on the environment, for example:
  - watercourses, waterways
  - wildlife corridors
- analyse the effect of transport systems on society, for example:
  - travel times, eg air compared to train
  - light rail in high-density areas
- compare and contrast renewable and non-renewable resources used by engineers, for example:
  - car tyre recycling
  - railway sleepers made from recycled plastic
  - vehicle parts recycling industry

Links to industry

Students:

- compare and contrast contemporary industrial manufacturing techniques, materials and equipment with classroom experiences, for example:
  - material manufacturing processes
  - windshield manufacturing processes
- compare the development of technologies used in the transport industry, for example:
  - passenger safety systems
  - braking systems
- investigate an emerging technology being developed by the transport industry, for example:
  - autonomous control, eg driverless mining vehicles and trains
  - sustainable fuels, eg hydrogen-powered vehicles
- identify and discuss various career opportunities in engineering that are involved in transport systems, for example:
  - electrical engineer, eg electric motor manufacturing
  - logistics engineer, eg supply chain management
  - mechanical engineer, eg car suspension systems

Farm Maintenance Content for Years 7–10

The Farm Maintenance focus area provides opportunities for students to develop knowledge, understanding and skills in relation to farm maintenance and its associated industries.

The Farm Maintenance 1 core module develops knowledge and skills in the use of tools, materials and techniques related to farm maintenance. These are enhanced and further developed through the study of the Farm Maintenance 2 specialist module.

Practical projects should reflect the nature of the Farm Maintenance focus area and provide opportunities for students to develop specific knowledge, understanding and skills related to farm maintenance. These may include:

- fences and gates
- maintenance and repair of farm appliances and equipment
- small structures for farm applications
- structures for containing/restraining livestock
- tools and implements to assist on the farm.

Core Module: Farm Maintenance 1

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Content

WHS and risk management

Students:

- demonstrate safe workshop practices and procedures, for example:
  - follow workshop signage instructions
  - lift and carry materials safely
  - use appropriate sun protection when working outdoors
  - work collaboratively
- safely use and maintain hand, power and machine tools
- select and use personal protective equipment (PPE) when working with tools, materials and machines, for example:
  - wear appropriate footwear
  - wear eye protection, eg safety glasses when drilling
  - wear protective clothing
- apply the principles of risk management, for example:
  - hierarchies of control
  - identify a particular risk and implement risk-reduction procedures
- describe elementary first aid procedures, for example:
  - outline the procedure to follow after a particular incident, eg burns, cuts

Design

Students:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available (ACTDEK046)
- identify and investigate factors influencing design in farm maintenance, for example:
  - functional requirements of farm structures
- apply the principles of design in the modification of a range of farming products and procedures to enhance their function and/or aesthetics
- use and/or modify existing designs when completing projects
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - use spreadsheets to calculate material quantities and monitor project costs
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects

Materials

Students:

- select and use materials based on their properties and common usage in farm applications
- identify and describe the nature and use of natural and manufactured materials in farm applications
- select, prepare and use a range of materials commonly applied in the farm context, for example:
  - ferrous and non-ferrous metals and alloys
  - petroleum or petroleum products and derivatives
  - sealants and gasket materials to assemble components
  - timber or timber products
- modify properties of metals through the use of heat
- identify and describe the difference between materials in terms of structure and properties
- join similar and dissimilar materials by mechanical or chemical systems

Tools, equipment and techniques

Students:

- use a range of processes in the production of practical projects (ACTDEK046)
- apply measuring standards and methods
- select measuring tools for accuracy appropriate to the task, for example:
  - measuring tape
  - vernier calipers
- select, use and adjust a range of hand tools in the production of practical projects, for example:
  - cutting, eg hacksaw, tenon saw
  - holding metal, eg engineers vice
  - marking out, eg rule, try square
  - shaping timber, eg bench plane
- select, use and adjust machines and portable power tools in the production of metal and timber projects, for example:
  - cutting metal using an angle grinder
  - cutting plywood using a jigsaw
  - drilling holes using a pedestal drill
  - grinding tools using a bench grinder

- apply a range of equipment, tools and machines associated with farm maintenance, for example:
  - farm building maintenance
  - farm motor mechanics
- construct practical projects using a variety of joining methods, for example: (ACTDEK046)
  - gluing
  - hard soldering
  - metal fasteners
  - timber joints
- perform lathe operations, for example:
  - appropriate set-up
  - knurling
  - parallel turning
  - drilling
- prepare surfaces and apply appropriate finishes suitable for farm maintenance
- investigate advanced manufacturing techniques to assist in the production of projects, for example:
  - CNC equipment, eg laser cutters, CNC milling machines
  - plasma/water cutters
  - rapid prototyping

Workplace communication skills

Students:

- recognise and comply with WHS signage, for example:
  - identify the colours and shapes associated with types of WHS signage
- select and use specialist terminology in context, for example:
  - glossary
  - record of production
- produce freehand sketches of project components and/or projects
- read and interpret plans and/or materials lists to prepare materials for the completion of projects
- develop design and production folios using appropriate ICT, for example:
  - CAD
  - simulations
  - spreadsheets
- prepare design and production folios to describe the management and processes undertaken in the production of practical projects, for example:
  - procedure
  - recount

Societal and environmental impact

Students:

- identify renewable and non-renewable resources in the farming industry
- understand ethical responsibilities surrounding Indigenous cultural and intellectual property, for example:
  - preservation of the Aboriginal heritage value of a site
  - protocols and procedures relating to Aboriginal Peoples' significant sites
- recognise the importance of the conservation of materials and recycling in the farming industry, for example:
  - reclaiming of oils and lubricants
  - recycling of metal components, eg machine parts

- describe the environmental need for safe disposal of waste products, for example:
  - disposal of oils and lubricants
  - disposal of out of date chemicals, eg pesticides
- investigate issues relating to a range of farm maintenance activities, procedures and products on the environment, for example:
  - maintaining waterways and water supplies
  - responsible use of chemicals, eg engine degreasers
  - managing timber resources
  - use of a windmill to pump water from a well

Links to industry

Students:

- identify general farm maintenance practices and relate them to work in the classroom, for example:
  - building maintenance and repair
  - fence building
- investigate a range of career paths in farm maintenance, for example:
  - farm manager
  - plumber
  - small engine and machinery repair
  - welder

Specialised Module: Farm Maintenance 2

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Content

WHS and risk management

Students:

- demonstrate safe workshop practices and procedures, for example:
  - follow workshop signage instructions
  - lift and carry equipment and materials safely
  - test engines in a well-ventilated area
  - use appropriate sun protection when working outdoors
- safely use and maintain hand, power and machine tools
- select and use personal protective equipment (PPE) when working with tools, materials and machines, for example:
  - wear appropriate footwear
  - wear eye protection, eg welding helmets when MIG welding
  - wear protective clothing
- describe the WHS Act and WHS Regulations, and describe the role of SafeWork NSW in maintaining a safe workplace, for example:
  - complete SafeWork NSW White Card Training
- identify and apply the principles of risk management, for example:
  - identify a particular risk and implement risk-reduction procedures
- identify and apply the principles of first aid, for example:
  - outline the procedure to follow after a particular incident, eg burns, cuts

Design

Students:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available (ACTDEK046)
- identify and investigate factors influencing design in farm maintenance, for example:
  - cost of repair or replacement
  - intended function of components
- identify the functional and aesthetic aspects of design in farm maintenance, for example:
  - cattle grid
  - farm gates
  - feed and water troughs
- use and/or modify designs when completing projects (ACTDEP049)
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - determine processes for the efficient use of materials
  - use spreadsheets to calculate material quantities and monitor project costs
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects

Materials

Students:

- identify defects in materials and apply management techniques to overcome such defects
- select, prepare, use and justify a range of appropriate materials used in farm maintenance, for example:
  - ferrous and non-ferrous metals and alloys
  - petroleum or petroleum products and derivatives
  - polymers and composite materials
  - sealants and gasket materials to assemble components
  - treated pine for external applications
- join similar and dissimilar materials by mechanical or chemical systems
- identify, select and make joints to produce and assemble timber structures

Tools, equipment and techniques

Students:

- construct a range of practical projects using a range of processes
- apply a range of tools and processes to mark out, measure, check for square, level and/or plumb
- use a range of joining methods suitable for practical projects
- select, use and adjust a range of hand tools in the production of practical projects, for example:
  - cutting and joining timber, eg skew nailing timber, bracing a gate
  - shaping metal, eg using an engineer's hammer and a vice to bend metal
  - connecting irrigation pipes and fittings
  - removing and replacing components
- select, use and adjust machines and portable power tools in the production of metal and timber projects, for example: (ACTDEK046)
  - assembling a shed using portable power tools
  - drilling holes using a pedestal drill
  - joining metal by welding
  - repairing metal parts by hard soldering
- select, use and justify a suitable range of processes and techniques for individual projects

- apply a range of equipment, tools and machines associated with farm maintenance, for example:
  - farm building construction, eg installing a fence post, using an auger to dig post holes
  - farm maintenance, eg hanging a gate, straining fence wire
  - farm motor mechanics, eg servicing an engine, replacing a spark plug
  - metal shop practice, eg maintaining the cutting edge on farm implements, remaking threaded components
- select measuring and testing tools for accuracy needed for tasks, for example:
  - using a measuring tape
  - using a water level
  - ensuring fence posts are plumb
- fabricate and/or use jigs to assist in the production, construction and assembly of practical projects
- apply a range of appropriate finishes suitable for farm projects and farm maintenance
- investigate advanced manufacturing techniques to assist in the production of projects, for example:
  - CNC equipment, eg laser cutters, CNC milling machines
  - plasma/water cutters
  - rapid prototyping

Workplace communication skills

Students:

- recognise and comply with WHS signage
- select and use specialist terminology in context, for example:
  - glossary
  - procedure/storyboard
  - record of production
- read and interpret plans and/or materials lists to prepare materials for the completion of projects
- produce annotated freehand sketches of project components and/or projects to visualise, communicate, understand and record ideas
- modify and/or apply workshop drawings in the completion of projects, for example:
  - use CAD applications in the production of workshop drawings
- develop design and production folios using appropriate ICT, for example:
  - CAD
  - project management tools
  - simulations
- prepare design and production folios to describe the management and processes undertaken in the production of practical projects

Societal and environmental impact

Students:

- describe the effects of the farming industry on society and the environment, for example:
  - producing food for Australian consumption
  - sustainable farming practices
- identify sustainable natural resources and the impact on the environment, for example:
  - biofuels
  - timber from plantations and managed forests
- use recycled materials as a viable alternative to new materials, for example: (ACTDEK046)
  - recycled road base for farm roads
  - recycled timber for farm structure

- use renewable resources where appropriate
- explain the environmental and societal impact of resources and processes used in the development and production of practical projects
- describe the legal and ethical responsibilities towards the community and the environment, for example:
  - the protection and maintenance of waterways

Links to industry

Students:

- compare and contrast contemporary industrial manufacturing techniques, materials and equipment with classroom experiences
- investigate historical technologies related to farm maintenance
- identify new and emerging technologies used in farm maintenance and contrast them with those used in the past, for example:
  - drones to check fence integrity replacing a physical visual check
- compare and contrast careers and professions in farm maintenance, for example:
  - farm manager
  - plumber
  - small engine and machinery repair
  - support services

Metal Content for Years 7–10

The Metal focus area provides opportunities for students to develop knowledge, understanding and skills in relation to the metal and associated industries.

The Metal focus area comprises two content areas:

Metal

The Metal 1 core module develops knowledge and skills in the use of tools, materials and techniques related to general metalwork. These are enhanced and further developed through the study of specialist modules in Metal Machining and Fabrication.

Practical projects should reflect the nature of the Metal focus area and provide opportunities for students to develop specific knowledge, understanding and skills associated with metal-related technologies. These may include:

- fabricated projects
- metal machining projects
- sheet metal products

Art Metal

The Art Metal 1 core module develops knowledge and skills in the use of tools, materials and techniques related to art metalwork. These are enhanced and further developed through the study of the Art Metal 2 specialist module.

Practical projects should reflect the nature of the Metal focus area and provide opportunities for students to develop specific knowledge, understanding and skills associated with art metal-related technologies. These may include:

- artistic metal projects
- jewellery and accessories

Core Module: Metal 1

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and competently uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Content

WHS and risk management

Students:

- demonstrate safe workshop practices and procedures, for example:
  - follow workshop signage instructions
  - return lengths of steel to the racks after cutting
  - wear gloves when heating metal
  - work collaboratively
- safely use and maintain hand, power and machine tools
- select and use personal protective equipment (PPE) when working with tools, materials and machines, for example:
  - wear appropriate footwear
  - wear eye protection, eg safety glasses when drilling
  - wear protective clothing
- apply the principles of risk management, for example:
  - hierarchies of control
  - risk identification and implementation of risk-reduction procedures
- describe elementary first aid procedures, for example:
  - outline the procedure to follow after a particular incident, eg burns, cuts

Design

Students:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available (ACTDEK046)
- identify and investigate factors influencing design in metal, for example:
  - finishing requirements, eg powder coating
  - joining methods
  - material selection
  - service requirements, eg hardness
  - shaping and forming processes
- use and/or modify existing designs when completing projects
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - use spreadsheets to calculate material quantities and monitor project costs
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects

Materials

Students:

- use a range of metals in the production of practical projects
- identify properties and applications of a range of metals and metal products, for example:
  - ferrous metals, eg steel, cast iron
  - non-ferrous metals and alloys, eg brass, copper
  - sheet metal, eg galvanised steel, tinplate
- select metals and metal profiles for specific applications, for example:
  - sheet, eg galvanised steel, tinplate
  - solid stock, eg flat, square and round bar, angle
  - tube, eg round, RHS
- modify the properties of metals through heat-treatment processes, for example:
  - annealing
  - hardening
- describe the processes and materials used in the production of steel, for example:
  - alloying elements, eg carbon in steel
  - blast furnace
  - electric arc furnace

Tools, equipment and techniques

Students:

- measure and mark out materials from a project drawing with accuracy and precision
- apply techniques and equipment for the cutting, shaping and forming of angle, rod and flat bar
- apply techniques and equipment for the cutting, shaping and forming of sheet metal
- use and adjust a range of hand tools in the production of practical projects, for example:
  - marking out, eg scriber, rule, try square, jenny calipers
  - cutting and shaping, eg hacksaw, bench shears, files
  - joining, eg soldering iron, rivet gun

- select, use and maintain appropriate machine and power tools for metal projects, for example:
  - cutting stock using a cold saw
  - drilling and reaming holes to a tolerance
  - polishing with a buffing wheel
  - shaping metal using a milling machine
- apply a variety of joining methods, for example:
  - fasteners
  - rivets
  - soft and hard soldering
- perform metal lathe operations, for example:
  - drilling
  - facing
  - knurling
  - parallel turning
- calculate and correctly size internal and external screw threads using screw thread terminology and reference charts
- prepare and finish metal surfaces, for example:
  - buffing and polishing
  - enamelling
  - painting
  - plastic coating
- investigate advanced manufacturing techniques to assist in the production of projects, for example:
  - CNC equipment, eg laser cutters, CNC milling machines
  - plasma/water cutters
  - rapid prototyping

Workplace communication skills

Students:

- recognise and comply with WHS signage, for example:
  - identify the colours and shapes associated with types of WHS signage
- select and use specialist terminology in context, for example:
  - glossary
  - procedure/storyboard
  - record of production
- read and interpret plans and/or materials lists to prepare materials for the completion of projects, for example:
  - sheet metal developments
- produce freehand sketches of project components and/or projects
- produce developments of sheet metal projects
- develop design and production folios using appropriate ICT, for example:
  - CAD
  - simulations
  - spreadsheets
- prepare design and production folios to describe the management and processes undertaken in the production of practical projects, for example:
  - equipment used
  - identification and use of materials
  - processes employed

Societal and environmental impact

Students:

- identify renewable and non-renewable resources in metal industries
- recognise the importance of conservation of materials and recycling in metal, for example:
  - recycling of metals
  - repairing of metal parts
- identify issues relating to the sustainability of resources in metal, for example:
  - embodied energy
  - impurities in materials to be recycled
- identify the benefits and associated costs of recycling
- discuss the effects of metal industry activities and processes on society and the environment
  - employment opportunities
  - pollution
  - recycling of waste materials

Links to industry

Students:

- compare industrial production processes to those used in the classroom, for example:
  - computer numerically controlled (CNC) machinery compared to traditional mechanically controlled machinery
  - CAD/CAM production processes, eg plasma cutting
- investigate historical technologies related to the metal industry
- investigate a range of career paths in the metal industry, for example:
  - boilermaker
  - fitter and turner
  - plumber
  - roof plumber
  - welder

Specialised Module: Metal Machining 2

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Content

WHS and risk management

Students:

- demonstrate safe workshop practices and procedures, for example:
  - follow workshop signage instructions
  - return lengths of steel to the racks after cutting
  - use a brush to clear swarf from machines
  - work collaboratively
- safely use and maintain hand, power and machine tools
- select and use personal protective equipment (PPE) when working with tools, materials and machines, for example:
  - wear appropriate footwear
  - wear eye protection, eg safety glasses when milling
  - wear protective clothing
- describe the WHS Act and WHS Regulations, and the role of SafeWork NSW in maintaining a safe workplace
- identify and apply the principles of risk management, for example:
  - identify a particular risk and implement risk-reduction procedures
- identify and apply the principles of first aid, for example:
  - outline the procedure to follow after a particular incident, eg burns, cuts

