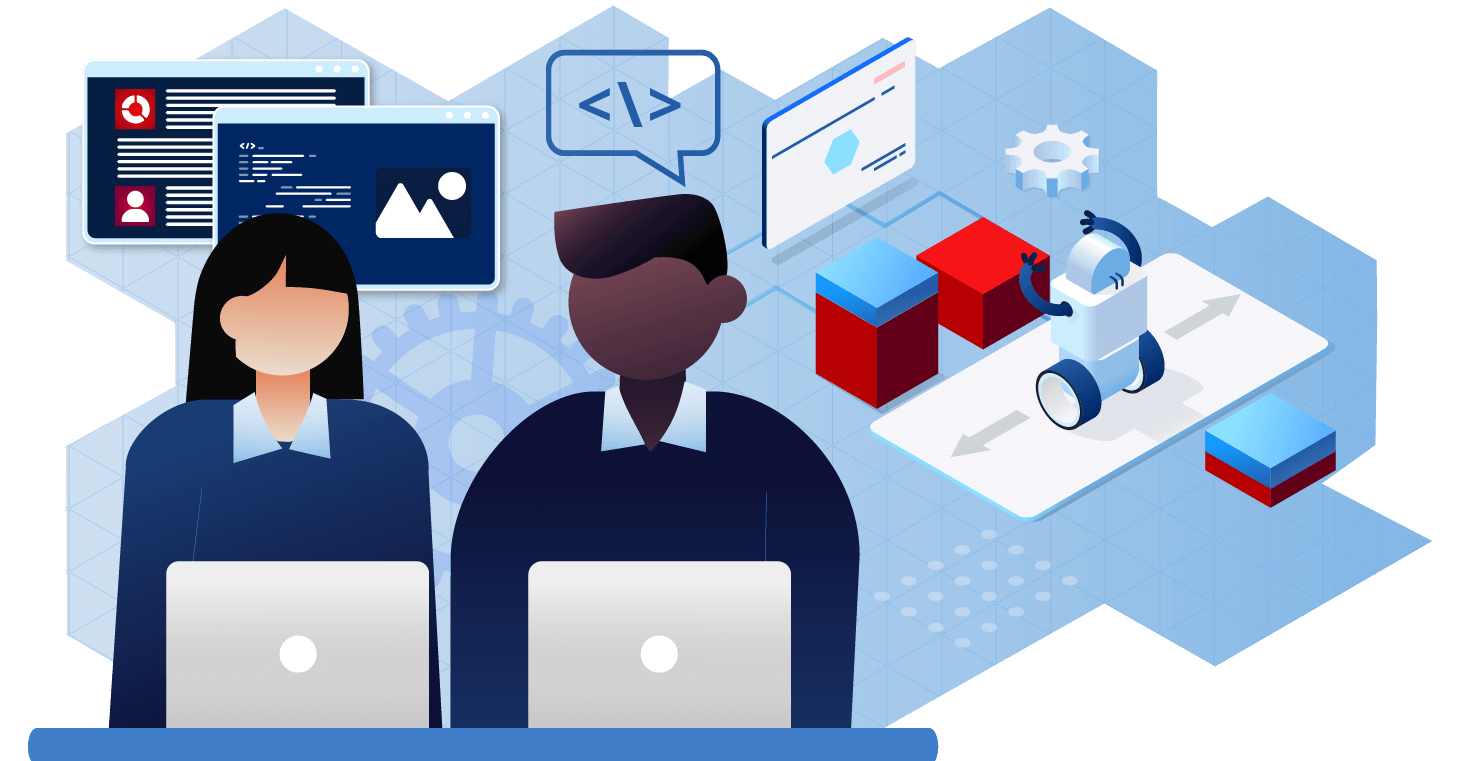
# Computing Technology Stage 5 (Year 9) – sample program of learning

**Building mechatronic and automated systems**



Contents

[Rationale 3](#_Toc135315657)

[Overview 4](#_Toc135315658)

[Outcomes 5](#_Toc135315659)

[Lesson sequence and details 7](#_Toc135315660)

[Week 1 7](#_Toc135315661)

[Week 2 15](#_Toc135315662)

[Week 3 24](#_Toc135315663)

[Week 4 29](#_Toc135315664)

[Weeks 5–7 34](#_Toc135315665)

[Week 8 38](#_Toc135315666)

[Weeks 9–10 48](#_Toc135315667)

[Weeks 11–18 54](#_Toc135315668)

[Week 19 62](#_Toc135315669)

[Week 20 64](#_Toc135315670)

[Additional information 66](#_Toc135315671)

[Further implementation support 66](#_Toc135315672)

[Assessment for learning 66](#_Toc135315673)

[Differentiation 67](#_Toc135315674)

[Support and alignment 68](#_Toc135315675)

[Evidence base 70](#_Toc135315676)

[References 72](#_Toc135315677)

## Rationale

The NSW Department of Education publishes a range of curriculum support materials, including samples of lesson sequences, scope and sequences, assessment tasks, examinations, student and teacher resource booklets, and curriculum planning and curriculum evaluation templates. The samples are not exhaustive and do not represent the only way to complete or engage in each of these processes. Curriculum design and implementation is a dynamic and contextually-specific process. While the mandatory components of syllabus implementation must be met by all schools, it is important that the approach taken by teachers is reflective of their needs and faculty/school processes.

NESA defines [programming](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/understanding-the-curriculum/programming) as the process of ‘selecting and sequencing learning experiences which enable students to engage with syllabus outcomes and develop subject specific skills and knowledge’ (NESA 2022). A program is developed collaboratively within a faculty. It differs from a unit in important ways, as outlined by NESA on their [advice on units](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/understanding-the-curriculum/programming/advice-on-units) page. A unit is a contextually-specific plan for the intended teaching and learning for a particular class for a particular period. The organisation of the content in a unit is flexible and it may vary according to the school, the teacher, the class, and the learning space. They should be working documents that reflect the thoughtful planning and reflection that takes place during the teaching and learning cycle. There are mandatory components of programming and unit development, and this template provides one option for the delivery of these requirements. The NESA and department guidelines that have influenced this template are elaborated upon at the end of the document.

This resource has been developed to assist teachers in NSW Department of Education schools to create learning that is contextualised to their classroom. It can be used as a basis for the teacher’s own program, assessment, or scope and sequence, or be used as an example of how the new curriculum could be implemented. The resource has suggested timeframes that may need to be adjusted by the teacher to meet the needs of their students.

## Overview

**Description**: this program of learning addresses **the focus area of building mechatronic and automated systems.** The lessons and sequences in this program of learning are designed to allow students to develop the knowledge and skills to **create a working mechatronic and automated systems model as a solution to a user’s needs.**

During weeks 1 to 10 of the learning sequence, students will gain an understanding of the computational, design and systems thinking used in **mechatronic and automated systems. A range of systems will be investigated that allows students to** understand how innovation, enterprise and automation have inspired the evolution of computing technology.

During weeks 11 to 18 of the learning sequence, students will design, construct, and test a system, creating a model which is coded and iterative in design. To develop their coding skills, students work collaboratively in a small team to design, produce and evaluate algorithms and implement them in a general-purpose and/or object-oriented programming language. Students manage, document and explain individual and collaborative work practices.

During weeks 19 to 20 of the learning sequence, students showcase their project to the class and seek self and peer review. Students also investigate careers in the mechatronic industry.

**Duration**: this program of learning is designed to be completed over a period of approximately 20 weeks in 60-minute lesson sequences but can be adapted to suit the school context.

**Explicit teaching**: suggested learning intentions and success criteria are available for some lessons provided. Learning intentions and success criteria are most effective when they are contextualised to meet the needs of students in the class. The examples provided in this document are generalised to demonstrate how learning intentions and success criteria could be created.

## Outcomes

A student:

* applies iterative processes to define problems and plan, design, develop and evaluate computing solutions **CT5-DPM-01**
* manages, documents and explains individual and collaborative work practices **CT5-COL-01**
* understands how innovation, enterprise and automation have inspired the evolution of computing technology **CT5-EVL-01**
* designs, produces and evaluates algorithms and implements them in a general-purpose and/or object-oriented programming language **CT5-OPL-01**
* applies computational, design and systems thinking to the development of computing solutions **CT5-THI-01**

[Computing Technology 7–10 Syllabus](https://curriculum.nsw.edu.au/syllabuses/computing-technology-7-10-2022) © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2022.

**Prior to planning for teaching and learning, please consider the following**:

**Engagement**

How will I provide authentic, relevant learning opportunities for students to personally connect with lesson content?

How will I support every student to grow in independence, confidence, and self-regulation?

How will I facilitate every student to have high expectations for themselves?

How will I identify and provide the support each student needs to sustain their learning efforts?

**Representation**

What are some different ways I can present content to enable every student to access and understand it?

How will I identify and address language and/or cultural considerations that may limit access to content for students?

How will I make lesson content and learning materials more accessible?

How will I plan learning experiences that are relevant and challenging for the full range of students in the classroom?

**Expression**

How will I provide multiple ways for students to respond and express what they know?

What tools and resources can students use to demonstrate their understanding?

* How will I know every student has understood the concepts and language presented in each lesson?
* How will I monitor if every student has achieved the learning outcomes and learning growth?

