BSSS
AUSTRALIAN CAPITAL TERRITORY

Engineering Studies

A / T

Cover Art provided by Canberra College student Aidan Giddings

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The ACT Senior Secondary System

The ACT senior secondary system recognises a range of university, vocational or life skills pathways.

The system is based on the premise that teachers are experts in their area: they know their students and community and are thus best placed to develop curriculum and assess students according to their needs and interests. Students have ownership of their learning and are respected as young adults who have a voice.

A defining feature of the system is school-based curriculum and continuous assessment. School-based curriculum provides flexibility for teachers to address students' needs and interests. College teachers have an opportunity to develop courses for implementation across ACT schools. Based on the courses that have been accredited by the BSSS, college teachers are responsible for developing programs of learning. A program of learning is developed by individual colleges to implement the courses and units they are delivering.

Teachers must deliver all content descriptions; however, they do have flexibility to emphasise some content descriptions over others. It is at the discretion of the teacher to select the texts or materials to demonstrate the content descriptions. Teachers can choose to deliver course units in any order and teach additional (not listed) content provided it meets the specific unit goals.

School-based continuous assessment means that students are continually assessed throughout years 11 and 12, with both years contributing equally to senior secondary certification. Teachers and students are positioned to have ownership of senior secondary assessment. The system allows teachers to learn from each other and to refine their judgement and develop expertise.

Senior secondary teachers have the flexibility to assess students in a variety of ways. For example: multimedia presentation, inquiry-based project, test, essay, performance and/or practical demonstration may all have their place. College teachers are responsible for developing assessment instruments with task specific rubrics and providing feedback to students.

The integrity of the ACT Senior Secondary Certificate is upheld by a robust, collaborative and rigorous structured consensus-based peer reviewed moderation process. System moderation involves all year 11 and 12 teachers from public, non-government and international colleges delivering the ACT Senior Secondary Certificate.

Only students who desire a pathway to university are required to sit a general aptitude test, referred to as the ACT Scaling Test (AST), which moderates student scores across courses and colleges. Students are required to use critical and creative thinking skills across a range of disciplines to solve problems. They are also required to interpret a stimulus and write an extended response.

Senior secondary curriculum makes provision for student-centred teaching approaches, integrated and project-based learning inquiry, formative assessment and teacher autonomy. ACT Senior Secondary Curriculum makes provision for diverse learners and students with mild to moderate intellectual disabilities, so that all students can achieve an ACT Senior Secondary Certificate.

The ACT Board of Senior Secondary Studies (BSSS) leads senior secondary education. It is responsible for quality assurance in senior secondary curriculum, assessment and certification. The Board consists of nominees from colleges, professional bodies, universities, industry, parent/carer organisations and unions. The Office of the Board of Senior Secondary Studies (OBSSS) consists of professional and administrative staff who support the Board in achieving its objectives and functions.

ACT Senior Secondary Certificate

Courses of study for the ACT Senior Secondary Certificate:

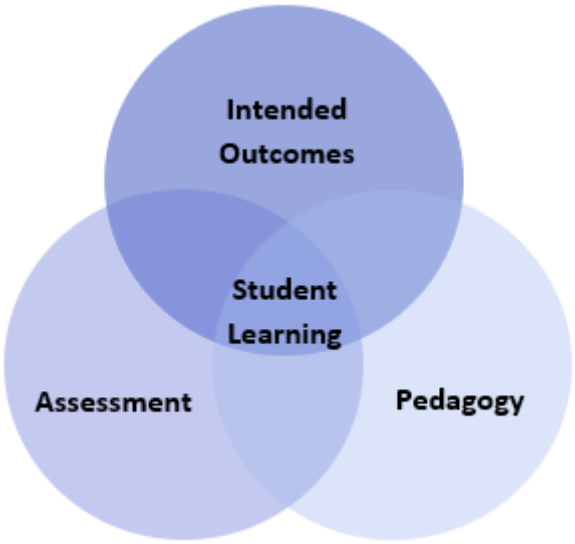
- provide a variety of pathways, to meet different learning needs and encourage students to complete their secondary education
- enable students to develop the essential capabilities for twenty-first century learners
- empower students as active participants in their own learning
- engage students in contemporary issues relevant to their lives
- foster students' intellectual, social and ethical development
- nurture students' wellbeing, and physical and spiritual development
- enable effective and respectful participation in a diverse society.

Each course of study:

- comprises an integrated and interconnected set of knowledge, skills, behaviours and dispositions that students develop and use in their learning across the curriculum
- is based on a model of learning that integrates intended student outcomes, pedagogy and assessment
- outlines teaching strategies which are grounded in learning principles and encompass quality teaching
- promotes intellectual quality, establish a rich learning environment and generate relevant connections between learning and life experiences
- provides formal assessment and certification of students' achievements.

Underpinning beliefs

- All students are able to learn.
- Learning is a partnership between students and teachers.
- Teachers are responsible for advancing student learning.



Learning Principles

1. Learning builds on existing knowledge, understandings and skills.
   (Prior knowledge)
2. When learning is organised around major concepts, principles and significant real world issues, within and across disciplines, it helps students make connections and build knowledge structures.
   (Deep knowledge and connectedness)
3. Learning is facilitated when students actively monitor their own learning and consciously develop ways of organising and applying knowledge within and across contexts.
   (Metacognition)
4. Learners' sense of self and motivation to learn affects learning.
   (Self-concept)
5. Learning needs to take place in a context of high expectations.
   (High expectations)
6. Learners learn in different ways and at different rates.
   (Individual differences)
7. Different cultural environments, including the use of language, shape learners' understandings and the way they learn.
   (Socio-cultural effects)
8. Learning is a social and collaborative function as well as an individual one.
   (Collaborative learning)
9. Learning is strengthened when learning outcomes and criteria for judging learning are made explicit and when students receive frequent feedback on their progress.
   (Explicit expectations and feedback)

General Capabilities

All courses of study for the ACT Senior Secondary Certificate should enable students to develop essential capabilities for twenty-first century learners. These 'capabilities' comprise an integrated and interconnected set of knowledge, skills, behaviours and dispositions that students develop and use in their learning across the curriculum.

The capabilities include:

- literacy
- numeracy
- information and communication technology (ICT)
- critical and creative thinking
- personal and social
- ethical understanding
- intercultural understanding.

Courses of study for the ACT Senior Secondary Certificate should be both relevant to the lives of students and incorporate the contemporary issues they face. Hence, courses address the following three priorities. These priorities are:

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

Elaboration of these General Capabilities and priorities is available on the ACARA website at www.australiancurriculum.edu.au.

Literacy

In Engineering Studies, students develop literacy as they learn how to communicate ideas, concepts and detailed proposals to a variety of audiences. They access engineering and technological content through a variety of print, oral, visual, spatial and electronic forms. Students learn to investigate, interpret, and apply engineering principles from a variety of sources to design solutions for engineering tasks. They understand and use language and terminology specific to the study of engineering to communicate ideas about product or systems design. Students learn to monitor their own language use for accuracy in the use of design principles and technological terms, for clarity of ideas, processes and explanations of engineering activities, and for development and evaluation of functioning prototypes.

Numeracy

Engineering Studies gives students opportunities to interpret and use mathematical knowledge and skills in a range of real-life situations. Numeracy is fundamental in calculating and evaluating engineering processes. Learners develop their understanding and skills of numeracy while undertaking tasks to produce, test and evaluate engineered products. Students use number to calculate and create algorithms; interpret and draw conclusions from data; measure and record throughout the process of generating ideas; develop, refine and test concepts; and in identifying, deconstructing, and solving problems when designing and creating best-fit solutions.

Information and Communication Technology (ICT) Capability

Information and Communication Technology is important in all stages of the design process. Students gain skills using a range of software applications and digital hardware that enable them to realise their design ideas. Students use ICT when they investigate and analyse information, in evaluating design ideas, and when communicating and collaborate online. Learners use digital tools and strategies to locate, access, process and analyse information. They use ICT skills and understandings to investigate, devise and test design ideas. Learners access information from websites and software programs to develop design solutions. They use computer-aided drawing software to assist in the design and production engineered products.

Critical and Creative Thinking

Students of Engineering Studies develop capability in critical and creative thinking as they imagine, generate, develop and critically evaluate ideas. They develop reasoning and the capacity for abstraction through challenging problems that do not have straightforward solutions. They identify, explore and clarify engineering information and use that knowledge in a range of situations. Students think critically and creatively about possible, probable and preferred futures and devise plausible solutions to problems. Through critical analysis, students identify possible weaknesses in their design solutions, and analyse, evaluate and modify the developing solution to construct a functioning prototype.

Personal and Social Capability

Students develop personal and social capability as they engage in project management and development in a collaborative workspace. They direct their own learning, plan and carry out investigations, and become independent learners who can apply design thinking, and engineering and technological understanding and skills when making decisions. Students develop social and employability skills through working cooperatively in teams, sharing and discussing ideas about problems, progress, and innovative solutions, listening to and respecting the perspectives of others. There are collaborative opportunities for sharing resources and processes, making group decisions, resolving conflict and showing leadership.

