ANU EXTENSION

Discovering Engineering ANU

H Course

H Course

College: The Australian National University Secondary College

Course Title: Discovering Engineering ANU	**Course Code:**

Classification: H

Unit Title(s)	**Value (1.0)**	**Length**	**Unit Codes**
Discovering Engineering ANU 1	**1.0**	**S**	
Discovering Engineering ANU 2	**1.0**	**S**	

Dates of Course Recognition:

From: 2019 **to:** 2019

Course Development Coordinator:

/ /

Panel Chair:

/ /

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Discovering Engineering

Course Classification

H

Course Developers

Name	Qualifications
Thomas White	PhD (Physics), BSc (Hons)
Sam Cheah	BE (Hons)
Jeremy Smith	BE (Hons), BIT, MPhil, Grad Cert (Teaching and Learning in Higher Education)

This group gratefully acknowledges the contributions of Professor Kylie Catchpole (ANU Research School of Engineering).

Course Length and Composition

The definition of a unit and hour requirements for a standard unit and course duration, as outlined in policies 3.2.7 Unit, 3.2.7.1 Unit Values and 3.2.6.3 Course Duration (*2009 BSSS Policy and Procedures Manual*), apply to H courses.

Unit Title	Unit Value
Discovering Engineering ANU 1	1.0
Discovering Engineering ANU 2	1.0

Available Course Patterns

Course	Minimum number of hours per course	Number of standard 1.0 value units to meet course requirements
Minor	110 hours	2 units of 55 hours

Implementation Guidelines

Arrangements for continuing students

Students completing the Discovering Engineering 1 unit (83561) in the previous Discovering Engineering course (8274) in 2018 may combine that unit with the Discovering Engineering 2 unit from this course in 2019 to form a minor.

Prerequisites or co requisites home college course/s

Students who take this course should be enrolled in Specialist Mathematics at their home college. If a student is enrolled in Mathematics Methods their enrolment in this course will be dependent on a recommendation from their college and a consideration of other courses in which they are enrolled.

Contribution towards an ATAR

Students can count up to 2 H courses to a maximum weight of 1.2 (equivalent to 2 minors) out of the required 3.6 in the calculation of the ATAR.

A maximum of 4 standard units from H courses can contribute to the minimum requirements for a Year 12 Certificate and Tertiary Entrance Statement.

Reporting of H courses on the ACT Year 12 certificate

Home college and H courses are reported separately, each with its own course type.

A T classified major minor and H minor in the same subject are equivalent to a double major course type.

If the student has completed insufficient H units to form a course, the units may be included in the home college course in the same course area but do not contribute to the course score. *(Refer section 10 University Programs in 2009 Policies and Procedures Manual).*

Goals

Discovering Engineering engages students in engineering and provides a foundation of 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.

Upon successful completion of the course, students should be able to:

- demonstrate research into engineering concepts, technology and contexts
- select and use appropriate engineering tools to model and analyse engineering components
- apply design and problem-solving skills, processes and tools in the production of engineering solutions
- identify and discuss the relevance of engineering systems to people, and the societal and ethical responsibilities of the engineers
- communicate engineering concepts and solutions effectively using oral, written and graphical techniques
- 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

Group

Students apply to ANU for entry to this course and suitable applicants are selected at the beginning of their Year 11 year through a selection process. This process may include some or all of; a selection test, evidence provided of past academic successes, school/college recommendation.

The course caters for students who have an interest in, and aptitude for, Engineering Science and is offered as a way to deepen and broaden their understanding of this subject area. This course is at or very similar to a first year undergraduate level and students would be expected to have a good grasp of mathematics.

A student who achieves a satisfactory standard in this course will be made an early offer of entry to the ANU. The offer will be for a degree in the College Engineering and Computer Science. A pass in this Discovering Engineering ANU course is not a guarantee of an early offer. Early offers are decided by the Dean or delegate, ANU College Engineering and Computer Science. Students who are made early offers will also receive credit for Engn1211 Discovering Engineering in their university program.

Assessment

Assessment tasks will consist of 4-6 summative assessment items. Weighting of assessment tasks will be consistent with the values in the table below.

Assessment Task Types	Design and Problem Solving	Technology Skills	Knowledge and Understanding
Task Types	• Design solution for a client • Design report • Design rationale or evaluation	• Practical project • Practical test • Model • Prototype • Lab report	• Multimedia presentation with speaker's notes • Research report • Seminar presentation • Test • Written task
Weighting	25 - 50%	20 - 50%	25 - 50%

Moderation

Teachers of H courses will be required to present portfolios of student work for verification that units are taught and assessed as documented. The Moderation Officer will report any concerns to the Board.

Bibliography

Recommended Text/s

There is no prescribed or recommended text for the course. Readings and links will be made available as required.

Books

Horenstien, M., 2010, *Design Concepts for Engineers,* pp 2-13, Prentice Hall, New York

Howell, S., 2002, *Engineering Design and Problem Solving*, pp 41-46, Prentice Hall, Upper Saddle River, NJ

Journal Articles

Householder, D. L. and Hailey, C. E., 2012, "Incorporating Engineering Design Challenges into STEM Courses," *Publications.* Paper 166. https://digitalcommons.usu.edu/ncete_publications/166

Websites

College of Engineering and Computer Science (CECS) Research

https://cecs.anu.edu.au/research

Institution of Engineers Australia

https://www.engineersaustralia.org.au/

Engineers Australia Stage 1 Competency Standards for Professional Engineer (2013)

https://www.engineersaustralia.org.au/sites/default/files/resource-files/2017-03/Stage%201%20Competency%20Standards.pdf

