Sample teaching planner –
Engineering principles and systems

Design and Technologies

Levels 7–10

**Disclaimer:** It is the responsibility of the school to ensure that duty of care is exercised in relation to the health and safety of all students undertaking any activities suggested in this teaching planner.

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Introduction

The Technologies Contexts sub-strand Engineering principles and systems in the Victorian Curriculum F–10 Design and Technologies explores the design process and materials properties, technologies, components, tools and equipment used to make designed solutions. Students consider the ways that motion, forces and energy affect a system and safely produce a product or system.

This teaching planner identifies themes, key messages and ideas for teaching content from specific content descriptions of Engineering principles and systems Levels 7 to 10. The information in the teaching planner has been provided to assist teachers to design and plan teaching and learning programs that are suitable for their own cohort of students. The ideas for teaching curriculum content are not intended to comprise a sequence of learning but rather they are ideas to support teachers to plan suitable lessons.

Please note, teachers are advised to use their professional judgment to ensure lesson plans comprehensively address the relevant content descriptions.

Online resources for Engineering principles and systems

To complement the sample teaching planner, a suite of online resources has been curated and published on FUSE’s [Engineering principles and systems page](https://fuse.education.vic.gov.au/pages/engineering). The resources are categorised according to the four themes identified in this sample teaching planner and support the teaching of content in the Technologies Contexts sub-strand Engineering principles and systems in Victorian Curriculum F–10 Design and Technologies.

Hyperlinks to relevant FUSE resources, plus other online resources, are included within the ‘Ideas for the classroom’ sections in this teaching planner

Key theme 1: Forces, motion and energy

The ‘Ideas for the classroom’ in this theme promote skills, knowledge and understanding of concepts related to how a product or system is affected by forces, motion and energy.

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|  | **Levels 7 and 8** | **Levels 9 and 10** |
| **Key messages** | * Common machines use motion, forces and energy.
* Historical developments, society, new materials and control systems impact on manufactured products and processes.
 | * Electromechanical systems combine motion, forces and energy.
 |
| **Ideas for the classroom** | * Discuss different household systems through time and how the development of new control systems has improved them.
* Identify reasons why wind turbines are used to generate electrical energy. Brainstorm design ideas for creating a wind turbine that uses motion, forces and energy. Annotate the design ideas with the types of materials used, using appropriate technical terms.
* Discuss how engines produce power by forcing a mixture of fuel into a tight space and then burning it. Explain the difference between piston engines and turbine engines.
* Explore reasons for industries changing from using pressed metal to new materials such as carbon fibre.
* Investigate the inputs, processes and outputs of various household and office systems, such as a photocopy machine or an app used to control home electronics such as lamps.
* Experiment with movement using a mechanism similar to a servo motor that is controlled by a microcontroller.
 | * Discuss the benefits and challenges associated with the use of a lawnmower.
* Investigate how several subsystems are used to produce thrust and lift, and overcome drag, in an aeroplane.
* Explore how the properties and combination of materials help to create the desired outcomes of strength, weight and glide for a pair of snow skis.
* Develop criteria for success to evaluate design ideas for an electromechanical system that uses motion, forces and energy, including evaluating production processes and solutions. Use project management processes to coordinate production of this system, and then rank the product in terms of its intended function and how it uses motion, forces and energy.
 |
| **Content descriptions** | * Examine and prioritise competing factors including social, ethical, economic and sustainability considerations in the development of technologies and designed solutions to meet community needs for preferred futures [(VCDSTS043)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSTS043)
* Investigate the ways in which designed solutions evolve locally, nationally, regionally and globally through the creativity, innovation and enterprise of individuals and groups [(VCDSTS044)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSTS044)
* Analyse how motion, force and energy are used to manipulate and control electromechanical systems when creating simple, engineered solutions [(VCDSTC045)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSTC045)
* Critique needs or opportunities for designing and investigate, analyse and select from a range of materials, components, tools, equipment and processes to develop design ideas [(VCDSCD049)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSCD049)
 | * Investigate and make judgements on how the characteristics and properties of materials are combined with force, motion and energy to create engineered solutions [(VCDSTC056)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSTC056)
* Critique needs or opportunities to develop design briefs and investigate and select an increasingly sophisticated range of materials, systems, components, tools and equipment to develop design ideas [(VCDSCD060)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSCD060)
* Develop project plans to plan and manage projects individually and collaboratively taking into consideration time, cost, risk and production processes [(VCDSCD064)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSCD064)
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Key theme 2: Electronics

The ‘Ideas for the classroom’ in this theme promote skills, knowledge and understanding of concepts related to the way that the characteristics and properties of materials affect the behaviour of a product or system used in circuitry.

