Electronics and Advanced Technologies

LEVEL 2	15 TCE CREDIT POINTS
COURSE CODE	EAT215124
COURSE SPAN	2024 — 2028
READING AND WRITING STANDARD	NO
MATHEMATICS STANDARD	NO
COMPUTERS AND INTERNET STANDARD	NO

This course was delivered in 2024. Use A-Z Courses to find the current version (if available).

This course introduces learners to the field of electronics and the role they play in advanced technologies today.

Course Description

Electronics and Advanced Technologies Level 2 builds on Australian Curriculum: Technologies. This course introduces learners to the field of electronics and the role they play in advanced technologies today. The course explores innovation in electronics the impacts on advanced technologies and the way we connect to the world around us.

In Electronics and Advanced Technologies Level 2 learners will apply a transdisciplinary science, technology, engineering and mathematics (STEM) approach to:

- explore how electricity in circuits works
- construct and investigate simple circuits
- identify problems with circuits and solve them
- prototype simple electronic solutions such as, a rain alarm for water conservation or automatic irrigation systems, an automatic night light or safety light for walking or cycling, or health tech such as a heart rate monitor
- develop knowledge and skills to work safely with tools, chemicals and electricity
- identify the role of electronics in their own lives and in today's technological society
- investigate advanced technologies including automation, renewable energy sources and embedded systems.

Learners undertake a variety of individual and collaborative projects to research, plan and develop electronic circuits and systems. The course culminates in a folio of work based on a design process to create a microcontroller system.

This course will suit learners with an interest in building STEM knowledge and skills within an electronics context. Electronics and Advanced Technologies Level 2 will also be helpful in developing foundational skills for the Level 3 course or be a complement to vocational courses in technical trades.

Focus Area

Transdisciplinary projects

Courses aligned to the Years 9 to 12 Curriculum Framework belong to one of the five focus areas of Discipline-based study, Transdisciplinary projects, Professional studies, Work-based learning and Personal futures.

Electronics and Advanced Technologies Level 2 is a Transdisciplinary projects course.

Transdisciplinary projects courses require learners to integrate, transfer and reflect on their prior knowledge, skills, attitudes and values in transdisciplinary ways. Learners will engage critically and creatively to integrate the learning and ways of working from multiple disciplines. Learners will produce outcomes that are only possible through the intersection between disciplines. Learners will share the outcomes of Transdisciplinary projects as appropriate to their methodology and their exhibition of work will form a major element of their assessment. Learners will reflect upon their learning by evaluating their project outputs, the effectiveness of their methodology and the implications of their work on the pre-existing body of knowledge.

Transdisciplinary projects courses have three key features that guide teaching and learning:

- engage and ideate
- connect and apply
- exhibit and reflect.

Figure 1: Transdisciplinary project cycle of learning adapted from OECD Learning Compass 2030

In this course learners will do this by:

- exploring and discovering the field of electronics
- combining the STEM[†] disciplines and processes needed to work with electronics as they build, test and prototype circuits
- using practical problem solving skills, learners will create, share and reflect upon solutions.

[†] STEM is an approach to learning and development that integrates the discipline areas of science, technology, engineering and mathematics.

Rationale

Technologies enrich and impact on the lives of people and societies globally. "Learning in Technologies is also important for a diverse and capable science, technology, engineering and mathematics (STEM) workforce. STEM learning involves explicit teaching of knowledge and skills in each learning area: Science, Technologies and Mathematics. A transdisciplinary approach can enhance the application of students' scientific and mathematical literacy, design and computational thinking, problem-solving and collaboration skills. Developing STEM competencies enables students to develop, model, analyse and improve solutions to real-world problems. It supports students to access further study and a variety of careers and jobs". (ACARA, 2021).

Advanced Technologies refers to those technologies at the 'cutting edge' or latest technological equipment available on the market at point in time. The characteristics of current electronic systems have evolved to become part of the sophisticated systems that make advanced technology possible today. The evolution of the telephone is one such advanced technology. As electronic components became smaller in scale, the telephone became smaller and more advanced. The evolution of advanced technologies are inextricably reliant on the field of electronics and are transforming modern manufacturing within industry.

The field of electronics combines design creativity with scientific concepts to develop electronic products that make our lives more convenient. Electronic products pervade all aspects of modern living including communications, power generation, transport and computing. High-tech products and services enabled by electronics will define our future; for example, smart grids, electric vehicles, wearable tech, artificial intelligence (AI), robotics, automation and Internet of Things (IoT) technologies.

Electronics and Advanced Technologies Level 2, introduces learners to the field of electronics through:

- practical exploration applied within real-world projects
- development of the knowledge and skills to design innovative solutions to real world problems, challenges and needs
- application of foundational scientific and mathematical knowledge and understanding along with engineering skills required to tackle problems in an electronics context.

This introduction to electronics will provide an accessible, robust foundation for life or further study. Areas for further study include Vocational Education and Training (VET) Electrotechnology, VET Sustainable Energy and Electronics and Advanced Technologies Level 3.

The purpose of Years 9 to 12 Education is to enable all learners to achieve their potential through Years 9–12 and beyond in further study, training or employment.

Years 9–12 Education enables personal empowerment, cultural transmission, preparation for citizenship and preparation for work.

This course is built on the principles of access, agency, excellence, balance, support and achievement as part of a range of programs that enables learners to access a diverse and flexible range of learning opportunities suited to their level of readiness, interests and aspirations.

Learning Outcomes

On successful completion of this course, learners will be able to:

1. describe and apply skills for safely using equipment, experimenting and building circuits
2. describe and apply STEM concepts involved in the design and testing of electronic solutions
3. decompose real world problems and appraise existing solutions to inform the development or modification of electronic solutions
4. communicate electronic concepts for technical and non-technical audiences
5. use project management strategies when working independently and collaboratively with others
6. identify and explain the function and operation of circuits and their components
7. select and use appropriate input and output devices and controllers for digital systems
8. use microcontrollers to control and investigate electronic circuits.

Pathways

Electronics and Advanced Technologies Level 2 provides a pathway for secondary learners who have studied the Australian Curriculum: Technologies context of engineering principles and systems. The course builds on knowledge and skills from the Year 8 curriculum and complements continued elective studies in this context for Years 9 and 10.

