Sample Course Outline

Engineering Studies (Mechatronics)

ATAR Year 12

**Acknowledgement of Country**

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2025 Sample course outline

Engineering Studies – ATAR Year 12 (Mechatronics)

Unit 3 and Unit 4

Semester 1

| **Week** | **Key teaching points** |
| --- | --- |
| 1–3 | Overview of unit and assessment requirements Introduction to design process**Engineering design process (Core – Unit 3)****Investigating*** develop a comprehensive design brief in response to a problem, need or opportunity (student and/or teacher directed)
* conduct research to identify and assess existing solutions or similar products
* research and critique materials and components relevant to the design brief
* consider different ways to supply energy for efficient and effective functioning of the design

**Devising** * produce annotated pictorial sketches and/or drawings of design ideas
* produce annotated third-angle orthographic sketches of design ideas
* compare and analyse alternative designs and justify the choice of options to be used as the solution

**Effects on society, the environment and industry (Core – Unit 4)****Life cycle analysis of engineered products*** define the term ‘life cycle analysis’
* describe stages of the life cycle
* describe effects on society, the environment and industry that occur during the life cycle of engineered products

**Task 1A: Problem statement and design brief** |
| 4–5 | **Materials** **Types and classification (Core – Unit 3)*** define and compare
* classify

**Properties (Core – Unit 4)*** define and compare
* fitness for purpose

**Effects on society, the environment and industry (Core – Unit 3)****Energy** * energy, work, and power – definitions and examples
* conservation of energy – definition and examples
* forms of energy – kinetic and potential – definition and examples
* non-renewable sources of energy – fossil fuels (coal, gas, and oil), nuclear
* renewable sources of energy – solar (thermal and photovoltaic), wind, hydroelectric, geothermal, ocean (tidal and waves), hydrogen (assuming production uses renewable sources)
* advantages and disadvantages for society, industry and the environment of obtaining and using non-renewable and renewable sources of energy

**Fundamental engineering calculations (Core – Unit 3)*** dimensional
* perimeter
* surface area
* volume

**Fundamental engineering calculations (Core – Unit 4)*** density
* quantity estimates
* efficiency
* energy, work and power

**Task 1B: Concepts****Task 2: Test – Core theory: Orthographic drawings and fundamental engineering calculations (Unit 3 [50%] and Unit 4 [50%])** |
| 6–10 | **Engineering design process (Core – Unit 3)****Producing*** present specifications for the selected solution
* display project management skills for timely development and testing of project
* construct the prototype or working model by selecting and using appropriate tools and machines, and by following safe work practices
* test those aspects of the prototype or working model that have been completed for correct function and document using checklists and test data

**Study of specialist engineering field – Mechatronics****Electrical and electronics** **Components and equipment** **(Mechatronics – Unit 3)*** circuit symbol
* read and understand markings
* read and sketch circuit diagrams that contain listed components
* multimeter

**Laws and principles** **(Mechatronics – Unit 3)*** charge
* Ohm’s law
* power
* voltage
* current
* resistance
* Kirchoff’s laws
* cells and batteries
* resistor networks
* capacitor networks
* voltage dividers
* diodes

**Laws and principles** **(Mechatronics – Unit 4)*** NPN transistor model
* Darlington pair
* data extraction

**Evaluating (Core – Unit 3)*** evaluate the development of the project
 |
| 11–13 | **Systems and control****Interfacing with microcontroller (Mechatronics – Unit 4)*** microcontroller
* digital inputs
* analogue inputs
* digital outputs

**Task 3A: Project build (electrical)** **Task 3B: Build documentation (electrical)****Task 4:** **Test – Mechatronics: Electronics, interfacing and circuit theory** **(Unit 3 [50%] and Unit 4 [50%])** |
| 14 -15 | **Task 5: Semester 1 examination based on Unit 3 (50%) and Unit 4 (50%) content** |

Semester 2

| **Week** | **Key teaching points** |
| --- | --- |
| 1–5 | Overview of unit and assessment requirements **Engineering design process (Unit 4)****Producing*** present specifications for the selected solution
* display project management skills for timely completion and testing of project
* construct the prototype or working model by selecting and using appropriate tools and machines, and by following safe work practices
* test the prototype or working model for correct function and document using checklists and test data

**Mechanisms** **Simple machines and mechanisms (Core – Unit 3)*** mechanical advantage (*MA*)
* velocity ratio (*VR*)
* explain and give examples of types of motion
* recognise and describe general characteristics and applications of drive systems

**Fundamental engineering calculations (Core – Unit 4)*** mechanical advantage (*MA*)
* velocity ratio (*VR*)
* rack and pinion – lead screw
* ideal machine (100% efficiency)
* speed
* torque
* unfamiliar formula
 |
| 6–11 | **Engineering design process (Core – Unit 4)****Producing*** present specifications for the selected solution
* display project management skills for timely completion and testing of project
* construct the prototype or working model by selecting and using appropriate tools and machines and by following safe work practices
* test the prototype or working model for correct function and documents using checklists and test data

**Systems and control****Systems and control diagrams (Mechatronics – Unit 3)*** universal block diagram
* subsystem diagram
* open-loop
* closed-loop

**Flow charts (Mechatronics – Unit 4)*** standard symbols
* interpret flow charts
* draw flow charts

**Task 6A: Project build (structural, mechanical and control)****Task 6B: Build documentation (structural, mechanical and control)** **Task 7:** **Test – Mechatronics: Structural, mechanical and control** **(Unit 3 [50%] and Unit 4 [50%])** |
| 12–14 | **Evaluating (Core – Unit 4)*** evaluate the resulting prototype or working model

**Task 1C: Project evaluation** |
| 15 | **Task 8: Semester 2 examination based on Unit 3 (50%) and Unit 4 (50%) content** |