## Lesson sequence and details

### Week 1

Table 1 – week 1 – identifiying and defining lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| Outcomes**:**  CT5-EVL-01  Content:  **Students:**   * **describe mechatronic systems.** | **Learning intention**  Investigate the development and impact of a mechatronic, robotic and automated systems in real-world applications.  **Success criteria**   * I can define and identify mechatronic systems. * I can define and identify robotic systems. * I can define and identify automated systems. * I can use specialist terminology.   **Teaching and learning activity**  Teacher introduces the learning sequence and gives an overview of the semester, outlining the sequence of activities and assessments.  Students are introduced to the design production structure.  Students fill in a glossary as required or complete the glossary to ensure they are pre-taught vocabulary and can select and use specialist terminology in context.  Teacher discusses and analyses how [mechatronics (11:34)](https://www.youtube.com/watch?v=4Yb8mwGmFdg) acts as an overarching term and investigates what areas (mechanical, electrical and computational) are required to understand this concept.  Teacher presents [robotic systems (10:25)](https://www.youtube.com/watch?v=4YjLZcQRLds) and [automated systems (6:19).](https://www.youtube.com/watch?v=uEhuxYXPTOE)  Teacher-led class discussion and analysis of robotic and automated systems.  Students create definitions for mechatronic, robotic and automated systems. | Students commence a glossary of key terms and begin with defining mechatronic, robotic and automated systems.  Students add to this glossary throughout the learning sequence to assist in correct use of specialist terminology.  Students can define and explain the concepts of mechatronic, robotic and automated systems in real-world applications. | This section is also for use in school when making adjustments to support all students to achieve in their learning.  Pre-teach key vocabulary and concepts prior to viewing videos, provide a transcript, and use closed captions when viewing.  Provide a glossary and allow the use of bilingual dictionaries for uncommon terms. |  |
| CT5-EVL-01  **Students:**   * **investigate the development and impact of a mechatronic, robotic and/or automated system in a real-world application** * **identify mechatronic and automated systems that operate through human or autonomous control** | **Learning intention**  Investigate the development and impact of a mechatronic, robotic and automated system in real-world applications.  **Success criteria**   * I can discuss the development and impact of real-world systems. * I have the knowledge to identify human or autonomous control in systems.   **Teaching and learning activity**  Teacher presents a variety of settings that mechatronics and automated systems are used in, and class discusses:   * systems development and the impact on individuals and society * how to identify human or autonomous control.   Examples are unpacked and class discussion is facilitated.  Teacher presents how households may use [robotic cleaning (6:39)](https://www.youtube.com/watch?v=hoY2YxLGV98).  This example lends to the impact on society through its autonomous control.  The agricultural industry has many advancements. Examine this case of [tomato picking (2:54)](https://www.cnbc.com/video/2019/05/10/root-ai-unveils-a-ripeness-detecting-tomato-picking-robot.html). This example also demonstrates machine sight through artificial intelligence.  Teacher presents [robotic surgery (2:15).](https://www.youtube.com/watch?v=QksAVT0YMEo) Teacher-led class discussion on how hospitals have advanced technology.  To explore autonomous control, investigate [TESLA](https://www.tesla.com/autopilot) autopilot and [autonomous driving](https://animagraffs.com/how-self-driving-cars-work/).  Students examine an area of mechatronic use and further investigate the development and impact of one chosen real-world application.  Students complete a table to show classification of different systems and identify real-world applications.  Students identify mechatronic and automated systems that operate through human or autonomous control.  Students analyse concepts and describe with example:   * What does human control of a system involve? * What does autonomous control of a system involve? | Students record the mechatronic, robotic and automated systems investigated in their workbooks.  Student responses demonstrate an understanding of the concepts addressed.  Students, when looking at different real-world systems can:   * discuss systems development and the impact on individuals and society * identify human or autonomous control.   Students can participate in class discussions and can distinguish similarities and differences in various real-world systems. | This section is also for use in school when making adjustments to support all students to achieve in their learning.  Provide visual and/or multimedia examples and check understanding of concepts.  Ensure all students understand both technical and culturally-based terms.  Message abundancy may be useful when introducing new terminology. The word is spoken, written on the board, represented by visuals. |  |
| CT5-EVL-01  **Students:**   * **describe inputs, storage, transmission, processes and outputs in mechatronic and automated systems.** | **Learning intention**  Investigate the development and impact of a mechatronic, robotic and automated system in real-world applications.  **Success criteria**   * I can apply my understanding of inputs, storage, transmission, processes and outputs to describe mechatronic and automated systems.   **Teaching and learning activity**  Discuss the previous learning of a variety of settings that mechatronics and automated systems are used in, and as a class discuss:   * inputs, storage, transmission, processes and outputs as unique in each system.   Teacher presents household [robotic cleaning (6:39).](https://www.youtube.com/watch?v=hoY2YxLGV98) The video is used to demonstrate how each component can be categorised as common components.  Students describe using common components of a mechatronic and/or automated system:   * inputs * storage * transmission * processes * outputs. | Students demonstrate understanding by analysing inputs, storage, transmission, processes and outputs to describe a specific mechatronic and automated system and discuss as a class.  Student responses demonstrate an understanding of the concepts addressed.  As part of summative assessment in Assessment task 1, students demonstrate understanding by analysing inputs, storage, transmission, processes and outputs to describe a specific mechatronic and automated system they research in depth. | This section is also for use in school when making adjustments to support all students to achieve in their learning.  Provide visual and/or multimedia examples and check understanding of concepts.  Ensure all students understand both technical and culturally-based terms.  Message abundancy may be useful when introducing new terminology. The word is spoken, written on the board, represented by visuals. |  |

### Week 2

Table 2 – week 2 – identifiying and defining lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| Outcomes:  CT5-EVL-01  Content:  **Students:**   * **specify the functional requirements of a mechatronic or automated system, including stating the purpose of a system, describing use cases and developing test cases of inputs and expected outputs** * **specify the non-functional requirements of a mechatronic or automated system.** * **battery disposal** * **improved wellbeing as result of implementation** * **ease of manufacturing the system.** | **Learning intention**  Explore how mechatronic or automated systems have functional and non-functional requirements.  **Success criteria**   * I have specified in a table the functional and non-functional requirements of a chosen system. * I have the skills to discuss functional requirements, including the purpose of a system, describing use cases and developing test cases of inputs and expected outputs * I can explain the non-functional requirements of a mechatronic or automated system.   **Teaching and learning activity**  Teacher presents [software documentation and planning (10:48)](https://youtu.be/2qlcY9LkFik).  Teacher-led discussion on the functional requirements including:   * the purpose of a system * describing use cases * developing test cases.   Teacher presents [non-functional requirements (9:28)](https://www.youtube.com/watch?v=fc-5HJPBZMQ).  Teacher-led discussion on examples of a mechatronic system:   * battery disposal * improved wellbeing as a result of implementation * the ease of manufacturing the system.   Students investigate learning how [software design](https://www.linkedin.com/learning-login/share?account=74950778&forceAccount=false&redirect=https%3A%2F%2Fwww.linkedin.com%2Flearning%2Fsoftware-design-developing-effective-requirements%2Ffunctional-vs-non-functional%3Ftrk%3Dshare_video_url%26shareId%3DPYyvVVlfSRm2vId4vY1Ikw%253D%253D) understands functional and non-functional requirements.  Model and discuss how to develop functional and non-functional requirements and how they will need to be evaluated at the end of the iterative process to determine success.  Students describe the differences between functional and non-functional requirements.  Students examine an example of a system and create a table to show functional and non-functional requirements.  Students create a table to show the functional and non-functional requirements of their envisioned project for Assessment task 1.  Teacher presents [test cases (3:30).](https://youtu.be/BBmA5Qp6Ghk) Teacher-led discussion on how industry applies test cases.  Teacher presents [use cases vs user stories (6:37).](https://www.youtube.com/watch?v=Vnf3xg3oY4A) Teacher-led discussion on investigating this example of a business analyst discussing use cases versus user stories. | Students can describe and analyse software documentation and planning as classified by functional and non-functional requirements.  Students complete a functional and non-functional table for a system as a class as an activity.  Student responses demonstrate an understanding of the concepts addressed.  As part of summative assessment in Assessment task 1, students demonstrate understanding by completing a functional and non-functional system report to describe a specific mechatronic and automated system they research in depth. | This section is also for use in school when making adjustments to support all students to achieve in their learning.  Provide visual and/or multimedia examples and check understanding of concepts.  Ensure all students understand both technical and culturally-based terms.  Message abundancy may be useful when introducing new terminology. The word is spoken, written on the board, represented by visuals. |  |
| CT5-EVL-01  **Students:**   * **consider the social impacts and ethical and legal responsibilities associated with mechatronic and automated systems.** * **companion robots, job loss due to automation, the impact of surveillance** * **Asimov’s laws of robotics, military robots** * **safety and liability, privacy acts.** | **Learning intention**  Compare the ways mechatronic and automated systems impact social, ethical and legal responsibilities.  **Success criteria**   * I can analyse an issue such as companion robots or robots used in military and explain the impact of social, ethical and legal responsibilities. * I can apply my understanding and skills to examine privacy and the impact of surveillance.   **Teaching and learning activity**  Students examine social, ethical and legal responsibilities through answering a range of questions as the teacher introduces various real-world systems.  Teacher-ledInvestigation to why there has been a need for [companion robots](https://medicalfuturist.com/the-top-12-social-companion-robots/).  Students answer the following questions:   * What benefit does a companion robot have? * Many industries require people to be employed. With technology advancements, some skilled positions have become redundant. What happens to society when there is job loss due to automation?   Teacher presents [Concept for Robotics and Autonomous Systems (1:30)](https://www.youtube.com/watch?v=BxfBrU8TKYY). Class examines how military use the latest technology through video by exploring the concept document on the [Australian Defence Force (ADF) website](https://defence.gov.au/vcdf/forceexploration/adf-concept-future-robotics-autonomous-systems.asp).  Class investigate ethical issues with [robots and the military](https://newsroom.unsw.edu.au/news/science-tech/world%E2%80%99s-tech-leaders-urge-un-ban-killer-robots).  Students answer the following questions:   * What ethical issues are challenged with the development of military robots? * How is society challenged by mechatronic and automated systems that create products that have safety and liability issues? * How does the current federal law regarding privacy apply to mechatronic and automated systems? * Why is it important that computing engineers work ethically in relation to safety? * Why is it important that computing engineers work ethically in relation to honesty and integrity? * What would you consider to be a legal responsibility associated with mechatronic and automated systems? * What would you consider to be an illegal use of a mechatronic or automated system?   Teacher presents [mechatronic technology (5:36)](https://www.youtube.com/watch?v=zq9Mj5eMpBw).  Teacher-led class discussion on how mechatronic technology can be used in surveillance and affect your privacy.  Class examines [Asimov’s](https://theconversation.com/after-75-years-isaac-asimovs-three-laws-of-robotics-need-updating-74501) laws of robotics.  Students answer the following questions:   * People change and adjust their behaviour when they are being watched. What is the impact of surveillance? * What are Asimov’s laws of robotics?   Students [Think-Pair-Share](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/645) on the social impact of mechatronic and automated systems. | Students can recount various examples of mechatronic and automated systems that showcase social, ethical and legal responsibilities.  Students construct answers to questions around social, ethical and legal responsibilities.  Student responses demonstrate an understanding of the concepts addressed.  Students check their understanding with a Think-Pair-Share activity to compare how their knowledge and understanding of social, ethical and legal responsibilities align with their peers. | This section is also for use in school when making adjustments to support all students to achieve in their learning.  Provide visual and/or multimedia examples and check understanding of concepts.  Ensure all students understand both technical and culturally-based terms.  Message abundancy may be useful when introducing new terminology. The word is spoken, written on the board, represented by visuals.  Include multiple opportunities to respond, for example:   * verbally * individually * partner turn and talk. * non-verbally * gesture * response cards. |  |