Electronics and Advanced Technologies Level 2 complements learning in mathematics and science and other technologies courses.

Electronics and Advanced Technologies Level 2 provides a strong foundational pathway to Level 3 technologies courses and to further study in both vocational and academic fields.

Integration of General Capabilities and Cross-curriculum Priorities

The general capabilities addressed specifically in this course are:

- Critical and creative thinking
- Digital literacy
- Numeracy
- Personal and social capability.

The cross-curriculum priorities enabled through this course are:

- Sustainability.

Course Size And Complexity

This course has a complexity level of 2.

For a full description of courses at a complexity level of 2, please refer to the Levels of Complexity - Tasmanian Senior Secondary Education document.

This course has a size value of 15. Upon successful completion of this course (i.e., a Preliminary Achievement (PA) award or higher), a learner will gain 15 credit points at Level 2 towards the Participation Standard of the Tasmanian Certificate of Education (TCE).

Course Structure

This course consists of three 50-hour modules.

Module 1: Discovering electronics

Module 2: Electronic systems

Module 3: Digital electronics

Course Delivery

The three modules should be delivered in order 1, 2 and 3.

Course Requirements

Access

Learners enrolled in this course are required to be able to work responsibly and safely in practical situations.

This course requires learners to collaborate with others. This could include peers, community members and industry professionals.

Previously submitted work cannot be used in meeting the requirements of Electronics and Advanced Technologies Level 2. Therefore, a learner cannot use work including, but not limited to, an independent study, folio, project or assignment that has already been presented for assessment for a previously or concurrently studied TASC accredited or recognised senior secondary course.

Resource requirements

Providers offering this course will need equipment, materials and associated facilities for prototypes to be created and tested safely and effectively. Learners need to be able to access a wide range of reliable sources of information about the uses and applications of electronics within industry and the wider community.

Learners require access to equipment such as:

- multimeters, oscilloscopes, breadboards, direct current (DC) power supplies and equipment for circuit board manufacturing is necessary for this course
- computers with circuit design
- microcontrollers. There is no prescribed microcontroller system for this course. When selecting a microcontroller or microcontrollers, providers should ensure they are well resourced, challenge learners and encourage early success to develop learner confidence.

Course Content: Module 1

Module 1: Discovering electronics

Learners will explore the fundamental concepts and principles of electronics with an emphasis on learning by doing. Transdisciplinary STEM skills and approaches are highlighted as learners develop an applied understanding of the science of electronics, use mathematical skills to record measurements and conduct basic calculations and begin to apply the inquiry and problem-solving processes used by scientists and engineers.

They will:

- understand and apply safe working practices
- build, test and evaluate simple circuits
- experiment with a variety of components
- use breadboards for prototyping and building circuits.
- develop the knowledge and skills to communicate technical information, document processes and create a product.

See Appendix 6: Content specifications for further guidance.

Module 1 learning outcomes

The following learning outcomes are a focus for this module:

1. describe and apply skills for safely using equipment, experimenting and building circuits
2. describe and apply STEM† concepts involved in the design and testing of electronic solutions
3. decompose real world problems and appraise existing solutions to inform the development or modification of electronic solutions
4. communicate electronic concepts and principles for technical and non-technical audiences
5. use project management strategies when working independently and collaboratively with others
6. identify and explain the function and operation of circuits and their components.

†STEM is an approach to learning and development that integrates the areas of science, technology, engineering and mathematics.

Module 1 content

Introducing safe work practices is fundamental to this module. Learners will be instructed in the safe use of a variety of equipment including power tools, chemicals and electrical safety including sources of dangerous voltage or current levels. Learners are familiarised with safety equipment including residual current devices such as RCDs or safety switches, fuses, circuit breakers and personal protective equipment (PPE). Learners explore electronics systems in homes, industry and modern manufacturing.

Key knowledge and skills

The key knowledge outlined should be applied in practical situations wherever possible to build foundational skills. Learners will:

- describe, using appropriate engineering terminology, the operation of simple electronic circuits
- identify basic components of circuits and their function
- understand, use and design circuit diagrams to complete simple circuit prototypes
- understand real world applications of electronics and career pathways
- apply appropriate health and safety practices including:
    - the use of PPE and following prescribed procedures
    - apply risk assessment and management strategies
    - use tools, equipment, machines and components compliant with Occupational Health and Safety (OH&S) requirements
    - use specifications, data sheets, safety data sheets and technical data manuals
- use a basic scientific methodology to plan and conduct experiments with simple circuits which include switches, resistors and capacitors
- use design and systems thinking to identify and solve simple problems
- use a design process to undertake projects, such as: plan, create, improve
- apply prototyping techniques including the use of circuit simulation software and breadboarding
- build LED and a standard transistor or switching circuits
- use equipment to make measurements on electrical circuits
- use standard scientific and mathematical conventions for communicating measurements and performing calculations including the International System (SI) for units
- apply foundational circuit theory and analysis calculations including current, voltage, resistance, power and voltage gain.

See Appendix 6 for further content specifications.

Module 1 work requirements summary

This module includes the following work requirements:

- one presentation on testing and fault finding
- one investigation documenting 4–5 circuit tasks for skill building.

See Appendix 3 for the full specifications of the work requirements of this course.

Module 1 assessment

This module has a focus on criteria 1, 2, 3, 4, 5 and 6.

Course Content: Module 2

Module 2: Electronic systems

Learners begin their investigation of advanced technologies in relation to electronics. They will consider the social, economic and environmental impacts of electronic components, systems and devices. Learners will also identify historical and current trends in the application of electronics and explore innovations within a negotiated context. Learners continue with the approach of learning by doing. They will apply and extend their understanding of circuits to basic electronic systems.

Module 2 learning outcomes

The following learning outcomes are a focus for this module:

1. describe and apply skills for safely using equipment, experimenting and building circuits
2. describe and apply STEM† concepts involved in the design and testing of electronic solutions
3. decompose real world problems and appraise existing solutions to inform the development or modification of electronic solutions
4. communicate electronic concepts for technical and non-technical audiences
5. use project management strategies when working independently and collaboratively with others
7. select and use appropriate input and output devices and controllers for digital systems.