Design

Students:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available (ACTDEK046)
- identify and investigate factors influencing design in metal machining
- identify the functional and aesthetic aspects of design in metal machining
- use and/or modify designs when completing projects (ACTDEP049)
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - determine processes for the efficient use of materials
  - use spreadsheets to calculate material quantities and monitor project costs
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects

Materials

Students:

- describe and compare the properties and applications of different metals associated with fitting and machining, for example:
  - aluminium alloys
  - brass
  - mild steel
- select, investigate and use suitable metals for specific machining projects, for example:
  - stainless steel for marine applications
- explain how varying the carbon content of steel changes its properties

Tools, equipment and techniques

Students:

- use a range of tools, equipment and machines commonly used for fitting and machining in the production of practical projects, for example:
  - hand tools
  - metal lathes and CNC metal lathes
  - milling machines and CNC milling machines
  - portable power tools
- select and use a range of processes, methods and techniques commonly used for fitting and machining, for example:
  - cutting, shaping and forming
  - holding of metal when machining, eg using vices, jigs, clamps
  - measuring and marking out
- perform boring, reaming and knurling operations on a metal lathe, for example:
  - knurling a screwdriver handle
  - reaming an engine block for a piston
- machine metals with precision, ensuring accuracy by using micrometer and vernier calipers
- apply fit and tolerance charts when machining components for accuracy
- apply a range of joining techniques and fastening devices, for example:
  - adhesives
  - mechanical fasteners
  - threads
  - welding (MIG and oxy-acetylene)

- investigate advanced manufacturing techniques to assist in the production of projects, for example:
  - laser/plasma/water cutters
  - rapid prototyping

Workplace communication skills

Students:

- recognise and comply with WHS signage
- select and use specialist terminology in context, for example:
  - procedure/storyboard
- read and interpret plans and/or materials lists to prepare materials for the completion of projects
- produce annotated freehand sketches of project components and/or projects to visualise, communicate, understand and record ideas
- modify and/or apply workshop drawings in the completion of projects, for example:
  - use CAD applications in the production of workshop drawings
- develop design and production folios using appropriate ICT, for example:
  - CAD
  - project management tools
  - simulations
- prepare design and production folios to describe the management and processes undertaken in the production of practical projects

Societal and environmental impact

Students:

- investigate the impact of metal-related activities and processes on society and the environment, for example:
  - extraction of raw materials
  - manufacture of transport vehicles, eg buses, trains, aircraft
- explain pollution-control measures used in metal activities and the consequences for the environment of limited control measures, for example:
  - Environmental Protection Authority (EPA) inspections

Links to industry

Students:

- compare and contrast contemporary industrial manufacturing techniques, materials and equipment with classroom experiences
- compare new and emerging technologies to traditional technologies in metal machining, for example:
  - CAM
  - metal laser cutter
  - CNC metal lathes and milling machines
- describe the impact of new and emerging technologies on careers and professions in the metal industry
- compare and contrast careers and professions in the metal machining industry, for example:
  - aircraft maintenance
  - engine rebuilding
  - mechanic
  - panel beater

Specialised Module: Metal Machining 3

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Content

WHS and risk management

Students:

- demonstrate safe workshop practices and procedures, for example:
  - clean spills of oils and cutting fluids
  - ensure machinery is set up safely before use
  - follow workshop signage instructions
- safely use and maintain hand, power and machine tools
- select and use personal protective equipment (PPE) when working with tools, materials and machines, for example:
  - wear appropriate footwear
  - wear eye protection, eg safety glasses when machining
  - wear protective clothing
- describe the WHS Act and WHS Regulations, and the role of SafeWork NSW in maintaining a safe workplace
- identify and apply the principles of risk management, for example:
  - identify a particular risk and implement risk-reduction procedures
- identify and apply the principles of first aid, for example:
  - outline the procedure to follow after a particular incident, eg burns, cuts

Design

Students:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available (ACTDEK046)
- identify and investigate factors influencing design in metal machining
- identify the functional and aesthetic aspects of design in metal machining
- select and justify the use of materials, processes and equipment in the production of practical projects
- use and/or modify designs when completing projects (ACTDEP049)
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - determine processes for the efficient use of materials
  - use spreadsheets to calculate material quantities and monitor project costs
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects

Materials

Students:

- select and justify appropriate metals used for metal machining projects according to their intended use
- identify common metal alloys and their desired properties, for example:
  - aluminium alloys
  - brass
  - steel

Tools, equipment and techniques

Students:

- identify, select and use a range of tools, equipment and machines in the production of metal machining projects, for example:
  - metal lathes and CNC metal lathes
  - milling machines and CNC milling machines
- identify, select and use a range of metal machining processes, for example:
  - advanced machining operations, eg screw cutting or metal spinning
  - CAD and CAM automated operations
  - milling operations, eg indexing, slot cutting or gang milling
- investigate advanced manufacturing techniques to assist in the production of projects, for example:
  - CNC equipment, eg laser cutters, CNC milling machines
  - plasma/water cutters
  - rapid prototyping

Workplace communication skills

Students:

- recognise and comply with WHS signage
- select and use specialist terminology in context, for example:
  - glossary
  - procedure/storyboard
  - record of production
- read and interpret plans and/or materials lists to prepare materials for the completion of projects
- produce annotated freehand sketches of project components and/or projects to visualise, communicate, understand and record ideas
- modify and/or apply workshop drawings in the completion of projects, for example:
  - use CAD applications in the production of workshop drawings
- develop design and production folios using appropriate ICT, for example:
  - CAD
  - project management tools
  - simulations
- prepare design and production folios to describe the management and processes undertaken in the production of practical projects

Societal and environmental impact

Students:

- investigate the societal and environmental impacts of resources used in the development and production of metal projects, for example:
  - employment opportunities
  - impact of extraction of ore, eg open-cut mining environmental effects
  - pollution from the processing of steel
  - transport, eg trains, bridges

Links to industry

Students:

- investigate current techniques, materials and equipment used by industry
- compare and contrast contemporary industrial manufacturing techniques, materials and equipment with classroom experiences

Specialised Module: Fabrication 2

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Content

WHS and risk management

Students:

- demonstrate safe workshop practices and procedures, for example:
  - follow workshop signage instructions
  - return lengths of steel to the racks after cutting
  - use gloves when heating and welding
  - work collaboratively
- safely use and maintain hand, power and machine tools
- select and use personal protective equipment (PPE) when working with tools, materials and machines, for example:
  - wear appropriate footwear
  - wear eye protection, eg safety glasses when drilling
  - wear protective clothing
- describe the WHS Act and WHS Regulations, and the role of SafeWork NSW in maintaining a safe workplace
- identify and apply the principles of risk management, for example:
  - identify a particular risk and implement risk-reduction procedures
- identify and apply the principles of first aid, for example:
  - outline the procedure to follow after a particular incident, eg burns, cuts

Design

Students:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available (ACTDEK046)
- identify and investigate factors influencing design in metal fabrication
- identify the functional and aesthetic aspects of design in metal fabrication
- use and/or modify designs when completing projects (ACTDEP049)
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - use spreadsheets to calculate material quantities and monitor project costs
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects

Materials

Students:

- select and justify material choice in the development and production of fabricated projects, for example:
  - malleability
  - weldability
- apply finishes and protective coatings suitable for metal fabricated projects, for example:
  - anodising and galvanising for corrosion resistance
  - painting by brush and spray for ease of application
  - powder coating for durability

Tools, equipment and techniques

Students:

- select, use and adjust a range of hand tools in the production of practical projects, for example:
  - cutting and shaping, eg bench shears, files
  - joining, eg screwing and bolting
  - marking out, eg scriber, rule, try square
- produce practical projects using machines and portable power tools, for example: (ACTDEK046)
  - cutting/bending/rolling/forming equipment
  - portable and bench grinders
  - welding equipment, eg oxy-acetylene, MIG, spot welder
- select and use a range of techniques to shape, bend and form metals in the production of metal fabricated projects, for example:
  - use a bossing mallet and mould to shape sheet metal
  - use a magnetic sheet metal folder to bend sheet metal
  - utilise jigs to bend flat bar
- select and use a range of joining techniques and processes, for example:
  - MIG welding frames
  - pop riveting hinges to a toolbox
- investigate advanced manufacturing techniques to assist in the production of projects, for example:
  - CNC equipment, eg laser cutters, CNC milling machines
  - plasma/water cutters

Workplace communication skills

Students:

- recognise and comply with WHS signage
- select and use specialist terminology in context, for example:
  - glossary
  - procedure/storyboard
  - record of production
- read and interpret plans and/or materials lists to prepare materials for the completion of projects
- produce annotated freehand sketches of project components and/or projects to visualise, communicate, understand and record ideas
- modify and/or apply workshop drawings in the completion of projects, for example:
  - use CAD applications in the production of workshop drawings
- develop design and production folios using appropriate ICT, for example:
  - project management tools
  - simulations
- prepare design and production folios to describe the management and processes undertaken in the production of practical projects

Societal and environmental impact

Students:

- investigate the reduction of waste by carefully planning and calculating material quantities from standard material sizes
- examine the effects of metal industry activities and processes on society and the environment, for example:
  - extraction of raw materials
  - manufacture of transportation, eg buses, trains, aircraft
- explain pollution-control measures used in metal industries and the consequences for the environment of having limited control measures, for example:
  - Environmental Protection Authority (EPA) inspections
- identify the benefits and associated costs of recycling

Links to industry

Students:

- compare and contrast contemporary industrial manufacturing techniques, materials and equipment with classroom experiences
- compare new and emerging technologies to traditional technologies in metal fabrication, for example:
  - computer-aided manufacturing (CAM)
  - metal laser cutting of metal components
- describe the impact of new, emerging and contemporary technologies on careers and professions in metal industries
- compare and contrast careers and professions in the metal fabrication industry

Specialised Module: Fabrication 3

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Content

WHS and risk management

Students:

- demonstrate safe workshop practices and procedures, for example:
  - clean spills of oils and cutting fluids
  - ensure machinery is set up safely before use
  - follow workshop signage instructions
  - work collaboratively
- safely use and maintain hand, power and machine tools
- select and use personal protective equipment (PPE) when working with tools, materials and machines, for example:
  - wear appropriate footwear
  - wear eye protection, eg safety glasses when grinding
  - wear protective clothing
- describe the WHS Act and WHS Regulations, and the role of SafeWork NSW in maintaining a safe workplace
- identify and apply the principles of risk management, for example:
  - identify a particular risk and implement risk-reduction procedures
- identify and apply the principles of first aid, for example:
  - outline the procedure to follow after a particular incident, eg burns, cuts

Design

Students:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available (ACTDEK046)
- identify and investigate factors influencing design in metal fabrication
- identify the functional and aesthetic aspects of design in metal fabrication
- select and justify the use of materials, processes and equipment in the production of practical projects
- use and/or modify designs when completing projects (ACTDEP049)
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - determine processes for the efficient use of materials
  - use spreadsheets to calculate material quantities and monitor project costs
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects

Materials

Students:

- select and justify material choice in the development and production of metal and metal profiles in metal fabricated projects
- identify common metal alloys and their properties, for example:
  - aluminium alloys
  - brass
  - steel
- describe the manufacture processes of a range of steel sections, for example:
  - forging components to create grain flow
  - rolling and drawing sheet metal, wire, bar and tube
  - sintering and casting complex shapes

Tools, equipment and techniques

Students:

- select, use and adjust a range of hand tools in the production of practical projects, for example:
  - assembling, eg clamps, magnetic clamps
  - cutting and shaping, eg guillotine
  - marking out, eg plate square
- produce practical projects using machines and portable power tools, for example: (ACTDEK046)
  - cutting/bending/rolling/forming equipment
  - portable and bench grinders
- investigate advanced manufacturing techniques to assist in the production of projects, for example:
  - CNC equipment, eg laser cutters, CNC milling machines
  - plasma/water cutters
  - rapid prototyping
- identify, select and use a range of suitable processes and techniques for metal fabricated projects, for example:
  - using a magnetic sheet metal folder to fold the body, lid and drawers of a toolbox
- use jigs to assist in the construction and assembly of projects

- join metals using a range of hard/soft soldering and welding techniques, for example:
  - brazing
  - MIG welding
- apply a range of metal-cutting methods, for example:
  - metal power shears
  - metal-cutting bandsaws
  - oxy-acetylene cutting

Workplace communication skills

Students:

- recognise and comply with WHS signage
- select and use specialist terminology in context, for example:
  - glossary
  - procedure/storyboard
  - record of production
- read and interpret plans and/or materials lists to prepare materials for the completion of projects
- produce annotated freehand sketches of project components and/or projects to visualise, communicate, understand and record ideas
- modify and/or apply workshop drawings in the completion of projects, for example:
  - use CAD applications in the production of workshop drawings
- develop design and production folios using appropriate ICT, for example:
  - CAD
  - project management tools
  - simulations
- prepare design and production folios to describe the management and processes undertaken in the production of practical projects

Societal and environmental impact

Students:

- analyse the societal and environmental impacts of resources used in the development and production of metal projects, for example:
  - building, eg reinforcing steel, structural beams
  - degradation of the environment from open-cut mines
  - development of transport infrastructure
  - employment
  - pollution from the processing of steel
- identify the benefits and associated costs of recycling

Links to industry

Students:

- compare and contrast contemporary industrial manufacturing techniques, materials and equipment with classroom experiences
- describe industrial manufacturing techniques in the metal fabrication industry, for example:
  - robotic welding of a car chassis
  - waterjet cutting of sensitive machine parts

Core Module: Art Metal 1

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Content

WHS and risk management

Students:

- demonstrate safe workshop practices and procedures, for example:
  - follow workshop signage instructions
  - wear gloves when heating and soldering
  - wear gloves when using chemicals
  - work collaboratively
- safely use and maintain hand, power and machine tools
- select and use personal protective equipment (PPE) when working with tools, materials and machines, for example:
  - wear appropriate footwear
  - wear eye protection, eg safety glasses when cutting or drilling metal
  - wear protective clothing
- apply the principles of risk management, for example:
  - hierarchies of control
  - identify a particular risk and implement risk-reduction procedures
- describe elementary first aid procedures, for example:
  - outline the procedure to follow after a particular incident, eg burns, cuts

Design

Students:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available (ACTDEK046)
- identify and investigate factors influencing design in art metal, for example:
  - finishing processes and applications
  - joining methods
  - service requirements, eg corrosion resistance
  - shaping and forming processes
- use and/or modify existing designs when completing projects
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - use spreadsheets to calculate material quantities and monitor project costs
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects

Materials

Students:

- produce art metal projects using a range of common metals
- identify properties and applications of a range of metals used in art metal, for example:
  - corrosion resistance
  - ductility
  - toughness
- identify the properties and selection of commonly used metals and metal profiles for specific art metal applications, for example:
  - ferrous metals and alloys
  - pure metals and alloys
- modify the properties of metals through heat-treatment processes, for example:
  - annealing work-hardened copper
- enhance the appearance of an art metal project, for example:
  - applying corrosion
  - etching a brass pendant using ferric chloride
  - plating with another metal to improve properties
- describe the mining and processing of ores and the refining of metals

Tools, equipment and techniques

Students:

- measure and mark out projects from a workshop drawing with accuracy and precision
- apply a range of simple forming, shaping and cutting methods in the production of art metal projects, for example:
  - embossing shapes onto copper sheet
  - twisting and hammering silver wire when forming a ring
  - using a bossing mallet and formers to produce beaten hollow ware
  - using scroll jigs to produce wrought iron work
- select, use and adjust a range of hand tools for art metal processes and projects, for example:
  - bending and twisting
  - cutting and sawing
  - filing and drilling
  - marking out and holding

- select and use a range of machines, portable power tools and equipment to produce art metal projects using a variety of processes, for example:
  - annealing
  - drilling and polishing
  - heating and shaping
  - joining techniques
- treat the edges of metal by removing sharp edges and burrs
- apply a range of skills and techniques to enhance the appearance, function and surface finish of art metal projects, for example:
  - complex settings, eg twists, piercings, tapers and scrolls
  - enamelling, oxidising and mirror finishes
  - planishing, hammering, repoussage and embossing
  - simple stone setting and jewellery processes
  - spotting
- investigate advanced manufacturing techniques to assist in the production of projects, for example:
  - CNC equipment, eg laser cutters, CNC milling machines
  - plasma/water cutters
  - rapid prototyping

Workplace communication skills

Students:

- recognise and comply with WHS signage, for example:
  - identify the colours and shapes associated with types of WHS signage
- select and use specialist terminology in context, for example:
  - glossary
  - procedure/storyboard
  - record of production
- read and interpret plans and/or materials lists to prepare materials for the completion of projects
- produce freehand sketches of project components and/or projects
- select and use presentation techniques for projects, for example:
  - displaying projects
  - jewellery displays
  - packaging for jewellery
- develop design and production folios using appropriate ICT, for example:
  - CAD
  - simulations
  - spreadsheets
- prepare design and production folios to describe the management and processes undertaken in the production of practical projects