### Week 3

Table 3 – week 3 – identifiying and defining lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcome and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| Outcome:  CT5-EVL-01  Content:  **Students:**   * **explore mechatronic and automated systems considering the perspectives of diverse groups, including Aboriginal and Torres Strait Islander Peoples, culturally and linguistically diverse people, people of different ages and gender, and people with disability.** * **permissions and protocols for capturing images, voice or video of Aboriginal peoples** * **understanding of Native Title and access to land for automated vehicles** * **supporting independence for some people with disability through autonomous transport or robotic prosthetics.** | **Learning intention**  Explore how mechatronic and automated systems help diverse people in society.  **Success criteria**   * I can apply my understanding and knowledge to examine native title and access to land for automated vehicles. * I can apply my understanding and knowledge to examine how robotic prosthetics can assist in independence. * I can evaluate social and ethical considerations of mechatronic and automated systems.   **Teaching and learning activity**  Teacher-led discussion on diverse groups and guided brainstorm on how mechatronic and automated systems can help diverse groups.  Discuss and investigate permissions and protocols for capturing images, voice or video of Aboriginal peoples.  Teacher presents [Native Title (15:33)](https://www.youtube.com/watch?v=8-Pr3c7ovnc).  Teacher-led discussion on what native title is and discussion on how automated vehicles could be used considering social, ethical and legal responsibilities of indigenous [land use](https://www.environment.nsw.gov.au/topics/parks-reserves-and-protected-areas/park-management/aboriginal-joint-management/how-aboriginal-joint-management-works/indigenous-land-use-agreements).  Examine how mechatronics can support people with disability. Including, presenting examples of [exoskeleton (6:23)](https://www.youtube.com/watch?v=BLnOPA7oMxY), [bionics (19:00)](https://www.youtube.com/watch?v=CDsNZJTWw0w), [prosthetics (4:09)](https://www.youtube.com/watch?v=fZOYPlxtAMk) and the ability of [autonomous vehicles](https://www.tesla.com/autopilot) to provide independence.  Students examine how mechatronic and automated systems have assisted diverse groups including:   * Aboriginal and Torres Strait Islander peoples * culturally diverse people * linguistically diverse people * people of different ages * people of different genders * people with disability.   Students [brainstorm](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/542) or [concept map](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/577) the ways that mechatronic and automated systems can help diverse groups.  Students choose 3 examples from the brainstorm and describe how mechatronic and automated systems impact peoples’ lives.  Students answer the following questions:   * There are permissions and protocols for capturing images, voice or video of Aboriginal peoples. What beliefs do the Aboriginal peoples hold that underpin this need? * There is land that is protected by native title. If automated vehicles would like to access this land, what considerations would need to be made?   Students create a [PMI chart](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/551) on the use of automated vehicles on native title land.  Students investigate autonomous transport or robotic prosthetics and summarise how these systems have been able to assist people. | Students can recount various examples of mechatronic and automated systems that can help diverse people in society.  Students construct answers to questions around diverse people in society and their use of systems.  Student responses demonstrate an understanding of the concepts addressed.  Students check their understanding with a PMI activity to deepen their understanding of social, ethical and legal responsibilities and diverse people. | This section is also for use in school when making adjustments to support all students to achieve in their learning.  Provide visual and/or multimedia examples and check understanding of concepts.  Ensure all students understand both technical and culturally-based terms.  Message abundancy may be useful when introducing new terminology. The word is spoken, written on the board, represented by visuals.  Include multiple opportunities to respond, for example:   * verbally * individually * partner turn and talk. * non-verbally * gesture * response cards. |  |

### Week 4

Table 4 – week 4 – researching and planning lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| Outcomes:  CT5-EVL-01  Content:  **Students:**   * **select and justify control systems, components, microcontrollers and co-processors for a mechatronic or automated system.** | **Learning intention**  Break a real-world problem or need down into manageable parts.  **Success criteria**   * I can select and justify control systems, components, microcontrollers and co-processors for a mechatronic or automated system. * I will investigate motion required for mechatronic and automated systems.   **Teaching and learning activity**  Teacher discussesand explainscontrol systems, components, microcontrollers and co-processors for a mechatronic or automated system.  Control systems are discussed as open or closed loop systems.  Discussion includes how motion is a key element of mechatronic systems.  Students identify and justify the use of control systems, components, microcontrollers and co-processors for a mechatronic or automated system. | Students identify and justify the use of control systems, components, microcontrollers and co-processors for any mechatronic or automated system examined.  Student responses demonstrate an understanding of the concepts addressed.  As part of summative assessment in Assessment task 1, students demonstrate understanding by completing a table showing how they identify and justify the use of control systems, components, microcontrollers and co-processors for a specific system they research in depth. | This section is also for use in school when making adjustments to support all students to achieve in their learning.  Provide visual and/or multimedia examples and check understanding of concepts.  Ensure all students understand both technical and culturally-based terms.  Message abundancy may be useful when introducing new terminology. The word is spoken, written on the board, represented by visuals.  Include multiple opportunities to respond, for example:   * verbally * individually * partner turn and talk. * non-verbally * gesture * response cards. |  |
| CT5-EVL-01  **Students:**   * **select and justify sensors for a mechatronic or automated system.** | **Learning intention**  Break a real-world problem or need down into manageable parts.  **Success criteria**   * I can select and justify sensors for a mechatronic or automated system.   **Teaching and learning activity**  Teacher presents use of mechatronic and automated systems in [industry (6:08)](https://www.youtube.com/watch?v=U2XepZNbWi8).  Teacher-led discussion on the range of sensors used in mechatronic or automated systems and investigates how many kinds of sensors are used in industry.  Students complete a table of sensors researching images and descriptions.  Students identify and justify the use of 3 sensors in a mechatronic or automated system.  Teacher unpacks how the ultrasonic sensor works in depth.  Teacher demonstration on the use of a microcontroller to operate an ultrasonic sensor which will detect distance and observe feedback on a serial monitor.  Students learn practical skills and understand how an ultrasonic sensor operates.  Students code a microcontroller to operate an ultrasonic sensor which will detect distance and observe feedback on a serial monitor. | Students demonstrate understanding of sensors in a mechatronic or automated system.  Students research and record many different sensors used in systems and examine how they are classified. They investigate an ultrasonic sensor in depth.  Student responses demonstrate an understanding of the concepts addressed.  As part of summative assessment in Assessment task 1, students demonstrate understanding by completing a table showing how they identify and justify the use of sensors for a specific mechatronic and automated system they research in depth. | This section is also for use in school when making adjustments to support all students to achieve in their learning.  Provide visual and/or multimedia examples and check understanding of concepts.  Ensure all students understand both technical and culturally-based terms.  Message abundancy may be useful when introducing new terminology. The word is spoken, written on the board, represented by visuals. |  |

