ANU H Course
Discovering Engineering

Written under the Technologies Framework

Accredited from 2023 – 2027

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https://www.anu.edu.au/giving/impact-stories/talent-is-everywhere-opportunity-is-not

Fiona Foley, Winged harvest 2001, Wood, aluminium, ochre, and stainless steel, commissioned 2000 (WEH Stanner Building courtyard)

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H Courses

H classification is given to a year 11 and 12 course which is designed and accredited by the Board of Senior Secondary Studies (BSSS) and an Australian university, and where successful completion of the course will be recognised both towards the ACT Senior Secondary Certificate and an undergraduate degree with that university.

The BSSS considers H courses as complementary to studies in the home college. These extension courses allow students to pursue depth of study in an area of interest, while also gaining experience in a tertiary context to prepare for future studies.

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:

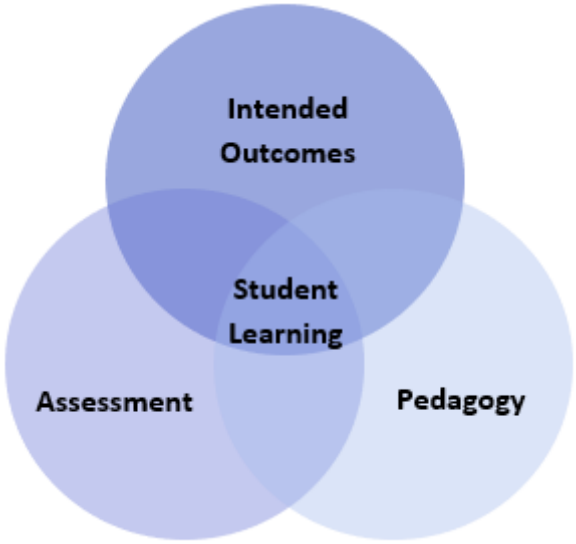
- provide a variety of pathways, to meet different learning needs and encourage students to complete their secondary education
- enable students to develop the essential capabilities for twenty-first century learners
- empower students as active participants in their own learning
- engage students in 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 *ANU H Course Discovering Engineering*, students develop literacy for a university context as they learn how to communicate ideas, concepts, and detailed proposals for an academic audience. 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

ANU H Course Discovering Engineering 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 numbers 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, and students will engage with contemporary ICT in the university context. 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 *ANU H Course Discovering Engineering* develop capability in critical and creative thinking as they imagine, generate, develop, and critically evaluate ideas. They engage critically with contemporary scholarship and research at the ANU. 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 in the university context. 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. They engage with university level ethics procedures. 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 *ANU H Course Discovering Engineering* 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 learn to engage with societies, cultures, beliefs, and environments in Asia towards more effective applications of engineering. They understand how the application of technology impacts and influences the lives and connections of peoples of Asia, Australia, and the rest of the world. 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.

ANU H Course
Discovering Engineering

Rationale

Discovering Engineering engages students in engineering and provides an opportunity to consolidate and extend foundational and new skills and knowledge for their future engineering and academic studies. It introduces three aspects of engineering: disciplines; skills and practice; and responsibilities, which are interwoven throughout the course to enhance student learning. Students will have the opportunity to practice and use engineering skills in a new context and develop insight into engineering by synthesising their learning from BSSS courses with learning from the *ANU H Course Discovering Engineering* in novel circumstances.

Students will benefit from learning in the university context. They will extend and develop understanding, knowledge and skills established in BSSS courses by applying that capacity to new and more complex situations and engineering problems. They will develop their personal and social capability by working collaboratively with academics and students from a wide range of contexts to solve problems. In studying at the university context, meeting the expectations of academics, and using university facilities students will enhance their capacity to transition to further study at university.

Upon successful completion of the course, students should be able to demonstrate research into engineering concepts, technology, and contexts by selecting and using appropriate engineering tools to model and analyse engineering components. They will apply design and problem-solving skills, processes, and tools in the production of engineering solutions. Students identify and discuss the relevance of engineering systems to people, and the societal and ethical responsibilities of engineers. In doing so they will communicate engineering concepts and solutions effectively using oral, written, and graphical techniques. They will engage in an improvement mindset and demonstrate self-reflection and evaluation of ideas

This course is aligned to deliver outcomes against the Engineers Australia (EA) Stage 1 Competencies as outlined in the EA Stage 1 table immediately below.

