

Systems Engineering

VCE Systems Engineering promotes innovative systems thinking and problem-solving skills through the Systems Engineering Process, which takes a project-management approach. It focuses on mechanical and electrotechnology engineered systems. The study provides opportunities for students to learn about and engage with systems from a practical and purposeful perspective. Students gain knowledge and understanding about, and learn to appreciate and apply technological systems. VCE Systems Engineering integrates aspects of designing, planning, fabricating, testing and evaluating in a project management process. It prepares students for careers in engineering, manufacturing and design through either a university or TAFE vocational study pathway, employment, apprenticeships and traineeships. The study provides a rigorous academic foundation and a practical working

Percentage contributions to the study score in VCE Systems Engineering are as follows:

- Unit 3 School-assessed Coursework: 10 per cent
- Unit 4 School-assessed Coursework: 10 per cent
- Unit 3 and Unit 4 School-assessed Task: 50 per cent
- End-of-year examination: 30 per cent.

Career Pathways

- Systems Engineering
- Electrical/Electronic Engineering
- Mechanical Engineering
- Computer Programming
- Robotics
- Information Technology
- Design Technology

UNIT 1

In this unit, students are introduced to the Systems Engineering Process. They are introduced to the fundamental mechanical engineering principles, including recognition of mechanical subsystems and devices, their motions, the elementary applied physics, and the related mathematical calculations that can be applied to define and explain the physical characteristics of these systems.

While this unit contains the fundamental physics and theoretical understanding of mechanical systems and how they work, the main focus is on the construction of a system. The construction process draws heavily upon design and innovation. Students apply their knowledge to design, construct, test and evaluate operational systems. The focus of the system should be mechanical; however, it may include some electronic components. The constructed operational systems demonstrate selected theoretical principles studied in this unit.

Learning Activities

- Small practical engineering projects aimed at ensuring understanding of fundamental systems theory
- Student choice long term systems engineering project based on a design brief and design specifications document - eg. A remote controlled robot or robotic arm
- Theoretical activities, discussions, tests and exams
- 'Real-life Systems' excursion

Key skills

- Systems thinking
- Logic thinking
- Critical thinking & problem solving
- Electrical and mechanical design
- Computer programming
- Workshop tool manipulation and handling
- Team work
- Leadership
- Project management
- Test and evaluate systems
- Investigation and case study evaluation
- Communication and information presentation

Assessed tasks

- Small Practical tasks focused on systems and mechanical theory
- Long-term student negotiated project which demonstrates practical design elements outlined in a design brief and specifications document, including investigate, design, production, and evaluate stages

UNIT 2

In this unit students study fundamental electrotechnology engineering principles. Through the application of their knowledge and the Systems Engineering Process, students produce operational systems that may also include mechanical components. In addition, students conduct research and produce technical reports.

While this unit contains fundamental physics and theoretical understanding of electrotechnology systems and how they work, student focus remains on the construction of electrotechnology systems. The construction process draws heavily upon design and innovation.

Students study fundamental electrotechnology principles including applied electrical theory, representation of electronic components and devices, elementary applied physics in electrical circuits, and mathematical calculations that can be applied to define and explain electrical characteristics of circuits. The unit offers opportunities for students to apply their knowledge in the design, construction, testing and evaluation of an operational system. The system should be predominately electrotech based, but would generally have electro-mechanical components within the system. The constructed system should provide a tangible demonstration of some of the theoretical principles studied in this unit.

Learning Activities

- Small practical engineering projects aimed at ensuring understanding of fundamental systems theory
- Student choice long term systems engineering project based on a design brief and design specifications document –eg. A remote controlled robot or robotic arm
- Theoretical activities, discussions, tests and exams

Key skills

- Systems thinking
- Logic thinking
- Critical thinking & problem solving
- Electrical and mechanical design
- Computer programming
- Workshop tool manipulation and handling
- Team work
- Leadership
- Project management
- Test and evaluate systems
- Investigation and case study evaluation
- Communication and information presentation

Assessed tasks

- Small Practical tasks focused on systems and mechanical theory
- Long-term student negotiated project which demonstrates practical design elements outlined in a design brief and specifications document, including investigate, design, production, and evaluate stages

UNIT 3

In this unit students study the engineering principles that are used to explain the physical properties of integrated systems and how they work. Through the application of their knowledge, students design and plan an operational, mechanical-electrotechnology integrated and controlled system. They learn about the technologies used to harness energy sources to provide power for engineered systems.

Students commence work on the design, planning and construction of one substantial controlled integrated system. This project has a strong emphasis on designing, manufacturing, testing and innovation. Students manage the project throughout the Systems Engineering Process, taking into consideration the factors that will influence the design, planning, production and use of their integrated system.

Students learn about sources and types of energy that enable engineered technological systems to function. Comparisons are made between the impacts of the use of renewable and non-renewable energy sources. Students learn about the technological systems developed to capture and store renewable energy and technological developments to improve the credentials of non-renewables.

Learning Activities

- Commencement and development of a student negotiated long term project involving the investigation, design, and production of an integrated mechanical/electrotechnology system - eg. A complex robot, quad copter, or CNC machine
- Theoretical course work including tests, case studies, investigations, and discussions.

Key skills

- Systems thinking
- Logic thinking
- Critical thinking & problem solving
- Electrical and mechanical design
- Computer programming
- Workshop tool manipulation and handling
- Team work
- Leadership
- Project management
- Test and evaluate systems
- Investigation and case study evaluation
- Communication and information presentation

Assessed tasks

- An investigative 'case study' report on a chosen system which harnesses renewable energy, including a comparative analysis and evaluation of non-renewable and renewable energy systems.
- A design folio that includes reference to the Systems Engineering Process and factors that influence the design, planning, production and use of an advanced mechanical-electrotechnology integrated and controlled system

UNIT 4

In this unit students complete the production work and test and evaluate the integrated controlled system they designed in Unit 3. Students investigate new and emerging technologies, consider reasons for their development and analyse their impacts. Students use their investigations, design and planning to continue the fabrication of their mechanical/electrotechnology integrated and controlled system using the Systems Engineering Process. They use project and risk management methods through the construction of the system and use a range of materials, tools, equipment, and components. In the final stages of the Systems Engineering Process, students test, diagnose and analyse the performance of the system. They evaluate their processes and the system. Students expand their knowledge of new and emerging developments and innovations through their investigation and analysis of a range of engineered systems. They analyse a specific new or emerging innovation, including its impacts.

Learning Activities

- Completion of a student negotiated long term project involving the production, testing, and evaluation of an integrated mechanical/electrotechnology system – eg. A complex robot, quad copter, or CNC machine
- Theoretical course work including tests, case studies, investigations, and discussions.

Key skills

- Systems thinking
- Logic thinking
- Critical thinking & problem solving
- Electrical and mechanical design
- Computer programming
- Workshop tool manipulation and handling
- Team work
- Leadership
- Project management
- Test and evaluate systems
- Investigation and case study evaluation
- Communication and information presentation

Assessed tasks

- Describe and evaluate a range of new or emerging technologies, and analyse the likely impact of a selected innovation.
- A production folio showing the Systems Engineering process involved in the production, testing, and evaluation of an advanced mechanical-electrotechnology integrated and controlled system
- Final VCAA Examination