†STEM is an approach to learning and development that integrates the discipline areas of science, technology, engineering and mathematics.

Module 2 content

Learners investigate and develop:

- input and output devices such as switches, sensors, light-emitting diodes (LEDs), buzzers and speakers
- processes to undertake routine circuit analysis to find out the voltages and current in each element.
- circuit construction skills including designing and manufacturing printed circuit boards (PCB)
- processes and skills for testing and fault-finding techniques to evaluate their constructed electronic circuits.

They apply their learning through scaffolded systems projects, using iterative problem-solving and design processes.

Key knowledge and skills

The key knowledge and skills should continue to be applied in practical situations wherever possible. This enables learners to build on and extend their understanding and skills from their work with electronic circuits into electronic systems. Learners will:

- understand that electronic systems are made up of inputs, processes and outputs
- investigate and understand:
    - input, process and output devices and their real-world applications
    - functions of different input and output (I/O) devices
- understand how to:
    - interpret and communicate technical information using flowcharts and block diagrams
    - represent complex systems in terms of sub-systems
    - interpret and design systems using system diagrams
- understand the function of feedback circuits
- use multimeters, timing equipment, logic probes and oscilloscopes to make and record circuit measurements
- collect, assess and interpret data
- operate a range of tools, equipment and processes to produce practical projects safely
- apply prototyping techniques to manufacture printed circuit boards (PCBs)
- use techniques for finding problems and implementing solutions in circuit construction
- use research techniques to investigate new or emerging electronic innovations and explore reasons for the development of the new and emerging technologies
- apply project management skills including time management and self-imposed deadlines
- use techniques for recording and reflecting on investigations, experiments and projects
- collaborate with others.

See Appendix 6 for further content specifications.

Module 2 work requirements summary

This module includes the following work requirements:

- one report on advanced technologies and electronic systems
- one project folio consisting of a systems design task.

See Appendix 3 for the full specifications of the work requirements of this course.

Module 2 assessment

This module has a focus on criteria 1, 2, 3, 4, 5 and 7.

Course Content: Module 3

Module 3: Digital electronics

Learners will connect and apply their understanding of electronic components and the foundations of circuit theory with microcontroller programming. This enables learners to explore a range of advanced technologies applications. Examples of these applications can be found in the home and in enterprises; for example:

- building automation and industrial automation
- manufacturing
- robotics
- automotive
- lighting
- smart energy
- communications
- internet of things (IoT).

Project based work requirements in this module are to be developed in conjunction with the delivery of key knowledge and skills.

Module 3 learning outcomes

The following learning outcomes are a focus for this module:

1. describe and apply skills for safely using equipment, experimenting and building circuits
2. describe and apply STEM† concepts involved in the design and testing of electronic solutions
3. decompose real world problems and appraise existing solutions to inform the development or modification of electronic solutions
4. communicate electronic concepts for technical and non-technical audiences
5. use project management strategies when working independently and collaboratively with others
8. use microcontrollers to control and investigate electronic circuits.

† STEM is an approach to learning and development that integrates the discipline areas of science, technology, engineering and mathematics.

Module 3 content

Learners will apply their knowledge and skills of electronic circuits and systems to develop an understanding of embedded systems. They will do this through structured projects that enable tinkering, inventing and prototyping. Learners will identify a problem or need that can be solved in response to design briefs provided by or negotiated with providers. Learners will be required to make modifications to existing code, such as:

- manipulating values
- researching and using open-source code and libraries with appropriate support
- developing the skills to use a visual programming language.

Programming of the microcontrollers will need to be differentiated, based on learner needs. Providers should look for opportunities to scaffold learning and make practical connections that extend learner's knowledge and skills base.

Key knowledge and skills

Learners will consolidate and extend their understanding and skills to:

- understand how to apply the foundational concepts of circuits and systems to digital systems
- identify core elements of a microcontroller, including processors, memory, peripherals both input and output
- analyse and design flowchart programs to program microcontrollers
- interface sensing circuits and output devices with microcontrollers
- investigate, design and program microcontroller-based circuits using simple constructs of a visual programming language or by manipulating given code
- use research techniques to investigate applications of microcontrollers and the reasons for their adoption as standard technology in a variety of industries
- interpret a design brief
- use an engineering design process to research, ideate, plan, create, test and improve electronic solutions
- manage projects, including identifying objectives, setting targets and timescales, managing resources and carrying out a risk assessment
- use techniques for recording and reflecting on investigations, experiments and projects.

See Appendix 6 for further content specifications.

Module 3 work requirements summary

This module includes the following work requirements:

- one series of investigations; documentation of 4–5 programmable electronics skill building tasks
- one project folio consisting of an advanced technologies design project.

See Appendix 3 for the full specifications of the work requirements of this course.

Module 3 assessment

This module has a focus on criteria 1, 2, 3, 4, 5 and 8.

Assessment

Criterion-based assessment is a form of outcomes assessment that identifies the extent of learner achievement at an appropriate endpoint of study. Although assessment as part of the learning program is continuous, much of it is formative and is done to help learners identify what they need to do to attain the maximum benefit from their study of the course. Therefore, assessment for summative reporting to the Office of TASC will focus on what both teacher and learner understand to reflect endpoint achievement.

The standard of achievement each learner attains on each criterion is recorded as a rating 'A', 'B', or 'C', according to the outcomes specified in the standards section of the course.
A 't' notation must be used where a learner demonstrates any achievement against a criterion less than the standard specified for the 'C' rating.

A 'z' notation is to be used where a learner provides no evidence of achievement at all.

Providers offering this course must participate in quality assurance processes specified by the Office of TASC to ensure provider validity and comparability of standards across all awards. To learn more, see the Office of TASC's quality assurance processes and assessment information.

Assessment of all criteria will be made by the provider. Providers will report the learner's rating for each criterion to the Office of TASC.

Quality Assurance Process

The following processes will be facilitated by the Office of TASC to ensure there is:

- a match between the standards of achievement specified in the course and the skills and knowledge demonstrated by individual learners
- community confidence in the integrity and meaning of the qualification.

