SAMPLE COURSE OUTLINE

ENGINEERING STUDIES
ATAR YEAR 12
## Sample course outline

**Engineering Studies ATAR Year 12**

**Unit 3 and Unit 4**

**Semester 1**

<table>
<thead>
<tr>
<th>Week</th>
<th>Key teaching points</th>
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</table>
| 1–3  | Overview of unit and course outline  
Introduction to Engineering design process, and development of a design folio  
**Core content: Engineering design process**
  **Investigating**  
  • develop a comprehensive design brief  
  • identify and assess existing solutions or similar products that are identified, using a variety of research skills  
  **Core content: Materials**  
  • define and classify types of materials  
  **Task 1: Design Project one**  
  • design brief – description of problem, need or opportunity  
  • identify and research examples of existing solutions  
  • develop a list of requirements and restrictions |
| 4–6  | **Core content: Engineering in society**  
  • relationships between energy, power and work, and different forms of energy; non-renewable and renewable sources of energy  
  **Core content: Engineering design process**
  **Devising**  
  • produce annotated, pictorial drawings of design ideas  
  • produce annotated, orthographic drawings of design ideas  
  • analyse and justify the choice of option to be used as the solution  
  **Task 2: Devise concepts for Project one and select the best option for the solution**  
  • conduct additional research, produce sketches and drawings of concepts, and evaluate these to select the best option  
  **Specialist engineering fields:** Learning of specialist theory and specific understandings from either Mechanical or Mechatronics  
  **Mechanical: Materials**  
  • processes for steel alloys  
  • stress/strain graphs  
  • use of formulae for stress, strain and Young’s modulus  
  • convert between stress units  
  • derive values from graphical and tabled data  
  • properties of materials  
  or  
  **Mechatronics: Electrical/electronics**
  **Components**  
  • listed circuit symbols  
  • general characteristics of listed components  
  • read and sketch simple circuit diagrams  
  • read and understand listed component markings  
  **Laws and principles**  
  • Ohm’s law  
  • Kirchhoff’s laws  
  • power  
  • cells and batteries  
  • resistor networks  
  • capacitor networks  
  • digital input  
  • quantities |
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| **7–9** | **Core content: Fundamental engineering calculations**  
• dimensional, perimeter and surface area  
**Specialist engineering fields:** Learning of specialist theory and specific understandings from either  
Mechanical or Mechatronics  
**Mechanical: Statics**  
• moments  
• three conditions for equilibrium  
• vertical and horizontal components  
• reaction forces (two supports only)  
• unknown external force or distance variable  
• reaction forces (beams)  
**Mechatronics: Systems and control**  
• systems/control diagrams  
• flowcharts  
**Core content: Engineering design process**  
**Devising (continued)**  
• produce annotated, pictorial drawings of design ideas  
• produce annotated, orthographic drawings of design ideas  
• analyse and justify the choice of option to be used as the solution  
**Task 2 (continued): Devise concepts for Project one and select the best option for the solution**  
• conduct more research, produce and refine sketches and drawings of concepts, and evaluate these to select the best option for the solution  
**Core content: Engineering design process**  
**Producing**  
• present specifications for the selected solution  
  • dimensioned pictorial and orthographic drawings  
  • orthographic drawings and sketches as 3rd angle projections, and include lines and dimensioning  
  • materials selection  
  • parts lists  
  • costing of prototype or working model  
**Task 3: Produce specifications for the selected solution for Project one**  
• working drawings  
• lists of materials and costing  
• develop production plan on a timeline |
| **10–13** | **Specialist engineering fields:** Learning of specialist theory and specific understandings from either  
Mechanical or Mechatronics  
**Mechanical: Statics**  
• shear force and bending moment diagrams, with shear force and bending moment calculations  
**Mechatronics: Systems and control**  
• interfacing with microcontroller  
**Core content: Engineering design process**  
**Producing**  
• develop and use timeline for construction and testing of solution  
• construct solution by selecting and using appropriate tools and machines, and by following safe work practices  
• test the solution for correct function and document using checklists and test data  
**Task 4: Production of Project one**  
• construct the proposed solution, using prepared production plan, materials and available equipment  
• record progress in design folio |
### Semester 1

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<tr>
<td>14–15</td>
<td><strong>Core content: Engineering design process</strong>&lt;br&gt;<strong>Evaluating</strong>&lt;br&gt;• evaluate the final solution in terms of:&lt;br&gt;  ▪ meeting the requirements of the design brief&lt;br&gt;  ▪ modifications and changes to the design and processes during production&lt;br&gt;  ▪ refinements and changes for future development&lt;br&gt;<strong>Task 5: Evaluate completed Project one</strong>&lt;br&gt;• written report on, and photographs of, completed Project one&lt;br&gt;<strong>Task 6: Semester 1 Examination</strong> – of approximately 2.5 hours, using modified examination design brief from the Year 12 syllabus</td>
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### Semester 2