Ethical Understanding

Students develop the capacity to understand and apply ethical and socially responsible principles when collaborating with others and creating, sharing and using technologies – materials, data, processes, tools and equipment. Using an ethical lens, they investigate past, current and future local, national, regional and global engineering priorities. When engaged in systems thinking, students evaluate their findings against the criteria of legality, environmental sustainability, economic viability, health, social and emotional responsibility and social awareness. They are encouraged to develop informed values and attitudes.

Intercultural Understanding

Students consider engineering and technological influences in diverse communities at local, national, regional and global levels, including their impact and potential to transform people's lives. They explore ways in which past and present practices enable people to use engineering and technologies to interact with one another across cultural boundaries. Students investigate how cultural identities and traditions influence the function and form of solutions, products, services and environments designed to meet the needs of daily life now and in the future.

Cross-Curriculum Priorities

Opportunities exist for students to use Engineering Studies as a means of better understanding these priorities as they engage in research and interpretation and presentation of relevant data.

Aboriginal and Torres Strait Islander Histories and Cultures

The Aboriginal and Torres Strait Islander histories and cultures priority provides the opportunity for all young Australians to gain a deeper understanding and appreciation of Aboriginal and Torres Strait Islander histories and cultures, deep knowledge traditions and holistic world views. This knowledge and understanding will enrich all learners' ability to participate positively in the ongoing development of Australia through a deepening knowledge and connection with the world's oldest continuous living cultures.

Asia and Australia's Engagement with Asia

The Asia and Australia's engagement with Asia priority ensures that students learn about and recognise the diversity within and between the countries of the Asia region. They develop knowledge and understanding of Asian societies, cultures, beliefs and environments, and the connections between the peoples of Asia, Australia, and the rest of the world. Asia literacy provides students with the skills to communicate and engage with the peoples of Asia so they can effectively live, work and learn in the region. Students investigate a range of contexts that draw on Asia and Australia's engagement with Asia.

Sustainability

The Sustainability priority provides the opportunity for students to develop the knowledge, skills, values and world views necessary for them to act in ways that contribute to more sustainable patterns of living. This priority is futures-oriented, focusing on protecting environments and creating a more ecologically and socially just world through informed action. Actions that support more sustainable patterns of living require consideration of environmental, social, cultural and economic systems and their interdependence. Students appreciate the importance of looking at potential use of materials and design to predict possible effects on human and other activity, and the environment, to develop management plans or alternative technologies that minimise these effects and provide for a more sustainable future.

Engineering Studies
A/T

Rationale

Engineering Studies introduces students to engineering principles and systems, and is based on finding solutions to real-world problems. In this interdisciplinary course, students apply engineering processes, understand underpinning scientific and mathematical principles, develop engineering technology skills and explore the interrelationships between engineering and society. They rely strongly on their creativity, critical thinking and problem solving skills to turn ideas into reality and to develop solutions to problems.

The course focuses on understanding the engineering design process, to develop products, systems and processes. Students are required to undertake a variety of engineering design challenges which include activities such as testing of materials, formulation of problems, analysis of engineering solutions, modelling solutions and prototyping.

Engineering Studies equips students with the skills and knowledge to make positive contributions to the future of societies and the environment. The course promotes the importance of being socially responsible and conscious of global community issues that may impact on the environment and sustainable management of resources.

Goals

This course should enable students to:

- analyse problems or challenges to determine needs for solutions or products
- apply the process of design (investigate, design, plan, manage, create, evaluate solutions)
- use critical and creative thinking to design innovative solutions
- produce or create solutions or products to address a need, problem or challenge
- evaluate and use technologies in a range of contexts
- demonstrate problem solving skills
- communicate to different audiences using a range of methods
- engage confidently with and responsibly select and manipulate appropriate technologies – materials, data, systems, tools and equipment.

Unit Titles

- Engineering Systems
- Engineering: Processes & Concepts
- Applied Engineering
- Emerging Challenges & Innovation
- Independent Study

Organisation of Content

Engineering Systems

This unit focuses on engineering systems and how multiple components operate and interact, to serve a single function as a solution. Students learn about the broader context of an engineering solution taking a holistic view. Systems that may be explored include building, mechanical, electrical or mechatronic systems. Students explore user needs, including user needs analysis and requirements, and breaking design problems and solutions into smaller parts. They create design solutions using scientific concepts, mathematical tools and computer-based simulations.

Engineering Processes & Concepts

Students learn about engineering design processes and concepts, and how they are used to develop and optimise solutions to problems, with reference to sustainability, cost and the life cycle of an engineered solution. They explore and investigate existing products, materials and components in response to a design brief. Students design and create working models or prototypes of their solutions.

Applied Engineering

In this unit, students learn how engineering design processes are applied to solve existing problems. They explore real world problems of increasing complexity requiring project-based solutions. Students use guidelines and a context to apply knowledge of the engineering process and theory, to develop and respond to design briefs.

Future Challenges & Innovations

In this unit, students learn about emerging societal, global and environmental challenges, and the potential for innovative engineering and emerging technological solutions. They explore and research future global challenges. Students research and understand the implications, ethical and otherwise for new innovations to develop novel engineering solutions to these challenges.

Independent Study

An Independent Study unit has an important place in senior secondary courses. It is a valuable pedagogical approach that empowers students to make decisions about their own learning. An Independent Study unit can be proposed by an individual student for their own independent study and negotiated with their teacher. The program of learning for an Independent Study unit must meet the unit goals and content descriptions as they appear in the course.

Independent Study units are only available to individual students in Year 12. A student can only study a maximum of one Independent Study unit in each course. Students must have studied at least three standard 1.0 units from this course. An Independent Study unit requires the principal's written approval. Principal approval can also be sought by a student in Year 12 to enrol concurrently in an Independent Study unit and their third 1.0 unit in this course of study.

Assessment

The identification of criteria within the achievement standards and assessment task types and weightings provides a common and agreed basis for the collection of evidence of student achievement.

Assessment Criteria (the dimensions of quality that teachers look for in evaluating student work) provide a common and agreed basis for judgement of performance against unit and course goals, within and across colleges. Over a course, teachers must use all these criteria to assess students' performance but are not required to use all criteria on each task. Assessment criteria are to be used holistically on a given task and in determining the unit grade.

Assessment Tasks elicit responses that demonstrate the degree to which students have achieved the goals of a unit based on the assessment criteria. The Common Curriculum Elements (CCE) is a guide to developing assessment tasks that promote a range of thinking skills (see Appendix C). It is highly desirable that assessment tasks engage students in demonstrating higher order thinking.

Rubrics are constructed for individual tasks, informing the assessment criteria relevant for a particular task and can be used to assess a continuum that indicates levels of student performance against each criterion.

Assessment Criteria

Students will be assessed on the degree to which they demonstrate:

- knowledge and understanding
- skills.

Assessment Task Types

Task Type	Design Process	Design Solution(s)
	Suggested tasks: • design development • design documentation • essay • extended response • oral presentation • podcast • portfolio (design process) • project management • report • research task • return brief • review • seminar • short response • storyboard • web portfolio • workshop	**Suggested tasks:** • digital artefact • digital asset • major project • network • portfolio • product • prototyping • software application • storyboard • website
Weightings in A 1.0 and 0.5 units	30 - 70%	30 - 70%
Weightings in T 1.0 and 0.5 units	40 - 60%	40 - 60%

Additional Assessment Information

- For a standard unit (1.0), students must complete a minimum of three assessment tasks and a maximum of five.
- For a half standard unit (0.5), students must complete a minimum of two and a maximum of three assessment tasks.
- Assessment tasks for a standard (1.0) or half-standard (0.5) unit must be informed by the Achievement Standards.
- Students should experience a variety of task types and different modes of communication to demonstrate the Achievement Standards.

Achievement Standards

Years 11 and 12 achievement standards are written for A/T courses.

A Year 12 student in any unit is assessed using the Year 12 achievement standards. A Year 11 student in any unit is assessed using the Year 11 achievement standards. Year 12 achievement standards reflect higher expectations of student achievement compared to the Year 11 achievement standards. Years 11 and 12 achievement standards are differentiated by cognitive demand, the number of dimensions and the depth of inquiry.

An achievement standard cannot be used as a rubric for an individual assessment task. Assessment is the responsibility of the college. Student tasks may be assessed using rubrics or marking schemes devised by the college. A teacher may use the achievement standards to inform development of rubrics. The verbs used in achievement standards may be reflected in the rubric. In the context of combined Years 11 and 12 classes, it is best practice to have a distinct rubric for Years 11 and 12. These rubrics should be available for students prior to completion of an assessment task so that success criteria are clear.