Societal and environmental impact

Students:

- identify renewable and non-renewable resources in art metal industries
- understand ethical responsibilities surrounding Indigenous cultural and intellectual property, for example:
  - integrating culture through jewellery and art
- investigate issues relating to the sustainability of resources in art metal industries

- recognise the importance of conservation of materials and recycling in metal industries, for example:
  - recycling of metal parts
  - repurposing parts, eg sculptural items
- discuss the effects of art metal industry activities and processes on society and the environment, for example:
  - employment opportunities
- investigate issues of pollution and recycling in relation to art metal-based industries
  - contamination of the environment
  - recycling of waste materials

Links to industry

Students:

- compare art metal industry production processes to those used in the classroom, for example:
  - 3D printing of patterns
  - CAD/CAM production processes
- identify historical technologies related to art metal, for example:
  - blacksmithing
  - hammer welding
- investigate a range of career paths in the art metal and related industries, for example:
  - farrier
  - jeweller
  - sculptor
  - silversmith

Specialised Module: Art Metal 2

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Content

WHS and risk management

Students:

- demonstrate safe workshop practices and procedures, for example:
  - follow workshop signage instructions
  - wear gloves when heating and welding
  - wear gloves when using chemicals
  - work collaboratively
- safely use and maintain hand, power and machine tools
- select and use personal protective equipment (PPE) when working with tools, materials and machines, for example:
  - wear appropriate footwear
  - wear eye protection, eg safety glasses when buffing or hard soldering
  - wear protective clothing
- describe the WHS Act and WHS Regulations, and the role of SafeWork NSW in maintaining a safe workplace
- identify and apply the principles of risk management, for example:
  - identify a particular risk and implement risk-reduction procedures
- identify and apply the principles of first aid, for example:
  - outline the procedure to follow after a particular incident, eg burns, cuts

Design

Students:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available (ACTDEK046)
- identify and investigate factors influencing design in art metal
- identify the functional and aesthetic aspects of design in art metal**,** for example:
  - the selection of durable metals for rings
- use and/or modify designs when completing projects (ACTDEP049)
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - determine processes for the efficient use of materials
  - use spreadsheets to calculate material quantities and monitor project costs
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects

Materials

Students:

- select and use materials based on their properties, aesthetic appeal and application in the development and production of projects, for example:
  - ferrous and non-ferrous metals and alloys
  - pure metals and alloys
  - semi-precious stones for jewellery
- identify, select and use materials to enhance the appearance of an art metal project
- select and use finishes and protective coatings suitable for practical projects, for example:
  - anodising
  - painting
  - plating
  - powder coating
- select and analyse the properties, aesthetic appeal and applications of metal and allied materials in art metal and jewellery projects.
- describe the manufacture of a range of metal sectional shapes and their application to art metal, for example:
  - forging
  - rolling and drawing
  - sintering and casting

Tools, equipment and techniques

Students:

- identify, select and use a range of hand, power and machine tools and equipment in the production of art metal projects, for example:
  - cutting/bending/rolling/forming/spinning/polishing equipment
  - heating equipment for soldering, joining, annealing, forging and welding
  - use and adjust tools for metal lathe turning
- select and use appropriate equipment for heating and joining metals
- use jigs to assist in the construction and assembly of art metal projects
- investigate advanced manufacturing techniques to assist in the production of projects, for example:
  - CNC equipment, eg laser cutters, CNC milling machines
  - plasma/water cutters

- select and use a range of techniques to shape, bend, finish and form metals in the production of art metal projects, for example:
  - edge treatments and appropriate surface treatments
  - forging, spinning and turning
  - stone setting, engraving, dapping and punching
- select and use a range of joining techniques and processes, for example:
  - adhesives
  - mechanical fasteners
  - sandwich work and inlays
  - welding and soldering
- identify, select and use a range of suitable processes and techniques for art metal projects, for example:
  - appropriate surface finishes
  - design, make and use jigs in the production of practical projects

Workplace communication skills

Students:

- recognise and comply with WHS signage
- select and use specialist terminology in context, for example:
  - glossary
  - procedure/storyboard
  - record of production
- read and interpret plans and/or materials lists to prepare materials for the completion of projects
- produce annotated freehand sketches of project components and/or projects to visualise, communicate, understand and record ideas
- modify and/or apply workshop drawings in the completion of projects, for example:
  - use CAD applications in the production of workshop drawings
- select and use presentation techniques for projects, for example:
  - displaying projects
  - jewellery displays
  - packaging for jewellery
- develop design and production folios using appropriate ICT, for example:
  - CAD
  - project management tools
  - simulations
- prepare design and production folios to describe the management and processes undertaken in the production of practical projects

Societal and environmental impact

Students:

- identify pollution-control measures used in art metal industries and the consequences for the environment of having limited control measures, for example:
  - Environmental Protection Authority (EPA) inspections
- understand ethical responsibilities surrounding Indigenous cultural and intellectual property, for example:
  - integrating culture through jewellery and art
- describe the effects of art metal industry activity and processes on society and the environment, for example:
  - mining of ores

Links to industry

Students:

- compare and contrast contemporary industrial manufacturing techniques, materials and equipment with classroom experiences
- compare new and emerging technologies to traditional technologies in art metal, for example:
  - 3D printing
  - CAD/CAM applications
  - metal casting processes
  - metal laser cutters
- describe the impact of new and emerging technologies on careers and professions in art metal industries
- compare and contrast careers and professions in art metal and related industries, for example:
  - farrier
  - jeweller
  - sculptor
  - silversmith

Multimedia Content for Years 7–10

The Multimedia focus area provides opportunities for students to develop knowledge, understanding and skills in relation to multimedia, photographic and associated industries.

The Multimedia 1 core module includes common content and topic content that develops knowledge and skills in the use of tools, materials and techniques related to Web Design and Video Production. These are enhanced and further developed through the study of the Multimedia 2 specialist module in Apps and Interactivity, and Games and Simulations.

Practical projects should reflect the nature of the Multimedia focus area and provide opportunities for students to develop specific knowledge, understanding and skills related to multimedia technologies.

These may include:

- 2D and 3D animations
- augmented reality (AR) or virtual reality (VR) products
- computer games
- ePublications
- individual photographic images and graphics (for print and/or digital display)
- videos
- websites and apps

Core Module: Multimedia 1

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Common Content for Topics 1 and 2

Common content must be integrated with either Topic 1 and/or Topic 2 content.

WHS and risk management

Students:

- demonstrate safe practices and procedures, for example:
  - maintain a clean and hygienic work environment
  - manage trip hazards
  - rest breaks to avoid eye strain
  - work collaboratively
- safely use and maintain multimedia technology, for example:
  - check cables are in good working order
  - ensure all mains electrical products are safety tested and tagged
- explore factors related to safety in the production of multimedia products, for example:
  - adequate lighting
  - ergonomic adjustment of work stations
  - risk assess the production environment, eg WHS signage, drone regulations
  - RSI and Carpal Tunnel Syndrome
- apply the principles of risk management, for example:
  - hierarchies of control
  - identify a particular risk and implement risk-reduction procedures

- describe elementary first aid procedures, for example:
  - outline the procedure to follow after a particular incident, eg burns, cuts

Workplace communication skills

Students:

- recognise and comply with WHS signage, for example:
  - identify the colours and shapes associated with types of WHS signage
- select and use specialist terminology in context, for example:
  - glossary
  - procedure/storyboard
  - record of production
- apply appropriate planning techniques to communicate ideas, for example:
  - brainstorms and mind maps
  - sketches and layouts
  - storyboards, scripts and shot lists
- produce freehand sketches of project components and/or projects, for example:
  - site map for a filming location
- develop design and production folios using appropriate ICT, for example:
  - CAD
  - screen captures
  - spreadsheets
  - time-lapse videography
- prepare design and production folios to describe the management and processes undertaken in the production of practical projects

Societal and environmental impact

Students:

- identify the impact of multimedia on society and the environment (ACAMAM073)
- select and incorporate content for multimedia presentations that is appropriate to the target audience (ACAMAM077)
- recognise and discuss the societal and environmental differences between traditional and digital media (ACAMAM073)
- investigate end-user requirements and limitations in both ability and access to hardware and software, for example: (ACAMAM077)
  - website accessibility legislation
- explore multimedia productions that consider cultural, personal and social diversity (ACAMAM077)
- understand and respect cultural, personal and social differences and sensitivities in the use of images, sound and video in presentations, for example: (ACAMAM079)
  - cultural protocols around art, images, film and sound
  - cultural protocols when working with Aboriginal or Torres Strait Islander communities as audiences/hypothetical clients
  - unconscious bias in the selection of content, eg gender
  - use of community-owned content
- recognise legal and ethical issues relating to the production of multimedia projects, for example: (ACAMAM077)
  - age classifications
  - copyright
  - privacy

Links to industry

Students:

- compare and contrast contemporary industry processes, techniques, materials and equipment with classroom experiences ✸
- discuss the impact of emerging technologies in the multimedia industry, for example:
  - internet connectivity, eg e-commuting, interconnected work sites
  - robotics, eg drones, gimbals
- investigate a range of career paths in the multimedia industry, for example: ✸
  - animator
  - graphic designer
  - videographer
  - website designer

Topic 1: Web Design

Content

Design

Students:

- develop and produce projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available (ACTDEK046)
- apply design principles and processes when completing projects, for example: (ACTDEK047)
  - prototyping for development feedback
- identify and investigate factors influencing design in web design, for example: (ACAMAM076)
  - accessibility
  - balanced composition in photographs, eg rule of thirds
  - user experience (UX) and user interface (UI), eg consistent layouts, font, F Diagrams, interactive prompts, intuitive labels, navigation elements, rollover effects, tones and drop shadows, typography, white space and colour choices
  - user need and capability
- implement, develop or manipulate style guides
- use and/or modify designs when completing projects (ACTDEP049)
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - calculate the cost of hardware used in project production
  - use spreadsheets to calculate material quantities and monitor project costs
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects

Tools, equipment and techniques

Students:

- select and use appropriate tools to generate digital graphics, for example: (ACAMAM075)
  - 2D scanner
  - digital cameras, eg DSLR, digital still camera, mobile devices
  - graphics tablet
- apply graphics production techniques, for example: (ACAMAM075)
  - masking and cropping
  - use of layers and opacity
  - warping
- apply appropriate lighting to digital graphics, for example:
  - reflectors
  - three-point lighting
- explore characteristics and features of digital graphics, for example:
  - bitmap and vector graphics
  - colour palette
  - file types, eg , gif, png, jpeg
  - resolution
- select and use appropriate digital graphics software, for example: (ACAMAM075)
  - drawing software
  - photo editing/manipulation software

- create webpages using a range of processes, for example:
  - CSS
  - HTML
- select, produce or export appropriate file and/or graphic types according to product requirements, for example: (ACTDEK046)
  - compressed jpeg files
  - file types that support transparent backgrounds
- select, produce or export appropriate digital media for online display, for example: (ACTDEK046)
  - different screen resolutions
  - interlaced images and progress
  - portable devices

Topic 2: Video Production

Content

Design

Students:

- develop and produce projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available (ACTDEK046)
- apply design principles and processes when completing projects, for example: (ACTDEK047)
  - contrast, eg lighting
  - frame composition, eg rule of thirds
- identify and investigate factors influencing design in video production, for example: (ACAMAM073, ACAMAM076)
  - appropriate font types and sizes
  - sound in video production
  - target audience needs, eg subtitles in video productions, culturally sensitive content
- use and/or modify designs when completing projects (ACTDEP049)
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - calculate the cost of hardware used in project production
  - using spreadsheets to calculate material quantities and monitor project costs
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects

Tools, equipment and techniques

Students:

- explore characteristics and features of digital sound, for example:
  - analogue to digital conversion (ADC)
  - bit depth
  - sample rate
- identify and use appropriate microphones and accessories to capture sound, for example:
  - booms
  - omni-directional microphone
  - socks
  - uni-directional microphone
- produce and/or manipulate sound, for example: (ACAMAM075)
  - apply filters, eg noise reduction, equalisers, effects
  - live recordings, eg podcasts, Foley, automated dialogue replacement (ADR)
  - MIDI
  - mixing loops and sound effects
- mix and sequence sound clips using audio software (ACAMAM075)
- explore characteristics and features of digital video, for example:
  - aspect ratio
  - bit depth
  - frame rate
  - resolution

- identify and use appropriate video cameras to capture footage, for example:
  - digital video camera
  - DSLR
  - specialist cameras, eg action cameras, drones, 360 degree cameras
- apply appropriate videography techniques, for example:
  - camera shot types, eg close, wide, mid, pan
  - in-camera effects, eg focus pull, monochrome
  - multi-camera shooting
  - smooth camera movement, eg camera dolly, slide bar
- combine and edit video footage using software
- apply a variety of video editing and post-production techniques, for example: (ACAMAM075, ACTDEK046)
  - sound synchronisation
  - special effects, eg chroma key, colour correction, computer-generated imagery (CGI)
  - titles and subtitles
  - transitions
- select, produce or export appropriate video types according to product requirements, for example: (ACAMAM075, ACTDEK046)
  - aspect ratios and resolutions appropriate for different displays, eg mobile devices, televisions, monitors
  - compression
  - file types, eg mov, mp4, 3gp, mp3, wav, wma, m4a
- produce 2D or 3D animations using animation software
- explore characteristics and features of animation, for example:
  - file types for export, eg gif, mpeg
  - frame rate
  - principles of animation, eg squash and stretch, timing, secondary actions, anticipation
  - resolution
- explore and apply a range of animation techniques, for example:
  - CGI
  - motion capture
  - path-based animation
  - stop-motion and cell-based animation

Specialised Module: Multimedia 2

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Common Content for Topics 3 and 4

Common content must be integrated with either Topic 3 and/or Topic 4 content.

WHS and risk management

Students:

- demonstrate safe practices and procedures, for example:
  - maintain a clean and hygienic work environment
  - manage trip hazards
  - rest breaks to avoid eye strain
- demonstrate the safe use of multimedia technology, for example:
  - check cables are in good working order
  - ergonomic adjustment of work stations
- identify and apply the principles of risk management, for example:
  - identify a particular risk and implement risk-reduction procedures
  - seizure warnings in games
  - timed pauses or notifications to promote rest breaks
- identify and apply the principles of first aid, for example:
  - outline the procedure to follow after a particular incident
- describe the WHS Act and WHS Regulations, and the role of SafeWork NSW in maintaining a safe workplace

Workplace communication skills

Students:

- recognise and comply with WHS signage
- select and use specialist terminology in context, for example:
  - procedure/storyboard
  - terms specific to app production
- read and interpret plans and/or materials lists to prepare materials for the completion of projects, for example:
  - scripts for character dialogue
- produce annotated sketches of project components and/or projects to visualise, communicate, understand and record ideas, for example:
  - storyboard for a tutorial
  - sketches of objects used in a simulation
- modify and/or apply scripts and storyboards in the completion of projects
- modify and/or apply plans in the completion of projects
- interpret and develop drawings to plan 3D models and environments, for example:
  - blocking diagrams
  - floorplans and/or environmental maps
  - perspective sketches
- document control structures to develop the project, for example: (ACTDEP052)
  - comments in the code
  - system flow charts
- develop user guides that explain how to use the final product
- develop design and production folios using appropriate ICT, for example:
  - project management tools
  - simulations
  - supporting video presentations
- prepare design and production folios to describe the management and processes undertaken in the production of projects

Societal and environmental impact

Students:

- explore multimedia productions that consider cultural, personal and social diversity (ACAMAM077)
- investigate how people use multimedia and its effect on society
- consider ethical issues during the development of projects (ACAMAM077)
- understand and respect the need for cultural, personal and social differences and sensitivities to the use of images, sound and video in presentations (ACAMAM077)
- apply knowledge of cultural protocols when working with Aboriginal and/or Torres Strait Islander communities as audiences/hypothetical clients, for example: (ACAMAM077)
  - cultural protocols around art, images, film and sound
  - use of community-owned content
- discuss the social impacts of mobile technology and applications, for example:
  - privacy
  - screen time limitations for users
  - situational awareness, eg GPS to assist finding destinations, looking at mobile devices while boarding public transport
  - the ability to spread information quickly, eg natural disasters

- investigate the environmental impacts of hardware redundancy and upgrades, for example:
  - built-in obsolescence of devices
  - recycling of redundant hardware
- explore the social impacts of computer games, for example: (ACAMAM077)
  - health issues related to computer games, eg seizures, sleep deprivation
  - safety issues, eg online gaming communities, augmented reality (AR) and mobile devices
  - social issues, eg collaborative gaming, skill development
- recognise legal and ethical considerations in relation to games and simulations (ACAMAM077)

Links to industry

Students:

- compare and contrast contemporary industry processes, techniques, materials and equipment with classroom experiences, for example:
  - rendering farms compared to rendering on a single computer
- identify new and emerging technologies and contrast with those used in the past
- explore the application of apps, games and/or simulations used by industry with those developed in the classroom, for example:
  - entertainment
  - monitoring apps, eg exercise, fitness and health
  - training apps, eg employee skill development
- compare and contrast careers and professions in the multimedia industry, for example:
  - a graphic designer compared to an animator