Process

The Office of TASC will verify that the provider's course delivery and assessment meet the course requirements and community expectations for fairness, integrity and validity of qualifications the Office of TASC issues. This will involve checking:

- scope and sequence documentation (Provider Standard 1):
    - course delivery plan
    - course assessment plan (assessment matrix)
- student attendance records (Provider Standard 2)
- examples of assessments tools and instruments and associated rubrics and marking guides (Provider Standard 3)
- examples of student work including that related to any work requirements articulated in the course document (Provider Standard 1 and 3)
- class records of assessment (Provider Standard 4)

This process will be scheduled by the Office of TASC using a risk-based approach.

Providers must retain electronic copies of each learner's major folio(s) in a centralised storage system for three (3) years. The Office of TASC may require these to monitor the integrity of folios produced in other courses in subsequent years.

Criteria

The assessment for Electronics and Advanced Technologies Level 2 will be based on the degree to which the learner can:

1. describe and use processes and tools
2. describe and apply scientific and mathematical concepts in electronics
3. design, create and appraise electronic solutions to meet an identified need
4. communicate information in a variety of modes
5. apply self and project management skills
6. describe and apply practical knowledge of how electronic components and circuits work
7. use and describe input and output devices and controllers
8. use microcontrollers to control and investigate electronic circuits.

	Module 1	**Module 2**	**Module 3**
Criteria focus	1, 2, 3, 4, 5, 6	1, 2, 3, 4, 5, 7	1, 2, 3, 4, 5, 8

Standards

Criterion 1: describe and use processes and tools

Standard Element	Rating A	Rating B	Rating C
E01 - Safety protocols and risk management	applies procedures for occupational health and safety to minimise risks to self and others, including using appropriate personal protective equipment	selects and uses established safety procedures for the use of equipment and facilities, including using appropriate personal protective equipment	follows established safety procedures for the use of equipment and facilities, including using appropriate personal protective equipment, as directed
E02 - Selection of equipment and technologies	selects and uses appropriate equipment and technologies to safely measure, test and build identified circuits and perform appropriate experiments on these circuits	selects and uses appropriate equipment and technologies to safely measure, test and build identified circuits with limited experimentation	identifies and uses equipment and technologies to safely measure, test experiment with and build basic circuits in a given context
E03 - Fault finding	identifies the presence of faults and undertakes some test procedures using work safe practices to locate them. The test procedures applied may, or may not, locate the fault	identifies the presence of faults and undertakes a given procedure using work safe practices to locate them. The procedure applied may, or may not, locate the fault	recognises faults in basic circuits using work safe practices
E04 - Digital technologies	selects and uses digital technologies to design, model and test circuits.	selects and uses digital technologies from a given range to design, model and test circuits.	uses digital technologies as instructed to design, model and test circuits.

Criterion 2: describe and apply scientific and mathematical concepts in electronics

Standard Element	Rating A	Rating B	Rating C
E01 - Scientific understanding	explains scientific concepts used in electronics	describes scientific concepts used in electronics	identifies scientific concepts used in electronics
E02 - Scientific inquiry	designs, conducts and adjusts experiments to generate data and explain relationships	designs and conducts experiments to generate data and describe relationships	follows a procedure to conduct experiments to generate simple data and identify trends
E03 - Modelling and predicting	selects, uses and applies appropriate mathematical concepts and techniques to model or predict the behaviour of a circuit	uses appropriate mathematical concepts and techniques to model or predict the behaviour of a circuit	follows instructions to use mathematical formulae to model or predict the behaviour of a circuit in a given context
E04 - Mathematical calculations	accurately calculates component values or physical quantities using appropriate mathematical formulae and correct units.	accurately calculates component values or physical quantities using identified mathematical formulae.	performs calculations to solve equations with given formulae.

Criterion 3: design, create and appraise electronic solutions to meet an identified need

Standard Element	Rating A	Rating B	Rating C
E01 - Investigate and define	selects and uses appropriate research techniques to identify needs and constraints in response to a problem or challenge	selects and uses research techniques to identify needs and constraints in response to a problem or challenge	uses given research techniques, as directed, to identify limited needs and constraints in response to a problem or challenge
E02 - Generate and design	generate, iterate and document ideas and explain the factors that impact on design decisions to effectively meet identified needs or opportunities	generate, iterate and document ideas that describe the factors that impact design decisions to meet identified needs or opportunities	generate and document appropriate design ideas and decisions to meet identified needs or opportunities
E03 - Produce and implement	produces, tests, modifies and refines a prototype that could solve a defined	produces, tests and modifies a prototype that could solve a defined problem and addresses the identified	produces and tests a prototype that could solve a defined problem

	problem and addresses identified requirements	requirements: may not address all requirements	
E04 - Appraise	assesses the suitability and appropriateness of a solution using design criteria and describes suggestions for future improvement	describes the suitability and appropriateness of a solution using design criteria	identifies the suitability and appropriateness of a solution using design criteria
E05 - Social, ethical and sustainability considerations	explains how competing social, ethical and sustainability considerations impact creation and development of solutions.	describes how competing social, ethical and sustainability considerations impact creation and development of solutions.	identifies how competing social, ethical and sustainability considerations impact creation and development of solutions.

Criterion 4: communicate information in a variety of modes

Standard Element	Rating A	Rating B	Rating C
E01 - Use of terminology	accurately uses a range of appropriate terminology to effectively communicate electronic ideas and processes	uses a range of terminology to clearly communicate electronic ideas and processes	uses given terminology to communicate simple electronic ideas and processes
E02 - Interprets technical and graphic information	uses informed and accurate interpretations of schematics and technical information to construct electronic solutions	effectively interprets and uses schematics and technical information, to construct electronic solutions	interprets and uses simple engineering drawings and technical information, to construct electronic solutions
E03 - Uses graphical representation techniques	effectively uses graphical representation techniques including digital tools to communicate complex electronic concepts and ideas	uses graphical representation techniques including digital tools to communicate electronic concepts and ideas	uses simple graphical representation techniques including digital tools to communicate simple electronic concepts and ideas. There may be errors.
E04 - Communicating problem solving processes	explains the process of solving design problems using reliable evidence to justify the choices made	describes the process of solving design problems using evidence to justify the choices made	records the process of solving design problems with limited explanation of the choices made
E05 - Communication mode	appropriately selects and uses a range of communication formats to effectively convey meaning	uses nominated communication formats to clearly convey meaning	uses nominated communication formats that convey meaning in targeted communication
E06 - Academic integrity	uses appropriate referencing conventions to correctly identify all sources of information† used in own work and creates structured reference lists and/or bibliographies.	uses appropriate referencing conventions to identify sources of information† used in own work and creates reference lists and/or bibliographies: there may be errors.	uses given referencing conventions as directed, to identify sources of information† used in own work: there may be errors.