Achievement Standards Technologies A Course Year 11

	*A student who achieves an **A** grade typically*	*A student who achieves a **B** grade typically*	*A student who achieves a **C** grade typically*	*A student who achieves a **D** grade typically*	*A student who achieves an **E** grade typically*
Knowledge and understanding	• analyses the design process and explains decision making • analyses technology concepts and principles and explains the properties of materials or data or systems to address a need, problem, or challenge • analyses technologies, explains ethical and sustainable application • thinks critically, drawing on data and information to solve complex problems and analyses opportunities for application of technology	• explains the design process and describes decision making • explains technology concepts and principles and describes the properties of materials or data or systems to address a need, problem, or challenge • explains technologies, describes ethical and sustainable application • thinks critically, drawing on data and information to solve problems and explains opportunities for application of technology	• describes the design process with reference to decision making • describes technology concepts and principles with some reference to properties of materials or data or systems to address a need, problem, or challenge • describes technologies with some reference to ethical and sustainable application • draws on data and information to solve problems and describes opportunities for application of technology	• identifies major features of the design process with minimal reference to decision making • identifies major technology concepts and principles with some reference to properties of materials or data or systems to address a need, problem, or challenge • identifies major features of technologies with minimal reference to ethical and sustainable application • identifies some opportunities for application of technology with minimal use of information and data	• identifies some features of the design process • identifies few technology concepts and principles with minimal reference to properties of materials or data or systems to address a need, problem, or challenge • identifies some features of technologies with minimal reference to ethical and sustainable application • identifies some opportunities for application of technology with minimal evidence of use of information and data
Skills	• applies technology concepts, strategies and methodologies with control and precision demonstrating understanding of the historical and cultural context and its impact • creates innovative and high-quality design solutions/products using techniques and approaches and justifies ideas • analyses potential prototypes and solutions analysing their appropriateness and effectiveness via iterative improvement and review • communicates complex ideas and insights effectively in a range of mediums and justifies ideas coherently using appropriate evidence, metalanguage, and accurate referencing • reflects with insight on their own thinking and evaluates inter and intrapersonal skills including planning, time management, use of appropriate techniques and strategies and capacity to work both independently and collaboratively	• applies technology concepts, strategies and methodologies with control demonstrating understanding of the historical and cultural context and its impact • creates high-quality design solutions/products using techniques and approaches and explains ideas • explains potential prototypes and solutions and explains their appropriateness and effectiveness via iterative improvement and review • communicates ideas effectively in a range of mediums and justifies ideas coherently using appropriate evidence, metalanguage and referencing • reflects on their own thinking and analyses inter and intrapersonal skills including planning, time management, use of appropriate techniques and strategies and capacity to work both independently and collaboratively	• applies technology concepts, strategies and methodologies with some control demonstrating understanding of context and its impact • creates functional design solutions/products using techniques and approaches and explains ideas • describes potential prototypes and solutions and explains their appropriateness and effectiveness via iterative improvement and review • communicates ideas appropriately in mediums and explains ideas coherently using appropriate evidence, metalanguage and referencing • reflects on their own thinking and explains inter and intrapersonal skills including planning, time management, use of appropriate techniques and strategies and capacity to work both independently and collaboratively	• applies technology concepts, strategies and methodologies with minimal control demonstrating understanding of its impact • creates simple, functional design solutions/products using some techniques and approaches and describes ideas • identifies potential prototypes and solutions and describes their appropriateness and effectiveness via iterative improvement and review • communicates ideas in mediums and describes ideas with some use of appropriate evidence with minimal use metalanguage and referencing • reflects on their own thinking with some reference to planning, time management, use of appropriate techniques and strategies and capacity to work both independently and collaboratively	• applies technology concepts, strategies and methodologies with limited control demonstrating minimal evidence of understanding its impact • creates simple design solutions/products using some basic techniques and approaches and description of ideas • identifies potential prototypes and solutions with minimal reference to their appropriateness and effectiveness via iterative improvement and review • communicates basic ideas in few mediums and describes ideas with ~~or no~~ minimal use of appropriate evidence and referencing • reflects on their own thinking with minimal reference to planning, time management, use of appropriate techniques and strategies and capacity to work both independently and collaboratively

Achievement Standards Technologies T Course Year 11

	*A student who achieves an **A** grade typically*	*A student who achieves a **B** grade typically*	*A student who achieves a **C** grade typically*	*A student who achieves a **D** grade typically*	*A student who achieves an **E** grade typically*
Knowledge and understanding	• critically analyses the design process and evaluates constraints and implications for decision making • synthesises technology theories, concepts and principles and evaluates the properties of materials or data or systems to address a need, problem, or challenge • critically analyses technologies and evaluates ethical and sustainable application of technology • thinks critically and creatively, drawing on data and information to solve complex problems	• analyses the design process and explains constraints and implications for decision making • analyses technology theories, concepts and principles and explains the properties of materials or data or systems to address a need, problem, or challenge • analyses technologies and explains ethical and sustainable application of technology • thinks critically, drawing on data and information to solve complex problems	• explains the design process and describes constraints and implications for decision making • explains technology theories, concepts and principles and describes the properties of materials or data or systems to address a need, problem, or challenge • explains technologies and describes ethical and sustainable application of technology • thinks critically, drawing on data and information to solve problems	• describes the design process with some reference to constraints and implications for decision making • describes technology theories, concepts, and principles with some reference to properties of materials or data or systems to address a need, problem, or challenge • describes technologies with some reference to ethical and sustainable application of technology • draws on data and information to solve problems and describes opportunities	• identifies features of the design process with minimal reference to decision making • identifies technology theories, concepts, and principles with some reference to properties of materials or data or systems to address a need, problem, or challenge • identifies some features of technologies with minimal reference to ethical and sustainable application of technology • applying minimal use of information and data
Skills	• applies technology concepts, strategies and methodologies with control and precision demonstrating understanding of the historical and cultural context and its impact • creates innovative and high quality design solutions/products using techniques and approaches and justifies ideas coherently • analyses potential prototypes and solutions analysing their appropriateness and effectiveness via iterative improvement and review • communicates complex ideas and insights effectively in a range of mediums to a variety of audiences using appropriate evidence, metalanguage, and accurate referencing • reflects with insight on their own thinking and that of others and evaluates inter and intrapersonal skills including planning, time management, use of appropriate techniques and strategies and capacity to work independently and collaboratively	• applies technology concepts, strategies and methodologies with control demonstrating understanding of the historical and cultural context and its impact • creates high-quality design solutions/products using techniques and approaches and justifies ideas coherently • analyses potential prototypes and solutions explaining their appropriateness and effectiveness via iterative improvement and review • communicates ideas effectively in a range of mediums to a variety of audiences using appropriate evidence, metalanguage, and accurate referencing • reflects on their own thinking and analyses inter and intrapersonal skills including planning, time management, use of appropriate techniques and strategies and capacity to work independently and collaboratively	• applies technology concepts, strategies and methodologies with some control demonstrating understanding of context and its impact • creates functional quality design solutions/products using techniques and approaches and explains ideas coherently • explains potential prototypes and solutions describing their appropriateness and effectiveness via iterative improvement and review • communicates ideas appropriately in a range of mediums to a variety of audiences using appropriate evidence, metalanguage, and accurate referencing • reflects on their own thinking and explains inter and intrapersonal skills including planning, time management, use of appropriate techniques and strategies and capacity to work independently and collaboratively	• applies technology concepts, strategies and methodologies with minimal control demonstrating understanding of its impact • creates simple, functional design solutions/products using some techniques and approaches and explains ideas • describes potential prototypes and solutions with some reference to their appropriateness and effectiveness via iterative improvement and review • communicates ideas in mediums to a variety of audiences using some evidence, metalanguage, and referencing • reflects on their own thinking with some reference to inter and intrapersonal skills including planning, time management, use of appropriate techniques and strategies and capacity to work independently and collaboratively	• applies technology concepts, strategies and methodologies with limited control demonstrating minimal evidence of understanding its impact • creates design solutions/products using some basic techniques and approaches and describes ideas • identifies potential prototypes and solutions with minimal reference to their appropriateness and effectiveness via iterative improvement and review • communicates basic ideas in mediums to a variety of audiences using minimal evidence, metalanguage, and some referencing • reflects on their own thinking with minimal reference to planning, time management, use of appropriate techniques and strategies and capacity to work independently and collaboratively