Topic 3: Apps and Interactivity

Content

Design

Students:

- develop and produce projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available, for example: (ACTDEK046)
  - processing capability of end-user hardware
- identify and investigate factors influencing design in apps and interactivity, for example: (ACAMAM076)
  - user experience (UX), eg minimal load and reaction times
  - user interface (UI), eg intuitive labels in menus and buttons, interactive help options or tutorials, rollover effects
- identify the functional and aesthetic aspects of design in apps and interactivity, for example: (ACAMAM077)
  - appropriate interface components, eg checkboxes, menus, radio buttons and text boxes
  - button or swipe options
  - screen readers
  - text sizing
- use and/or modify designs when completing projects (ACTDEP049)
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - calculate the cost of hardware used in project production
  - use spreadsheets to calculate material quantities and monitor project costs
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects

Tools, equipment and techniques

Students:

- select and use authoring software to build interactive applications
- explore a range of input and output devices used to interact with software, for example: (ACTDEK046)
  - mobile device components, eg accelerometers, location services, camera, microphone
  - touch screens
- assess appropriate hardware for its purpose, for example:
  - virtual reality (VR) goggles versus full-size simulator
- prepare media for display across a range of platforms by using appropriate techniques (ACAMAM075)
- explore the properties of media files that affect their display across a range of devices, for example: (ACTDEK046)
  - file formats, eg operating system restrictions on certain file types
  - file sizes and storage, eg mobile data limits, device storage limits, mobile streaming capability
- investigate ways to compile projects to prepare applications for distribution
- select and use an appropriate programming language to produce applications and/or interactive functions in presentations

- modify and/or apply libraries of code to produce apps, for example:
  – use existing games or assets and modify them to create projects or components
- prepare and embed media to be used in the application
- develop working prototypes to allow for user feedback and evaluation during the design process

Topic 4: Games and Simulations

Content

Design

Students:

- apply design principles and processes when completing a game or simulation that meets the identified needs of a target audience (ACTDEK047)
- develop and produce projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available, for example: (ACTDEK046)
  - processing capability of end-user hardware
- identify and investigate factors influencing design in games and simulations, for example: (ACAMAM076)
  - data that enables the production of precise simulations and/or game components, eg size, speed, weight, density
- explore health and safety issues associated with use of augmented reality (AR), virtual reality (VR) and mixed reality (MR)
- develop and evaluate component prototypes for games and/or simulations
- use and/or modify designs when completing projects (ACTDEP049)
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - calculate the cost of hardware used in project production
  - use spreadsheets to calculate material quantities and monitor project costs
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects

Tools, equipment and techniques

Students:

- explore devices used to interface with games and simulations, for example:
  - accelerometers and gyroscopes
  - game pads and game controllers
  - motion sensors and VR headsets
  - touchscreens
- explore and/or use animation techniques used to produce games and simulations, for example:
  - motion capture
  - path-based animations
  - sprite sheets
- produce sprite sheets for 2D character/object animations
- create or modify textures when rendering 3D objects
- develop rendered 3D models for use in games or simulations
- develop or refine libraries of code to produce game functions
- investigate the impacts of storage limitations on the development and delivery of games and simulations, for example: (ACTDEK046)
  - 3D model wireframes and number of vectors
  - bitmap texture file sizes
  - online games
  - storage media, eg portable storage, local storage, cloud storage

- determine hardware requirements for both the development and effective display of multimedia products, for example: (ACTDEK046)
  - processor speed/graphics processing unit (GPU)
  - memory
  - storage

Timber Content for Years 7–10

The Timber focus area provides opportunities for students to develop knowledge, understanding and skills in relation to the timber and associated industries.

The core module develops knowledge and skills in the use of tools, materials and techniques related to timber which are enhanced and further developed through the study of a specialist module.

Practical projects undertaken should reflect the nature of the Timber focus area and provide opportunities for students to develop specific knowledge, understanding and skills related to timber technologies. These may include:

- decorative timber products
- furniture items
- small bowls or turned items
- storage and display units
- storage and transportation products

Projects should promote the sequential development of skills and reflect an increasing degree of student autonomy as they progress through the course.

Core Module: Timber 1

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Content

WHS and risk management

Students:

- demonstrate safe workshop practices and procedures, for example:
  - clamp materials securely when cutting or drilling
  - lift and carry materials safely
  - manage trip hazards in the workshop
  - work collaboratively
- safely use and maintain hand, power and machine tools
- select and use personal protective equipment (PPE) when working with tools, materials and machines, for example:
  - wear appropriate footwear
  - wear eye protection, eg safety glasses when drilling
  - wear protective clothing
- apply the principles of risk management, for example:
  - hierarchies of control
  - identify a particular risk and implement risk-reduction procedures
- describe elementary first aid procedures, for example:
  - outline the procedure to follow after a particular incident, eg burns and cuts

Design

Students:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available, for example: (ACTDEK046)
  - finishing
  - joining processes
  - material selection
  - shaping processes
- identify and investigate factors influencing design in timber projects, for example:
  - grain
  - hardware
  - proportion
  - timber species
- use and/or modify existing designs when completing projects
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - use spreadsheets to calculate material quantities and monitor project costs
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects

Materials

Students:

- investigate the structure of trees and how they grow
- describe the differences between hardwoods and softwoods and justify their selection in a range of projects
- investigate the properties and working characteristics of solid timber, for example:
  - colour
  - defects, eg gum veins in Tasmanian oak
  - density
  - strength
- investigate timber conversion and seasoning processes, for example:
  - compare the advantages and disadvantages of air and kiln seasoning
  - outline and apply the appropriate method of stacking cut timber for seasoning and storage
- identify differences in appearance and properties of radially and tangentially cut boards
- contrast the properties and working characteristics of a range of timbers when planning and using timber for specific projects, for example:
  - durability
  - workability
- identify, select and use a range of hardware and cabinet fittings in the completion of projects, for example:
  - catches
  - drawer handles
  - hinges

Tools, equipment and techniques

Students:

- measure and mark out materials accurately from a workshop drawing
- select, use and adjust hand tools in the production of practical projects, for example:
  - chisel a lap joint
  - mark out using a try square and marking gauge
  - plane a timber edge in preparation for joining
  - using sash cramps to join two boards of timber
- accurately cut and prepare materials to size, for example:
  - cutting curves in timber using a coping saw
  - using a tenon saw to cut on waste side of line
- produce practical projects using machines and portable power tools, for example:
  - cutting a curve using a jigsaw
  - cutting a profile using a router
  - sanding a surface using an orbital sander
  - turning a small bowl
- maintain hand and machine tools
- identify and use a variety of joining methods, for example:
  - adhesives/glue
  - nails/screws
- identify and cut a range of timber joints, for example:
  - box joints, eg rebate, housing, mitre
  - carcase joints, eg mortise and tenon, bridle
  - widening joints, eg biscuit
- incorporate features into projects, for example:
  - drawers
  - lids
- select and prepare timber for the lathe, for example:
  - between centres turning
  - faceplate turning
- set up and use lathe techniques for basic turning processes, for example:
  - between centres turning, eg rolling pin, mallet handle
  - cup chuck or screw chuck turning, eg drawer knob, egg cup
- explore timber decoration techniques, for example:
  - laser engraving
  - marquetry
  - pyrography
  - veneering
- identify reasons for preparing surfaces and applying timber finishes
- describe a range of timber finishes and their applications, for example:
  - clear finishes
  - oils
  - stains
- apply a range of processes and techniques for finishing timber, for example:
  - applying an oil finish
  - burnishing
- investigate tools and techniques used by Aboriginal and/or Torres Strait Islander Peoples to manipulate timber and the environment, for example:
  - selection of an appropriate tree for didgeridoo production

- investigate advanced manufacturing techniques to assist in the production of projects, for example:
  - CNC equipment, eg laser cutters, CNC milling machines
  - rapid prototyping

Workplace communication skills

Students:

- recognise and comply with WHS signage, for example:
  - identify the colours and shapes associated with types of WHS signage
- select and use specialist terminology in context, for example:
  - glossary
  - procedure/record of production
- read and interpret plans and/or materials lists to prepare materials for the completion of projects, for example:
  - workshop drawings of joints
- produce freehand sketches of project components and/or projects
- develop design and production folios using appropriate ICT, for example:
  - CAD
  - spreadsheets
- prepare design and production folios to describe the management and processes undertaken in the production of practical projects

Societal and environmental impact

Students:

- identify renewable and non-renewable resources in the timber industry
- recognise the importance of conservation of materials and recycling in the timber industry, for example:
  - recycling of timbers, eg beams from old warehouses
  - the use of plantation timbers in the production of manufactured boards
- investigate issues relating to the sustainability of resources in the timber industry, for example:
  - old-growth logging
  - the use of plantation timbers
- explore the role of Aboriginal Peoples and organisations in sustainable forestry management
- investigate technologies used in the timber industry to reduce the use of non-renewable resources, for example:
  - use of finger jointed timbers
  - use of laminated veneered lumber (LVL) to conserve old-growth forests

Links to industry

Students:

- compare industrial production processes to those used in the classroom, for example:
  - application of timber finishes
  - using jigs and templates
- investigate historical technologies related to the timber industry
- investigate a range of career paths in the timber and related industries, for example:
  - carpenter
  - cabinetmaker
  - joiner
  - wood machinist

Specialised Module: Timber 2

Outcomes

A student:

› identifies, assesses, applies and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies IND5-1
› applies design principles in the modification, development and production of projects IND5-2
› identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects IND5-3
› selects, justifies and uses a range of relevant and associated materials for specific applications IND5-4
› selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects IND5-5
› identifies and participates in collaborative work practices in the learning environment IND5-6
› applies and transfers skills, processes and materials to a variety of contexts and projects IND5-7
› evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction IND5-8
› describes, analyses and uses a range of current, new and emerging technologies and their various applications IND5-9
› describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally IND5-10

Related Stage 4 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10

Related Life Skills outcomes: INDLS-1, INDLS-2, INDLS-3, INDLS-4, INDLS-5, INDLS-6, INDLS-7, INDLS-8, INDLS-9, INDLS-10

Content

WHS and risk management

Students:

- demonstrate safe workshop practices and procedures, for example:
  - apply finishes in a well-ventilated area
  - clamp materials securely when cutting, drilling or routing
  - follow workshop signage instructions
- safely use and maintain hand, power and machine tools
- select and use personal protective equipment (PPE) when working with tools, materials and machines, for example:
  - wear appropriate footwear
  - wear ear protection, eg ear muffs when using machinery
  - wear eye protection, eg safety glasses when woodturning
  - wear protective clothing
- describe the WHS Act and WHS Regulations, and the role of SafeWork NSW in maintaining a safe workplace
- identify and apply the principles of risk management, for example:
  - identify a particular risk and implement risk-reduction procedures
- identify and apply the principles of first aid, for example:
  - outline the procedure to follow after a particular incident, eg cuts and lacerations

Design

Students:

- develop and produce practical projects allowing for the characteristics and properties of materials, systems, components, tools and equipment available, for example: (ACTDEK046)
  - finishing
  - joining processes
  - material selection
  - shaping and forming processes
- identify and investigate factors influencing design in timber projects, for example:
  - colour
  - grain
  - hardware
  - proportion
- identify the functional and aesthetic aspects of design in timber projects, for example:
  - suitability of finish for desired appearance
  - suitability of species for outdoor applications
- use and/or modify designs when completing projects (ACTDEP049)
- calculate quantities and costs of materials and components used in the completion of projects, for example:
  - determine processes for the efficient use of materials
  - use spreadsheets to calculate material quantities and monitor project costs
- apply project management techniques and follow a planned sequence through to project completion
- evaluate the impact of design and work practices/processes on the quality of finished projects

Materials

Students:

- research and select appropriate timbers or timber products and allied materials when completing projects (ACTDEK046)
- investigate methods of cutting veneers and their associated characteristics and properties
- identify and check for defects in solid timber and apply techniques to overcome defects in the production of practical projects
- analyse the effects of incorrect seasoning and insect attack on properties and appearance of the timber
- compare the machining properties of solid timbers and timber products in relation to production, for example: (ACTDEK046)
  - straight grain for ease of planing
  - tight grain for improved surface finish when routing
  - uniform strength of plywood
- identify, select and use a range of cabinet fittings, hardware and allied materials in the production of projects, for example:
  - glass top for a coffee table
  - hinges/handles on a cabinet
  - knock-down fittings for flatpack furniture
  - metal runners for smooth-running drawers

Tools, equipment and techniques

Students:

- identify, select and use suitable processes and techniques for specific projects (ACTDEK047, ACTDEP050)
- identify, select and use a range of hand, power and machine tools for preparation, marking out, cutting, shaping and joining timber (ACTDEK046)
- maintain hand tools used to cut and shape timber
- apply power and machine tools in the preparing, cutting, shaping and joining of construction of projects, for example:
  - moulding an edge using a router
  - turning a table leg on a lathe
- select and use a range of framing, corner, joining and widening methods, for example: (ACTDEK046)
  - biscuit and dowel widening joints
  - mortise and tenon joint for a table
  - through housing joint for a shelf or divider
- prepare and use jigs and templates to assist in the construction and assembly of projects
- select and apply a range of appropriate techniques to check projects for square, for example:
  - measuring diagonals
  - using a builder's square
- select and apply appropriate woodturning techniques to shape timber, for example:
  - cutting
  - faceplate turning, eg bowl turning
  - scraping
- select and apply a range of production and detailing techniques, for example:
  - inlay
  - laser engraving
- select and apply appropriate surface preparation methods and apply a variety of finishes
- investigate advanced manufacturing techniques to assist in the production of projects, for example:
  - CNC equipment, eg laser cutters, CNC milling machines
  - copy lathes

Workplace communication skills

Students:

- recognise and comply with WHS signage
- select and use specialist terminology in context, for example:
  - glossary
  - procedure/storyboard
  - record of production
- read and interpret plans and/or materials lists to prepare materials for the completion of projects
- produce annotated freehand sketches of project components and/or projects to visualise, communicate, understand and record ideas
- modify and/or apply workshop drawings in the completion of projects, for example:
  - use CAD applications in the production of workshop drawings
- develop design and production folios using appropriate ICT, for example:
  - CAD
  - project management tools, eg timeline, cutting list
- prepare design and production folios to describe the management and processes undertaken in the production of practical projects

Societal and environmental impact

Students:

- explore the environmental effect from the production and use of manufactured boards
  - plantation timbers used to conserve old-growth timbers
- investigate the environmental implications of the use of old-growth timbers
- describe the effects of the timber and furnishing industries on society and the environment, for example:
  - conserving historic furniture
  - employment and training
- explain the environmental and societal impact of resources used in the development and production of projects

Links to industry

Students:

- compare and contrast contemporary industrial manufacturing techniques, materials and equipment with classroom experiences
  - production of kitchen cabinetry using multi-head boring machinery
  - embedding laminated timber with composite fibres
- research current techniques, materials and equipment used by industry to develop and produce timber products (ACTDEK047)
- describe the impact of new and emerging technologies on careers and professions in the timber industry
- compare and contrast careers and professions in the timber and related industries, for example:
  - a kitchen manufacturer compared to a builder

Years 7–10 Life Skills Outcomes and Content

The Years 7–10 Life Skills outcomes and content are developed from the objectives of the *Industrial Technology Years 7–10 Syllabus*.

Before deciding that a student should undertake a course based on Life Skills outcomes and content, consideration should be given to other ways of assisting the student to engage with the regular course outcomes. This assistance may include a range of adjustments to teaching, learning and assessment activities.

If the adjustments do not provide a student with sufficient access to some or all of the Stage 4 and Stage 5 outcomes, a decision can be explored for the student to undertake Life Skills outcomes and content. This decision should be made through the collaborative curriculum planning process involving the student and parent/carer and other significant individuals. School principals are responsible for the management-of the collaborative curriculum planning process.

The following points need to be taken into consideration:

- students are required to demonstrate achievement of one or more Life Skills outcomes
- specific Life Skills outcomes should be selected based on the needs, strengths, goals, interests and prior learning of each student
- achievement of an outcome may be demonstrated through selected Life Skills content
- outcomes may be demonstrated independently or with support.

Further information in relation to planning, implementing and assessing Life Skills outcomes and content can be found in support materials for:

- Technologies
- Special Education
- Life Skills.