### Weeks 5–7

Table 5 – weeks 5–7 – researching and planning lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcome and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| Outcome:  CT5-EVL-01  ****Content**:**  **Students:**   * **select and justify actuators for a mechatronic or automated system** * **select and justify end effectors/manipulators for a mechatronic or automated system** * **investigate motion required for mechatronic and automated systems.** | **Learning intention**  Break a real-world problem or need down into manageable parts.  **Success criteria**   * I can select and justify actuators for a mechatronic or automated system. * I can select and justify end effectors or manipulators for a mechatronic or automated system. * I have the knowledge to identify the use of motion within a mechatronic or automated system.   **Teaching and learning activity**  Teacher-led discussion on actuators and the variety of ways they interact with the system to cause motion.  Students complete a table of actuators by researching images and descriptions.  Students identify and justify the use of 3 actuators in a mechatronic or automated system.  Teacher-led discussion on the terms ‘end effectors’ and ‘manipulators’. Investigates how these terms can be used and are currently applied.  Students identify and justify the use of end effectors and manipulators in a mechatronic or automated system.  Teacher demonstrates the use of a microcontroller (for example, Arduino UNO) to control a servo.  The demonstration leads to an activity where students program and control a prototype of a simple end effector or robotic hand.  An alternate project can be a boom gate which features the use of a microcontroller and a servo that lifts a [gate or a garage door](http://www.damienkee.com/4-starter-arduino-projects-for-classrooms/).  Students code a microcontroller to operate a servo in a design challenge where they create a [cardboard prototype of an end effector](https://learn.microsoft.com/en-us/training/educator-center/instructor-materials/build-machines-that-emulate-humans). This project can be adapted and may take 3 to 6 lessons to complete and explore through practical activities.  Class discussion on how motion is a key element of mechatronic systems.  Students recount how motion is used in their end effector. | Students demonstrate understanding of actuators in a mechatronic or automated system. They research and record many different actuators and their classification. They investigate a servo in depth.  Students can demonstrate understanding of end effectors and manipulators in a mechatronic or automated system.  Students can demonstrate a range of skills and techniques to code and design movement of a ‘robotic hand’ or end effector and understand the necessity for motion in mechatronics.  Student responses demonstrate an understanding of the concepts addressed.  As part of summative assessment in Assessment task 1, students demonstrate understanding by completing a table showing how they identify and justify the use of actuators, end effectors and manipulators for a specific mechatronic and automated system they research in depth. | This section is also for use in school when making adjustments to support all students to achieve in their learning.  Provide visual and/or multimedia examples and check understanding of concepts.  Ensure all students understand both technical and culturally-based terms.  Message abundancy may be useful when introducing new terminology. The word is spoken, written on the board, represented by visuals.  Include multiple opportunities to respond, for example:   * verbally * individually * partner turn and talk. * non-verbally * gesture * response cards. |  |

### Week 8

Table 5 – week 8 – researching and planning lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| Outcomes:  CT5-DPM-01  CT5-COL-01  CT5-EVL-01  Content:  **Students:**   * **describe how mechatronic and automated systems have evolved in response to people's needs and opportunities** * **explore design principles and issues relevant to mechatronic and automated** **systems.** | **Learning intention**  Investigate how mechatronic and automated systems have evolved in response to people’s needs.  **Success criteria**   * I can describe how design principles and issues affect the evolution of mechatronic and automated systems.   **Teaching and learning activity**  Teacher-led discussion on how mechatronic and automated systems have evolved in response to people’s needs and opportunities.  Guide students through a [KWLH chart](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/562).  This will help students activate prior knowledge, formulate questions and reflect on new information learned.  Teacher presents domesticated robots and [aged care (14:16).](https://youtu.be/5ppyWqFdc1Q)  Teacher-led discussion on an area of evolution including aged care.  Students describe how systems evolve in response to people’s needs and opportunities. Students explain in the example given of aged care.  Teacher-led class discussion on how design principals are applied to mechatronic systems.  Discussion highlights that designs need to ensure safety, device functionality and quality based on predetermined specifications.  Students complete a [KWLH chart](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/562) on how design principles affect the evolution of solutions.  Students list 4 design principals and give an example of their impact.  Students research and identify 4 relevant issues and an example of their impact. | Student knowledge connects that design principles evolve as people’s need change.  Student responses demonstrate an understanding of the concepts addressed.  Students can connect that aged care would also benefit from autonomous vehicles for transport. | This section is also for use in school when making adjustments to support all students to achieve in their learning.  Provide visual and/or multimedia examples and check understanding of concepts.  Ensure all students understand both technical and culturally-based terms.  Message abundancy may be useful when introducing new terminology. The word is spoken, written on the board, represented by visuals.  Include multiple opportunities to respond, for example:   * verbally * individually * partner turn and talk. * non-verbally * gesture * response cards. |  |
| Outcomes:  CT5-DPM-01  CT5-COL-01  Content:  **Students:**   * **generate alternative designs and evaluate them against the requirements to select a preferred design.** | **Learning intention**  Investigate how mechatronic and automated systems have evolved in response to people’s needs.  **Success criteria**   * I can generate alternative designs and evaluate them against the requirements to select a preferred design. * I can identify and apply iterative processes to mechatronic and automated systems.   **Teaching and learning activity**  Teacher-led discussion on how technology advancement and human needs have led to integration among many engineering disciplines. These systems also adapt with emerging technology.  Discuss how mechatronics engineering is an integrated discipline that focuses on the design and analysis of complete engineering systems. These systems include mechanical, electrical, computer and control subsystems and each have unique design principles.  Students recall how systems evolve in response to people’s needs and opportunities.  Teacher-led class discussion on how creating alternate designs and evaluating these designs helps evolve their development and is an iterative approach.  Students work collaboratively in small teams to develop ideas and plan for a mechatronic system they may model.  Students produce 3 napkin sketches and annotate drawings of the initial ideas that include labels of components such as microcontrollers and other required components such as sensors and actuators.  Students can work with a model for a vehicle that has the capacity to have additional sensors attached. The model could be viewed as an autonomous vehicle or depending on attachments utilised in agriculture, exploring Mars, bomb disposal and so on.  Having generated 3 alternative designs, students progress these designs to be evaluated against the requirements to select a preferred design. | Student responses demonstrate an understanding of the concepts addressed.  Students can create alternate designs. They can demonstrate iterative processes and select a preferred design.  Students link their design thinking on selection to how systems have evolved in response to people’s needs. | This section is also for use in school when making adjustments to support all students to achieve in their learning.  Provide visual and/or multimedia examples and check understanding of concepts.  Ensure all students understand both technical and culturally-based terms.  Message abundancy may be useful when introducing new terminology. The word is spoken, written on the board, represented by visuals.  Include multiple opportunities to respond, for example:   * verbally * individually * partner turn and talk. * non-verbally * gesture * response cards. |  |
| Outcomes:  CT5-EVL-01  CT5-THI-01  Content:  **Students:**   * **investigate data collection and interpretation adhering to privacy and cybersecurity principles, including specify what data is collected, who owns it, and how it will be protected.** * **data collected: recording smartphone GPS data** * **ownership: users and vendors, suspending collection of data, cultural considerations such as Indigenous Cultural and Intellectual Property (ICIP**) * **who has access: onselling of data to a third party; law enforcement access to data** * **protection: password protection, encryption or legal protection over how the data can be used** | **Learning intention**  Investigate data collection and interpretation adhering to privacy and cybersecurity principles.  **Success criteria**   * I can specify what data is collected, who owns it and how it will be protected. * I can evaluate cybersecurity considerations of mechatronic and automated systems.   **Teaching and learning activity**  Students complete a [KWLH chart](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/562) on data collection, privacy and cybersecurity to check for understanding.  This will help students activate prior knowledge, formulate questions and reflect on new information learned.  Teacher-led discussion on ways in which privacy and cybersecurity is needed and how [mechatronic](https://www.linkedin.com/pulse/cyber-security-breach-mechatronics-system-sabik-tk) and automated systems could be breached.  Teacher outlines the common [cyber threats](https://www.cyber.gov.au/threats) that need to be minimised in mechatronic and automated systems.  Students define common cyber threats that can affect mechatronic and automated systems including:   * data spills * denial of service * hacking * malicious insiders.   Teacher presents [GPS data (4:50).](https://youtu.be/FU_pY2sTwTA)  Teacher-led class discussion on how [GPS data (4:50)](https://youtu.be/FU_pY2sTwTA) is collected and recorded.  Students summarise how GPS data works with a smart phone.  Teacher-led discussion on ownership of data, including users and vendors, suspending collection of data, cultural considerations such as [Indigenous Cultural and Intellectual Property (ICIP)](https://www.artslaw.com.au/information-sheet/indigenous-cultural-intellectual-property-icip-aitb/).  Outline who has access to data, including on selling of data to a third party and law enforcement’s access to data.  Teacher-led investigation into examples such as [Amazon](https://digitalrightswatch.org.au/2022/08/08/media-release-amazons-acquisition-of-roomba-raises-privacy-concerns/) and data collected in homes or data collected in agriculture by [John Deere](https://www.abc.net.au/news/2022-02-19/agriculture-data-protection/100840436).  Investigate the update to [surveillance legislation](https://theconversation.com/facebook-or-twitter-posts-can-now-be-quietly-modified-by-the-government-under-new-surveillance-laws-167263).  Students choose a mechatronic system as a case study and specify what data is collected, who owns it and how it will be protected.  Students analyse who may own data and who has access to data.  Teacher-led discussion on data protection, including password protection, encryption or legal protection over how data can be used.  Students investigate ways to ensure data has protection such as passwords, encryption and legal protection.  Students take [quizzes](https://www.cyber.gov.au/learn-basics/view-resources/quiz-library) on multifactor identification, passphrases and how to detect a scam to ensure they understand password protection and privacy. | Student prior knowledge is activated through documenting their understanding on a KWLH chart.  Student responses demonstrate an understanding of the concepts addressed.  Students can specify the nature of data collection and interpretation.  Students can evaluate cybersecurity considerations of mechatronic and automated systems. | This section is also for use in school when making adjustments to support all students to achieve in their learning.  Provide visual and/or multimedia examples and check understanding of concepts.  Ensure all students understand both technical and culturally-based terms.  Message abundancy may be useful when introducing new terminology. The word is spoken, written on the board, represented by visuals.  Include multiple opportunities to respond, for example:   * verbally * individually * partner turn and talk. * non-verbally * gesture * response cards. |  |