Achievement Standards Technologies A Course Year 12

	*A student who achieves an **A** grade typically*	*A student who achieves a **B** grade typically*	*A student who achieves a **C** grade typically*	*A student who achieves a **D** grade typically*	*A student who achieves an **E** grade typically*
Knowledge and understanding	• analyses the design process and explains opportunities, constraints and implications for decision making • analyses technology theories, concepts and principles and explains the properties of materials or data or systems to address a need, problem, or challenge • analyses technologies in a range of contexts and explains ethical and sustainable application • thinks critically, drawing on data and information to solve complex problems and analyses opportunities for application of technology	• explains the design process and describes opportunities, constraints and implications for decision making • explains technology theories, concepts and principles and describes the properties of materials or data or systems to address a need, problem, or challenge • explains technologies in a range of contexts and describes ethical and sustainable application • thinks critically, drawing on data and information to solve problems and explains opportunities for application of technology	• describes the design process with reference to opportunities, constraints and implications for decision making • describes technology theories, concepts, and principles with some reference to properties of materials or data or systems to address a need, problem, or challenge • describes technologies in a range of contexts with some reference to ethical and sustainable application • draws on data and information to solve problems and describes opportunities for application of technology	• identifies major features of the design process with minimal reference to opportunities, constraints and implications for decision making • identifies major technology theories, concepts, and principles with some reference to properties of materials or data or systems to address a need, problem, or challenge • identifies major features of technologies with minimal reference to ethical and sustainable application • identifies some opportunities for application of technology with limited use of information and data	• identifies some features of the design process with minimal understanding of opportunities, constraints, and implications • identifies few technology theories, concepts, and principles with minimal reference to properties of materials or data or systems to address a need, problem, or challenge • identifies some features of technologies with no reference to ethical and sustainable application • identifies some opportunities for application of technology with minimal evidence of use of information and data
Skills	• applies technology concepts, strategies and methodologies with control and precision demonstrating understanding of the historical and cultural context and its impact • creates innovative and high-quality design solutions/products using efficient techniques and approaches and justifies ideas • analyses potential prototypes and solutions, and analyses their appropriateness and effectiveness via iterative improvement and review • communicates complex ideas and insights effectively in a range of mediums and justifies ideas coherently using appropriate evidence, metalanguage, and accurate referencing • reflects with insight on their own thinking and evaluates inter and intrapersonal skills including planning, time management, use of appropriate techniques and strategies and capacity to work both independently and collaboratively	• applies technology concepts, strategies and methodologies with control demonstrating understanding of the historical and cultural context and its impact • creates high-quality design solutions/products using techniques and approaches and explains ideas • explains potential prototypes and solutions, and explains their appropriateness and effectiveness via iterative improvement and review • communicates ideas effectively in a range of mediums and justifies ideas coherently using appropriate evidence, metalanguage and referencing • reflects on their own thinking and analyses inter and intrapersonal skills including planning, time management, use of appropriate techniques and strategies and capacity to work both independently and collaboratively	• applies technology concepts, strategies and methodologies with some control demonstrating understanding of context and its impact • creates functional design solutions/products using some techniques and approaches and explains ideas • describes potential prototypes and solutions, and describes their appropriateness and effectiveness via iterative improvement and review • communicates ideas appropriately in mediums and explains ideas coherently using appropriate evidence, metalanguage and referencing • reflects on their own thinking explains inter and intrapersonal skills including planning, time management, use of appropriate techniques and strategies and capacity to work both independently and collaboratively	• applies technology concepts, strategies and methodologies with minimal control demonstrating understanding of its impact • creates functional design solutions/products using some techniques and approaches and describes ideas • identifies potential prototypes and solutions, and identifies their appropriateness and effectiveness via iterative improvement and review • communicates ideas in mediums and describes ideas with some use of appropriate evidence with minimal use metalanguage and referencing • reflects on their own thinking with some reference to planning, time management, use of appropriate techniques and strategies and capacity to work both independently and collaboratively	• applies technology concepts, strategies and methodologies with limited control demonstrating minimal evidence of understanding its impact • creates simple design solutions/products using basic techniques and approaches and description of ideas • identifies potential prototypes and solutions with minimal reference to their appropriateness and effectiveness via iterative improvement and review • communicates basic ideas in few mediums and describes ideas with minimal use of appropriate evidence and referencing • reflects on their own thinking with minimal reference to planning, time management, use of appropriate techniques and strategies and capacity to work both independently and collaboratively

Achievement Standards Technologies T Course Year 12

	*A student who achieves an **A** grade typically*	*A student who achieves a **B** grade typically*	*A student who achieves a **C** grade typically*	*A student who achieves a **D** grade typically*	*A student who achieves an **E** grade typically*
Knowledge and understanding	• critically analyses the design process and evaluates opportunities, constraints and implications for decision making	• analyses the design process and explains opportunities, constraints and implications for decision making	• explains the design process and describes opportunities, constraints and implications for decision making	• describes the design process with some reference to opportunities, constraints and implications for decision making	• identifies features of the design process with minimal reference to decision making
	• critically analyses strategies, methodologies and procedures and evaluates their validity and reliability	• analyses strategies, methodologies and procedures and explains their validity and reliability	• explains strategies, methodologies and procedures and describes their validity and reliability	• describes strategies, methodologies, and procedures with some reference to validity and reliability	• identifies some strategies, methodologies, and procedures with minimal reference to validity and reliability
	• synthesises technology theories, concepts and principles and evaluates the properties of material or data or systems to address a need, problem, or challenge	• analyses technology theories, concepts and principles and explains the properties of materials or data or systems to address a need, problem, or challenge	• explains technology theories, concepts and principles and describes the properties of materials or data or systems to address a need, problem, or challenge	• describes technology theories, concepts, and principles with some reference to properties of materials or data or systems to address a need, problem, or challenge	• identifies technology theories, concepts, and principles with some reference to properties of materials or data or systems to address a need, problem, or challenge
	• critically analyses technologies in a range of contexts and evaluates ethical and sustainable application of technology	• analyses technologies in a range of contexts and explains ethical and sustainable application of technology	• explains technologies in a range of contexts and describes ethical and sustainable application of technology	• describes technologies in a range of contexts with some reference to ethical and sustainable application of technology	• identifies some features of technologies in a range of contexts with minimal reference to ethical and sustainable application of technology
	• thinks critically and creatively, drawing on data and information to solve complex problems and evaluates opportunities for application of technology	• thinks critically, drawing on data and information to solve complex problems and analyses opportunities for application of technology	• thinks critically, drawing on data and information at times to solve problems and explains opportunities for application of technology	• draws on data and information at times to solve problems and describes opportunities for application of technology	• identifies some opportunities for application of technology with limited use of information and data
Skills	• applies technology concepts, strategies and methodologies demonstrating an understanding of the historical and cultural context and impact on individuals, groups, communities, and society	• applies technology concepts, strategies and methodologies with control demonstrating understanding of the historical and cultural context and impact on individuals, groups, communities, and society	• applies technology concepts, strategies and methodologies with some control demonstrating understanding of context and the impact on individuals, groups, communities, and society	• applies technology concepts, strategies and methodologies with minimal control demonstrating understanding of the impact on individuals, groups, communities, and society	• applies technology concepts, strategies and methodologies with limited control demonstrating little evidence of understanding of the impact on individuals, groups, communities, and society
	• creates innovative and high-quality design solutions/products using techniques and approaches and justifies ideas logically and coherently	• creates high quality design solutions/products using techniques and approaches and justifies ideas coherently	• creates functional design solutions/products using techniques and approaches and justifies ideas	• creates functional design solutions/products using some techniques and approaches and explains ideas	• creates simple, functional design solutions/products using basic techniques and approaches and describes ideas
	• critically analyses potential prototypes and solutions evaluating their appropriateness and effectiveness via iterative improvement and review	• analyses potential prototypes and solutions analysing their appropriateness and effectiveness via iterative improvement and review	• explains potential prototypes and solutions explaining their appropriateness and effectiveness via iterative improvement and review	• describes potential prototypes and solutions describing their appropriateness and effectiveness via iterative improvement and review	• identifies potential prototypes and solutions identifying their appropriateness and effectiveness via iterative improvement and review
	• communicates complex ideas and insights effectively in a range of mediums to a variety of audiences using appropriate evidence, metalanguage, and accurate referencing	• communicates ideas effectively in a range of mediums to a variety of audiences using appropriate evidence, metalanguage, and accurate referencing	• communicates ideas appropriately in a range of mediums to a variety of audiences using appropriate evidence, metalanguage, and accurate referencing	• communicates ideas in mediums to a variety of audiences using some evidence, metalanguage and referencing	• communicates basic ideas in mediums to a variety of audiences using minimal evidence, metalanguage, and some referencing
	• reflects with insight on their own thinking and that of others and evaluates inter and intrapersonal skills including planning, time management, use of appropriate techniques & strategies and capacity to work independently and collaboratively	• reflects on their own thinking and that of others and analyses inter and intrapersonal skills including planning, time management, use of appropriate techniques and strategies and capacity to work both independently and collaboratively	• reflects on their own thinking and that of others and explains inter and intrapersonal skills including planning, time management, use of appropriate techniques and strategies and capacity to work both independently and collaboratively	• reflects on their own thinking with some reference to inter and intrapersonal skills including planning, time management, use of appropriate techniques and strategies and capacity to work both independently and collaboratively	• reflects on their own thinking with minimal reference to planning, time management, use of appropriate techniques and strategies and capacity to work both independently and collaboratively

Engineering Systems — Value: 1.0

Engineering Systems a — **Value 0.5**

Engineering Systems b — **Value 0.5**

Unit Description

This unit focuses on engineering systems and how multiple components operate and interact, to serve a single function as a solution. Students learn about the broader context of an engineering solution taking a holistic view. Systems that may be explored include building, mechanical, electrical or mechatronic systems. Students explore user needs, including user needs analysis and requirements, and breaking design problems and solutions into smaller parts. They create design solutions using scientific concepts, mathematical tools and computer-based simulations.