†sources of information include the images, words and ideas of others.

Criterion 5: apply self and project management skills

Standard Element	Rating A	Rating B	Rating C
E01 - Organisational skills	uses a range of effective planning and self-management strategies to facilitate the successful completion of tasks within agreed timeframes	uses appropriate planning strategies to facilitate successful completion of tasks within agreed timeframes	uses limited planning strategies to facilitate partial completion of tasks within agreed timeframes
E02 - Digital planning tools	selects and uses suitable technologies to plan and effectively execute project work	selects and uses from given technologies to plan and execute project work	as directed, uses given technologies to plan and execute aspects of project work
E03 - Reflective skills: reviewing processes	provides detailed reflections on learning and processes[l] and suggests and makes modifications to improve the effectiveness of design processes or experimentation	reflects on learning and processes[l] and suggests and makes minor modifications to improve the effectiveness of design processes or experimentation	reflects on learning and processes[l] in response to stimulus questions or prompts and makes minor modifications as directed to improve the effectiveness of design processes or experimentation
E04 - Roles and responsibilities for	explains own and others' contributions to the successful	describes own contribution to the successful completion of	identifies own contribution to the successful completion of collaborative

collaboration	completion of collaborative activities.	collaborative activities.	activities.

[†]processes include implications and consequences of actions and decision-making including planning and time management and how this learning can be transferred to current and future designed solutions.

Criterion 6: describe and apply practical knowledge of how electronic components and circuits work

Standard Element	Rating A	Rating B	Rating C
E01 - Constructs circuits	designs and constructs appropriate circuits, and identifies and isolates problems	constructs simple circuits and identifies problems: there may be some errors	completes simple circuits as directed
E02 - Identify common components	identifies and appropriately selects common components, explaining function and application	identifies and selects common components, describing function and application	identifies and selects common components
E03 - Identify common circuits	identifies common circuit types and explains how the current flow changes in different areas of the circuit	identifies common circuit types and describes how the current changes in different areas of the circuit	identifies common circuit types
E04 - Transistors, resistors and capacitors	explains the function and properties of transistors, diodes, resistive networks and capacitors.	describes the function and properties of transistors, diodes, resistive networks and capacitors.	identifies the operation of simple circuits containing transistors, diodes, resistive networks and capacitors.

Criterion 7: use and describe input and output devices and controllers

Standard Element	Rating A	Rating B	Rating C
E01 - Systems diagram	explains a system in terms of subsystems by producing a systems diagram of the solution	describes a system in terms of subsystems by producing a systems diagram of the solution	identifies a system in terms of subsystems by interpreting a systems diagram of the solution
E02 - Input and output devices	selects and uses appropriate input and output devices for effective electronic solutions with explanation	selects and uses from a given range, input and output devices for appropriate electronic solutions	uses given input and output devices for practical situations as directed
E03 - Integrated circuits	selects, uses and explains the most appropriate processing components[†] for the production of circuits	selects, uses and describes the most appropriate processing components[†] from a given range for the production of circuits	identifies and uses given processing components[†] to produce circuits as directed
E04 - Role of advancing technologies	explains the roles that advanced technologies play in electronics-related contexts[‡].	describes the roles that advanced technologies play in electronics-related contexts[‡].	identifies the roles that advanced technologies play in electronics-related contexts[‡].

[†] processing components may include semiconductors, integrated circuits and electronics modules.
[‡] contexts may include modern manufacturing, consumer electronics or industry sectors such as agriculture, education, communication.

Criterion 8: use microcontrollers to control and investigate electronic circuits

Standard Element	Rating A	Rating B	Rating C
E01 - Applications of microprocessors	explains microprocessor control applications in everyday consumer products	describes microprocessor control applications in everyday consumer products	identifies microprocessor control applications in everyday consumer products
E02 - Programs microcontrollers	programs microcontrollers by assessing and designing flowchart programs using simple constructs of a visual programming language	programs microcontrollers using scaffolded flowchart programs and by modifying given code	programs microcontrollers by following a flowchart program
E03 - Design and construct microcontroller systems physically and virtually	designs, constructs and analyses simple interface-based microcontroller systems by observing, recording, interpreting and comparing their operation	designs, constructs and explains simple interface-based microcontroller systems by observing, recording and interpreting their operation	constructs and describes simple interface-based microcontroller systems as directed, by observing and recording their operation

E04 - Evaluation of existing, new and emerging tools, technologies and systems for design opportunities	assesses existing, new and emerging tools, technologies and systems to determine suitability for designing and creating solutions.	describes a range of existing, new and emerging tools, technologies and systems that could be suitable for designing and creating solutions.	identifies a limited range of existing, new and emerging tools, technologies and systems that could be suitable for designing and creating solutions.

Qualifications Available

Electronics and Advanced Technologies Level 2 (with the award of):

EXCEPTIONAL ACHIEVEMENT

HIGH ACHIEVEMENT

COMMENDABLE ACHIEVEMENT

SATISFACTORY ACHIEVEMENT

PRELIMINARY ACHIEVEMENT

Award Requirements

The final award will be determined by the Office of TASC from 8 ratings.