EA Stage 1 - competencies (extracted from Engineers Australia, 2013)

Element	Competency
1.4	**Discernment** of knowledge development and research directions within the engineering discipline
1.5	**Knowledge** of contextual factors impacting the engineering discipline
1.6	**Understanding** of the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the specific discipline
2.1	**Application** of established engineering methods to complex engineering problem solving
2.3	**Application** of systematic engineering synthesis and design processes
3.2	**Effective** oral and written communication in professional and lay domains
3.3	**Creative**, innovative, and pro-active demeanour
3.4	**Professional** use and management of information
3.5	**Orderly** management of self, and professional conduct

Goals

All courses based on the Technologies framework 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 Concepts
- Engineering Solutions

Organisation of Content

Engineering Concepts

In Engineering Concepts, students consolidate and extend understanding of key engineering concepts and foundational skills. It consolidates and extends three aspects of engineering: disciplines; skills and practice; and responsibilities, which are interwoven throughout the course to enhance student learning.

Students will gain theoretical and practical knowledge and skills in several broad engineering discipline areas and will learn to apply these in the context of engineering design and problem solving. The course will consist of a combination of lectures, tutorials, practical workshops, and a major design-and-build project. Context and exposure to professional engineering practice will be provided through industry and academic guest lectures and student-led panel discussions with practicing engineers and engineering researchers.

Engineering Solutions

Engineering Solutions builds on the knowledge and skills gained from Engineering Concepts, and studies in the home school, and consolidates and extends their learning in engineering. Students extend their learning by engaging with new disciplines, developing their skills further, and exploring the place and impact of engineering in society.

The course consists of a number of modules, each focusing on a different discipline of engineering. Students will apply the skills developed in the previous course as well as new skills to explore these emerging engineering disciplines. Through this, the concept of the engineering design process in research will be expanded, giving students a more nuanced understanding of the considerations and complexities of research and development. These activities will also provide an opportunity to explore how engineering design and technological solutions impact society as well as to explore the different ways that engineers work when in a research context.

Assessment

The identification of criteria within the achievement standards and assessment tasks types and weightings provide 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 • design analysis	**Suggested tasks:** • digital artefact • digital asset • major project • network • portfolio • product • prototyping • software application • storyboard • website
Weightings in T 1.0	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.
- Assessment tasks for a standard (1.0) 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

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 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 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 Concepts Value: 1.0

Unit Description

In Engineering Concepts, students consolidate and extend understanding of key engineering concepts and foundational skills. It consolidates and extends three aspects of engineering: disciplines; skills and practice; and responsibilities, which are interwoven throughout the course to enhance student learning.

Students will gain theoretical and practical knowledge and skills in several broad engineering discipline areas and will learn to apply these in the context of engineering design and problem solving. The course will consist of a combination of lectures, tutorials, practical workshops, and a major design-and-build project. Context and exposure to professional engineering practice will be provided through industry and academic guest lectures and student-led panel discussions with practicing engineers and engineering researchers.

Specific Unit Goals

This unit should enable students to:

- engage with contemporary engineering research, concepts technology and contexts at ANU
- consolidate and extend capacity to apply engineering concepts and methods
- implement the design process and produce prototypes using current technologies
- communicate and collaborate effectively in academic and practical engineering contexts.

Content Descriptions

All knowledge, understanding and skills below must be delivered:

Design Process

- evaluate and apply the engineering design process, including specific activities and techniques for defining a problem, identifying design criteria, and generating research projects
- critically analyse contemporary engineering research, concepts technology and contexts at ANU.

Strategies, methodologies, and procedures

- critically analyse problems to apply processes for producing and testing physical prototypes using 3D printing and/or other appropriate tools and techniques
- apply Engineering and related academic skills including, research, design, communication, and reflection and evaluate their use critically in an engineering context
- use industry-standard Computer-Aided Design (CAD) tools to design and document engineering solutions.