Specific Unit Goals

This unit should enable students to:

A Course	T Course
• explain how a specific engineering system works in terms of multiple parts working together • apply a design process to create an engineered-system • test, evaluate, and redesign a system to create a solution • meet design requirements and client/user needs in engineering problems and design solutions	• investigate and explain how a specific engineering system works in terms of multiple parts working together • apply a design process to create an engineered-system • test, evaluate, and redesign a system to create an optimised solution • address design requirements and client/user needs in engineering problems and design solutions

Content Descriptions

All knowledge, understanding and skills below must be delivered:

A Course	T Course
Design process	
• analyse functional and working systems using the design process to solve problems, for example, mechanical, medical technologies, building structures, renewable energy or hydraulics • understand the workings of the component parts and their interactions in whole systems to solve engineering problems, for example, mechanical (levers, pivots, mechanisms, control components and gears)	• critically analyse functional and working systems using the design process to solve problems, for example, mechanical, medical technologies, building structures, renewable energy or hydraulics • understand the workings of the component parts and their interactions in whole systems to solve engineering problems, for example, mechanical (levers, pivots, mechanisms, control components and gears)

A Course	T Course
• understand how a design process is used to create engineering-based solutions that meets design specifications	• understand how a design process is used to create engineering-based solutions that meets design specifications
Strategies, methodologies and procedures	
• understand how systems use various components to interact and operate • understand user needs and requirements to develop an engineered system, for example, vehicle systems, building systems, logistical systems • apply mathematical and scientific concepts, for example, forces, loads • apply engineering-field specific methodologies to create and design engineered systems • apply strategies to work both independently and collaboratively	• investigate how systems use various components to interact and operate • analyse user needs and requirements to develop an engineered system, for example, vehicle systems, building systems, logistical systems • apply strategies for mathematical and scientific concepts, for example, forces, loads • implement engineering-field specific methodologies to create and design engineered systems which integrate components and subfunctions, for example, control programming in mechatronic systems or load analysis in structures • evaluate the effectiveness of strategies, methodologies and procedures to address a problem • apply strategies to work both independently and collaboratively
Theories, concepts and materials	
• analyse theories in specific engineering systems • apply elementary scientific concepts, mathematical tools and computer-based techniques • explain materials and components to solve problems, for example, design methods • reflect on the effectiveness of designed systems in relation to the design brief	• analyse theories in specific engineering systems, for example, process input and output, aerodynamic theory, circuit design • apply scientific concepts, mathematical tools and computer-based techniques to investigate and analyse design solutions to engineering problems • evaluate materials and components to optimise solutions to problems, for example, design methods • evaluate the effectiveness of designed systems in relation to the design brief
Contexts	
• understand the social, historical and cultural impact of engineering on individuals or groups • explain ethical, environmental and sustainability considerations in engineered solutions	• critically analyse the social, historical and cultural impact of engineering on individuals or groups • critically analyse ethical, environmental and sustainability considerations in engineered solutions

A Course	T Course
Communication	
• communicate accurately with others using correct terms in an appropriate format, both orally and in writing • communicate ideas and insights in a range of appropriate mediums to a variety of audiences • explain the process of solving design problems in response to a design brief • justify ideas coherently using appropriate evidence and accurate referencing	• communicate accurately with others using correct terms in an appropriate format, both orally and in writing • communicate ideas and insights in a range of appropriate mediums to a variety of audiences • explain the process of solving design problems and justify the choices made in response to a design brief • justify ideas coherently using appropriate evidence and accurate referencing
Reflection	
• reflect on own learning style and performance, including planning and time management, to develop strategies to improve own learning	• reflect on own learning style and performance, including planning and time management, to develop strategies to improve own learning

A guide to reading and implementing content descriptions

Content descriptions specify the knowledge, understanding and skills that students are expected to learn and that teachers are expected to teach. Teachers are required to develop a program of learning that allows students to demonstrate all the content descriptions. The lens which the teacher uses to demonstrate the content descriptions may be either guided through provision of electives within each unit or determined by the teacher when developing their program of learning.

A program of learning is what a college provides to implement the course for a subject. It is at the discretion of the teacher to emphasis some content descriptions over others. The teacher may teach additional (not listed) content provided it meets the specific unit goals. This will be informed by the student needs and interests.

Assessment

Refer to pages 9-11.

Engineering Processes & Concepts — Value: 1.0

Engineering Processes & Concepts a — **Value 0.5**

Engineering Processes & Concepts b — **Value 0.5**

Unit Description

Students learn about engineering design processes and concepts, and how they are used to develop and optimise solutions to problems, with reference to sustainability, cost and the life cycle of an engineered solution. They explore and investigate existing products, materials and components in response to a design brief. Students design and create working models or prototypes of their solutions.

Specific Unit Goals

This unit should enable students to:

A Course	T Course
• understand concepts and tools for analysing, interpreting and presenting design solutions	• examine concepts and tools for analysing, interpreting and optimising design solutions
• draw conclusions based on evidence and correct engineering concepts	• draw valid and reasoned conclusions based on evidence and correct engineering concepts
• create quality design solutions using engineering techniques and approaches	• create innovative and high-quality design solutions using engineering techniques and approaches
• create a prototype for a process or concept, carry out tests and evaluate the solution	• create a prototype for a process or concept, carry out tests, evaluate and refine the solution

Content Descriptions

All knowledge, understanding and skills below must be delivered:

A Course	T Course
Design process	
• use a design process to develop solutions to a problem	• critically analyse and use a design process to optimise solutions to a problem, including limitations and constraints
• understand how a design process is used to create engineering-based solutions that meets design specifications	• understand how a design process is used to create engineering-based solutions that meets design specifications
Strategies, methodologies and procedures	
• understand the engineering design process and how it is used to develop existing products and components	• investigate the engineering design process and analyse how it is used to develop existing products and components
• explains and selects materials and components relevant to the design brief	• critically analyse and select materials and components relevant to the design brief

A Course	T Course
• apply a design process and use time management strategies in the development of prototypes, for example, time and sequence planning tools • use design process methodologies, for example, design brief, research, concept development • apply strategies to work both independently and collaboratively	• apply a design process and use project management strategies in the development of prototypes, for example, time and sequence planning tools • implement design process methodologies, for example, design brief, research, concept development • evaluate the effectiveness of strategies, methodologies and procedures to address a problem • apply strategies to work both independently and collaboratively
Theories, concepts and materials	
• understand theories and analyse properties of engineering materials • apply elementary scientific concepts, mathematical tools and computer-based techniques in a design process to develop solutions to problems • explain choice of materials and components to develop solutions to problems, for example, design methods • reflect on the effectiveness of designed solutions in relation to the design brief	• analyse theories and properties of engineering materials, for example, Young's modulus, hardness, elasticity, strength • apply scientific concepts, mathematical tools and computer-based techniques in a design process to develop optimal solutions to problems • evaluate materials and components to optimise solutions to problems, for example, design methods • evaluate the effectiveness of designed solutions in relation to the design brief
Contexts	
• analyse the social, historical and cultural impact of engineering on individuals or groups • analyse ethical, environmental and sustainability considerations in engineered solutions	• critically analyse the social, historical and cultural impact of engineering on individuals or groups • critically analyse ethical, environmental and sustainability considerations in engineered solutions
Communication	
• communicate accurately with others using correct terms in an appropriate format, both orally and in writing • communicate ideas and insights in a range of appropriate mediums to a variety of audiences • explain the process of interpreting a design brief and select appropriate presentation techniques such as folio, podcast • justify ideas coherently using appropriate evidence and accurate referencing	• communicate accurately with others using correct terms in an appropriate format, both orally and in writing • communicate ideas and insights in a range of appropriate mediums to a variety of audiences • explain the process of interpreting a design brief and select appropriate presentation techniques such as folio, podcast • justify ideas coherently using appropriate evidence and accurate referencing

A Course	T Course
Reflection	
• reflect on own learning style and performance, including planning and time management, to develop strategies to improve own learning	• reflect on own learning style and performance, including planning and time management, to develop strategies to improve own learning

A guide to reading and implementing content descriptions

Content descriptions specify the knowledge, understanding and skills that students are expected to learn and that teachers are expected to teach. Teachers are required to develop a program of learning that allows students to demonstrate all the content descriptions. The lens which the teacher uses to demonstrate the content descriptions may be either guided through provision of electives within each unit or determined by the teacher when developing their program of learning.