The minimum requirements for an award in this course are as follows:

EXCEPTIONAL ACHIEVEMENT (EA)
6 'A' ratings, 2 'B' ratings

HIGH ACHIEVEMENT (HA)
3 'A' ratings, 4 'B' ratings, 1 'C' rating

COMMENDABLE ACHIEVEMENT (CA)
4 'B' ratings, 3 'C' ratings

SATISFACTORY ACHIEVEMENT (SA)
6 'C' ratings

PRELIMINARY ACHIEVEMENT (PA)
4 'C' ratings

A learner who otherwise achieves the ratings for an SA (Satisfactory Achievement) award but who fails to show any evidence of achievement in one or more criteria ('z' notation) will be issued with a PA (Preliminary Achievement) award.

Course Evaluation

Years 9-12 Learning will develop and regularly review and revise the curriculum. Course evaluation is informed by the experience of the course's implementation, delivery and assessment. More information about course evaluation can be found on the Years 9-12 website.

Course Developer

This course has been developed by the Department for Education, Children and Young People's Years 9-12 Learning Unit in collaboration with Catholic Education Tasmania and Independent Schools Tasmania.

Accreditation

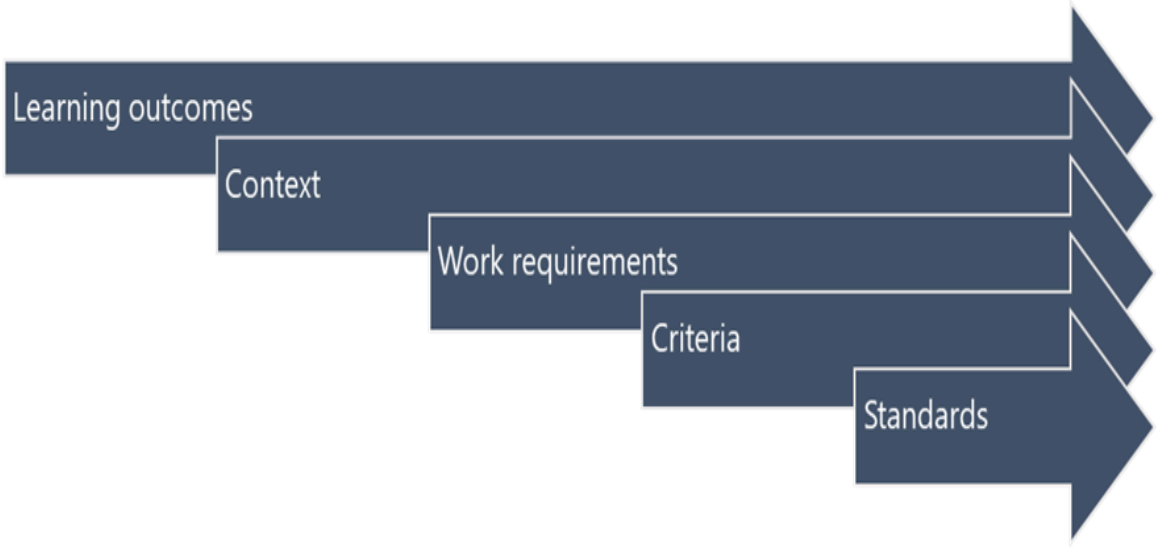
Accredited on 22 March 2023 for use from 1 January 2024 to 31 December 2028.

Version History

Version 1

Accredited on 22 March 2023 for use from 1 January 2024 to 31 December 2028. This course replaces Electronics Foundation Level 2 (ELT215114) which expires on 31 December 2023.

Appendix 1 – Line of sight



Learning outcomes	Course content: module	Work requirements: module	Criterion	Criterion elements	General capabilities
1. **describe and apply skills for safely using equipment, experimenting and building circuits**	1, 2, 3	1, 2, 3	1	1, 2, 3, 4	Critical and creative thinking; Personal and social capability
2. **describe and apply STEM† concepts involved in the design and testing of electronic circuits**	1, 2, 3	1, 2, 3	2	1, 2, 3, 4	Critical and creative thinking; Digital literacy; Numeracy
3. **decompose real world problems and appraise existing solutions to inform the development or modification of electronic solutions**	1, 2, 3	1, 2, 3	3	1, 2, 3, 4, 5	Critical and creative thinking; Digital literacy
4. **communicate simple electronic concepts for technical and non-technical audiences**	1, 2, 3	1, 2, 3	4	1, 2, 3, 4, 5, 6	Critical and creative thinking; Digital literacy; Numeracy
5. **use project management strategies when working independently and collaboratively with others**	1, 2, 3	1, 2, 3	5	1, 2, 3, 4	Critical and creative thinking; Digital literacy; Numeracy; Personal and social capability

6. **identify and explain the function and operation of simple circuits and their components**	1	1	6	1, 2, 3, 4	Critical and creative thinking
7. **select and use appropriate input and output devices and controllers for simple digital systems**	2	2	7	1, 2, 3, 4	Critical and creative thinking
8. **use microcontrollers to control and investigate simple electronic circuits**	3	3	8	1, 2, 3, 4	Critical and creative thinking; Digital literacy

† STEM is an approach to learning and development that integrates the discipline areas of science, technology, engineering and mathematics.

Appendix 2 – Alignment to curriculum frameworks

Links to Foundation to Year 10

Aligns with version 9 of the Australian Curriculum: Technologies the mandated F-8 curriculum and the following elements of the digital literacy continuum: investigating, creating and exchanging, managing and operating.

Progression from the F-8 Australian Curriculum: Technologies

This course continues to develop learner understanding and skills across the two strands:

- knowledge and understanding
- process and production

of the F-8 Australian Curriculum: Technologies and draws from the two subjects:

- Digital Technologies
- Design and Technologies, contexts: Engineering principles and systems; Materials and technologies specialisations.

Note: The Australian Curriculum: Technologies is written on the basis that all learners will study the two subjects from Foundation to the end of Year 8.

Mathematical skills expected of learners studying Electronics and Advanced Technologies Level 2

This course component requires learners to use the mathematical skills they developed through the F-10 Australian Curriculum: Mathematics.