Years 7–10 Life Skills Outcomes

Table of objectives and outcomes

Knowledge, understanding and skills

Objective

Students develop:

- knowledge of and capability in applying Work Health and Safety and risk-management procedures and practices

Life Skills outcomes A student:
INDLS-1 identifies safe and unsafe conditions in the context of undertaking a project **INDLS-2** demonstrates safe practices in the use of tools, materials and equipment

Objective

Students develop:

- knowledge and skills in the design and production of practical projects

Life Skills outcomes A student:
INDLS-3 recognises that a design process is used to develop and make projects **INDLS-4** selects appropriate tools to undertake projects

Objective

Students develop:

- knowledge and understanding of the relationship between the properties of materials and their applications

Life Skills outcome
A student:
INDLS-5 selects and uses appropriate materials to undertake projects

Objective

Students develop:

- skills in communicating ideas, processes and technical information with a range of audiences

Life Skills outcomes
A student:
INDLS-6 uses a variety of communication techniques in the context of undertaking projects **INDLS-7** works collaboratively in the learning environment

Objective

Students develop:

- understanding to transfer knowledge and skills to other experiences

Life Skills outcome
A student:
INDLS-8 uses skills and processes in a variety of contexts and projects

Objective

Students develop:

- knowledge and understanding to critically evaluate manufactured products in order to become a discriminating consumer

Life Skills outcome
A student:
INDLS-9 evaluates the success of projects

Objective

Students develop:

- knowledge and understanding of the role of traditional, current, new and emerging technologies in industry and their impact on society and the environment

Life Skills outcome A student:
INDLS-10 explores the effects of current and emerging technologies

Values and attitudes

Students:

- appreciate the contribution and impact of innovation and technologies on leisure, lifestyle, work and further learning
- appreciate the dynamic nature of design and production processes and how they are used to develop solutions to personal, social and global issues
- appreciate the finite nature of some resources and the impact of their use on the environment and society
- value the development of skills and gain satisfaction from their use to solve problems and create quality products.

Years 7–10 Life Skills and Related Syllabus Outcomes

Knowledge, understanding and skills

Objective

Students develop:

- knowledge of and capability in applying Work Health and Safety and risk-management procedures and practices

Life Skills outcomes A student:	**Related Stage 4 and 5 outcomes** A student:
INDLS-1 identifies safe and unsafe conditions in the context of undertaking a project **INDLS-2** demonstrates safe practices in the use of tools, materials and equipment	**IND4-1** identifies and applies fundamental WHS principles when working with tools, materials and machines **IND5-1** identifies, assesses and manages the risks and WHS issues associated with the use of a range of tools, equipment, materials, processes and technologies

Objective

Students develop:

- knowledge and skills in the design and production of practical projects

Life Skills outcomes A student:	**Related Stage 4 and 5 outcomes** A student:
INDLS-3 recognises that a design process is used to develop and make projects	**IND4-2** applies a design process in the modification of projects **IND5-2** applies design principles in the modification, development and production of projects
INDLS-4 selects appropriate tools to undertake projects	**IND4-3** identifies and uses a range of hand and machine tools to produce quality practical projects **IND5-3** identifies, selects and uses a range of hand and machine tools, equipment and processes to produce quality practical projects

Objective

Students develop:

- knowledge and understanding of the relationship between the properties of materials and their applications

Life Skills outcome A student:	**Related Stage 4 and 5 outcomes** A student:
INDLS-5 selects and uses appropriate materials to undertake projects	**IND4-4** selects and uses a range of relevant materials for specific purposes **IND5-4** selects, justifies and uses a range of relevant and associated materials for specific applications

Objective

Students develop:

- skills in communicating ideas, processes and technical information with a range of audiences

Life Skills outcomes A student:	**Related Stage 4 and 5 outcomes** A student:
INDLS-6 uses a variety of communication techniques in the context of undertaking projects	**IND4-5** selects and uses communication techniques when designing, making and evaluating projects and ideas **IND5-5** selects, interprets and applies a range of suitable communication techniques in the development, planning, production and presentation of ideas and projects
INDLS-7 works collaboratively in the learning environment	**IND4-6** participates in collaborative work practices in the learning environment **IND5-6** identifies and participates in collaborative work practices in the learning environment

Objective

Students develop:

- understanding to transfer knowledge and skills to other experiences

Life Skills outcome A student:	**Related Stage 4 and 5 outcomes** A student:
INDLS-8 uses skills and processes in a variety of contexts and projects	**IND4-7** applies skills, processes and materials to a variety of contexts and projects **IND5-7** applies and transfers skills, processes and materials to a variety of contexts and projects

Objective

Students develop:

- knowledge and understanding to critically evaluate manufactured products in order to become a discriminating consumer

Life Skills outcome A student:	**Related Stage 4 and 5 outcomes** A student:
INDLS-9 evaluates the success of projects	**IND4-8** evaluates products in terms of functional use and aesthetics **IND5-8** evaluates products in terms of functional, economic, aesthetic and environmental qualities and quality of construction

Objective

Students develop:

- knowledge and understanding of the role of traditional, current, new and emerging technologies in industry and their impact on society and the environment

Life Skills outcome A student:	**Related Stage 4 and 5 outcomes** A student:
INDLS-10 explores the effects of current and emerging technologies	**IND4-9** identifies a range of technologies and their intended uses **IND4-10** describes the impact of technology on society, the environment and cultural issues locally and globally **IND5-9** describes, analyses and uses a range of current, new and emerging technologies and their various applications **IND5-10** describes, analyses and evaluates the impact of technology on society, the environment and cultural issues locally and globally

Years 7–10 Life Skills Content

The Years 7–10 Life Skills content is suggested.

Content describes the intended learning for students as they work towards achieving one or more of the Life Skills outcomes. It provides the foundations for students to progress to the next stage of schooling or post-school opportunities.

Teachers will make decisions about the choice of outcomes and selection of content regarding the sequence, emphasis and any adjustments required based on the needs, strengths, goals, interests and prior learning of students. Examples provided in the content are suggestions only. Teachers may use the examples provided or use other examples to meet the particular needs of individual students.

Focus areas

The Years 7–10 Life Skills outcomes and content has been organised around the following focus areas:

- Automotive
- Building and Construction
- Electronics
- Engineering
- Farm Maintenance
- Metal
- Multimedia
- Timber.

Students may study up to **two** focus areas based on the Industrial Technology syllabus that contribute to the award of their Record of School Achievement (RoSA). A student may undertake a focus area once only.

Where a student undertakes two courses in Industrial Technology, they must be from different focus areas.

Practical experiences

Where appropriate, students should have the opportunity to develop their knowledge, understanding and skills of principles and techniques associated with industrial technologies by engaging in a range of practical experiences. Students with disability may require adjustments and/or additional support in order to engage in practical experiences.

Further information can be found in Course Structure and Requirements.

Automotive

Outcomes

A student:

› identifies safe and unsafe conditions in the context of undertaking a project INDLS-1
› demonstrates safe practices in the use of tools, materials and equipment INDLS-2
› recognises that a design process is used to develop and make projects INDLS-3
› selects appropriate tools to undertake projects INDLS-4
› selects and uses appropriate materials to undertake projects INDLS-5
› uses a variety of communication techniques in the context of undertaking projects INDLS-6
› works collaboratively in the learning environment INDLS-7
› uses skills and processes in a variety of contexts and projects INDLS-8
› evaluates the success of projects INDLS-9
› explores the effects of current and emerging technologies INDLS-10

Related Stage 4/5 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10, IND5-1, IND5-2, IND5-3, IND5-4, IND5-5, IND5-6, IND5-7, IND5-8, IND5-9, IND5-10

Content focus

The Automotive focus area provides opportunities for students to develop knowledge, understanding and skills in the use of tools, materials and techniques related to automotive maintenance and repair.

Emphasis is on the practical application of skills that reflect the nature of the focus area and provide opportunities for students to develop specific knowledge, understanding and skills related to automotive technologies and industries.

Students have opportunities to engage with practical projects relevant to their strengths, needs and interests and may be drawn from one or more of the following suggested automotive contexts:

- automotive restorations
- building a small powered vehicle
- maintenance and repair of small engines
- making metal tools and parts
- repairing metal components
- work undertaken on major or auxiliary automotive components by rebuilding or restoring.

Content

WHS and risk management

Students:

- identify and respond to safety and warning signage
- identify, select and use appropriate personal protective equipment (PPE) when participating in automotive practical tasks, for example:
  - eye protection
  - protective clothing and footwear
  - hearing protection

- identify and apply safe working practices when handling and using tools, materials and equipment, for example:
  - hand tools
  - power tools
  - machine tools
- identify and apply safe working practices to the handling and storage of hazardous materials, for example:
  - solvents
  - petrol
  - batteries
  - spray paint
- identify potential risks and suggest ways to improve safety in general and specific automotive contexts, for example:
  - trip hazards
  - unlabelled chemicals
- identify and apply safe working practices to be followed in the undertaking of practical tasks, for example:
  - emergency evacuation procedures
  - safe lifting and/or handling
- identify and apply first aid procedures in automotive contexts

Design

Students:

- explore factors that influence design in automotive contexts, for example:
  - function
  - aesthetics
  - available resources
  - environmental impact
  - regulatory standards
- explore features of automotive vehicles, for example:
  - chassis
  - steering
  - braking
  - suspension
  - transmission
  - power source
- explore features of automotive electrical systems, for example:
  - battery
  - fuse
  - alternator
  - ignition
- explore features of automotive fuel systems, for example:
  - petrol
  - fuel pump
  - carburettor
  - fuel filter
- explore management factors of the design process in the preparation of a selected project, for example:
  - key actions in the design and production of a project
  - time allocations for required actions
  - availability of materials and resources required

- explore examples of automotive design with personal, local or cultural significance
- select from a range of strategies to communicate ideas about design solutions, for example:
  - electronic media
  - print media
  - sketches or drawings
  - libraries
- investigate the use of automotive electrical systems in the wider community
- identify and compare the features of 2 stroke and 4 stroke engines
- investigate the use of 2 stroke and 4 stroke engines in the wider community

Materials

Students:

- explore properties of materials that make them suitable for automotive projects, for example:
  - density
  - durability
  - flexibility
  - transparency
- select materials for use in the production of an automotive project, for example:
  - common metals and alloys
  - polymers and other composites
  - sheet, cast and manufactured materials
- identify chemicals used in automotive contexts, for example:
  - oils, greases and other lubricants
  - cleaning solutions
  - paints, lacquers and solvents

Tools, equipment and techniques

Students:

- identify hand, machine and power tools for metalworking and automotive tasks, for example:
  - cordless drill
  - puller
  - spanner
- use hand tools for the production of an automotive project, for example:
  - scraper for preparing metal surfaces
  - socket wrench for tightening nuts
- use machine and power tools for the production of an automotive project, for example:
  - angle grinder for cutting and preparing materials
  - pneumatic sander for finishing surfaces
- identify features of tools that make them hazardous and suggest ways to reduce risk, for example:
  - heat
  - movement
  - sharpness
- identify and apply safe practices to maintain and store tools
- identify techniques in the construction of an automotive project, for example
  - cutting
  - shaping
  - joining
  - finishing

- apply techniques to maintain and repair automotive systems, for example:
  - disassembly
  - cleaning
  - inspection
  - lubrication
  - reassembly
- apply techniques to join materials, for example:
  - fasteners
  - rivets
  - threads
  - adhesives
- apply techniques to prepare surfaces and apply finishes to materials, for example:
  - polishing
  - painting
- explore processes used in automotive body repair, for example:
  - chassis alignment
- evaluate techniques used in the construction of an automotive project

Workplace communication skills

Students:

- interpret and respond to workplace texts, for example:
  - verbal instructions
  - procedural texts, eg flowcharts, list of materials
  - workshop drawings
  - floor plans
- follow a sequence in the completion of a task
- work collaboratively in the completion of a task, for example:
  - request clarification
  - contribute to discussions
  - share ideas
  - express a point of view
- select a variety of strategies to communicate ideas about the design and production of an industrial project, for example:
  - collect images
  - digital presentations
  - sketches and drawings
  - annotated diagrams
  - spreadsheets
- collect information from a range of sources to evaluate an industrial project, for example:
  - feedback from peers, surveys or interviews

Links to industry

Students:

- explore the use of renewable and/or non-renewable resources within the automotive industry, for example:
  - recycled materials
  - alternative energy sources
- explore sustainability practices related to the automotive industry, for example:
  - automotive manufacturing
  - environmental protection
  - government regulations
  - disposal of hazardous waste material
- compare industrial and/or commercial processes with those undertaken in the classroom
- explore vocational opportunities related to the automotive industry
- explore automotive industries with a local context

Building and Construction

Outcomes

A student:

› identifies safe and unsafe conditions in the context of undertaking a project INDLS-1
› demonstrates safe practices in the use of tools, materials and equipment INDLS-2
› recognises that a design process is used to develop and make projects INDLS-3
› selects appropriate tools to undertake projects INDLS-4
› selects and uses appropriate materials to undertake projects INDLS-5
› uses a variety of communication techniques in the context of undertaking projects INDLS-6
› works collaboratively in the learning environment INDLS-7
› uses skills and processes in a variety of contexts and projects INDLS-8
› evaluates the success of projects INDLS-9
› explores the effects of current and emerging technologies INDLS-10

Related Stage 4/5 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10, IND5-1, IND5-2, IND5-3, IND5-4, IND5-5, IND5-6, IND5-7, IND5-8,IND5-9, IND5-10

Content focus

The Building and Construction focus area provides opportunities for students to develop knowledge, understanding and skills in the use of tools, materials and techniques related to building and its associated industries.

Emphasis is on the practical application of skills that reflect the nature of the focus area and provide opportunities for students to develop specific knowledge, understanding and skills related to building and construction-related technologies.

Students have opportunities to engage with practical projects relevant to their strengths, needs and interests and may be drawn from one or more of the following suggested building and construction-related contexts:

- construction of small structures
- scale models
- elementary repairs and renovations
- development of garden and recreational areas
- work undertaken on isolated building models and mock-ups.

Content

WHS and risk management

Students:

- identify and respond to safety and warning signage
- identify, select and use appropriate personal protective equipment (PPE) when participating in building and construction of projects, for example:
  - eye protection
  - protective clothing and footwear
  - hearing protection
  - sun protection

- identify and apply safe working practices when handling and using tools, materials and equipment, for example:
  - hand tools
  - power tools
  - machine tools
- identify and apply safe working practices to the handling and storage of hazardous materials, for example:
  - solvents
  - paint
- identify potential risks and suggest ways to improve safety in building and construction contexts, for example:
  - trip hazards
  - unstable equipment
  - unsafe working heights
- identify and apply safe working practices to be followed in the undertaking of practical tasks, for example:
  - emergency evacuation procedures
  - safe lifting and/or handling
  - safety fencing around outdoor projects
- identify and apply first aid procedures in building and construction contexts

Design

Students:

- explore factors that influence design in building and construction contexts, for example:
  - function
  - aesthetics
  - available resources
  - environmental impact
  - regulatory standards
- investigate design factors in the modification of projects, for example:
  - material choices, eg timber versus metal
  - structural sizes
  - shape and position
- explore management factors of the design process in the preparation of a selected project, for example:
  - key actions in the design and production of a project
  - time allocations for required actions
  - availability of materials and resources required
- explore examples of building design with personal, local or cultural significance
- select from a range of strategies to communicate ideas about design solutions, for example:
  - electronic media
  - print media
  - sketches or drawings
  - libraries

Materials

Students:

- explore properties of materials that make them suitable for building and construction projects, for example:
  - density
  - durability
  - flexibility
  - fire resistance
- investigate the application of materials used in a range of building and construction contexts, for example:
  - footings
  - framing
  - flooring
  - roofing
  - cladding
- explore the properties and applications of building and construction materials over time, including those designed with and for Aboriginal and/or Torres Strait Islander Peoples
- select materials for use in the production of a project, for example:
  - concrete
  - timber
  - manufactured boards
  - bricks, blocks or pavers
  - sand, soil or gravel
  - roofing materials
- identify defects in solid timber, timber products and allied materials
- explore the impact of defects in timber and metal materials on structural integrity in building and construction contexts
- investigate the application of fixtures and fittings used in building and construction, for example:
  - windows and doors
  - masonry fixings
  - skirtings and architraves
  - fascia

Tools, equipment and techniques

Students:

- identify hand, machine and power tools in the production of practical tasks, for example:
  - drill
  - hacksaw
  - hammer
- use hand tools in the production of practical tasks, for example:
  - chiselling using a bevelled edge chisel
  - cutting framing timber using a handsaw
  - planing a door to fit a frame
  - skew nailing using a claw hammer
  - using a builder's square to square formwork for casting a concrete paver
- use machine and power tools in the production of practical tasks, for example:
  - cutting and joining a range of materials
  - marking out a site for excavation preparation
  - pre-drilling a handle for fixings
  - preparing a metal frame for riveting
  - routing a trench with a router

- explore the properties and application of hand and power tools for tasks associated with construction, renovation or landscaping projects, for example:
  - using a hacksaw to complete a garden irrigation project
  - using a sheet metal bender to fold galvanised mesh into a planter box
- explore the properties and application of specialist tools used in building and construction contexts, for example:
  - pallet trolley for moving materials
  - temporary fencing installed around outdoor projects
  - automatic level for setting heights for formwork
- identify features of tools that make them hazardous and suggest ways to reduce risk, for example:
  - heat
  - movement
  - sharpness
- identify and apply safe practices to maintain and store tools, for example:
  - changing blades on a hacksaw
  - coil up and store an extension cord appropriately
  - honing a chisel
- identify techniques in the construction of a project, for example:
  - cutting
  - shaping
  - joining
  - finishing
- apply techniques to mark out and cut materials, for example:
  - measure area to be cut using a rule
  - cut plywood using a jigsaw
- apply techniques to join materials, for example:
  - fix lining materials to a wall
  - framing joints
  - nailing
  - riveting
  - screwing
- apply techniques to prepare surfaces and apply finishes to materials, for example:
  - formwork for concrete pavers
  - keying metal surfaces
  - patterns for laying pavers
  - plasterwork
- explore techniques to combine metal, timber and composite materials in the construction of a project
- explore the application of jigs in the production or maintenance of projects, for example:
  - garden edging
  - tile preparation and fixing
  - non-structural repairs to buildings
- evaluate techniques used in the construction of a project