A program of learning is what a college provides to implement the course for a subject. It is at the discretion of the teacher to emphasis some content descriptions over others. The teacher may teach additional (not listed) content provided it meets the specific unit goals. This will be informed by the student needs and interests.

Assessment

Refer to pages 9-11.

Applied Engineering — Value: 1.0

Applied Engineering a — **Value 0.5**

Applied Engineering b — **Value 0.5**

Unit Description

In this unit, students learn how engineering design processes, including project management, are applied to solve existing problems. They explore real world problems of increasing complexity requiring project-based solutions. Students use guidelines and a context to apply knowledge of the engineering process and theory, to develop and respond to design briefs.

Specific Unit Goals

This unit should enable students to:

A Course	T Course
• apply engineering design processes to solve existing problems	• evaluate engineering design processes and strategies to solve existing problems
• apply design thinking to real world engineering scenarios	• apply design thinking to real world engineering scenarios
• explore real world problems and develop project-based solutions	• critically analyse real world problems of varying complexity and develop project-based solutions
• respond to design briefs	• develop and respond to design briefs

Content Descriptions

All knowledge, understanding and skills below must be delivered:

A Course	T Course
Design process	
• use an engineering design process and a design brief for a structured project to solve an existing problem	• critically analyse an engineering design process and develop a comprehensive design brief for a structured project to solve an existing problem
• apply an engineering design process to develop, test and evaluate the solutions or products	• apply an engineering design process to develop, test and evaluate the solutions or products
• understand how a design process is used to create engineering-based solutions that meets design specifications	• understand how a design process is used to create engineering-based solutions that meets design specifications
Strategies, methodologies and procedures	
• understand how engineering design processes are used to solve existing problems, for example, climate change	• investigate how engineering design processes are used to solve existing problems, for example, climate change

A Course	T Course
• explore real world problems to identify possible approaches to develop a solution, for example, food security, energy renewal or water conservation • apply a design process in conjunction with project management strategies to develop a solution • use design process methodologies, for example, design thinking, lean thinking • apply strategies to work both independently and collaboratively	• critically analyse real world problems to identify possible approaches to develop a solution, for example, food security, energy renewal or water conservation • apply a design process in conjunction with project management strategies to develop a solution • implement design process methodologies, for example, design thinking, lean thinking • evaluate the effectiveness of strategies, methodologies and procedures to address a problem • apply strategies to work both independently and collaboratively
Theories, concepts and materials	
• respond to design briefs • apply elementary scientific concepts, mathematical tools and computer-based techniques in a design process to develop solutions to problems • explain choice of materials and components to develop solutions to problems • reflect on the effectiveness of design solutions to real world problems in relation to the design brief	• understand the purpose of, and develop design briefs, for example, target audience, scope of the project, objectives and goals, budgets and schedules related to problems to be solved • apply scientific concepts, mathematical tools and computer-based techniques to investigate and analyse design solutions to solve existing problems • evaluate materials and components to optimise solutions to problems • evaluate the effectiveness of design solutions to complex real world problems in relation to the design brief
Contexts	
• analyse the social, historical and cultural impact of engineering on individuals or groups • analyse ethical, environmental and sustainability considerations in engineered solutions	• critically analyse the social, historical and cultural impact of engineering on individuals or groups • critically analyse ethical, environmental and sustainability considerations in engineered solutions
Communication	
• communicate accurately with others using correct terms in an appropriate format, both orally and in writing • communicate ideas and insights in a range of appropriate mediums to a variety of audiences • explain how solutions address the design brief and justify design decisions	• communicate accurately with others using correct terms in an appropriate format, both orally and in writing • communicate ideas and insights in a range of appropriate mediums to a variety of audiences • explain how solutions address the design brief and justify design decisions

A Course	T Course
• justify ideas coherently using appropriate evidence and accurate referencing	• justify ideas coherently using appropriate evidence and accurate referencing
Reflection	
• reflect on own learning style and performance, including planning and time management, to develop strategies to improve own learning	• reflect on own learning style and performance, including planning and time management, to develop strategies to improve own learning

A guide to reading and implementing content descriptions

Content descriptions specify the knowledge, understanding and skills that students are expected to learn and that teachers are expected to teach. Teachers are required to develop a program of learning that allows students to demonstrate all the content descriptions. The lens which the teacher uses to demonstrate the content descriptions may be either guided through provision of electives within each unit or determined by the teacher when developing their program of learning.

A program of learning is what a college provides to implement the course for a subject. It is at the discretion of the teacher to emphasis some content descriptions over others. The teacher may teach additional (not listed) content provided it meets the specific unit goals. This will be informed by the student needs and interests.

Assessment

Refer to pages 9-11.

Future Challenges & Innovations — Value: 1.0

Future Challenges & Innovations a — **Value 0.5**

Future Challenges & Innovations b — **Value 0.5**

Unit Description

In this unit, students learn about emerging societal, global and environmental challenges, and the potential for innovative engineering and emerging technological solutions. They explore and research future global challenges. Students research and understand the implications, ethical and otherwise for new innovations to develop novel engineering solutions to these challenges.

Specific Unit Goals

This unit should enable students to:

A Course	T Course
• research and understand emerging societal, global and environmental challenges • create innovative engineering-based solutions for future focused problems • understand the concepts and skills that underpin new and emerging innovations in engineering	• critically analyse emerging societal, global and environmental challenges • create innovative engineering-based solutions for future focused problems • critically analyse concepts and skills that underpin new and emerging innovations in engineering

Content Descriptions

All knowledge, understanding and skills below must be delivered:

A Course	T Course
Design process	
• analyse and apply a design process to create an innovative engineering-based solution for an emerging, future focused problem • understand factors that impact innovation and the subsequent success or failure of a product such as economic, political, social or environmental pressures, issues and concerns • understand how a design process is used to create engineering-based solutions that meets design specifications	• critically analyse and apply a design process to create an innovative engineering-based solution for an emerging, future focused problem • critically analyse factors that impact innovation and enterprise, and the subsequent success or failure of a product such as economic, political, social or environmental pressures, issues and concerns • understand how a design process is used to create engineering-based solutions that meets design specifications
Strategies, methodologies and procedures	
• understand the impact of technologies on humanity and the environment, for example, global warming, pollution	• investigate the impact of technologies on humanity and the environment, for example, global warming, pollution

A Course	T Course
• analyse emerging technologies and potential opportunities and challenges, for example, autonomous systems • apply a design process in conjunction with time management strategies to develop a solution • use a methodology to innovate and create solutions for problems, for example, co-creation, technology road mapping • apply strategies to work both independently and collaboratively	• critically analyse emerging technologies and potential opportunities and challenges, for example, autonomous systems • apply a design process in conjunction with project management strategies to develop a solution • analyse and implement methodologies to innovate and create solutions for complex problems, for example, co-creation, technology road mapping • apply strategies to work both independently and collaboratively
Theories, concepts and materials	
• analyse theories to predict future challenges and issues in technology, society and the environment, for example researching trends in population growth • apply elementary scientific concepts, mathematical tools and computer-based techniques in a design concept to develop novel engineering solutions • explain choice of materials and components to develop solutions to problems • reflect on the effectiveness of innovative and technological solutions in relation to the design brief	• critically analyse theories to predict future challenges and issues in technology, society and the environment, for example forecasting population growth • apply scientific concepts, mathematical tools and computer-based techniques to critically analyse design concepts to develop novel engineering solutions • evaluate materials and components to optimise solutions to problems • evaluate the effectiveness of innovative and technological solutions in relation to the design brief
Contexts	
• analyse the social, historical and cultural impact of engineering on individuals or groups • analyse ethical, environmental and sustainability considerations in engineered solutions	• critically analyse the social, historical and cultural impact of engineering on individuals or groups • critically analyse ethical, environmental and sustainability considerations in engineered solutions
Communication	
• communicate accurately with others using correct terms in an appropriate format, both orally and in writing • communicate ideas and insights in a range of appropriate mediums to a variety of audiences • justify ideas coherently using appropriate evidence and accurate referencing	• communicate accurately with others using correct terms in an appropriate format, both orally and in writing • communicate ideas and insights in a range of appropriate mediums to a variety of audiences • justify ideas coherently using appropriate evidence and accurate referencing

A Course	T Course
Reflection	
• reflect on own learning style and performance, including planning and time management, to develop strategies to improve own learning	• reflect on own learning style and performance, including planning and time management, to develop strategies to improve own learning

A guide to reading and implementing content descriptions

Content descriptions specify the knowledge, understanding and skills that students are expected to learn and that teachers are expected to teach. Teachers are required to develop a program of learning that allows students to demonstrate all the content descriptions. The lens which the teacher uses to demonstrate the content descriptions may be either guided through provision of electives within each unit or determined by the teacher when developing their program of learning.