Digital Literacy Skills Framework (Department of Education, Skills and Employment)

- Electronics and Advanced Technologies Level 2 aligns with the Draft of the Digital Literacy Skills Framework, Level 3 in the following ways:
    - 3.12 Active awareness of self as a digital user in a range of familiar and some unfamiliar contexts
    - 3.13 Applies and experiments with digital tools and software in a range of familiar and some unfamiliar contexts

Appendix 3 – Work requirements

The work requirements of a course are processes, products or performances that provide a significant demonstration of achievement that is measurable against the course's standards. Work requirements need not be the sole form of assessment for a module.

Module 1 work requirements specifications

Work requirement 1 of 2

Title of work requirement: Test and fault finding

Mode or format: presentation

Description: Learners will be provided with a scenario relating to testing and fault finding; for example, 'as part of your ongoing training, you have been asked to test an electric circuit and carry out some fault finding on a faulty circuit board.'

Selection of equipment, appropriate safety protocols and assessment of risk should be demonstrated.

Learners will plan and create a multimodal presentation or instructional video.

Size: 3 minutes of live or recorded oral communication, or equivalent in multimodal form

Timing: none specified

Relevant criteria: 1, 4 and 5

Work requirement 2 of 2

Title of work requirement: Circuits skill building tasks

Mode or format: investigation

Description: Learners will document a series of circuit experiments enabling them to investigate components and undertake circuit analysis in terms of voltage, current, resistance, energy and power.

Size: approximately 10 hours on task

Timing: throughout module 1

Relevant criteria: 1, 2, 4, 5 and 6

Module 2 work requirements specifications

Work requirement 1 of 2

Title of work requirement: Impact of advanced technologies and electronic systems

Mode or format: extended response

Description:

Investigate the impact of advanced technologies and electronic systems in a selected context as negotiated with the teacher:

- explore reasons for, and drivers of, the development of new and emerging technologies, including discoveries, new materials, technology convergence and new manufacturing methods and processes
- research and describe operations and applications of new and emerging electronic components and products
- investigate impacts and the potential of the new and emerging developments (social, economic and environmental factors)
- present and describe information about a specific new or emerging electronic innovation. Many of these developments are made possible through the use of digital technologies.

Size: recommended maximum 750 words or 5 minutes of recorded oral communication, or equivalent in multimodal form

Timing: none specified

Relevant criteria: 4, 5 and 7

Work requirement 2 of 2

Title of work requirement: Systems design tasks

Mode or format: project folio

Description: Learners respond to a structured design brief provided by the teacher, to construct a simple electronic system or subsystem. Construction of the system or subsystem may be on a prototype board or printed circuit board (PCB). Whichever method of construction is chosen, the layout and mounting of components and wiring should be neat and logical, assist the design, testing and fault finding of the system.

Learners use an iterative problem-solving and design process to:

- investigate and define
- generate and design
- produce and implement
- evaluate

Learners must also document, risk assessment, project management strategies and tools and the application of STEM knowledge, skills and processes.

Size: maximum 1,000 words or 6 minutes multimodal format

Timing: none specified

Relevant criteria: 1, 2, 3, 4, 5 and 7

Module 3 work requirements specifications

Work requirement 1 of 2

Title of work requirement: Programmable electronics: skill-building tasks

Mode or format: investigation

Description: Learners will document a series of tasks involving microcontrollers. Learners will use a microcontroller to drive appropriate outputs dependent on input states and discuss feedback and control. They will design and analyse flowchart programs to enable microcontrollers to perform tasks. Learners describe applications of microcontrollers and the reasons for their adoption as standard technology in a variety of industries and their impact on society.

Size: approximately 10 hours (4–5 individual tasks)

Timing: throughout module 3

Relevant criteria: 1, 2, 4, 5 and 8

Work requirement 2 of 2

Title of work requirement: Advanced technologies design project

Mode or format: folio

Description: create a microcontroller system programmed via a flowchart to solve an identified problem, need or opportunity based on the analysis of a teacher provided scenario or scenarios.

Learners use an iterative problem-solving and design process and document the following:

- the analysis of the problem to be solved by the project
- the information researched and investigations carried out prior to drawing up the specification
- the specification of the solution
- alternative solutions considered
- the reasons for the selection of the chosen system
- the design of the chosen solution
- significant aspects of the development and progress
- the methods of testing and modifications made during the construction
- the testing methods employed after completion
- test results appropriately tabulated
- an assessment of how well the project works and an evaluation based on the original specification
- suggestions for changes which make the circuit match the initial specification more closely
- reference list
- reasons for all the decisions made.

Size: approximately 15 hours

Timing: none specified

Relevant criteria: 1, 2, 3, 4, 5 and 8

Appendix 4 – General capabilities and cross-curriculum priorities

Learning across the curriculum content, including the cross-curriculum priorities and general capabilities, assists students to achieve the broad learning outcomes defined in the *Alice Springs (Mparntwe) Education Declaration (December 2019)*.

General capabilities

The general capabilities play a significant role in the Australian Curriculum in equipping young Australians to live and work successfully in the twenty-first century.

In the Australian Curriculum, capability encompasses knowledge, skills, behaviours and dispositions. Students develop capability when they apply knowledge and skills confidently, effectively and appropriately in complex and changing circumstances, in their learning at school and in their lives outside school.

The general capabilities include:

- Critical and creative thinking
- Digital literacy
- Ethical understanding
- Intercultural understanding
- Literacy
- Numeracy
- Personal and social capability.

Cross-curriculum priorities

Cross-curriculum priorities enable students to develop understanding about and address the contemporary issues they face, for their own benefit and for the benefit of Australia as a whole. The priorities provide national, regional and global dimensions which will enrich the curriculum through development of considered and focused content that fits naturally within learning areas. Incorporation of the priorities will encourage conversations between students, teachers and the wider community.

The cross-curriculum priorities include:

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

Appendix 5 – Glossary

Refer to the Australian Curriculum Technologies glossary.

Appendix 6 - Content specifications

Given the broad scope of the field of electronics the following content specifications provide direction as to the knowledge required for, or developed during, construction projects in module 1.