### Weeks 9–10

Table 6 – weeks 9–10 – researching and planning lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| Outcomes**:**  CT5-THI-01  Content**:**  **Students:**   * **represent data and code to facilitate computation, including selecting appropriate data types,** **understanding data type limitations and structuring code systematically.** | **Learning intention**  Learn to represent data and code to facilitate computation.  **Success criteria**   * I have the skills to select appropriate data types. * I have developed knowledge to understand data type limitations. * I have the skills to structure code systematically.   **Teaching and learning activity**  Teacher-led discussion on common data types and when they are used, including:   * integer – numbers with no decimal or fractional parts * floating point – numbers that can contain a decimal or fractional part * Boolean – can take 2 possible values such as true or false, or yes or no * date or time – the number of days or seconds passed since the 'epoch' date * character – a single text character which can be a letter, number or symbol.   Students complete activities to define data types.  Teacher-led class discussion on data type limitations. Students describe a data type limitation relevant to the code they are using.  Teacher-led class discussion on how to structure code systematically.  Students deepen their knowledge of how to structure code systematically. | Students will have prior experience with code and will have performed troubleshooting in a general-purpose coding language.  Students can describe data and code and if computation is working properly and what components need further improvement.  Students can articulate how they know whether their code is working properly or not. | This section is also for use in school when making adjustments to support all students to achieve in their learning.  Provide visual and/or multimedia examples and check understanding of concepts.  Ensure all students understand both technical and culturally-based terms.  Message abundancy may be useful when introducing new terminology. The word is spoken, written on the board, represented by visuals.  Include multiple opportunities to respond, for example:   * verbally * individually * partner turn and talk. * non-verbally * gesture * response cards. |  |
| Outcomes:  CT5-OPL-01  Content:  **Students:**   * **represent algorithms using flowcharts and pseudocode** * **design or modify existing algorithms for mechatronic or automated systems** * **validate algorithms with desk checking.** | **Learning intention:**  Investigate how to design algorithms and check they are correct.  **Success criteria:**   * I can represent algorithms using flowcharts. * I can represent algorithms using pseudocode. * I can design or modify existing algorithms for mechatronic or automated systems. * I have the skills to validate algorithms with desk checking.   **Teaching and learning activity**  Teacher presents [What's an algorithm? – David J. Malan (4:57)](https://www.youtube.com/watch?v=6hfOvs8pY1k).  Teacher presents [Computer Science Basics: Sequences, Selections, and Loops (2:28)](https://www.youtube.com/watch?v=eSYeHlwDCNA).  Teacher-led discussion on the different structures of algorithms.  As a class, examine a simple automated system model such as representing a smoke detector so the entire system can be displayed in a flowchart, then pseudocode an algorithm.  Teacher explains that a larger and more sophisticated project will need to be broken into manageable parts before developing a pseudocode and algorithm.  Students create 3 flowcharts and pseudocode for mechatronic and automated systems.  Students work to create a concept and then produce a flowchart and pseudocode for a system that could be used in the home.  Students complete a self-check to gauge their understanding.  Students work individually to produce a flowchart and pseudocode as part of Assessment task 1 for the project they are developing later in the sequence of learning.  Teacher explains desk checking and as a class, examine an example.  Students complete a desk check and later apply this knowledge to the system they build. | Students create flowcharts and pseudocode in a sequence of activities to increase their understanding.  Students design and create a mechatronic or automated system for their home.  In Assessment task 1, students demonstrate their knowledge and complete flowcharts and pseudocode for the system they have researched in depth and intend to create.  Summative Assessment task 1 due. | This section is also for use in school when making adjustments to support all students to achieve in their learning.  Provide visual and/or multimedia examples and check understanding of concepts.  Ensure all students understand both technical and culturally-based terms.  Message abundancy may be useful when introducing new terminology. The word is spoken, written on the board, represented by visuals.  Include multiple opportunities to respond, for example:   * verbally * individually * partner turn and talk. * non-verbally * gesture * response cards. |  |

### Weeks 11–18

Table 7 – weeks 11–18 – producing and implementing lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| Outcomes:  CT5-DPM-01  CT5-COL-01  CT5-EVL-01  CT5-OPL-01  CT5-THI-01  Content:  **Students:**   * **investigate a real-world problem or need that can be solved by mechatronic and/or automated systems, including breaking it down into manageable parts and interviewing stakeholders to identify their needs** * **evaluate** existing **solutions to the problem or related problems** * **interpret and modify existing programs (code) for mechatronic and/or automated systems** * **design and implement modular programs (code) with functions for mechatronic and/or automated systems** * **plan and manage a project using an iterative approach** * **build a mechatronic system using the preferred design and code in a general-purpose programming language** * **apply selected algorithms and data structures for mechatronic or automated systems** * **validate programs using test cases and debug a range of errors** * **select and use specialist terminology in context** * **create a record of project development demonstrating iterative design** **and evaluation** * **develop and apply test criteria for components of a mechatronic and/or automated system** * **validate algorithms and programs through tracing and test cases.** | **Learning intention**  Work to produce and implement a project over 8 weeks.  Build a mechatronic system model and algorithms to code the system in a programming language.  Manage, document and explain work practices during development of the project.  Use an iterative approach and apply computational, design and systems thinking to the solution.  Develop and apply test criteria for components of a mechatronic and/or automated system.  **Success criteria**   * I can build a mechatronic system using the preferred design. * I can build a mechatronic system using the preferred code. * I can design, produce and evaluate algorithms and implement them in programming language. * I can select and use specialist terminology. * I have the skills to create a record of project development and manage a project using an iterative approach. * I can propose software and hardware modifications to increase the effectiveness of a mechatronic and/or automated system. * I have developed the skills to validate algorithms and programs through tracing and test cases.   **Teaching and learning activity**  Teacher provides an overview of the skills and timeline in producing and implementing their project.  For an autonomous vehicle, the breakdown of lessons could include:   * Week 10 – induction to safety and building a chassis * Weeks 12 and 13 – coding activities to investigate speed, range and manoeuvrability of servo motors and the H-bridge * Week 14 – refining and using the ultrasonic sensor to measure and respond to data input * Week 15 – testing under environmental conditions * Weeks 16 and 17 – exploring expansion, including adding a camera for advanced data input * Week 18 – final refinement of their code to ensure their system emulates the needs of the envisioned user.   Teacher explains the context of the project is to investigate a real-world problem or need that can be solved by mechatronic and/or automated systems. This includes breaking the system down into manageable parts and interviewing stakeholders to identify their needs.  Teacher prepares students for induction in the safe use of required tools and equipment by students, according to school processes.  Students complete any required safety tests and watch demonstrations. This project may include soldering components.  Students physically assemble their model and test these components.  Teacher explains common issues like syntax error with coding or electrical components being incorrectly connected.  Teacher-led discussion on problem-solving techniques and recording all aspects of the development in the record of project development.  Teacher demonstration on how an H-bridge (for example, LN980) controls actuators such as 2 direct current (DC) motors to create movement of a vehicle model.  Students code a microcontroller to operate an H-Bridge and see how these are used to control movement of 2 DC motors connected to wheels.  Students can then model a simple vehicle, that with additional sensors, could emulate an autonomous vehicle.  Students perform a series of challenges that increase in difficulty to enhance their knowledge of working and programming their model.  Students program their model to face a series of challenges such as drive straight, take corners, loop, detect obstacles, avoid crashes and rescue.  Students continue to create a physical prototype that includes the microcontroller and required components using appropriate tools and equipment, based on pseudocode and code they have researched, adapted and/or developed.  Using iterative design, students may face challenges to program and control their model as envisioned. Students may look to code more efficiently or perform test cases to improve reliability of the physical model.  Further knowledge acquired may see students redevelop their initial idea and seek advancement from their proposed concept.  Students adapt and change their model by adding on additional components and refining their code to emulate the needs of the envisioned user.  Students improve and optimise their programming of physical code.  Students assess what they know, what they need to know and how they might bridge any gaps in understanding that exist.  Students record steps through the project in their record of project development. | Students work individually and collaboratively on Assessment task 2 under the guidance of their teacher to create a prototype and working model.  Students receive ongoing formative feedback and summative feedback through Assessment task 2.  Students complete any required safety tests.  Students demonstrate practical skills, safely using appropriate tools, equipment and techniques to produce a working prototype that reflects the planning undertaken in the research and planning stages and Assessment task 1.  Students will be able to record their key learning events or activities using a procedural recount called the record of project development.  Students will demonstrate the impact of work practices by making judgments about what has happened and what they still need to understand.  Students can design, produce and evaluate algorithms and implement them in programming language.  Students can choose their preferred code and use trouble shooting techniques such as desk checking to eliminate errors.  Students demonstrate and record an iterative prototyping process until a workable design is achieved.  Students will record their mechatronic model as they test their algorithms and explore their system which has been broken into various components (such as the microcontroller, coprocessor, sensors and actuators) to demonstrate their iterative approach to coding, and learn how to control precision and automation.  Students can propose software and hardware modifications to increase the effectiveness of a mechatronic and/or automated system.  Learning can be enhanced using a physical challenge mat to emulate an environment or world the model is operating in. | This section is also for use in school when making adjustments to support all students to achieve in their learning.  Provide visual and/or multimedia examples and check understanding of concepts.  Ensure all students understand both technical and culturally-based terms.  Message abundancy may be useful when introducing new terminology. The word is spoken, written on the board, represented by visuals.  Include multiple opportunities to respond, for example:   * verbally * individually * partner turn and talk. * non-verbally * gesture * response cards. |  |