A program of learning is what a college provides to implement the course for a subject. It is at the discretion of the teacher to emphasis some content descriptions over others. The teacher may teach additional (not listed) content provided it meets the specific unit goals. This will be informed by the student needs and interests.

Assessment

Refer to pages 9-11.

Independent Study — Value: 1.0

Independent Study a — **Value 0.5**

Independent Study b — **Value 0.5**

Prerequisites

Independent Study units are only available to individual students in Year 12. A student can only study a maximum of one Independent Study unit in each course. Students must have studied at least three standard 1.0 units from this course. An Independent Study unit requires the principal's written approval. Principal approval can also be sought by a student in Year 12 to enrol concurrently in an Independent Study unit and their third 1.0 unit in this course of study.

Unit Description

An Independent Study unit has an important place in senior secondary courses. It is a valuable pedagogical approach that empowers students to make decisions about their own learning. An Independent Study unit can be proposed by an individual student for their own independent study and negotiated with their teacher. The program of learning for an Independent Study unit must meet the unit goals and content descriptions as they appear in the course.

Duplication of content

Students must not duplicate topics, case studies or issues studied in this course.

Specific Unit Goals

This unit should enable students to:

A Course	T Course
• select engineering concepts and theories relevant to the chosen problem	• select and evaluate engineering concepts and theories relevant to the chosen problem
• apply engineering design processes to solve problems	• apply engineering design processes to solve problems
• create design solutions and products using engineering techniques and approaches	• create innovative and quality design solutions and products using engineering techniques and approaches
• evaluate the effectiveness of the engineering solution to a brief or problem	• evaluate the effectiveness of the engineering solution to a brief or problem

Content Descriptions

All knowledge, understanding and skills below must be delivered:

A Course	T Course
Design process	
• analyse and apply an engineering design process to create a solution to a problem	• critically analyse and apply an engineering design process to create a solution to a problem

A Course	T Course
• create design solutions and products using engineering techniques and approaches • understand how a design process is used to create engineering-based solutions that meets design specifications	• create innovative design solutions and products using engineering techniques and approaches • understand how a design process is used to create engineering-based solutions that meets design specifications
Strategies, methodologies and procedures	
• explain problems, analyse different possible engineering solutions and select the best option • interact with others in solving problems, proposing solutions and justifying ideas, for example, advice from industry, mentoring • apply a design process in conjunction with time management strategies to develop a solution • apply strategies to work both independently and collaboratively	• identify and define problems, analyse different possible engineering solutions and select the best option • interact with others in solving problems, proposing solutions and justifying ideas, for example, advice from industry, mentoring • apply a design process in conjunction with time management strategies to develop a solution • evaluate the effectiveness of strategies, methodologies and procedures to address a problem • apply strategies to work both independently and collaboratively
Theories, concepts and materials	
• develop a project brief • apply elementary scientific concepts, mathematical tools and computer based techniques to investigate and analyse design solutions to engineering problems • explain choice of materials and components to develop solutions to problems • reflect on the effectiveness of engineered solutions in relation to the design brief	• understand the purpose of, and develop design briefs, for example, target audience, scope of the project, objectives and goals, budgets and schedules related to problems to be solved • apply scientific concepts, mathematical tools and computer based techniques to investigate and analyse design solutions to engineering problems • evaluate materials and components to optimise solutions to problems • evaluate the effectiveness of engineered solutions in relation to the design brief
Contexts	
• analyse the social, historical and cultural impact of engineering on individuals or groups • analyse ethical, environmental and sustainability considerations in engineered solutions	• critically analyse the social, historical and cultural impact of engineering on individuals or groups • critically analyse ethical, environmental and sustainability considerations in engineered solutions

A Course	T Course
Communication	
• communicate accurately with others using correct terms in an appropriate format, both orally and in writing • communicate ideas and insights in a range of appropriate mediums to a variety of audiences • explain the process of solving design problems and justify the choices made in response to the project brief • justify ideas coherently using appropriate evidence and accurate referencing	• communicate accurately with others using correct terms in an appropriate format, both orally and in writing • communicate ideas and insights in a range of appropriate mediums to a variety of audiences • explain the process of solving design problems and justify the choices made in response to the project brief • justify ideas coherently using appropriate evidence and accurate referencing
Reflection	
• reflect on own learning style and performance, including planning and time management, to develop strategies to improve own learning	• reflect on own learning style and performance, including planning and time management, to develop strategies to improve own learning

A guide to reading and implementing content descriptions

Content descriptions specify the knowledge, understanding and skills that students are expected to learn and that teachers are expected to teach. Teachers are required to develop a program of learning that allows students to demonstrate all the content descriptions. The lens which the teacher uses to demonstrate the content descriptions may be either guided through provision of electives within each unit or determined by the teacher when developing their program of learning.

A program of learning is what a college provides to implement the course for a subject. It is at the discretion of the teacher to emphasis some content descriptions over others. The teacher may teach additional (not listed) content provided it meets the specific unit goals. This will be informed by the student needs and interests.

Assessment

Refer to pages 9-11.

Appendix A – Implementation Guidelines

Available course patterns

A standard 1.0 value unit is delivered over at least 55 hours. To be awarded a course, students must complete at least the minimum units over the whole minor, major, major/minor or double major course.

Course	Number of standard units to meet course requirements
Minor	Minimum of 2 units
Major	Minimum of 3.5 units

Units in this course can be delivered in any order.

Prerequisites for the course or units within the course:

Students must have studied at least three standard 1.0 units from this course in order to access the Independent Study unit. An Independent Study unit requires the principal's written approval. Principal approval can also be sought by a student in Year 12 to enrol concurrently in an Independent Study unit and their third 1.0 unit in this course of study.

Arrangements for students continuing study in this course

Students who studied the previous course may undertake any units in this course provided there is no duplication of content.

Duplication of Content Rules

Students cannot be given credit towards the requirements for a Senior Secondary Certificate for a unit that significantly duplicates content in a unit studied in another course. The responsibility for preventing undesirable overlap of content studied by a student rests with the principal and the teacher delivering the course. While it is acceptable for a student to be given the opportunity to demonstrate competence in VET qualifications over more than one semester, substantial overlap of content is not permitted. Students will only be given credit for covering the content once.

Guidelines for Delivery

Program of Learning

A program of learning is what a school provides to implement the course for a subject. This meets the requirements for context, scope and sequence set out in the Board endorsed course. Students follow programs of learning in a college as part of their senior secondary studies. The detail, design and layout of a program of learning are a college decision.

The program of learning must be documented to show the planned learning activities and experiences that meet the needs of particular groups of students, taking into account their interests, prior knowledge, abilities and backgrounds. The program of learning is a record of the learning experiences that enable students to achieve the knowledge, understanding and skills of the content descriptions. There is no requirement to submit a program of learning to the OBSSS for approval. The Principal will need to sign off at the end of Year 12 that courses have been delivered as accredited.

Content Descriptions

Are all content descriptions of equal importance? No. It depends on the focus of study. Teachers can customise their program of learning to meet their own students' needs, adding additional content descriptions if desired or emphasising some over others. A teacher must balance student needs with their responsibility to teach all content descriptions. It is mandatory that teachers address all content descriptions and that students engage with all content descriptions

Half standard 0.5 units

Half standard units appear on the course adoption form but are not explicitly documented in courses. It is at the discretion of the college principal to split a standard 1.0 unit into two half standard 0.5 units. Colleges are required to adopt the half standard 0.5 units. However, colleges are not required to submit explicit documentation outlining their half standard 0.5 units to the BSSS. Colleges must assess students using the half standard 0.5 assessment task weightings outlined in the framework. It is the responsibility of the college principal to ensure that all content is delivered in units approved by the Board.

Reasonable Adjustment

Units in this course are suitable for students requiring reasonable adjustment for delivery and assessment. However, standards of competency (outcomes) as dictated by National Training Packages **cannot be modified**. Students must demonstrate competence to the level required by industry in order to gain a Statement of Attainment or Vocational Certificate.

Moderation

Moderation is a system designed and implemented to:

- provide comparability in the system of school-based assessment
- form the basis for valid and reliable assessment in senior secondary schools
- involve the ACT Board of Senior Secondary Studies and colleges in cooperation and partnership
- maintain the quality of school-based assessment and the credibility, validity and acceptability of Board certificates.

Moderation commences within individual colleges. Teachers develop assessment programs and instruments, apply assessment criteria, and allocate Unit Grades, according to the relevant Framework. Teachers within course teaching groups conduct consensus discussions to moderate marking or grading of individual assessment instruments and Unit Grade decisions.

The Moderation Model

Moderation within the ACT encompasses structured, consensus-based peer review of Unit Grades for all accredited courses over two Moderation Days. In addition to Moderation Days, there is statistical moderation of course scores, including small group procedures, for T courses.