Workplace communication skills

Students:

- interpret and respond to workplace texts, for example:
  - floor plans
  - procedural texts, eg flowcharts, list of materials
  - verbal instructions
  - workshop drawings
- follow a sequence in the completion of a task
- work collaboratively in the completion of a task, for example:
  - request clarification
  - contribute to discussions
  - share ideas
  - express a point of view
- select a variety of strategies to communicate ideas about the design and production of an industrial project, for example:
  - collect images
  - digital presentations
  - sketches and drawings
  - annotated diagrams
  - spreadsheets
- collect information from a range of sources to evaluate an industrial project, for example:
  - feedback from peers, surveys or interviews

Links to industry

Students:

- explore the use of renewable and/or non-renewable resources within the building and construction industry, for example:
  - recycled materials
  - reclaimed materials
  - plantation timbers
  - old-growth forest timbers
  - alternative energy sources
- explore sustainability practices related to the building and construction industry, for example:
  - environmental protection
  - government regulations
  - disposal of hazardous waste material
- explore the effects of construction and landscaping activity on the physical environment, for example:
  - water run-off
  - impact on flora and fauna
- compare industrial and/or commercial processes with those undertaken in the classroom
- explore vocational opportunities related to the building and construction industry
- explore building and construction industries with a local context

Electronics

Outcomes

A student:

› identifies safe and unsafe conditions in the context of undertaking a project INDLS-1
› demonstrates safe practices in the use of tools, materials and equipment INDLS-2
› recognises that a design process is used to develop and make projects INDLS-3
› selects appropriate tools to undertake projects INDLS-4
› selects and uses appropriate materials to undertake projects INDLS-5
› uses a variety of communication techniques in the context of undertaking projects INDLS-6
› works collaboratively in the learning environment INDLS-7
› uses skills and processes in a variety of contexts and projects INDLS-8
› evaluates the success of projects INDLS-9
› explores the effects of current and emerging technologies INDLS-10

Related Stage 4/5 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10, IND5-1, IND5-2, IND5-3, IND5-4, IND5-5, IND5-6, IND5-7, IND5-8, IND5-9, IND5-10

Content focus

The Electronics focus area provides opportunities for students to develop knowledge, understanding and skills in the use of tools, materials and techniques related to electronic devices.

Emphasis is on the practical application of skills that reflect the nature of the focus area and provide opportunities for students to develop specific knowledge, understanding and skills in relation to electronics and associated industries.

Students have opportunities to engage with practical projects relevant to their strengths, needs and interests and may be drawn from one or more of the following suggested electronics-related contexts:

- electronic circuits and kits
- electronic-controlled devices
- robotic projects
- computer systems
- work undertaken on isolated computer components.

Content

WHS and risk management

Students:

- identify and respond to safety and warning signage
- identify, select and use appropriate personal protective equipment (PPE) when participating in practical activities, for example:
  - eye protection
  - protective clothing and footwear
- identify and apply safe working practices when handling and using tools, materials and equipment, for example:
  - hand tools
  - power tools
  - machine tools

- identify and apply safe working practices to the handling and storage of hazardous materials, for example:
  - solvents
  - cleaning chemicals
  - batteries
- identify potential risks and suggest ways to improve safety in general and specific electronics contexts, for example:
  - trip hazards
  - electric shock from exposed electrical parts
- identify and apply safe working practices to be followed in the undertaking of practical tasks, for example:
  - emergency evacuation procedures
  - safe lifting and/or handling
- identify and apply first aid procedures in electronics contexts

Design

Students:

- explore factors that influence design in electronics contexts, for example:
  - function
  - aesthetics
  - available resources
  - environmental impact
  - regulatory standards
- investigate design factors in the modification of circuit prototypes, for example:
  - layout
  - outputs
  - sequencing
  - power usage
- explore management factors of the design process in the preparation of a selected project, for example:
  - key actions in the design and production of a project
  - time allocations for required actions
  - availability of materials and resources required
- explore examples of electronic design with personal, local or cultural significance
- select from a range of strategies to communicate ideas about design solutions, for example:
  - electronic media
  - print media
  - sketches or drawings
  - libraries

Materials

Students:

- explore properties of materials that make them suitable for circuit housings, for example:
  - acrylics
  - sheet metals
  - manufactured boards
  - timber products
- investigate the application of materials used in a range of electronics contexts, for example:
  - different types and diameters of wires
  - solder

- select materials for use in the production of a project, for example:
  - acrylic
  - plywood
- evaluate the materials and techniques used in the construction of an electronic circuit

Electronic concepts

Students:

- explore principles of electricity as a form of energy, for example:
  - flow/current
  - units of measurement
- explore components of a circuit, for example:
  - resistors
  - capacitors
  - conductors
- explore the use of Australian Standards symbols to represent components in circuit diagrams
- investigate the use of different power sources in circuit construction, for example:
  - batteries
  - solar cells
- investigate the function and purpose of a range of circuits, for example:
  - parallel, eg lighting
  - series, eg table lamp
  - timing, eg traffic lights and alarm clocks
- investigate the function and purpose of devices within circuits, for example:
  - switching devices
  - sensing devices

Tools, equipment and techniques

Students:

- identify hand and power tools used for electronic tasks, for example:
  - file
  - pliers
  - screwdriver
  - soldering iron
- use hand tools for electronic tasks, for example:
  - side cutters for preparing materials
- use power tools for electronic tasks, for example:
  - drill for preparing circuit boards
- identify features of tools that make them hazardous and suggest ways to reduce risk, for example:
  - heat
  - movement
  - sharpness
- identify and apply safe practices to maintain and store tools, for example:
  - removing power cord from a wall socket
  - inspecting power cords for damage
  - coiling up and storing an extension cord appropriately
- identify techniques in the construction of a circuit board, for example:
  - drilling
  - marking out
  - soldering

- explore the application and processes used for soldering in electronic contexts, for example:
  - joining
  - removal of excess solder, eg de-soldering pump
- explore the application of techniques to test circuits and components, for example:
  - joint inspection
  - use of multimeters
- apply techniques to assemble electronic circuits, for example:
  - switches
  - LED power
  - flashing LED using transistors
  - moisture sensing
  - alarms
  - race tracks
  - FM transmitters
  - remote controllers
- explore the properties and application of equipment for testing or manufacture in electronic contexts, for example:
  - 3D printer
  - laser cutter

Workplace communication skills

Students:

- interpret and respond to workplace texts, for example:
  - verbal instructions
  - procedural texts, eg flowcharts, list of materials
  - circuit drawings
- follow a sequence in the completion of a task
- work collaboratively in the completion of a task, for example:
  - request clarification
  - contribute to discussions
  - share ideas
  - express a point of view
- select a variety of strategies to communicate ideas about the design and production of an industrial project, for example:
  - collect images
  - digital presentations
  - sketches and drawings
  - annotated diagrams
  - spreadsheets
- collect information from a range of sources to evaluate an industrial project, for example:
  - feedback from peers, surveys or interviews

Links to industry

Students:

- explore the use of renewable and/or non-renewable resources within the electronics industry, for example:
  - recycled materials
  - reclaimed materials from decommissioned circuit boards
  - alternative power sources
- explore sustainability practices related to the electronics industry, for example:
  - environmental protection
  - government regulations
  - disposal of hazardous waste material, eg printer cartridges, batteries
- compare industrial and/or commercial processes with those undertaken in the classroom
- explore vocational opportunities related to the electronics industry
- explore the electronics industry with a local context

Engineering

Outcomes

A student:

› identifies safe and unsafe conditions in the context of undertaking a project INDLS-1
› demonstrates safe practices in the use of tools, materials and equipment INDLS-2
› recognises that a design process is used to develop and make projects INDLS-3
› selects appropriate tools to undertake projects INDLS-4
› selects and uses appropriate materials to undertake projects INDLS-5
› uses a variety of communication techniques in the context of undertaking projects INDLS-6
› works collaboratively in the learning environment INDLS-7
› uses skills and processes in a variety of contexts and projects INDLS-8
› evaluates the success of projects INDLS-9
› explores the effects of current and emerging technologies INDLS-10

Related Stage 4/5 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10, IND5-1, IND5-2, IND5-3, IND5-4, IND5-5, IND5-6, IND5-7, IND5-8, IND5-9, IND5-10

Content focus

The Engineering focus area provides opportunities for students to develop knowledge, understanding and skills in the use of tools, materials and techniques related to structures and mechanisms. Students have further opportunities to explore specialist engineering technologies including control systems, alternative energy and transport.

Emphasis is on the practical application of skills that reflect the nature of the focus area and provide opportunities for students to develop specific knowledge, understanding and skills related to engineering and associated industries.

Students have opportunities to engage with practical projects relevant to their strengths, needs and interests and may be drawn from one or more of the following suggested engineering contexts:

- small structures
- small vehicles
- a range of devices and appliances
- robotics projects
- programmable microcontrollers
- electronic and mechanical control systems.

Content

WHS and risk management

Students:

- identify and respond to safety and warning signage
- identify, select and use appropriate personal protective equipment (PPE) when participating in practical activities, for example:
  - eye protection
  - protective clothing and footwear
  - hearing protection

- identify and apply safe working practices when handling and using tools, materials and equipment, for example:
  - hand tools
  - power tools
  - machine tools
- identify and apply safe working practices to the handling and storage of hazardous materials, for example:
  - solvents
  - fuels
- identify potential risks and suggest ways to improve safety in general and specific engineering contexts, for example:
  - trip hazards
  - excessive noise levels
- identify and apply safe working practices to be followed in the undertaking of practical tasks, for example:
  - emergency evacuation procedures
  - safe lifting and/or handling
- identify and apply first aid procedures in engineering contexts

Design

Students:

- explore factors that influence design in engineering contexts, for example:
  - function
  - aesthetics
  - available resources
  - environmental impact
  - regulatory standards
- investigate design factors in the modification of projects, for example:
  - material choices
  - structural sizes
- explore management factors of the design process in the preparation of a selected project, for example:
  - key actions in the design and production of a project
  - time allocations for required actions
  - availability of materials and resources required
- explore examples of engineering design with personal, local, historical or cultural significance, for example:
  - water wheels
  - steam engines
- participate in the destructive and non-destructive testing of a range of engineered prototypes and structures, for example:
  - loading a beam to failure
- select from a range of strategies to communicate ideas about design solutions, for example:
  - electronic media
  - print media
  - sketches or drawings
  - libraries

Materials

Students:

- explore properties of materials that make them suitable for engineering projects, for example:
  - strength
  - durability
  - flexibility
  - corrosion resistance
- select materials for use in the production of an engineering project, for example:
  - metals
  - polymers
  - ceramics
- investigate factors that affect material corrosion and degradation in engineered systems, for example:
  - material selection
  - chemical reactions
  - environmental factors
- evaluate the materials and techniques used in the construction of engineering prototypes or projects

Engineering principles and processes

Students:

- explore the function and purpose of structural engineering features, for example:
  - beams
  - columns
  - plates
  - frames
  - arches
- explore the function and purpose of frame components in engineering contexts, for example:
  - joints
  - supports
  - braces
- explore the function and purpose of simple machines, for example:
  - levers
  - pulleys
  - ramps (inclined plane)
  - wheels and axles
- investigate the purpose and application of a range of engineered control systems, for example:
  - factory production lines
  - automated vehicle controls
- explore the use of alternative energy sources in engineered contexts, for example:
  - solar
  - hydro-electric power
  - biofuel
  - geothermal
- investigate the purpose and application of engineered transport systems used in the wider community, for example:
  - road
  - rail
  - air

- investigate power sources used in engineered transport systems, for example:
  - batteries, eg electric cars
  - fuels, eg aircraft
  - electricity, eg trains

Tools, equipment and techniques

Students:

- identify hand, machine and power tools in the production of practical tasks, for example:
  - try square
  - tenon saw
  - file
  - cordless drill
  - disc sander
- identify features of tools that make them hazardous and suggest ways to reduce risk, for example:
  - heat
  - movement
  - sharpness
- identify and apply safe practices to maintain and store tools
- use hand tools in the production of practical tasks, for example:
  - chisel for preparing surfaces
  - spanner for securing nuts
- use machine and power tools in the production of practical tasks, for example:
  - jigsaw for cutting
  - electric screwdriver for joining materials
- identify a range of techniques in the construction of an engineering project, for example:
  - measuring
  - cutting
  - drilling
  - holding
  - shaping
  - sanding
- investigate the application and processes used for joining materials in engineering contexts, for example:
  - rivets
  - bolts
  - screws
  - adhesives
- apply techniques to construct engineering prototypes or projects, for example:
  - alarms
  - paper beams, arches or roller-coasters
  - pinball machines
  - robots
  - rubber-band powered vehicles
  - small model vehicles, eg solar-powered vehicles
  - water rockets
  - wind-powered generators

- explore the properties and application of specialist tools and equipment used in engineering contexts, for example:
  - testing equipment, eg bridge-building software
  - sensor types, eg temperature
  - motor types, eg actuators

Workplace communication skills

Students:

- interpret and respond to workplace texts, for example:
  - verbal instructions
  - procedural texts, eg flowcharts, list of materials
  - workshop drawings
  - floor plans
- follow a sequence in the completion of a task
- work collaboratively in the completion of a task, for example:
  - request clarification
  - contribute to discussions
  - share ideas
  - express a point of view
- select a variety of strategies to communicate ideas about the design and production of an industrial project, for example:
  - collect images
  - digital presentations
  - sketches and drawings
  - annotated diagrams
  - spreadsheets
  - CAD software
- collect information from a range of sources to evaluate an industrial project, for example:
  - feedback from peers, surveys or interviews

Links to industry

Students:

- explore the use of renewable and/or non-renewable resources within the engineering industry, for example:
  - recycled materials
  - alternative energy sources
- explore sustainability practices related to the engineering industry, for example:
  - environmental protection
  - government regulations
  - disposal of hazardous waste material
- explore the impacts of engineered structures on the physical environment, for example:
  - cutting into a hillside for bridge construction
  - damage to water courses during construction of infrastructure projects
- compare industrial and/or commercial processes with those undertaken in the classroom
- explore vocational opportunities related to the engineering industry
- explore engineering industries with a local context

Farm Maintenance

Outcomes

A student:

› identifies safe and unsafe conditions in the context of undertaking a project INDLS-1
› demonstrates safe practices in the use of tools, materials and equipment INDLS-2
› recognises that a design process is used to develop and make projects INDLS-3
› selects appropriate tools to undertake projects INDLS-4
› selects and uses appropriate materials to undertake projects INDLS-5
› uses a variety of communication techniques in the context of undertaking projects INDLS-6
› works collaboratively in the learning environment INDLS-7
› uses skills and processes in a variety of contexts and projects INDLS-8
› evaluates the success of projects INDLS-9
› explores the effects of current and emerging technologies INDLS-10

Related Stage 4/5 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10, IND5-1, IND5-2, IND5-3, IND5-4, IND5-5, IND5-6, IND5-7, IND5-8, IND5-9, IND5-10

Content focus

The Farm Maintenance focus area provides opportunities for students to develop knowledge, understanding and skills in the use of tools, materials and techniques related to farm maintenance.

Emphasis is on the practical application of skills that reflect the nature of the focus area and provide opportunities for students to develop specific knowledge, understanding and skills related to farm maintenance and its associated industries.

Students have opportunities to engage with practical projects relevant to their strengths, needs and interests and may be drawn from one or more of the following suggested farm maintenance-related contexts:

- small structures for farm applications
- maintenance and repair of farm appliances and equipment
- tools and implements to assist on the farm
- fences and gates
- structures for containing/restraining livestock.