### Week 19

Table 8 – week 19 – testing and evaluating lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| Outcomes:  CT5-COL-01  CT5-THI-01  Content:  **Students:**   * **evaluate their own project and that of their peers using predetermined functional and non-functional requirements.** | **Learning intention**  Learn how to test and evaluate students’ own project and that of their peers.  **Success criteria**   * I can examine functional and non-functional requirements and evaluate these in multiple projects.   **Teaching and learning activity**  Teacher explains to the class that students will showcase their final project and go through self and peer review.  Students participate in self and peer review through a showcase of student projects looking at the functional and non-functional requirements of the project.  Students can be guided to give [peer feedback](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/549).  Students collaborate to develop a verbal presentation for the project evaluation, where each member presents the key information as part of their role in the team. The presentation can also include their video journal of their system completing challenges or testing data.  Teams of students present their project evaluation to the class and receive feedback. | Students can evaluate their own project and their peers against functional and non-functional requirements.  Students can showcase their completed project. | This section is also for use in school when making adjustments to support all students to achieve in their learning.  Include multiple opportunities to respond, for example:   * verbally * individually * partner turn and talk. * non-verbally * gesture * response cards. |  |

### Week 20

Table 9 – week 20 – testing and evaluating lesson sequence and details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcomes and content | Teaching and learning activities | Evidence of learning | Differentiation/ adjustments | Registration and evaluation notes |
| Outcomes:  CT5-COL-01  CT5-THI-01  Content:  **Students:**   * **explore careers in mechatronic and automated systems design, production, installation or maintenance.** | **Learning intention**  Investigate careers in the field of mechatronic and automated systems.  **Success criteria**   * I can research and explore careers in mechatronic and automated systems design, production, installation or maintenance.   **Teaching and learning activity**  Teacher explains the vast number of pathways into the industry, with a focus on tertiary education. Explain the competitive nature of the industry and the prevalence of small start-up companies.  Teacher shows a range of career profile videos including [entrepreneurial skills (5:15)](https://mybigtomorrow.com.au/careers/details/mechatronics-engineer) and presents [What's it like to be a Mechatronic Engineer? (2:27)](https://www.youtube.com/watch?v=ou6XzHKlvQg).  Students investigate various job search websites and create a table of research showing job description, pay and education requirements.  Students classify researched careers into automated systems design, production, installation or maintenance. | Students can recall different types of mechatronic careers and describe the pathways into the Australian industry.  Students can research careers and look at current job advertisements to understand tertiary education requirements and experience needed to apply for positions.  Students can document a range of current jobs available after completing further education. | This section is also for use in school when making adjustments to support all students to achieve in their learning.  Provide visual and/or multimedia examples and check understanding of concepts.  Include multiple opportunities to respond, for example:   * verbally * individually * partner turn and talk. * non-verbally * gesture * response cards. |  |

## Additional information

For additional support or advice, contact the Technological and applied studies (TAS) curriculum team by emailing [TAS@det.nsw.edu.au](mailto:TAS@det.nsw.edu.au).

### Further implementation support

Curriculum design and implementation is a dynamic and contextually-specific process. The department is committed to supporting teachers to meet the needs of all students. The advice below on assessment and planning for the needs of every student may be useful when considering the material presented in this sample program of learning.

### Assessment for learning

Possible formative assessment strategies that could be included:

* **Learning intentions** and **success criteria** assist educators to articulate the purpose of a learning task to make judgements about the quality of student learning. These help students focus on the task or activity taking place and what they are learning, and provide a framework for reflection and feedback. [Online tools](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/622) can assist implementation of this formative assessment strategy.
* Eliciting evidence strategies allow teachers to determine the next steps in learning and assist teachers in evaluating the impact of teaching and learning activities. Strategies that may be added to a learning sequence to elicit evidence include all student response systems, [exit tickets](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/543), mini whiteboards (actual or [digital](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/575)), [hinge questions](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/560), [Kahoot](https://app.education.nsw.gov.au/digital-learning-selector/LearningTool/Card/621), [Socrative](https://app.education.nsw.gov.au/digital-learning-selector/LearningTool/Card/587), or quick quizzes to ensure that individual student progress can be monitored and the lesson sequence adjusted based on formative data collected.
* Feedback is designed to close the gap between current and desired performance by informing teacher and student behaviour (AITSL 2017). AITSL provides a [factsheet to support evidence-based feedback](https://www.aitsl.edu.au/teach/improve-practice/feedback#:~:text=FEEDBACK-,Factsheet,-A%20quick%20guide).
* [Peer feedback](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/549) is a structured process where students evaluate the work of their peers by providing valuable feedback in relation to learning intentions and success criteria. It can be supported by [online tools](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Browser?cache_id=1d29b).
* Self-regulated learning opportunities assist students in taking ownership of their own learning. A variety of strategies can be employed and some examples include reflection tasks, [Think-Pair-Share](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/645), [KWLH charts](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/562), [learning portfolios](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/583) and [learning logs](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/583).

The primary role of assessment is to establish where individuals are in their learning so that teaching can be differentiated and further learning progress can be monitored over time.

Feedback is one of the most powerful influences on student achievement. Feedback that focuses on improving tasks, processes and student self-regulation is the most effective. Students engaging with feedback can take many forms including formal, informal, formative, summative, interactive, demonstrable, visual, written, verbal and non-verbal (CESE 2020a).

### Differentiation

Differentiated learning should be enabled by differentiating the teaching approach to content, process, product and the learning environment. For more information on differentiation go to [Differentiating learning](https://education.nsw.gov.au/teaching-and-learning/professional-learning/teacher-quality-and-accreditation/strong-start-great-teachers/refining-practice/differentiating-learning) and [Differentiation](https://education.nsw.gov.au/campaigns/inclusive-practice-hub/primary-school/teaching-strategies/differentiation).

When using these resources in the classroom, it is important for teachers to consider the needs of all students in their class, including:

* **Aboriginal and Torres Strait Islander students.** Targeted [strategies](https://education.nsw.gov.au/teaching-and-learning/aec/aboriginal-education-in-nsw-public-schools) can be used to achieve outcomes for Aboriginal students in K-12 and increase knowledge and understanding of Aboriginal histories and culture. Teachers should use students’ Personalised Learning Pathways to support individual student needs and goals.
* **EAL/D learners.** EAL/D learners will require explicit English language support and scaffolding, informed by the [EAL/D enhanced teaching and learning cycle](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/resources-for-schools/eald/enhanced-teaching-and-learning-cycle) and the student’s phase on the [EAL/D Learning Progression](https://education.nsw.gov.au/teaching-and-learning/curriculum/multicultural-education/english-as-an-additional-language-or-dialect/planning-eald-support/english-language-proficiency). In addition, teachers can access information about [supporting EAL/D learners](https://education.nsw.gov.au/teaching-and-learning/curriculum/multicultural-education/english-as-an-additional-language-or-dialect/teaching-and-learning#Differentiation2) and [literacy and numeracy support specific to EAL/D learners](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/resources-for-schools/eald).
* **Students with additional learning needs.** Learning adjustments enable students with disability and additional learning and support needs to access syllabus outcomes and content on the same basis as their peers. Teachers can use a range of [adjustments](https://education.nsw.gov.au/teaching-and-learning/disability-learning-and-support/personalised-support-for-learning/adjustments-to-teaching-and-learning) to ensure a personalised approach to student learning. Subject specific curriculum considerations can be found on the [Inclusive Practice hub](https://education.nsw.gov.au/campaigns/inclusive-practice-hub).
* **High potential and gifted learners.** [Assessing and identifying high potential and gifted learners](https://education.nsw.gov.au/teaching-and-learning/high-potential-and-gifted-education/supporting-educators/assess-and-identify#Assessment1) will help teachers decide which students may benefit from extension and additional challenge. [Effective strategies and contributors to achievement](https://education.nsw.gov.au/teaching-and-learning/high-potential-and-gifted-education/supporting-educators/evaluate) for high potential and gifted learners helps teachers to identify and target areas for growth and improvement. In addition, the [Differentiation Adjustment Tool](https://education.nsw.gov.au/teaching-and-learning/high-potential-and-gifted-education/supporting-educators/implement/differentiation-adjustment-strategies) can be used to support the specific learning needs of high potential and gifted students. The [High Potential and Gifted Education Professional Learning and Resource Hub](https://schoolsnsw.sharepoint.com/sites/HPGEHub/SitePages/Home.aspx) supports school leaders and teachers to effectively implement the High Potential and Gifted Education Policy in their unique contexts.

All students need to be challenged and engaged to develop their potential fully. A culture of high expectations needs to be supported by strategies that both challenge and support student learning needs, such as through appropriate curriculum differentiation (CESE 2020a).

### Support and alignment

**Resource evaluation and support:** all curriculum resources are prepared through a rigorous process. Resources are periodically reviewed as part of our ongoing evaluation plan to ensure currency, relevance and effectiveness. For additional support or advice, contact the TAS curriculum team by emailing [TAS@det.nsw.edu.au](mailto:TAS@det.nsw.edu.au).

**Alignment to system priorities and/or needs:** [School Excellence Policy](https://education.nsw.gov.au/policy-library/policies/pd-2016-0468), [School Success Model.](https://education.nsw.gov.au/public-schools/school-success-model/school-success-model-explained)

**Alignment to the School Excellence Framework:** this resource supports the [School Excellence Framework](https://education.nsw.gov.au/teaching-and-learning/school-excellence-and-accountability/sef-evidence-guide/resources/about-sef) elements of curriculum (curriculum provision) and effective classroom practice (lesson planning, explicit teaching).

