**Sample Course Outline**

Engineering Studies

ATAR Year 11

For teaching in 2024

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# 2024 Sample course outline

# Engineering Studies – ATAR Year 11

## Unit 1 and Unit 2

## Semester 1

| **Week** | **Key teaching points** |
| --- | --- |
| **Term 1**1–2 | Overview of Unit and assessment requirements Introduction to design process**Engineering design process****Investigating*** develop a design brief in response to a problem, need or opportunity, given guidelines and a context
* conduct research to identify and assess existing solutions/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

**Task 1 Part A:** **Design project** (include title or theme)* develop the first part of a design folio
* develop a design brief and investigate existing products, materials and ideas
 |
| 3–7 | **Materials** **Types and classification*** define
	+ metals (pure)
	+ alloys
	+ polymers
	+ composite
* classify
	+ metals (pure)
	+ alloys
	+ polymers
	+ composite

**Effects on society, the environment and business****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, the environment and industry of obtaining and using non-renewable and renewable sources of energy

**Task 2A: Investigate energy, power and work*** research, list, define and compare forms of energy
* list and outline advantages and disadvantages for society, the environment and industry of obtaining and using renewable and non-renewable forms of energy
* determine form of energy suitable for the project

**Task 2B: Investigate fundamental engineering calculations and mechanisms**Fundamental engineering calculations from Unit 1, including:* dimensional – examine dimensioned drawings
* perimeter – determine perimeter
* surface area – determine surface area
* volume – determine volume

Use units and prefix, symbols and factors**Mechanisms*** mechanical advantage (MA)
* velocity ratio (VR)
* explain and give examples of the listed types of motion
* recognise and describe general characteristics and applications for the listed types of mechanisms
 |
| 8–10 | **Study of specialist engineering fields**Learning of specialist theory and specific understandings from **one** of the following specialist engineering fields: * **Mechanica**l, including content of Unit 1 from Materials, Units, and Statics
	+ - * **Mechatronics** including content of Unit 1 from Electrical and electronics – Components and equipment, Laws and principles, Units, and Systems and control – diagrams
 |

| **Week** | **Key teaching points** |
| --- | --- |
| **Term 2**1–6 | **Task 1 Part B: Developing a solution for the project*** research materials and components suitable for the development of a solution

**Engineering design process****Producing*** present specifications for the selected solution
	+ annotated pictorial drawings
	+ 3rd angle projections that comply with the accepted standards for
		- lines – outlines, hidden detail and centrelines
		- dimensioning – linear, radii, circles, through holes and partial depth holes with flat base
	+ selected materials with justification of choices
	+ parts lists
	+ costing of project, i.e. prototype or working model

 **Task 5: Pre-production*** complete skills development exercises
* document process in folio/work log/time sheet

**Producing*** project management skills for timely completion and testing of the project
* construct prototype or working model by selecting and using appropriate tools and machines, and by following safe work practices

**Task 1 Part C: Evaluation of the development of the project*** meeting the requirements of the design
 |
| Examination weeks  | **Task 4: Semester 1 examination** – approximately two hours, using a modified examination design brief from the Year 12 syllabus |

## Semester 2

| **Week** | **Key teaching points** |
| --- | --- |
| **Term 3**1–3 | **Materials** **Properties*** define
	+ density
	+ elasticity
	+ plasticity
	+ ductility
	+ malleability
	+ strength
		- tensile
		- compressive
		- torsional
		- shear
	+ stiffness
	+ toughness
	+ conductivity
		- thermal
		- electrical
	+ corrosion resistance
	+ hardness
* fitness for purpose
	+ identify and describe the properties of a material required for a specified application

**Fundamental engineering calculations****Density*** density = ρ = $\frac{m}{V}$ kg m-3

**Quantity estimates*** determine the following for individual and simple combinations of previously specified Unit 1 geometric forms (may be solid and/or hollow)
	+ surface area
	+ volume
	+ mass
	+ density

**Efficiency*** calculate efficiency as a percentage
	+ *η* = $ \frac{Output}{Input}$ × 100%

**Unfamiliar formula*** determine unknown factor in unfamiliar formula given sufficient data to complete the calculation
 |
| 4 | **Task 3: Obsolescence assignment*** define and compare the three forms of obsolescence
* write about the advantages and disadvantages for society, industry and the environment that result from the different forms of obsolescence

**Effects on society, the environment and industry****Obsolescence*** define and compare forms of obsolescence
	+ technical
	+ functional
	+ planned
* advantages and disadvantages for society, industry and the environment that result from the different forms of obsolescence
 |
| 5–8 | **Study of either specialist engineering fields:**Learning of specialist theory and specific understandings from **one** of the following specialist engineering fields:* **Mechanical**, including content of Unit 2 from Materials, stress and strain, hardness test, toughness, shear strength and stress, and dynamics, and Units
* **Mechatronics**, including content of Unit 2 from Systems and control – Interfacing with microcontroller, Electrical and electronics – Laws and principles, Flow charts.
 |
| 8–10 |  **Task 6:** **Manufacture of proposed project**Using prepared production plan, materials and available equipment, construct a prototype or working model and record progress in design folio.**Producing*** project management skills for timely development and testing of the project
* construct 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
 |

| **Week** | **Key teaching points** |
| --- | --- |
| **Term 4**1–5 | **Task 6:** **Manufacture of proposed project (continuation)**Using prepared production plan, materials and available equipment, construct a prototype or working model and record progress in design folio.**Producing*** project management skills for timely development and testing of the project
* construct 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
 |
| 6 |  **Task 7: Evaluation of completed project**Prepare written report on and photographs of completed project.**Evaluating*** evaluate the development of the project
	+ meeting the requirements of the design
	+ safety, function fit and finish
	+ modifications and changes to the design during production
 |
| Examination weeks  | **Task 8: Semester 2 examination** –of approximately 2 hours, using a modified examination design brief from the Year 12 syllabus |