Content

WHS and risk management

Students:

- identify and respond to safety and warning signage
- identify, select and use appropriate personal protective equipment (PPE) when participating in practical activities, for example:
  - eye protection
  - enclosed footwear
  - sun-protection

- identify and apply safe working practices when handling and using tools, materials and equipment, for example:
  - hand tools
  - power tools
  - machine tools
- identify and apply safe working practices to the handling and storage of hazardous materials, for example:
  - fuels
  - solvents
- identify potential risks and suggest ways to improve safety in general and specific farm maintenance contexts, for example:
  - trip hazards
  - unsecured animal enclosures
  - unstable machinery
- identify and apply safe working practices to be followed in the undertaking of practical tasks, for example:
  - emergency evacuation procedures
  - safe lifting and/or handling
- identify and apply first aid procedures in metal contexts

Design

Students:

- explore factors that influence design in farm maintenance contexts, for example:
  - function
  - aesthetics
  - available resources
  - environmental impact
  - regulatory standards
- investigate design factors in the modification of projects, for example:
  - choice of material
  - structural sizes
  - shape and position
- explore management factors of the design process in the preparation of a selected project, for example:
  - key actions in the design and production of a project
  - time allocations for required actions
  - availability of materials and resources required
- explore examples of innovative farming designs with personal, local or cultural significance
- select from a range of strategies to communicate ideas about design solutions, for example:
  - electronic media
  - print media
  - sketches or drawings
  - libraries

Materials

Students:

- explore properties of materials that make them suitable for farm maintenance, for example:
  - density
  - durability
  - flexibility
  - transparency

- select materials for use in the production of a project, for example:
  - ferrous and non-ferrous metals and alloys
  - timber or timber products
  - petroleum or petroleum products and derivatives
  - sealants and gasket materials to assemble components
- identify and respond to defects in materials used in farm maintenance contexts

Tools, equipment and techniques

Students:

- identify hand, machine and power tools in the production of practical tasks, for example:
  - clamp
  - hacksaw
  - jigsaw
  - milling machine
- use hand tools for maintenance tasks, for example:
  - hand drill
  - screwdriver
  - plane for preparation of surfaces
- identify features of tools that make them hazardous and suggest ways to reduce risk, for example:
  - heat
  - movement
  - sharpness
- identify and apply safe practices to maintain and store tools, for example:
  - sharpening a chisel
  - changing blades on a hacksaw
- identify a range of techniques in the construction of a project, for example:
  - holding
  - cutting
  - shaping
  - drilling
  - finishing
- apply techniques to mark out and cut materials, for example:
  - measuring length to be cut using a rule or tape measure
  - cutting plywood using a jigsaw
  - drilling holes in sheet metal
- apply techniques to join materials, for example:
  - nailing
  - screwing
  - riveting
  - welding
- apply techniques to prepare surfaces and apply finishes to materials, for example:
  - roughening metal surfaces
  - plasterwork
  - patterns for laying pavers
  - formwork for concrete pavers
- explore techniques to combine metal, timber and composite materials in the construction of a project

- explore the application of techniques for repair and maintenance in farm maintenance, for example:
  - remove and replace components, gaskets or joining materials
  - repair or remake a threaded component
- evaluate techniques used in the construction of a project

Workplace communication skills

Students:

- interpret and respond to workplace texts, for example:
  - verbal instructions
  - procedural texts, eg flowcharts, list of materials
  - workshop drawings
  - floor plans
- follow a sequence in the completion of a task
- work collaboratively in the completion of a task, for example:
  - request clarification
  - contribute to discussions
  - share ideas
  - express a point of view
- select a variety of strategies to communicate ideas about the design and production of an industrial project, for example:
  - collecting images
  - digital presentations
  - sketches and drawings
  - annotated diagrams
  - spreadsheets
- collect information from a range of sources to evaluate an industrial project, for example:
  - feedback from peers, surveys or interviews

Links to industry

Students:

- explore the use of renewable and/or non-renewable resources within the farming industry, for example:
  - recycled materials
  - alternative energy sources
- explore sustainability practices related to the farming industry, for example:
  - environmental protection
  - government regulations
  - disposal of hazardous waste material
  - new and emerging technologies
- compare industrial and/or commercial processes with those undertaken in the classroom
- explore vocational opportunities related to farm maintenance
- explore farm industries with a local context

Metal

Outcomes

A student:

› identifies safe and unsafe conditions in the context of undertaking a project INDLS-1
› demonstrates safe practices in the use of tools, materials and equipment INDLS-2
› recognises that a design process is used to develop and make projects INDLS-3
› selects appropriate tools to undertake projects INDLS-4
› selects and uses appropriate materials to undertake projects INDLS-5
› uses a variety of communication techniques in the context of undertaking projects INDLS-6
› works collaboratively in the learning environment INDLS-7
› uses skills and processes in a variety of contexts and projects INDLS-8
› evaluates the success of projects INDLS-9
› explores the effects of current and emerging technologies INDLS-10

Related Stage 4/5 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10, IND5-1, IND5-2, IND5-3, IND5-4, IND5-5, IND5-6, IND5-7, IND5-8, IND5-9, IND5-10

Content focus

The Metal focus area provides opportunities for students to develop knowledge, understanding and skills in the use of tools, materials and techniques related to general metal or art metal. Students have further opportunities to explore specialist metal technologies including metal machining and fabrication.

Emphasis is on the practical application of skills that reflect the nature of the focus area and provide opportunities for students to develop specific knowledge, understanding and skills related to metal and its associated industries.

Students have opportunities to engage with practical projects relevant to their strengths, needs and interests and may be drawn from one or more of the following suggested metal-related contexts:

- artistic metal projects
- fabricated projects
- jewellery and accessories
- metal machining projects
- sheet metal products.

Content

WHS and risk management

Students:

- identify and respond to safety and warning signage
- identify, select and use appropriate personal protective equipment (PPE) when participating in practical activities, for example:
  - eye protection
  - protective clothing and footwear
  - hearing protection

- identify and apply safe working practices when handling and using tools, materials and equipment, for example:
  - hand tools
  - power tools
  - machine tools
- identify and apply safe working practices to the handling and storage of hazardous materials, for example:
  - paints
  - solvents
- identify potential risks and suggest ways to improve safety in general and specific metal construction contexts, for example:
  - trip hazards
  - poor ventilation
- identify and apply safe working practices to be followed in the undertaking of practical tasks, for example:
  - emergency evacuation procedures
  - safe lifting and/or handling
- identify and apply first aid procedures in metal contexts

Design

Students:

- explore factors that influence design in metalwork productions, for example:
  - function
  - aesthetics
  - available resources
  - environmental impact
  - regulatory standards
- investigate design factors in the modification of projects, for example:
  - choice of material
  - shaping and forming processes
  - joining methods
  - finishing applications
- explore management factors of the design process in the preparation of a selected project, for example:
  - key actions in the design and production of a project
  - time allocations for required actions
  - availability of materials and resources required
- explore examples of metalwork design with personal, local or cultural significance
- select from a range of strategies to communicate ideas about design solutions, for example:
  - CAD applications
  - electronic media
  - libraries
  - print media
  - sketches or drawings

Materials

Students:

- explore properties of metals that make them suitable for projects, for example:
  - durability
  - flexibility
  - finish

- investigate the application of metals for a range of contexts, for example:
  - fitting and machining
  - metal fabrication
  - marine applications
  - art metal
- select metals for use in the production of a project, for example:
  - ferrous metals, eg steel, cast iron
  - non-ferrous metals and alloys, eg brass, copper
  - sheet metal, eg galvanised steel, tinplate
- explore the modification of metal properties through heat-treatment processes, for example:
  - annealing
  - hardening
- explore the purpose and application of finishes and protective coatings on metal projects, for example:
  - painting
  - powder coating
  - plating
  - galvanising

Tools, equipment and techniques

Students:

- identify hand, machine and power tools in the production of practical tasks, for example:
  - hack saw
  - file
  - rivet gun
- use hand tools in the production of practical tasks, for example:
  - measuring and marking out, eg rule, square
  - cutting and shaping, eg snips
  - drilling, eg centre punching, pilot holes
  - joining, eg screwdrivers, spanners, rivet gun
- use machine and power tools in the production of practical tasks, for example:
  - drilling holes with a pedestal drill
  - cutting sheet metal using a guillotine
- explore the properties and application of specialist tools used in metal contexts, for example:
  - jigs
  - fitting and machining, eg milling machines
  - metal fabrication, eg MIG welding equipment
- identify features of tools that make them hazardous and suggest ways to reduce risk, for example:
  - heat
  - movement
  - sharpness
- identify and apply safe practices to maintain and store tools, for example:
  - removing rust
  - inspecting for damage

- identify a range of techniques in the construction of a metal project, for example:
  - measuring
  - cutting
  - bending
  - shaping
  - forming
  - joining
  - finishing
- apply techniques to hold and secure materials, for example:
  - vice
  - clamp
  - jig
- apply techniques to measure and prepare materials, for example:
  - mark out projects from a workshop drawing
  - cutting stock to length
- apply techniques to shape and form materials, for example:
  - cutting sheet metal with snips
  - removing sharp edges of metal with a file
  - twisting and hammering silver wire to form a ring
  - using jigs to bend a flat bar
- explore techniques used to join materials, for example:
  - adhesives
  - bolts and nuts
  - rivets
  - soft soldering
  - welding
- explore techniques used to apply finishes and protective coatings to materials, for example:
  - enamelling
  - painting
  - plastic coating
  - plating
  - polishing
- explore techniques used to perform metal lathe operations, for example:
  - facing
  - turning
- evaluate techniques used in the construction of a metal project

Workplace communication skills

Students:

- interpret and respond to workplace texts, for example:
  - verbal instructions
  - procedural texts, eg flowcharts, list of materials
  - workshop drawings
  - floor plans
- follow a sequence in the completion of a task
- work collaboratively in the completion of a task, for example:
  - requesting clarification
  - contributing to discussions
  - sharing ideas
  - expressing a point of view

- select a variety of strategies to communicate ideas about the design and production of an industrial project, for example:
  - collecting images
  - digital presentations
  - sketches and drawings
  - annotated diagrams
  - spreadsheets
  - CAD
- collect information from a range of sources to evaluate an industrial project, for example:
  - feedback from peers, surveys or interviews

Links to industry

Students:

- explore the use of renewable and/or non-renewable resources within the metal industry, for example:
  - recycled materials
  - reclaimed materials
  - alternative energy sources
- explore sustainability practices related to the metal industry, for example:
  - environmental protection
  - government regulations
  - disposal of hazardous waste material
  - new and emerging technologies
- compare industrial and/or commercial processes with those undertaken in the classroom
- explore vocational opportunities related to the metal industry
- explore metal industries with a local context

Multimedia

Outcomes

A student:

› identifies safe and unsafe conditions in the context of undertaking a project INDLS-1
› demonstrates safe practices in the use of tools, materials and equipment INDLS-2
› recognises that a design process is used to develop and make projects INDLS-3
› selects appropriate tools to undertake projects INDLS-4
› selects and uses appropriate materials to undertake projects INDLS-5
› uses a variety of communication techniques in the context of undertaking projects INDLS-6
› works collaboratively in the learning environment INDLS-7
› uses skills and processes in a variety of contexts and projects INDLS-8
› evaluates the success of projects INDLS-9
› explores the effects of current and emerging technologies INDLS-10

Related Stage 4/5 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10, IND5-1, IND5-2, IND5-3, IND5-4, IND5-5, IND5-6, IND5-7, IND5-8, IND5-9, IND5-10

Content focus

The Multimedia focus area provides opportunities for students to develop knowledge, understanding and skills in the use of tools, materials and techniques related to multimedia, photographic and associated industries. Students have further opportunities to explore specialist multimedia technologies such as games, simulations, apps and interactivity.

Emphasis is on the practical application of skills that reflect the nature of the focus area and provide opportunities for students to develop specific knowledge, understanding and skills related to multimedia.

Students have opportunities to engage with practical projects relevant to their strengths, needs and interests and may be drawn from one or more of the following suggested multimedia contexts:

- 2D and 3D animations
- augmented reality or virtual reality products
- computer games
- ePublications
- individual photographic images and graphics (for print and/or digital display)
- videos
- websites and apps

Content

WHS and risk management

Students:

- identify and respond to safety and warning signage
- identify, select and use appropriate personal protective equipment (PPE) when participating in practical activities, for example:
  - eye protection
  - protective clothing and footwear

- identify and apply safe working practices when handling and using tools, materials and equipment, for example:
  - adequate lighting
  - electrical equipment, eg check power cords
  - print materials
  - rest breaks
- identify and apply safe working practices to the handling and storage of hazardous materials, for example:
  - store toner cartridges safely
- identify potential risks and suggest ways to improve safety in general and specific multimedia contexts, for example:
  - trip hazards
  - poor lighting
  - damaged electrical equipment
- identify and apply safe working practices to be followed in the undertaking of practical tasks, for example:
  - emergency evacuation procedures
  - safe lifting and/or handling
- identify and apply first aid procedures in multimedia contexts

Design

Students:

- explore factors that influence design in multimedia productions, for example:
  - function
  - aesthetics
  - available resources
  - regulatory standards
- investigate design factors in the modification of projects, for example:
  - frame composition
  - contrast
  - font selection
- explore management factors of the design process in the preparation of a selected project, for example:
  - key actions in the design and production of a project
  - time allocations for required actions
  - availability of materials and resources required
- explore examples of multimedia productions with personal, local or cultural significance
- select from a range of strategies to communicate ideas about design solutions, for example:
  - electronic media
  - CAD applications
  - print media
  - sketches or drawings
  - libraries
- participate in the production of a multimedia prototype
- explore the use of interface components in multimedia projects, for example:
  - menus
  - text boxes
  - checkboxes
  - buttons or swipe options

Materials

Students:

- investigate the application of multimedia in a range of contexts, for example:
  - graphics
  - video
  - sound
  - animation
- explore multimedia presentations that allow for a range of features , for example:
  - resolution
  - frame rate
  - aspect ratio
- select features in the production of a multimedia presentation, for example:
  - fonts
  - graphics
  - video
  - sound
  - animation
- explore properties of file types for exporting multimedia presentations, for example:
  - graphics, eg jpeg, png
  - video, eg avi, mov, mp4
  - sound, eg mp3, wav, wma
  - animation, eg gif, mpeg

Tools, equipment and techniques

Students:

- identify hardware and/or software suitable for the production of multimedia tasks, for example:
  - game controllers
  - motion sensors
  - virtual reality (VR) headsets
  - drones
  - drawing
  - paint
- use hardware suitable for multimedia tasks, for example:
  - cameras
  - scanners
  - microphones
- use software suitable for multimedia tasks, for example:
  - photo editing
  - video editing
  - audio recording and/or editing
- explore the properties and application of input and output devices used to interact with software, for example:
  - touchscreens
  - location services
  - gyroscopes
- explore the application of animation techniques used to produce games and simulations, for example:
  - motion capture
  - path-based animation
  - computer-generated imagery (CGI)

- identify and apply safe practices to maintain and store tools, for example:
  - remove power cord from a wall socket
  - inspect power cords for damage
  - roll up and store an extension cord appropriately
- apply techniques in the production of graphics projects, for example:
  - cropping
  - warping
  - composition
  - font selection
  - lighting
- apply techniques in the production of videography projects, for example:
  - selection of camera angles
  - transitions
  - special effects, eg colour correction
  - text, eg subtitles
- apply techniques in the production of animation projects, for example:
  - stop-motion
  - cell-based
  - path-based
  - motion capture
- apply techniques in the production of sound projects, for example:
  - sound effects
  - live recordings, eg podcasts
  - filters, eg noise reduction

Workplace communication skills

Students:

- interpret and respond to workplace texts, for example:
  - verbal instructions
  - procedural texts, eg flowcharts, list of materials
  - storyboards
  - scripts
  - floorplans
  - code/programs
- follow a sequence in the completion of a task
- work collaboratively in the completion of a task, for example:
  - request clarification
  - contribute to discussions
  - express a point of view
- select a variety of strategies to communicate ideas about the design and production of a multimedia project, for example:
  - collecting images
  - digital presentations
  - sketches and drawings
  - annotated diagrams
  - spreadsheets
  - storyboards
- collect information from a range of sources to evaluate an industrial project, for example:
  - feedback from peers, surveys or interviews

Links to industry

Students:

- explore the use of renewable and/or non-renewable resources within the multimedia industry, for example:
  - recycled materials
- explore sustainability practices related to the multimedia industry, for example:
  - environmental protection
  - government regulations
  - disposal of hazardous waste material, eg toner cartridges
  - new and emerging technologies
- explore the importance of social responsibility within multimedia industries, for example:
  - privacy
  - copyright
  - age classification
  - accessibility for people with disability
- compare commercial processes with those undertaken in the classroom
- explore vocational opportunities related to the multimedia industry
- explore multimedia industries with a local context

Timber

Outcomes

A student:

› identifies safe and unsafe conditions in the context of undertaking a project INDLS-1
› demonstrates safe practices in the use of tools, materials and equipment INDLS-2
› recognises that a design process is used to develop and make projects INDLS-3
› selects appropriate tools to undertake projects INDLS-4
› selects and uses appropriate materials to undertake projects INDLS-5
› uses a variety of communication techniques in the context of undertaking projects INDLS-6
› works collaboratively in the learning environment INDLS-7
› uses skills and processes in a variety of contexts and projects INDLS-8
› evaluates the success of projects INDLS-9
› explores the effects of current and emerging technologies INDLS-10

Related Stage 4/5 outcomes: IND4-1, IND4-2, IND4-3, IND4-4, IND4-5, IND4-6, IND4-7, IND4-8, IND4-9, IND4-10, IND5-1, IND5-2, IND5-3, IND5-4, IND5-5, IND5-6, IND5-7, IND5-8, IND5-9, IND5-10

Content focus

The Timber focus area provides opportunities for students to develop knowledge, understanding and skills in the use of tools, materials and techniques related to timber. Students have further opportunities to explore specialist timber technologies such as cabinetwork and wood machining.