**Alignment to Australian Professional Teaching Standards:** this resource supports teachers to address [Australian Professional Teaching Standards](https://educationstandards.nsw.edu.au/wps/portal/nesa/teacher-accreditation/meeting-requirements/the-standards/proficient-teacher) 3.2.2, 3.3.2.

**Consulted with:** Curriculum and Reform and subject matter experts

**NSW syllabus:** Computing Technology 7–10

**Syllabus outcomes:** CT5-DPM-01, CT5-COL-01, CT5-EVL-01, CT5-OPL-01, CT5-THI-01.

**Author:** TAS, Curriculum Secondary Learners, Curriculum Reform

**Publisher:** State of NSW, Department of Education

**Resource:** Program of learning

**Related resources:** further resources to support Computing Technology 7–10 can be found on the [TAS curriculum page](https://education.nsw.gov.au/teaching-and-learning/curriculum/tas).

**Professional learning:** relevant professional learning is available through the TAS statewide staffroom.

**Creation date:** 2022

**Rights:** © State of New South Wales, Department of Education.

## Evidence base

[Computing Technology 7–10 Syllabus](https://curriculum.nsw.edu.au/syllabuses/computing-technology-7-10-2022) © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2022.

AITSL (Australian Institute for Teaching and School Leadership Limited) (n.d.)[*Learning intentions and success criteria [PDF 251KB]*](https://www.aitsl.edu.au/docs/default-source/feedback/aitsl-learning-intentions-and-success-criteria-strategy.pdf?sfvrsn=382dec3c_2#:~:text=Learning%20Intentions%20are%20descriptions%20of,providing%20feedback%20and%20assessing%20achievement.)*,* AITSL, accessed 29 August 2022.

Brookhart S (2011) *How to Assess Higher-Order Thinking Skills in Your Classroom*, Hawker Brownlow Education, Victoria.

CESE (Centre for Education Statistics and Evaluation) (2020a) [*What works best: 2020 update*](https://education.nsw.gov.au/about-us/educational-data/cese/publications/research-reports/what-works-best-2020-update), NSW Department of Education, accessed 29 August 2022.

CESE (Centre for Education Statistics and Evaluation) (2020b) [*What works best in practice*](https://education.nsw.gov.au/about-us/educational-data/cese/publications/practical-guides-for-educators-/what-works-best-in-practice), NSW Department of Education, accessed 29 August 2022.

Rosenshine B (2012) ‘[Principles of Instruction: Research-Based Strategies That All Teachers Should Know](https://www.aft.org/periodical/american-educator/spring-2012)’, American Educator, 36(1):12-19, 39, accessed 29 August 2022.

Wiliam D (2013) ‘[Assessment: The bridge between teaching and learning](https://www.researchgate.net/publication/258423377_Assessment_The_bridge_between_teaching_and_learning)’, Voices from the Middle, 21(2):15–20, accessed 29 August 2022.

Wiliam D (2018) Embedded Formative Assessment, 2nd edn, Solution Tree Press, Bloomington, IN.

Wisniewski B, Zierer K and Hattie J (2020) ‘[The Power of Feedback Revisited: A Meta-Analysis of Educational Feedback Research](https://doi.org/10.3389/fpsyg.2019.03087)’, *Frontiers In Psychology*, 10:3087, doi:10.3389/fpsyg.2019.03087, accessed 29 August 2022.

## References

This resource contains NSW Curriculum and syllabus content. The NSW Curriculum is developed by the NSW Education Standards Authority. This content is prepared by NESA for and on behalf of the Crown in right of the State of New South Wales. The material is protected by Crown copyright.

Please refer to the NESA Copyright Disclaimer for more information <https://educationstandards.nsw.edu.au/wps/portal/nesa/mini-footer/copyright>.

NESA holds the only official and up-to-date versions of the NSW Curriculum and syllabus documents. Please visit the NSW Education Standards Authority (NESA) website <https://educationstandards.nsw.edu.au/> and the NSW Curriculum website [https://curriculum.nsw.edu.au/home](https://aus01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fcurriculum.nsw.edu.au%2Fhome&data=05%7C01%7CCaitlin.Pace1%40det.nsw.edu.au%7C9c2c1a9f59c94d2df30708dafa7edb23%7C05a0e69a418a47c19c259387261bf991%7C0%7C0%7C638097720042599463%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=SYVPECiogUlm2Ck2OkCJ8LGVJ3ZUXn%2Bm5%2F%2FbO4ocGOM%3D&reserved=0).

[Computing Technology 7–10 Syllabus](https://curriculum.nsw.edu.au/syllabuses/computing-technology-7-10-2022) © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2022.

ABC (Australian Broadcasting Corporation) (10 November 2014) ['Talking stick: Native Title’ ABC 2010' [video]](https://www.youtube.com/watch?v=8-Pr3c7ovnc), Tranby NIAET, YouTube, accessed 9 September 2022.

Ackerman E (23 July 2022) ‘[How Robots Can Help Us Act and Feel Younger](https://spectrum.ieee.org/gill-pratt-toyota-elder-care-robots)’, IEEE (Institute of Electrical and Electronics Engineers) Spectrum, accessed 9 September 2022.

Ackerman E (1 September 2022) ‘[Aerial Dragon Robot Reconfigures Itself Into a Flying Manipulator](https://spectrum.ieee.org/dragon-robot-flying-manipulator)’, IEEE Spectrum, accessed 9 September 2022.

ADF (Australian Defence Force) (23 November 2020) ['Concept for Robotics and Autonomous Systems' [video]](https://www.youtube.com/watch?v=BxfBrU8TKYY&t=22s), Digital Media, YouTube, accessed 9 September 2022.

AITSL (Australian Institute for Teaching and School Leadership (2017) ‘[Feedback Factsheet](https://www.aitsl.edu.au/teach/improve-practice/feedback#:~:text=FEEDBACK-,Factsheet,-A%20quick%20guide)’, AITSL, accessed 12 May 2023.

AltexSoft (2 December 2021) ['Software Planning and Technical Documentation' [video]](https://www.youtube.com/watch?v=2qlcY9LkFik), AltexSoft, YouTube, accessed 9 September 2022.

AltexSoft (16 June 2022) ['What are Non-functional Requirements and How Do They Work?' [video]](https://www.youtube.com/watch?v=fc-5HJPBZMQ), AltexSoft, YouTube, accessed 9 September 2022.

Anderson MR (17 March 2017) ‘[After 75 years, Isaac Asimov’s Three Laws of Robotics need updating](https://theconversation.com/after-75-years-isaac-asimovs-three-laws-of-robotics-need-updating-74501)’, The Conversation, accessed 9 September 2022.

Animagraffs (2022) [*How Self Driving Cars Work*](https://animagraffs.com/how-self-driving-cars-work/), Animagraffs website, accessed 9 September 2022.

Arduino (2022) ‘[Servo Motor Basics with Arduino](https://docs.arduino.cc/learn/electronics/servo-motors)’, Learn: Electronics, Arduino website, accessed 9 September 2022.

Arts Law Centre of Australia (2022) ‘[Indigenous Cultural and Intellectual Property (ICIP)](https://www.artslaw.com.au/information-sheet/indigenous-cultural-intellectual-property-icip-aitb/)’, Info Sheets, Arts Law website, accessed 9 September 2022.

Beer J (22 May 2012) ['TEDxGeorgiaTech – Jenay Beer – Meet Your Grandparents' Assistant: The Domesticated Robot' [video]](https://www.youtube.com/watch?v=5ppyWqFdc1Q), TEDx Talks, YouTube, accessed 9 September 2022.

Bender E (25 March 2011) ['Eythor Bender demos human exoskeletons' [video]](https://www.youtube.com/watch?v=BLnOPA7oMxY), TED, YouTube, accessed 9 September 2022.

Black E (11 May 2019) ['This tomato-picking robot is more efficient than humans and can work 24/7' [video]](https://www.cnbc.com/video/2019/05/10/root-ai-unveils-a-ripeness-detecting-tomato-picking-robot.html), CNBC Work, CNBC (Consumer News and Business Channel) website, accessed 9 September 2022.

Brandenburg L (6 June 2018) ['User Stories vs Use Cases' [video]](https://www.youtube.com/watch?v=Vnf3xg3oY4A), Bridging the Gap – Resources for Business Analysts, YouTube, accessed 9 September 2022.

Camber Foundation and GCF (Goodwill Community Foundation) Inc (4 October 2018) ['Computer Science Basics: Sequences, Selections, and Loops' [video]](https://www.youtube.com/watch?v=eSYeHlwDCNA), GCFLearnFree, YouTube, accessed 9 September 2022.

CareerOne Pty Ltd (2022) [*CareerOne*](https://www.careerone.com.au/) [website], accessed 9 September 2022.

Commonwealth of Australia (2022) [*Threats*](https://www.cyber.gov.au/threats), ACSC website, accessed 12 May 2023.

Commonwealth of Australia (2022) ‘[Quiz library](https://www.cyber.gov.au/learn-basics/view-resources/quiz-library)’, Learn the basics: View resources, ACSC (Australian Cyber Security Centre) website, accessed 12 May 2023.

Curtin University (2 June 2016) ['What’s it like to be a Mechatronic Engineer?' [video]](https://www.youtube.com/watch?v=ou6XzHKlvQg), Curtin University, YouTube, accessed 9 September 2022.