Theories, concepts, and materials

- critically analyse concepts in engineering.

Contexts

- evaluate the significance of, and relationships between, disciplines across fields within engineering and computer science
- critically analyse the context of current engineering research projects in engineering.

Communication

- communicate accurately with others using correct terms in an appropriate format, both orally and in writing for a university context
- communicate ideas and insights in a range of appropriate mediums to a variety of audiences
- justify the choices made in response to a design brief and the choice of process for solving design problems
- 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 learning and opportunities in the university context and on the relevance and importance to modern engineering of the systems approach including the ANU engineering philosophy and program.

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 Solutions Value: 1.0

Unit Description

Engineering Solutions builds on the knowledge and skills gained from Engineering Concepts, and studies in the home school, and consolidates and extends their learning in engineering. Students extend their learning by engaging with new disciplines, developing their skills further, and exploring the place and impact of engineering in society.

The course consists of a number of modules, each focusing on a different discipline of engineering. Students will apply the skills developed in the previous course as well as new skills to explore these emerging engineering disciplines. Through this, the concept of the engineering design process in research will be expanded, giving students a more nuanced understanding of the considerations and complexities of research and development. These activities will also provide an opportunity to explore how engineering design and technological solutions impact society as well as to explore the different ways that engineers work when in a research context.

Specific Unit Goals

This unit should enable students to:

- engage with research into contemporary engineering concepts, technology, tools, and contexts at ANU
- consolidate and extend capacity to apply engineering concepts and methods
- understand the impact of engineering and technology in the social, environmental, and business spheres
- apply the engineering design process including advanced concepts and techniques for understanding user needs, defining the problem space, and generating and evaluating solutions and prototypes.

Content Descriptions

All knowledge, understanding and skills below must be delivered:

Design Process

- use the engineering design process to complete and evaluate a conceptual design and prototype for a real-world engineering problem, e.g. from the Engineers Without Borders Challenge, developing a tech start up, or solving issues for a Smart City
- critically analyse and use a design process to optimise solutions to a problem, including limitations and constraints.

Strategies, methodologies, and procedures

- evaluate the possibilities for prototyping and engineering design through the use of appropriate tools and facilities available at the ANU, e.g. 3D printing, coding, electronics, and the ANU makerspace
- conduct a research project to critically analyse the impact of engineering and technological solutions on a societal issue, e.g. humanitarian engineering, engineering disasters, artificial intelligence, and cyber security
- apply a range of tools and approaches to analyse complex problems, e.g. solar energy research, biomaterials lab-based projects, and solving a problem for a community in a cross-cultural setting
- create prototypes and testing measures to evaluate the success of a design.

Theories, concepts, and materials

- critically analyse engineering concepts, technology, and contexts.

Contexts

- use current research at ANU in engineering in designing solutions to problems
- critically analyse the impact of engineering and technology in the social, environmental, and business spheres.

Communication

- communicate accurately with others using correct terms in an appropriate format, both orally and in writing, for a university context
- 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 learning and opportunities in the university context and on the relevance and importance to modern engineering of the systems approach which encompasses the ANU engineering philosophy and program.

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 course.

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

Units in this course can be delivered in any order.

Co-requisites and prerequisites for the course or units within the course

Students must be enrolled in BSSS *Engineering Studies* or *Physics*, and at least *Mathematical Methods* in their home college to be eligible for this H Course.

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. 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.

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 guidelines at:

http://www.bsss.act.edu.au/grade_moderation/moderation_information_for_teachers

for current information regarding all moderation requirements including subject specific and photographic evidence.

Appendix B – Course Developers

Name	University
Sam Cheah	ANU
Associate Professor Dr Tom White	ANU
Dr Kiara Bruggeman	ANU

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
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.

A **negotiated study unit** makes provision for students, classes, groups, or individuals to negotiate the program of learning based on the specific unit goals, content descriptions, assessment, and achievement standards of the course.

An **elective** is a lens for demonstrating the content descriptions within a standard 1.0

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.