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|  | **Levels 7 and 8** | **Levels 9 and 10** |
| **Key messages** | * Engineering design involves the considered selection of materials and systems.
* Engineering design can include coding.
 | * Material properties interact with the function of an engineered designed solution.
* Safety in engineered systems interrelates with a material’s properties and forces.
 |
| **Ideas for the classroom** | * Discuss the properties of components, tools and equipment needed to produce a remote-controlled battery-powered vehicle. Test if the components identified are suitable for producing a remote-controlled battery-powered vehicle. Produce an instructional video demonstrating one testing procedure.
* Use code to program a microcontroller or a simple, object-based coding application to program a system such as a remote-controlled car or simple robotic arm.
* Design and build a creative and aesthetically-pleasing night-light using a LED circuit. Investigate the materials and technologies to make the case or enclose the circuit, such as craft materials, wood, 3D printer.
 | * Identify common circuit types and [explain how the flow of electrons changes in different areas](http://fuse.education.vic.gov.au/Resource/ByPin?Pin=WYNBB7&SearchScope=All).
* Discuss the properties of materials that would be suitable for the components, tools, equipment and mechanism of a simple pinball machine. Provide criteria for success to evaluate a simple pinball machine system that uses motion, forces and energy and operates using code. Ask students to work in small groups to evaluate it in terms of its:
* intended function and how it uses motion, forces and energy to operate
* the material or materials it is made from (their suitability and environmental impact)
* how it looks (visual appeal).

Ask each group to share its findings as a class.* Investigate the way modern vacuum cleaners are designed to include multiple subsystems that use different forces and motion.
* Assess the effectiveness of systems and subsystems within a project, applying fault-finding and diagnostic techniques that use multimeters.
 |
| **Content descriptions** | * Examine and prioritise competing factors including social, ethical, economic and sustainability considerations in the development of technologies and designed solutions to meet community needs for preferred futures [(VCDSTS043)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSTS043)
* Analyse how motion, force and energy are used to manipulate and control electromechanical systems when creating simple, engineered solutions [(VCDSTC045)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSTC045)
* Critique needs or opportunities for designing and investigate, analyse and select from a range of materials, components, tools, equipment and processes to develop design ideas [(VCDSCD049)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSCD049)
* Generate, develop and test design ideas, plans and processes using appropriate technical terms and technologies including graphical representation techniques [(VCDSCD050)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSCD050)
 | * Explain how designed solutions evolve with consideration of preferred futures and the impact of emerging technologies on design decisions [(VCDSTS055)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSTS055)
* Investigate and make judgements on how the characteristics and properties of materials are combined with force, motion and energy to create engineered solutions [(VCDSTC056)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSTC056)
* Critique needs or opportunities to develop design briefs and investigate and select an increasingly sophisticated range of materials, systems, components, tools and equipment to develop design ideas [(VCDSCD060)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSCD060)
* Apply design thinking, creativity, innovation and enterprise skills to develop, modify and communicate design ideas of increasing sophistication [(VCDSCD061)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSCD061)
* Work flexibly to safely test, select, justify and use appropriate technologies and processes to make designed solutions [(VCDSCD062)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSCD062)
* Evaluate design ideas, processes and solutions against comprehensive criteria for success recognising the need for sustainability [(VCDSCD063)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSCD063)
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Key theme 3: Robotics

The ‘Ideas for the classroom’ in this theme promote skills, knowledge and understanding of concepts related to the design, construction, operation and use of complex machines.