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<tr>
<td>1–3</td>
<td>Overview of unit and assessment requirements&lt;br&gt;Re-introduction to Engineering design process, and development of a design folio&lt;br&gt;<strong>Core content: Engineering design process</strong>&lt;br&gt;<strong>Investigating</strong>&lt;br&gt;• develop a comprehensive design brief&lt;br&gt;• identify and assess existing solutions or similar products that are identified, using a variety of research skills&lt;br&gt;• research and critique materials and components relevant to the design brief&lt;br&gt;• consider different and appropriate sources of energy&lt;br&gt;<strong>Task 7: Design Project two</strong>&lt;br&gt;Note: Project two may be completely separate from Project one or it may be the extension/completion of the theme used for Project one.&lt;br&gt;• design brief – description of problem, need or opportunity&lt;br&gt;• identify and research examples of existing solutions&lt;br&gt;• develop a list of requirements and restrictions</td>
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| 4–6  | **Core content: Materials**<br>• define physical properties of materials<br>• fitness for purpose<br>  ▪ identify and justify the required properties of a material for a specified application<br>**Core content: Engineering design process**<br>**Devising**<br>• produce annotated, pictorial drawings of design ideas<br>• produce annotated, orthographic drawings of design ideas<br>• analyse and justify the choice of option to be used as the solution<br>**Task 8: Devise concepts for Project two and select the best option for the solution**<br>• conduct research, produce sketches and drawings of concepts<br>• evaluate these to select the best option<br>**Specialist engineering fields:** Learning of specialist theory and specific understandings from either Mechanical or Mechatronics<br>**Mechanical: Materials**<br>• factor of safety<br>and **Statics**<br>• second moment of area<br>• deflection of beams<br>• method of sections for simply supported pin-jointed trusses or
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| 7–9  | **Mechatronics: Laws and principles**  
  - analogue inputs  
  - NPN transistor  
  - diodes  
  - voltage regulator  
  - unfamiliar formula  
  - data extraction  

**Core content: Fundamental engineering calculations**  
- volume  
- density  
- quantity estimates  
- energy  
- efficiency  
- unfamiliar formula

**Core content: Engineering design process**  
**Devising (continued)**  
- produce annotated, pictorial drawings of design ideas  
- produce annotated, orthographic drawings of design ideas  
- analyse and justify the choice of option to be used as the solution

**Task 8 (continued): Devise concepts for Project two and select the best option for the solution**  
- progress through theory, refine drawings and concepts to the best possible solution

**Core content: Engineering design process**  
**Producing**  
- present specifications for the selected solution  
- dimensioned pictorial and orthographic drawings  
- orthographic drawings and sketches as 3rd angle projections, and include lines and dimensioning  
- materials selection  
- parts lists  
- costing of prototype or working model

**Task 9: Produce specifications for the selected solution**  
- working drawings  
- lists of materials and costing  
- develop production plan on a timeline

**Core content: Engineering in society: Life cycle analysis of engineered products**  
- the stages of the life cycle of engineered products  
- impacts for society, business and the environment that occur during the life cycle of engineered products

**Task 10: Research and analyse the life cycle of an engineered product**  
- research and report on the stages of the life cycle of an engineered product

| 10–13 | **Specialist engineering fields:** Learning of specialist theory and specific understandings from either Mechanical or Mechatronics  
  **Mechanical: Dynamics**  
  - constant acceleration (straight line motion)  
  - potential energy  
  - kinetic energy  
  - energy and energy conservation  
  - work  
  - efficiency  
  - power  
  **Mechatronics: Systems and control**  
  - interfacing with microcontroller  
  - types of motion  
  - mechanical drive systems  
  - calculations  
  - quantities |
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|      | **Core content: Engineering design process**  
      | **Producing**  
      | • develop and use timeline for construction and testing of solution  
      | • construct solution by selecting and using appropriate tools and machines, and by following safe work practices  
      | • test the solution for correct function and document, using checklists and test data  
      | **Task 11: Production of Project two**  
      | • construct the proposed solution, using prepared production plan, materials and available equipment  
      | • record progress in design folio  
| 14   | **Core content: Engineering design process**  
      | **Evaluating**  
      | • evaluate the final solution in terms of:  
      |  ▪ meeting the requirements of the design brief  
      |  ▪ safety, function and finish of the product  
      |  ▪ modifications and changes to the design and processes during production  
      |  ▪ refinements and changes for future development  
      | **Task 12: Evaluate Project two**  
      | • written report on, and photographs of, completed Project two  
| 15   | **Task 13: Semester 2 Examination** – of approximately three hours, using examination design brief from the Year 12 syllabus