Module 1 content specifications

Basic electricity and simple circuits

- safe working practices and safe use of equipment
- understanding of charge and current
    - different types of current - overview of AC alternating current and DC direct current
- electronic circuits
    - materials: conductors, insulator, semiconductors
    - types of circuits – series and parallel
    - identification and orientation of components
    - standard symbols to interpret and draw circuit diagrams
    - introduction to simple schematic diagrams
- definitions of voltage, current and resistance
- conducting experiments with voltage, current and resistance
- basic measurements
    - making measurements on electrical circuits using multimeters
    - standard scientific and mathematical conventions
        - SI units
        - recognising and using expressions in decimal and standard form
        - estimating results
        - using an appropriate number of significant figures
- relationships between voltage, current and resistance and application of Ohm's law
- relationships between power, voltage and current
- basic calculations of current, voltage, resistance, power, voltage gain
- changing the subject of an equation
- conducting experiments with basic electronic components:
    - switches
    - resistors
    - capacitors
- identifying and using a variety of semiconductors and components; for example:
    - transistors
    - diodes
- interpreting reference material including codes and units of measurement for electronic components
- calculating values for capacitors in series and in parallel
- calculating values for resistors in series and in parallel
- introduction to circuit analysis including performing calculations using Kirchhoff's law in simple circuits.

Process and production

- application of scientific inquiry using scientific method to plan and conduct experiments
- introduction to iterative problem-solving such as design and systems thinking
- simple design processes – research, plan, create, test, improve.

Prototyping

- introduction to circuit simulation software
- introduction to breadboarding
    - features and purpose of a breadboard
    - using schematics to complete simple prototypes
    - apply circuit analysis techniques
- exposure to real world applications of electronics and career pathways
- exploration of electronic systems in homes and in industry and modern manufacturing.

Module 2 content specifications

Given the broad scope of the field of electronics the following content specifications provide direction as to the knowledge required for or developed during construction projects in module 2.

Electronic systems

- understanding how electronics function as a system
    - input – sensors, switches
    - process – semiconductors, integrated circuits, microprocessors
    - output – light, sound
- techniques for communicating systems
    - block diagrams
    - flowcharts

    - circuit diagrams
- feedback (the feedback section on simple systems may be applied based on context)
    - open loop systems
    - closed loop systems
- investigating input, process and output devices and how they are used in the real world
- understanding the properties and function of semiconductors in the production of analogue and digital circuits
- recognising electronic systems are made up of one or more subsystems
- representing complex systems in terms of sub-systems
- analysis and design of systems using system diagrams
- function of printed circuit boards (PCBs).

Experiments and projects

- interpreting and following technical and safety data relating to components and chemicals
- exploring the function and operation of a variety of circuits using transistors
- constructing projects using either digital or analogue circuits which may include, but not limited to, digital logic circuits, timer circuits, communication systems
- making measurements on electrical circuits using multimeters (on voltage and resistance ranges), timing equipment, logic probes and oscilloscopes (or computers configured as oscilloscopes)
- substituting numerical values into algebraic equations using appropriate units for physical quantities
- solving algebraic equations
- graphing results
- translating information between graphical, numerical and algebraic forms
- introduction to design briefs relating to the design of electronic systems, composed of sub-systems, to satisfy a design specification.

Process and production

- using strategies for isolating problems and implementing solutions in circuit construction
- applying safe use of circuit manufacturing equipment
- manufacturing of printed circuit board (PCB)
    - soldering techniques (in well-ventilated areas)
    - design a PCB from a circuit diagram by placing components, tracks and pads appropriately
    - modify designs to reflect changes in circuit diagrams, to improve on existing designs or correct errors
- using circuit simulation software to model circuits
- applying iterative problem-solving and design processes:
    - investigating and defining – analysing, exploring and investigating information, needs and opportunities. Identifying design criteria.
    - generating and designing – making predictions about the way that electronic systems behave, brainstorming and iterating ideas, consider alternatives and document various design ideas and possibilities
    - producing and implementing – applying a variety of skills and techniques to make designed solutions to meet specific purposes and user needs
    - evaluating – occurs throughout the design process. Reviewing design ideas, processes and solutions; and seeking feedback. Use design criteria to consider the implications and consequences of actions and decision-making throughout the process. Reflect on processes and transfer their learning to other design needs or opportunities
    - collaborating and managing - work individually and in groups to plan, organise and monitor timelines, activities and use of resources effectively to create designed solutions. Using project management strategies to consider various factors such as time, cost, risk assessment and management and quality control.
- documenting and communicating - use appropriate recording and drawing techniques including the use of digital technologies.

New and emerging technologies

- exploring reasons for and drivers of the development of the new and emerging technologies, including discoveries, new materials, technology convergence and new manufacturing methods and processes
- researching and describing the operations and applications of new and emerging electronic components and products
- exploring PCB Artwork
- investigating impacts and the potential of the new and emerging developments (social, economic and environmental factors)
- presenting and describing information about a specific new or emerging electronic innovation. Many of these developments are made possible through the use of digital technologies. Contexts may include but are not limited to:
- electric vehicles (EV's)
- consumer electrical devices
- wearable electronic devices
- modern manufacturing
- renewable energy systems
- right to repair movement and electronics
- electronic systems in homes
- space technology.

Module 3 content specifications

Given the broad scope of the field of electronics the following content specifications provide direction as to the knowledge required for, or developed during, construction projects in module 3.

Introduction to microcontrollers

- exploring the fundamentals of integrated circuits (ICs), microprocessors and microcontrollers
- understanding the structure of microcontrollers as programmable assemblies of:
    - memory
    - input ports
    - output ports
    - CPU
    - event handling
- using interface sensing circuits and output devices with microcontrollers
- designing and analysing flowchart programs to enable microcontrollers to perform tasks
- introduction to simple programming
    - modification of code (manipulating values)
    - researching and using open-source code and libraries
    - visual coding
- understanding the use and function of microcontrollers including advantages and disadvantages
- exploring applications of microcontrollers and the reasons for their adoption as standard technology in a variety of industries including consumer electronics, medical, entertainment, communication, transportation
- undertaking projects
    - application of iterative problem-solving and design processes to explore new and emerging technologies. Contexts may include but are not limited to:
        - mechatronics
        - intelligent devices
        - Internet of Things (IoT)
        - e-textiles (LilyPad)
        - communication systems
        - renewable energy systems.