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|  | **Levels 7 and 8** | **Levels 9 and 10** |
| **Key messages** | * An electromechanical system can use motion, forces and energy and be operated using code.
* The performance of a system is affected by numerous factors.
 | * Robots are an important part of our lives today.
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| **Ideas for the classroom** | * Discuss how the automotive industry uses robotic arms for dangerous and repetitive jobs, and the reasons for using this system.
* Explore different coding solutions to create algorithms that control the movements of an autonomous vehicle.
* Critique an electromechanical system that uses motion, forces and energy, such as an electric bicycle.
* Investigate electromechanical systems that use motion, forces and energy and operate using code, such as automatic dimming headlights in cars or sports watches that provide specialised content for the user.
* Create a buzz wire game using a microcontroller such as open-source [Arduino](https://www.arduino.cc/).
* Explore everyday applications of the infra-red technology used by robots, such as light sensors.
* Produce a simple vending machine or digital safe box that uses motion, forces and energy and operates using code. Select and effectively use a broad range of materials, components, tools, equipment and techniques to support safe work practices when creating this system.
 | * Brainstorm the ways robots are used in society today and assess how these robots are enhancing and impacting our lives.
* Discuss reasons for the development of autonomous cars, and evaluate the effects that these cars may have socially and environmentally.
* Critique an electromechanical system that uses motion, forces and energy and operates using code, such as planetary exploration rovers.
* Discuss the importance of good design and testing in creating [this robot fish](http://fuse.education.vic.gov.au/?HP9RBT).
* Produce, test and evaluate an obstacle-avoiding robot. Discuss what should be included in a production plan to make an obstacle-avoiding robot, for example parts (subsystems), timeline, materials, tools, processes and equipment. Work in small groups to develop a project plan to manage processes and to coordinate the production of the class-selected obstacle-avoiding robot. Share ideas.
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| **Content descriptions** | * Examine and prioritise competing factors including social, ethical, economic and sustainability considerations in the development of technologies and designed solutions to meet community needs for preferred futures [(VCDSTS043)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSTS043)
* Investigate the ways in which designed solutions evolve locally, nationally, regionally and globally through the creativity, innovation and enterprise of individuals and groups [(VCDSTS044)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSTS044)
* Analyse how motion, force and energy are used to manipulate and control electromechanical systems when creating simple, engineered solutions [(VCDSTC045)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSTC045)
* Effectively and safely use a broad range of materials, components, tools, equipment and techniques to produce designed solutions [(VCDSCD051)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSCD051)
 | * Critically analyse factors, including social, ethical and sustainability considerations, that impact on designed solutions for global preferred futures and the complex design and production processes involved [(VCDSTS054)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSTS054)
* Explain how designed solutions evolve with consideration of preferred futures and the impact of emerging technologies on design decisions [(VCDSTS055)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSTS055)
* Investigate and make judgements on how the characteristics and properties of materials are combined with force, motion and energy to create engineered solutions [(VCDSTC056)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSTC056)
* Work flexibly to safely test, select, justify and use appropriate technologies and processes to make designed solutions [(VCDSCD062)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSCD062)
* Evaluate design ideas, processes and solutions against comprehensive criteria for success recognising the need for sustainability [(VCDSCD063)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSCD063)
* Develop project plans to plan and manage projects individually and collaboratively taking into consideration time, cost, risk and production processes [(VCDSCD064)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSCD064)
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Key theme 4: Solving real-world problems

The ‘Ideas for the classroom’ in this theme promote skills, knowledge and understanding of concepts related to using engineering design to solve real-world problems in creative and innovative ways.

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|  | **Levels 7 and 8** | **Levels 9 and 10** |
| **Key messages** | * Engineered solutions can impact quality of lives.
 | * Engineering design thinking can solve real-world problems in a range of fields.
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| **Ideas for the classroom** | * Brainstorm examples of machines that have changed our quality of life by making everyday tasks easier, such as the washing machine.
* As a class, discuss the work of James E West, inventor of microphones, and techniques for creating polymer foil electrets.
* Visit the [Victorian Space Science Education Centre website](http://www.vssec.vic.edu.au/) to explore programs that relate to solving real-world problems.
* Test the functionality of materials by constructing prototypes and jigs to determine the strength, thermal insulation and acoustic insulation of an engineered brick.
* Investigate the work of Marc Edwards, an expert on water treatment and corrosion, and discuss how he used engineering design thinking to solve real-world design problems.
* Discuss how safety in engineered systems interrelates with the properties of a material and forces, such as the way aluminium and fibreglass are combined in aircraft shells to make them lighter and stronger.
 | * Compare a modern-day car with one from the past by annotating the features of each and identifying positives and negatives.
* Critique the work of engineers who have used engineering design thinking to solve real-world problems, such as Katherine Johnson and her work with NASA, LeeAnne Walters and her work uncovering a water contamination crisis or Jorge Odón and his work related to developing a mechanical device that assists during a difficult childbirth.
* Use the [CSIRO website](https://www.csiro.au/) to investigate what research is currently being undertaken that uses engineering design thinking to solve real-world problems.
* Calculate outputs of an engineered system, for example its speed, brightness of light, volume of sound.
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| **Content descriptions** | * Investigate the ways in which designed solutions evolve locally, nationally, regionally and globally through the creativity, innovation and enterprise of individuals and groups [(VCDSTS044)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSTS044)
* Analyse how motion, force and energy are used to manipulate and control electromechanical systems when creating simple, engineered solutions [(VCDSTC045)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSTC045)
* Critique needs or opportunities for designing and investigate, analyse and select from a range of materials, components, tools, equipment and processes to develop design ideas [(VCDSCD049)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSCD049)
* Generate, develop and test design ideas, plans and processes using appropriate technical terms and technologies including graphical representation techniques [(VCDSCD050)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSCD050)
 | * Explain how designed solutions evolve with consideration of preferred futures and the impact of emerging technologies on design decisions [(VCDSTS055)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSTS055)
* Investigate and make judgements on how the characteristics and properties of materials are combined with force, motion and energy to create engineered solutions [(VCDSTC056)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSTC056)
* Critique needs or opportunities to develop design briefs and investigate and select an increasingly sophisticated range of materials, systems, components, tools and equipment to develop design ideas [(VCDSCD060)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSCD060)
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