Engineers Australian National Committee on Engineering Design

https://www.engineersaustralia.org.au/Communities-And-Groups/National-Committees-And-Panels/Engineering-Design

Engineers Without Borders (EWB)

https://www.ewb.org.au/

EWB Challenge

https://ewbchallenge.org/

Stanford d.school Virtual Crash Course in Design Thinking

https://dschool.stanford.edu/resources/a-virtual-crash-course-in-design-thinking

Stratasys 3D Printing Curriculum

http://www.stratasys.com/industries/education/educators/curriculum/introduction-to-3d-printing

LinkEngineering Educator Exchange

https://www.linkengineering.org/EngineeringDesign.aspx

NASA Education Resources

https://www.nasa.gov/audience/foreducators/index.html

Thingiverse Education

https://www.thingiverse.com/education

TED Talks: Ideas Worth Spreading

http://www.ted.com/

Ultimaker lesson ideas and starter

https://ultimaker.com/en/resources/21890-lesson-ideas-and-starters

Autodesk Design Academy

https://academy.autodesk.com/

These were accurate at the time of publication.

Discovering Engineering ANU 1 Value 1.0

Unit Description

Discovering Engineering ANU 1 introduces students to key engineering concepts and foundational skills. It introduces 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:

- demonstrate research into engineering concepts, technology and contexts
- use a CAD tool to model engineering components
- use modern production methods to prototype physical components
- apply a systematic design process to develop solutions to engineering problems
- demonstrate an ability to co-design software and hardware components of engineering systems
- effectively communicate engineering concepts using different media.

Content

- exploration of disciplines across fields within engineering and computer science.
- an overview of the engineering design process including specific activities and techniques for defining a problem, identifying design criteria and generating and evaluating concepts
- introduction to the use of industry-standard Computer-Aided Design (CAD) tools
- production and testing of physical prototypes using 3D printing and/or other appropriate tools and techniques
- relevance and importance to modern engineering of the systems approach which encompasses the ANU's engineering philosophy and program
- engineering and related academic skills including, research, design, communication and reflection.

Teaching and Learning Strategies

A variety of teaching and learning strategies may be used to deliver the course objectives:

- lectures
- online resources and mini-modules
- tutorial-style class activities involving group discussions, problem solving, worksheets etc.

- practical/computer-based labs eg: CAD, electronics, programming etc
    - directed (worksheets/tutorials)
    - exploratory – extending beyond worksheet examples, responding to prompt/extension questions
    - projects/design assignments
- guest lectures from industry, academia/research, tertiary students
- case study discussions of ethics, professional responsibilities etc
- design exercises
    - in-class activities linked to specific design process stages (user needs, requirements, concept generation, prototyping, verification, validation etc)
    - major design and build project
- individual reflection

Assessment

Assessment tasks will consist of 4-6 summative assessment items. Weighting of assessment tasks will be consistent with the values in the table below.

Assessment Task Types	**Design and Problem Solving**	**Technology Skills**	**Knowledge and Understanding**
Task Types	• Design brief for a client • Process folio • Portfolio	• Practical project • Practical test • Model • Design rationale or evaluation	• Multimedia presentation with speaker's notes • Research report • Seminar presentation • Test • Written task
Weighting	25 - 50%	20 - 50%	25 - 50%

Specific Unit Resources

Wattle Site

All course information, announcements, assessment tasks and study materials will be made available via the course Wattle site.

Wattle is the ANU online environment that facilitates learning, communication and collaboration. It is used to make lecture notes, readings, digital lecture recordings and other learning resources available to students online.

Other resources

See Bibliography on pages 7-8.

Discovering Engineering ANU 2 Value 1.0

Unit Description

Discovering Engineering ANU 2 builds on the knowledge and skills gained from Discovering Engineering ANU 1. Students are introduced to new disciplines, develop their skills further, and explore 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. Students will work in a variety of engineering contexts, for example designing and testing based on a client brief, scoping and conducting research, or lab-based projects, and solving a problem for a community in a cross-cultural setting. Through this, the concept of the engineering design process will be expanded, giving students a more nuanced understanding of the considerations and complexities of design. These activities will also provide an opportunity to explore how engineering design and technological solutions impact society as well as explore the different ways that engineers work.

Specific Unit Goals

This unit should enable students to:

- demonstrate research into engineering concepts, technology and contexts
- apply a range of tools and approaches to analyse complex problems
- create prototypes and testing measures to evaluate the success of a design
- 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
- effectively communicate engineering concepts using different media.

Content

- using the engineering design process to complete a conceptual design and prototype for a real-world engineering problem, such as from the engineers without borders challenge, developing a tech start up, or solving issues for a smart city
- exploring the possibilities of prototyping and engineering design through the use of tools such as 3D printing
- conduct a research project examining the impact of engineering and technological solutions on a societal issue
- communicating engineering concepts using different media
- reflective and ethical practice applied through projects, engagement with course material and research assignments
- relevance and importance to modern engineering of the systems approach which encompasses the ANU's engineering philosophy and program
- engineering and related academic skills including, research, design, communication and reflection.

Assessment

Assessment tasks will consist of 4-6 summative assessment items. Weighting of assessment tasks will be consistent with the values in the table below.

Assessment Task Types	Design and Problem Solving	Technology Skills	Knowledge and Understanding
Task Types	• Design brief for a client • Process folio • Portfolio	• Practical project • Practical test • Model • Design rationale or evaluation	• Multimedia presentation with speaker's notes • Research report • Seminar presentation • Test • Written task
Weighting	25 - 50%	20 - 50%	25 - 50%

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All course information, announcements, assessment tasks and study materials will be made available via the course Wattle site.

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