Moderation by Structured, Consensus-based Peer Review

Consensus-based peer review involves the review of student work against system wide criteria and standards and the validation of Unit Grades. This is done by matching student performance with the criteria and standards outlined in the Achievement Standards, as stated in the Framework. Advice is then given to colleges to assist teachers with, or confirm, their judgments. In addition, feedback is given on the construction of assessment instruments.

Preparation for Structured, Consensus-based Peer Review

Each year, teachers of Year 11 are asked to retain originals or copies of student work completed in Semester 2. Similarly, teachers of a Year 12 class should retain originals or copies of student work completed in Semester 1. Assessment and other documentation required by the Office of the Board of Senior Secondary Studies should also be kept. Year 11 work from Semester 2 of the previous year is presented for review at Moderation Day 1 in March, and Year 12 work from Semester 1 is presented for review at Moderation Day 2 in August.

In the lead up to Moderation Day, a College Course Presentation (comprised of a document folder and a set of student portfolios) is prepared for each A, T and M course/units offered by the school and is sent into the Office of the Board of Senior Secondary Studies.

The College Course Presentation

The package of materials (College Course Presentation) presented by a college for review on Moderation Days in each course area will comprise the following:

- a folder containing supporting documentation as requested by the Office of the Board through memoranda to colleges, including marking schemes and rubrics for each assessment item
- a set of student portfolios containing marked and/or graded written and non-written assessment responses and completed criteria and standards feedback forms. Evidence of all assessment responses on which the Unit Grade decision has been made is to be included in the student review portfolios.

Specific requirements for subject areas and types of evidence to be presented for each Moderation Day will be outlined by the Board Secretariat through the *Requirements for Moderation Memoranda* and Information Papers.

Visual evidence for judgements made about practical performances

It is a requirement that schools' judgements of standards to practical performances (A/T/M) be supported by visual evidence (still photos or video).

The photographic evidence submitted must be drawn from practical skills performed as part of the assessment process.

Teachers should consult the BSSS website for current information regarding all moderation requirements including subject specific and photographic evidence.

Appendix B – Course Developers

Name	College
Associate Professor Thomas White	Australian National Univrsity
Graham Cassells	Lake Tuggeranong College
Mostyn Gale	Dickson College
Terence Pereira	Marist College

Appendix C – Common Curriculum Elements

Common curriculum elements assist in the development of high-quality assessment tasks by encouraging breadth and depth and discrimination in levels of achievement.

Organisers	Elements	Examples
create, compose and apply	apply	ideas and procedures in unfamiliar situations, content and processes in non-routine settings
	compose	oral, written and multimodal texts, music, visual images, responses to complex topics, new outcomes
	represent	images, symbols or signs
	create	creative thinking to identify areas for change, growth and innovation, recognise opportunities, experiment to achieve innovative solutions, construct objects, imagine alternatives
	manipulate	images, text, data, points of view
analyse, synthesise and evaluate	justify	arguments, points of view, phenomena, choices
	hypothesise	statement/theory that can be tested by data
	extrapolate	trends, cause/effect, impact of a decision
	predict	data, trends, inferences
	evaluate	text, images, points of view, solutions, phenomenon, graphics
	test	validity of assumptions, ideas, procedures, strategies
	argue	trends, cause/effect, strengths and weaknesses
	reflect	on strengths and weaknesses
	synthesise	data and knowledge, points of view from several sources
	analyse	text, images, graphs, data, points of view
	examine	data, visual images, arguments, points of view
	investigate	issues, problems
organise, sequence and explain	sequence	text, data, relationships, arguments, patterns
	visualise	trends, futures, patterns, cause and effect
	compare/contrast	data, visual images, arguments, points of view
	discuss	issues, data, relationships, choices/options
	interpret	symbols, text, images, graphs
	explain	explicit/implicit assumptions, bias, themes/arguments, cause/effect, strengths/weaknesses
	translate	data, visual images, arguments, points of view
	assess	probabilities, choices/options
	select	main points, words, ideas in text
identify, summarise and plan	reproduce	information, data, words, images, graphics
	respond	data, visual images, arguments, points of view
	relate	events, processes, situations
	demonstrate	probabilities, choices/options
	describe	data, visual images, arguments, points of view
	plan	strategies, ideas in text, arguments
	classify	information, data, words, images
	identify	spatial relationships, patterns, interrelationships
	summarise	main points, words, ideas in text, review, draft and edit

Appendix D – Glossary of Verbs

Verbs	Definition
Analyse	Consider in detail for the purpose of finding meaning or relationships, and identifying patterns, similarities and differences
Apply	Use, utilise or employ in a particular situation
Argue	Give reasons for or against something
Assess	Make a judgement about the value of
Classify	Arrange into named categories in order to sort, group or identify
Compare	Estimate, measure or note how things are similar or dissimilar
Compose	The activity that occurs when students produce written, spoken, or visual texts
Contrast	Compare in such a way as to emphasise differences
Create	Bring into existence, to originate
Critically analyse	Analysis that engages with criticism and existing debate on the issue
Demonstrate	Give a practical exhibition an explanation
Describe	Give an account of characteristics or features
Discuss	Talk or write about a topic, taking into account different issues or ideas
Evaluate	Examine and judge the merit or significance of something
Examine	Determine the nature or condition of
Explain	Provide additional information that demonstrates understanding of reasoning and /or application
Extrapolate	Infer from what is known
Hypothesise	Put forward a supposition or conjecture to account for certain facts and used as a basis for further investigation by which it may be proved or disproved
Identify	Recognise and name
Interpret	Draw meaning from
Investigate	Planning, inquiry into and drawing conclusions about
Justify	Show how argument or conclusion is right or reasonable
Manipulate	Adapt or change
Plan	Strategize, develop a series of steps, processes
Predict	Suggest what might happen in the future or as a consequence of something
Reflect	The thought process by which students develop an understanding and appreciation of their own learning. This process draws on both cognitive and affective experience
Relate	Tell or report about happenings, events or circumstances
Represent	Use words, images, symbols or signs to convey meaning
Reproduce	Copy or make close imitation
Respond	React to a person or text
Select	Choose in preference to another or others
Sequence	Arrange in order
Summarise	Give a brief statement of the main points
Synthesise	Combine elements (information/ideas/components) into a coherent whole
Test	Examine qualities or abilities
Translate	Express in another language or form, or in simpler terms
Visualise	The ability to decode, interpret, create, question, challenge and evaluate texts that communicate with visual images as well as, or rather than, words

Appendix E – Glossary for ACT Senior Secondary Curriculum

Courses will detail what teachers are expected to teach and students are expected to learn for year 11 and 12. They will describe the knowledge, understanding and skills that students will be expected to develop for each learning area across the years of schooling.

Learning areas are broad areas of the curriculum, including English, mathematics, science, the arts, languages, health and physical education.

A **subject** is a discrete area of study that is part of a learning area. There may be one or more subjects in a single learning area.

Frameworks are system documents for Years 11 and 12 which provide the basis for the development and accreditation of any course within a designated learning area. In addition, frameworks provide a common basis for assessment, moderation and reporting of student outcomes in courses based on the framework.

The **course** sets out the requirements for the implementation of a subject. Key elements of a course include the rationale, goals, content descriptions, assessment, and achievement standards as designated by the framework.

BSSS courses will be organised into units. A unit is a distinct focus of study within a course. A standard 1.0 unit is delivered for a minimum of 55 hours generally over one semester.

Core units are foundational units that provide students with the breadth of the subject.

Additional units are avenues of learning that cannot be provided for within the four core 1.0 standard units by an adjustment to the program of learning.

An **Independent Study unit** is a pedagogical approach that empowers students to make decisions about their own learning. Independent Study units can be proposed by a student and negotiated with their teacher but must meet the specific unit goals and content descriptions as they appear in the course.

An **elective** is a lens for demonstrating the content descriptions within a standard 1.0 or half standard 0.5 unit.

A **lens** is a particular focus or viewpoint within a broader study.

Content descriptions refer to the subject-based knowledge, understanding and skills to be taught and learned.

A **program of learning** is what a college develops to implement the course for a subject and to ensure that the content descriptions are taught and learned.

Achievement standards provide an indication of typical performance at five different levels (corresponding to grades A to E) following completion of study of senior secondary course content for units in a subject.

ACT senior secondary system **curriculum** comprises all BSSS approved courses of study.

Appendix F – Course Adoption

Conditions of Adoption

The course and units of this course are consistent with the philosophy and goals of the college and the adopting college has the human and physical resources to implement the course.

Adoption Process

Course adoption must be initiated electronically by an email from the principal or their nominated delegate to bssscertification@ed.act.edu.au. A nominated delegate must CC the principal.

The email will include the **Conditions of Adoption** statement above, and the table below adding the **College** name, and circling the **Classification/s** required.

College:	
Course Title:	**Engineering Studies**
Classification/s:	**A** **T**
Accredited from:	2020
Framework:	Technologies 2018