Emphasis is on the practical application of skills that reflect the nature of the focus area and provide opportunities for students to develop specific knowledge, understanding and skills related to timber and associated industries.

Students have opportunities to engage with practical projects relevant to their strengths, needs and interests and may be drawn from one or more of the following suggested timber-related contexts:

- furniture items
- decorative timber products
- storage and transportation products
- small bowls or turned items
- storage and display units.

Content

WHS and risk management

Students:

- identify and respond to safety and warning signage
- identify, select and use appropriate personal protective equipment (PPE) when participating in practical activities, for example:
  - eye protection
  - protective clothing and footwear

- identify and apply safe working practices when handling and using tools, materials and equipment, for example:
  - hand tools
  - power tools
  - machine tools
- identify and apply safe working practices to the handling and storage of hazardous materials, for example:
  - timbers
  - solvents
  - paints
- identify potential risks and suggest ways to improve safety in general and specific timber contexts, for example:
  - trip hazards
  - poor ventilation
  - excessive dust
- identify and apply safe working practices to be followed in the undertaking of practical tasks, for example:
  - emergency evacuation procedures
  - safe lifting and/or handling
- identify and apply first aid procedures in timber contexts

Design

Students:

- explore factors that influence design in timber contexts, for example:
  - function
  - aesthetics, eg, grain, colour and figure
  - available resources
  - environmental impact
  - regulatory standards
- investigate design factors in the modification of projects, for example:
  - choice of material
  - shaping processes
  - joining processes
  - finishing applications
- explore management factors of the design process in the preparation of a selected project, for example:
  - key actions in the design and production of a project
  - time allocations for required actions
  - availability of materials and resources required
- explore examples of timber design with personal, local or cultural significance
- select from a range of strategies to communicate ideas about design solutions, for example:
  - electronic media
  - print media
  - sketches or drawings
  - libraries

Materials

Students:

- explore properties of timber materials that make them suitable for projects, for example:
  - colour
  - defects
  - density
  - durability
  - flexibility
- investigate the application of materials used in a range of timber contexts, for example:
  - solid timber in cabinetwork
  - defect-free timber for woodturning
- explore the properties and applications of timber materials used over time, including those used by Aboriginal and/or Torres Strait Islander Peoples, for example:
  - identify appropriate timber for the making of cultural objects, eg instruments, canoes
- select timber and related materials for use in the production of a project, for example:
  - softwoods
  - hardwoods
  - solid timbers
  - manufactured products
- identify defects in solid timber, manufactured products
- explore the impact of defects in timber materials
- explore the function and processes of methods for timber seasoning
- investigate the application of hardware or allied materials used in timber projects, for example:
  - hinges
  - handles
  - knock-down fittings

Tools, equipment and techniques

Students:

- identify hand, machine and power tools in the production of practical tasks, for example:
  - saw
  - router
  - cordless drill
  - pedestal drill
  - disc sander
- use hand tools in the production of practical tasks, for example:
  - creating a lap joint with a chisel
  - cutting curves in timber with a coping saw
  - marking out with a try square
  - planing an edge of timber
  - securing timber with a bench hook
  - using sash cramps to join two boards of timber
- use machine and power tools in the production of practical tasks, for example:
  - cutting a curve using a jigsaw
  - drilling a hole for insertion of a dowel
  - sanding end grain on a disc sander
  - joining timber using a biscuit cutter
  - sanding timber surfaces with an orbital sander
  - shaping a curve with a drum sander
- explore the application of jigs in the production of machining and/or cabinetmaking projects

- explore the properties and application of specialist tools used in the preparation, cutting, shaping and joining of construction projects, for example:
  - squaring the end of a piece of timber using a disc sander
  - moulding an edge using a router
  - turning a rolling pin on a lathe
- identify features of tools that make them hazardous and suggest ways to reduce risk, for example:
  - heat
  - movement
  - sharpness
- identify and apply safe practices to maintain and store tools, for example:
  - sharpening a chisel
  - removing excess sawdust
- identify a range of techniques in the construction of a project, for example:
  - measuring
  - cutting
  - joining
  - finishing
  - turning
- apply techniques to measure and prepare timber materials, for example:
  - measuring length to be cut using a rule
  - marking out cut lines
  - securing timber before use, eg vice or bench hook
- apply techniques to join materials, for example:
  - joints
  - screws
  - rivets
  - nails
  - adhesives
  - clamps
- apply techniques for surface finishes to timber materials, for example:
  - lacquers
  - oils
  - stains
  - paints
- explore techniques for woodturning with a lathe, for example:
  - between centres turning
  - faceplate turning
- evaluate techniques used in the construction of a project

Workplace communication skills

Students:

- interpret and respond to workplace texts, for example:
  - verbal instructions
  - procedural texts, eg flowcharts, list of materials
  - workshop drawings
  - floor plans
- follow a sequence in the completion of a task

- work collaboratively in the completion of a task, for example:
  - request clarification
  - contribute to discussions
  - sharing ideas
  - expressing a point of view
- select a variety of strategies to communicate ideas about the design and production of an industrial project, for example:
  - collecting images
  - digital presentations
  - sketches and drawings
  - annotated diagrams
  - spreadsheets
  - CAD
- collect information from a range of sources to evaluate an industrial project, for example:
  - feedback from peers, surveys or interviews

Links to industry

Students:

- explore the use of renewable and/or non-renewable resources within the timber industry, for example:
  - recycled materials
  - manufactured boards
  - non-plantation timbers
  - alternative energy sources
- explore sustainability practices related to the timber industry, for example:
  - environmental protection
  - government regulations
  - disposal of hazardous waste material
- compare industrial and/or commercial processes with those undertaken in the classroom
- explore vocational opportunities related to the timber industry
- explore timber industries with a local context

Assessment

Standards

The NSW Education Standards Authority (NESA) *K–10 Curriculum Framework* is a standards-referenced framework that describes, through syllabuses and other documents, the expected learning outcomes for students.

Standards in the framework consist of three interrelated elements:

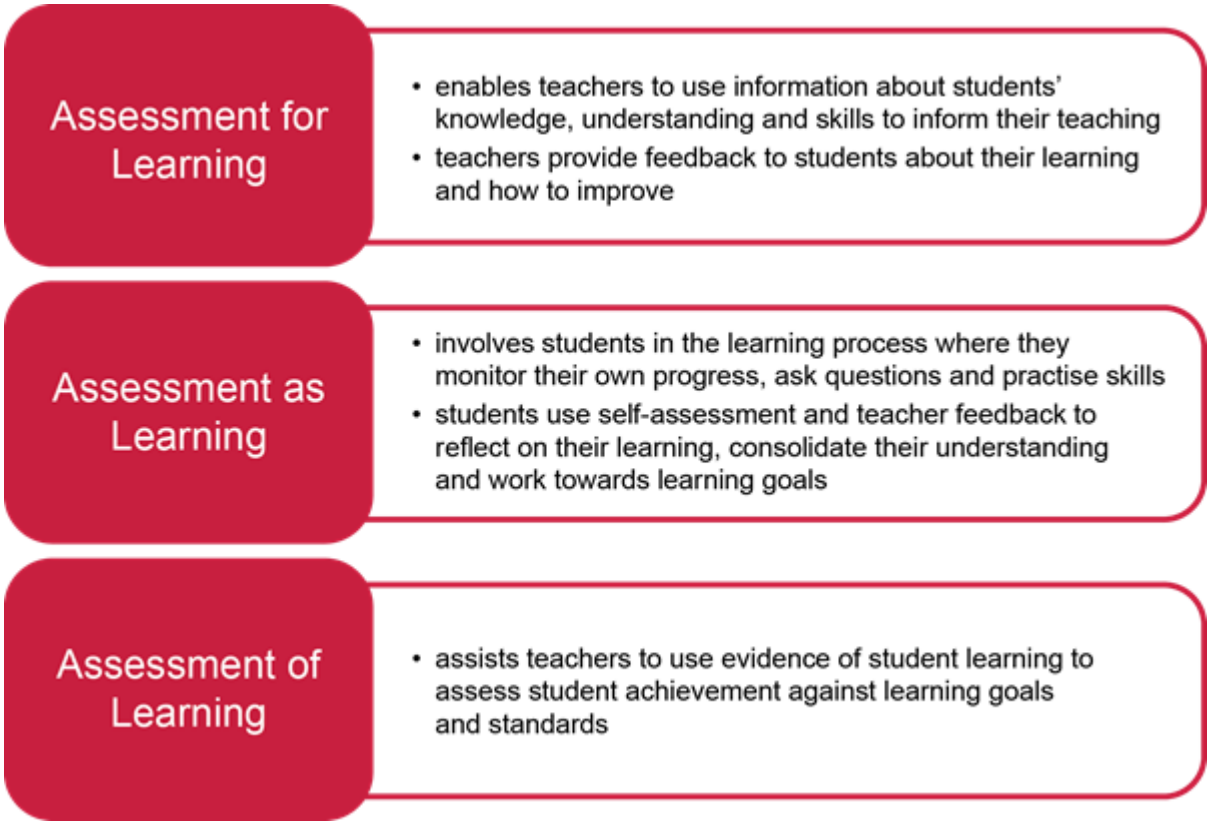
- outcomes and content in syllabuses showing what is to be learned
- Stage statements that summarise student achievement
- samples of work on the NESA website that provide examples of levels of achievement within a Stage.

Syllabus outcomes in Industrial Technology contribute to a developmental sequence in which students are challenged to acquire new knowledge, understanding and skills.

Assessment

Assessment is an integral part of teaching and learning. Well-designed assessment is central to engaging students and should be closely aligned to the outcomes within a Stage. Effective assessment increases student engagement in their learning and leads to enhanced student outcomes.

Assessment for Learning, *Assessment as Learning* and *Assessment of Learning* are three approaches to assessment that play an important role in teaching and learning. The NESA Years K–10 syllabuses particularly promote *Assessment for Learning* as an essential component of good teaching.



Further advice on programming and appropriate assessment practice is provided on the NESA website. This support material provides general advice on assessment as well as strategies to assist teachers in planning education programs.

Assessment for students with disability

Some students with disability will require adjustments to assessment practices in order to demonstrate what they know and can do in relation to syllabus outcomes and content. The type of adjustments and support will vary according to the particular needs of the student and the requirements of the activity. These may be:

- adjustments to the assessment process, for example scaffolded instructions, additional guidance provided, highlighted key-words or phrases, the use of specific technology, extra time in an examination
- adjustments to assessment activities, for example rephrasing questions, using simplified language, fewer questions or alternative formats for questions
- alternative formats for responses, for example written point form instead of essays, scaffolded structured responses, short objective questions or multimedia presentations.

It is a requirement under the *Disability Standards for Education 2005* for schools to ensure that assessment tasks are accessible to students with disability. Schools are responsible for any decisions made at school level to offer adjustments to coursework, assessment activities and tasks, including in-school tests. Decisions regarding adjustments should be made in the context of collaborative curriculum planning.

Further examples of adjustments to assessment for students with disability and information on assessment of students undertaking Life Skills outcomes and content can be found in support materials for:

- Technologies
- Special Education
- Life Skills.

Reporting

Reporting is the process of providing feedback to students, parents/carers and other teachers about student progress.

Teachers use assessment evidence to extend the process of Assessment for Learning into their Assessment of Learning. In a standards-referenced framework, teachers make professional judgements about student achievement at key points in the learning cycle. These points may be at the end of a Year or Stage, when schools may wish to report differentially on the levels of knowledge, understanding and skills demonstrated by students.

Descriptions of student achievement provide schools with a useful tool to report consistent information about student achievement to students and parents/carers, and to the next teacher to help plan the future steps in the learning process.

The A–E grade scale or equivalent provides a common language for reporting by describing observable and measurable features of student achievement at the end of a Stage, within the indicative hours of study. Teachers use the descriptions of the standards to make a professional, on-balance judgement, based on available assessment information, to match each student's achievement to a description. Teachers use the Common Grade Scale (A–E) or equivalent to report student levels of achievement from Stage 1 to Stage 5.

For students with disability, teachers may need to consider, in consultation with their school and sector, the most appropriate method of reporting student achievement. It may be deemed more appropriate for students with disability to be reported against outcomes or goals identified through the collaborative curriculum planning process. There is no requirement for schools to use the Common Grade Scale (A–E) or equivalent to report achievement of students undertaking Life Skills outcomes and content.

Glossary

Glossary term	Definition
Aboriginal and Torres Strait Islander Peoples	Aboriginal Peoples are the first peoples of Australia and are represented by more than 250 language groups, each associated with a particular Country or territory. Torres Strait Islander Peoples are represented by five major island groups, and are associated with island territories to the north of Australia's Cape York which were annexed by Queensland in 1879. An Aboriginal and/or Torres Strait Islander person is someone who: • is of Aboriginal and/or Torres Strait Islander descent • identifies as an Aboriginal person and/or Torres Strait Islander person, and • is accepted as such by the Aboriginal and/or Torres Strait Islander community(ies) in which they live.
accessibility	The extent to which a system, environment or object may be used irrespective of a user's capabilities or abilities. For example, the use of assistive technologies to allow people with disability to use computer systems, or the use of icons in place of words to allow young children to use a system.
characteristics	When discussing materials the characteristics are the qualities and properties used to determine their use and the way people work with them. They might include colour, hardness and strength.
collaboration	Working with others towards a shared goal, through a variety of modes of communication. This may be achieved using a range of technologies, tools and processes.
computer-aided design (CAD)	Software used by designers, architects and engineers to create lines, shapes and planes that can be combined, moved, rotated, adjusted and rendered. Measurements and calculations can be included. CAD can be used to create two- and three-dimensional models and drawings, eg floor plans, interiors and garden designs, and to represent objects and structures. Also known as computer-assisted design.
computer-aided manufacturing (CAM)	The control of machine tools via a computer for manufacturing components and objects.
computer numerically controlled (CNC)	A use of geometric design data (coordinates) to control computer numerically controlled (CNC) machine tools for manufacturing components and objects.
copyright	The protection provided to the creators of original works that offers a legal framework for the control and reproduction or transmission of their creations. Copyright protects written works, computer programs and artistic works, such as: architecture, broadcasts, computer programs, drawings, films, music, paintings, photographs, sound recordings and videos.

Glossary term	Definition
criteria	A descriptive list of essential features against which success can be measured and evaluated.
design and production folios	Ongoing evidence of design, management, production and evaluation processes and the specific technologies used.
designing	The development of a solution to an identified need or opportunity. Designing involves research and investigation with consideration of human, technical and environmental factors, available resources and timeframes. Designs should be tested and evaluated against predetermined criteria.
disability	An umbrella term for any or all of the following components: • impairments: challenges in body function or structure • activity limitations: difficulties in executing activities • participation restrictions: challenges an individual may experience in involvement in life situations.
diversity	Differences that exist within a group, eg age, sex, gender, gender expression, sexuality, ethnicity, ability/disability, body shape and composition, culture, religion, learning differences, socioeconomic background, values and experience.
emerging technologies	New technologies that are still immature or will be developed over the next five to ten years, which may deliver significant value and substantially alter the business and social environment.
engineering	A practical application of scientific and mathematical understanding and principles as a part of the process of developing and maintaining solutions for an identified need or opportunity.
engineering reports	An engineering report contributes to effective management, communication, decision-making and teamwork by providing a synthesis of the various elements that are relevant to a given project. Engineering reports may include: introduction to the purpose of the report, appropriate research, analysis/synthesis of related issues, conclusions and/or recommendations and references.
evaluate	Assessing performance against predetermined criteria.
Indigenous	Internationally recognised term for the first people of a land. In New South Wales the term ‘Aboriginal person/Peoples’ is preferred.
Indigenous cultural and intellectual property	Includes objects, sites, cultural knowledge, cultural expression and the arts, that have been transmitted or continue to be transmitted through generations as belonging to a particular Indigenous group or Indigenous people as a whole or their territory.
model	A mathematical, conceptual or physical representation that describes, simplifies, clarifies or provides an explanation of the structure, workings or relationships within an object, system or idea. Models can provide a means of testing and predicting behaviour within limited conditions. Models may be physical or exist in digital form.

Glossary term	Definition
multimedia	The use of ICT to present combinations of text, graphics, video, animation and/or sound in an integrated way. Where there is facility for a user to interact with multimedia, the term ‘interactive multimedia’ may be used. Examples include interactive games, media-rich websites, electronic books (eBooks) and animated films.
personal protective equipment (PPE)	Equipment used or worn by a person to minimise risk to the person’s health or safety, for example: apron, ear muffs, face shield, footwear, gloves, goggles, hard hat.
product	The tangible end results of natural, human, mechanical, manufacturing, electronic or digital production and processes.
project	An individual or collaborative activity undertaken by students that is planned to achieve an articulated aim.
resources	Materials, data, systems, components, tools and equipment used to create solutions for identified needs and opportunities, and the knowledge, understanding and skills used by people involved in the selection and use of these. Resources can also include energy, finance and time.
risk management	The process of devising or applying a set of procedures in order to minimise injuries in the workplace.
SafeWork NSW	The state's workplace health and safety regulator. It focuses on harm prevention and improving the safety culture in NSW workplaces.
sustainability	Supporting the needs of the present without compromising the ability of future generations to meet their needs.