Da Silva W (21 August 2017) ‘[World’s tech leaders urge UN to ban killer robots](https://newsroom.unsw.edu.au/news/science-tech/world%E2%80%99s-tech-leaders-urge-un-ban-killer-robots)’, UNSW (University of New South Wales) Sydney Newsroom, accessed 9 September 2022.

de Vinck M (2020) ‘[Soldering for Electronic Products and Manufacturing](https://www.linkedin.com/learning/learning-soldering-for-electronics/solder-for-electronic-products-and-manufacturing)’, Learning Soldering for Electronics, LinkedIn Learning website, accessed 9 September 2022.

Digital Rights Watch Inc (8 August 2022) [*Media Release: Amazon’s acquisition of Roomba raises privacy concerns*](https://digitalrightswatch.org.au/2022/08/08/media-release-amazons-acquisition-of-roomba-raises-privacy-concerns/) [media release], Digital Rights Watch, accessed 9 September 2022.

Dwivedi N (2019) ‘[Functional vs. non-functional](https://www.linkedin.com/learning/software-design-developing-effective-requirements/functional-vs-non-functional?autoplay=true&u=74950778)’, Software Design: Developing Effective Requirements, LinkedIn Learning website, accessed through the DoE portal, accessed 9 September 2022.

Dwivedi N (2019) [*Software Design: Developing Effective Requirements*](https://www.linkedin.com/learning/software-design-developing-effective-requirements), LinkedIn Learning website, accessed through the DoE portal, accessed 9 September 2022.

Fonseca L (15 February 2022) ‘[10 Use Case Diagram Examples (and How to Create Them)](https://venngage.com/blog/use-case-diagram-example/)’, Venngage blog, accessed 9 September 2022.

Freethink Media Inc (9 October 2020) ['Engineering the Impossible: The Future of Military Tech' [video]](https://www.youtube.com/watch?v=zq9Mj5eMpBw), Freethink, YouTube, accessed 9 September 2022.

Gallup R (2021) [*Arduino: Prototyping*](https://www.linkedin.com/learning/arduino-prototyping/prototype-with-arduino), LinkedIn Learning website, accessed through the DoE portal, accessed 9 September 2022.

Guest A (19 February 2022) ‘[Are big ag tech companies harvesting farmers’ confidential data?](https://www.abc.net.au/news/2022-02-19/agriculture-data-protection/100840436)’, ABC News, accessed 9 September 2022.

Guru99 (3 June 2014) ['How to write a TEST CASE? Software Testing Tutorial' [video]](https://www.youtube.com/watch?v=BBmA5Qp6Ghk), Guru99, YouTube, accessed 9 September 2022.

Hampson M (2 August 2022) ‘[Underwater Robots Get a Boost in Mapping the Ocean](https://spectrum.ieee.org/mapping-unchartered-waters)’, IEEE Spectrum, accessed 9 September 2022.

Hayne Robotics (2022) [*Hayne Robotics*](https://haynerobotics.com.au/) [website], accessed 9 September 2022.

Herr H (29 March 2014) ['New bionics let us run, climb and dance | Hugh Herr' [video]](https://www.youtube.com/watch?v=CDsNZJTWw0w), TED, YouTube, accessed 9 September 2022.

IEEE (2022) [*Robots: Your Guide to the World of Robotics*](https://robots.ieee.org/) [website], accessed 9 September 2022.

Indeed Inc (2022) [*Indeed*](https://au.indeed.com/) [website], accessed 9 September 2022.

Kang JJ and Abu-Khalaf J (7 September 2021) ‘[Facebook or Twitter posts can now be quietly modified by the government under new surveillance laws](https://theconversation.com/facebook-or-twitter-posts-can-now-be-quietly-modified-by-the-government-under-new-surveillance-laws-167263)’, The Conversation, accessed 9 September 2022.

Kee D (6 August 2021) ‘[4 Starter Arduino Projects for Classrooms](http://www.damienkee.com/4-starter-arduino-projects-for-classrooms/)’, Damien Kee blog, accessed 9 September 2022.

Lesics Engineers Pvt Ltd (31 January 2022) ['The Amazing Engineering behind the Cleaning Robots!' [video]](https://www.youtube.com/watch?v=hoY2YxLGV98), Lesics, YouTube, accessed 9 September 2022.

LKCollab, LLC (2022) [*Bubble.us*](https://bubbl.us/), accessed 9 September 2022.

Malan DJ (21 May 2013) ['What’s an algorithm? – David J. Malan' [video]](https://www.youtube.com/watch?v=6hfOvs8pY1k), TED-Ed, YouTube, accessed 9 September 2022.

Microsoft Educator Center (15 April 2022) ‘[Build machines that emulate humans](https://learn.microsoft.com/en-us/training/educator-center/instructor-materials/build-machines-that-emulate-humans)’, Microsoft Learn articles, accessed 9 September 2022.

Moghrabi H (28 April 2017) ['Sensors used in industry' [video]](https://www.youtube.com/watch?v=U2XepZNbWi8), Thundertronics, YouTube, accessed 9 September 2022.

NASA (National Aeronautics and Space Administration) (2022) [*MARS Exploration Rovers*](https://mars.nasa.gov/mer/), NASA Science: Mars Exploration website, accessed 9 September 2022.

NESA (New South Wales Education Standards Authority) (2021) ‘[Programming](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/understanding-the-curriculum/programming)’, *Understanding the curriculum*, NESA website, accessed 12 May 2023.

Newsocracy LLC (22 July 2014) ‘['i-Limb Bionic Hand is a Game Changer for Amputees' [video]](https://www.youtube.com/watch?v=fZOYPlxtAMk)**,** Newsocracy, YouTube, accessed 9 September 2022.

RealPars BV (22 May 2018) ['What is Process Automation?' [video]](https://www.youtube.com/watch?v=uEhuxYXPTOE), RealPars, YouTube, accessed 9 September 2022.

RealPars BV (28 August 2018) ['What is a Servo Motor and How it Works?' [video]](https://www.youtube.com/watch?v=ditS0a28Sko), RealPars, YouTube, accessed 9 September 2022.

Sabik TK (22 January 2020) ‘[Cyber Security Breach In Mechatronics System](https://www.linkedin.com/pulse/cyber-security-breach-mechatronics-system-sabik-tk)’, LinkedIn Pulse, accessed 9 September 2022.

Intuitive Surgical (3 May 2016) ['da Vinci® Surgery – How It Works' [video]](https://www.youtube.com/watch?v=QksAVT0YMEo), Samaritan Health Services, YouTube, accessed 9 September 2022.

sciBRIGHT (15 September 2016) ['How Does GPS Work?' [video]](https://www.youtube.com/watch?v=FU_pY2sTwTA), sciBRIGHT, YouTube, accessed 9 September 2022.

SEEK Limited (n.d.) [*SEEK*](https://www.seek.com.au/) [website], accessed 9 September 2022.

Star Z (18 September 2017) ['Robotics | Subfields and Which Majors to Pick' [video]](https://www.youtube.com/watch?v=4Yb8mwGmFdg), Zach Star, YouTube, accessed 9 September 2022.

State of New South Wales (Department of Planning and Environment) (2022) ‘[Indigenous land use agreements](https://www.environment.nsw.gov.au/topics/parks-reserves-and-protected-areas/park-management/aboriginal-joint-management/how-aboriginal-joint-management-works/indigenous-land-use-agreements)’, How Aboriginal joint management works, NSW Department of Planning and Environment website, accessed 9 September 2022.

Terrell Hanna K (2021) ‘[robotics](https://www.techtarget.com/whatis/definition/end-effector)’, Computer science: Robotics, TechTarget website, accessed 9 September 2022.

Tesla (2022) [*Autopilot: Future of Driving*](https://www.tesla.com/autopilot), Tesla website, accessed 9 September 2022.

The Medical Futurist (31 July 2018) ‘[The Top 12 Social Companion Robots](https://medicalfuturist.com/the-top-12-social-companion-robots/)’, The Medical Futurist, accessed 9 September 2022.

The University of Newcastle (n.d.) ‘[Mechatronics Engineer](https://mybigtomorrow.com.au/careers/details/mechatronics-engineer)’, Careers, My Big Tomorrow website, accessed 9 September 2022.

Voorhees J (12 November 2020) ['What Do Mechatronics Engineers Do? | Can Mechatronics Engineers Build Robots?' [video]](https://www.youtube.com/watch?v=4YjLZcQRLds), Jake Voorhees, YouTube, accessed 9 September 2022.

**© State of New South Wales (Department of Education), 2023**

The copyright material published in this resource is subject to the *Copyright Act 1968* (Cth) and is owned by the NSW Department of Education or, where indicated, by a party other than the NSW Department of Education (third-party material).

Copyright material available in this resource and owned by the NSW Department of Education is licensed under a [Creative Commons Attribution 4.0 International (CC BY 4.0) licence](https://creativecommons.org/licenses/by/4.0/).

[](https://creativecommons.org/licenses/by/4.0/)

This licence allows you to share and adapt the material for any purpose, even commercially.

Attribution should be given to © State of New South Wales (Department of Education), 2023.

Material in this resource not available under a Creative Commons licence:

* the NSW Department of Education logo, other logos and trademark-protected material
* material owned by a third party that has been reproduced with permission. You will need to obtain permission from the third party to reuse its material.

**Links to third-party material and websites**

Please note that the provided (reading/viewing material/list/links/texts) are a suggestion only and implies no endorsement, by the New South Wales Department of Education, of any author, publisher, or book title. School principals and teachers are best placed to assess the suitability of resources that would complement the curriculum and reflect the needs and interests of their students.

If you use the links provided in this document to access a third-party's website, you acknowledge that the terms of use, including licence terms set out on the third-party's website apply to the use which may be made of the materials on that third-party website or where permitted by the *Copyright Act 1968* (Cth). The department accepts no responsibility for content on third-party websites.