**Sample Course Outline**

Engineering Studies

General Year 12

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# Sample course outline

# Engineering Studies – General Year 12

## Unit 3 and Unit 4

Semester 1

| **Week** | **Key teaching points** |
| --- | --- |
| 1–2  | Overview of unit and assessment requirements **Core content: Engineering design process****Investigating** * develop a design brief
* use research skills to identify existing solutions/products
* describe and analyse existing solutions/products
* research and describe materials and components relevant to the design brief
* consider forms of energy supplies

**Task 1:** **Design project one** * develop a design folio
	+ develop a design brief/proposal
	+ identify and assess existing solutions or similar products
 |
| 3 | **Core content: Engineering in society – Energy*** define and describe relationships between energy, power and work
* define and compare forms of energy as listed in Unit 3 of the syllabus
* identification of non-renewable sources
	+ fossil fuels: coal, gas and oil
	+ nuclear
* identification of renewable sources
	+ solar: thermal, biomass, photovoltaic and wind (including waves)
	+ gravity: tidal and hydroelectric
	+ geothermal
* advantages and disadvantages of non-renewable and renewable sources

**Task 2: Investigate forms of energy** * research forms of energy
* determine form(s) of energy suitable for the project
 |
| 4–5 | **Core content: Materials – classify types of materials*** metals (pure)
* alloys (ferrous)
* alloys (non-ferrous)
* polymers
* composites

**Content of specialty field: Mechanical** **Materials*** engineering processes with respect to steel
* the effect of carbon content (C%) in steel
* steel’s ability to be worked and hardened and its properties after processing
* stress and use of the formula to determine one unknown value
* strain and use of the formula to determine one unknown value
* Young’s Modulus (elastic modulus) and the formulae to determine one unknown value
* pressure and use of the formula to solve for one unknown value
* conversions of pressure and stress units

**Task 3 Part A: Mechanical. Investigate materials from the Core and within the specialty field, and report on materials suitable for the development of a solution.** |
|  | **OR****Content of specialty field: Mechatronics****Components****Electrical/electronic components*** general characteristics of components and the circuit symbols
* read and sketch simple circuit diagrams that contain components listed in syllabus
* identify markings on selected components listed in syllabus

**Task 3 Part B: Mechatronics. Investigate materials from the Core and components within the specialty field, and report on suitable choices for the development of a solution.** |
| 6–7 | **Core content: Engineering design process****Devising** * annotated pictorial drawings of design ideas
* annotated orthographic drawings of design ideas
* the chosen option to be used as the solution

**Core content: Fundamental engineering calculations*** dimensional
* perimeter
* surface area
* quantity estimates

**Content of specialty field: Mechanical****Statics** * the three conditions for equilibrium
* the moments formula to determine one unknown variable where the applied force does not require vector resolution
	+ to determine the reaction forces at a horizontal structure’s supports (only two supports and only vertical forces applied)
	+ to solve for one unknown force or distance variable

**OR****Content of specialty field: Mechatronics****Laws and principles and types of circuits*** application of formula for:
	+ Ohm’s Law, Kirchhoff’s Laws, power
* cells and batteries; series and parallel
* resistor networks; series and parallel
	+ combinational networks of up to 3 resistors
* capacitors; in series and parallel

**Nature of control systems*** open loop
* closed loop

**Core content: Engineering design process****Producing** * present specifications for the selected solution
	+ dimensioned pictorial and orthographic drawings
	+ orthographic drawings and sketches are 3rd angle projections and include
* lines – outlines, hidden detail and centrelines
* dimensioning – linear, radii, circles, holes through or partial depth with flat base
	+ materials selected
	+ parts lists
	+ costing of prototype or working model
* develop a timeline to construct and test the solution

**Task 4: Devise a solution for project one*** apply theory from specialty fields
* annotated pictorial drawings of ideas
* annotated, orthographic concept drawings, either CAD or hand drawn, to a final drawn proposal
* calculations to estimate design function
 |
| 8–9 | **Content of specialty field: Mechanical****Mechanisms*** list and draw these simple machines
	+ lever, inclined plane, wheel and axle, pulley with pulley block, the screw jack
* label the load and effort associated with these simple machines
* calculate the mechanical advantage (MA) of each machine using the equation M=l/e
* identify and label the distances moved by the effort and the load for each simple machine
* calculate the resulting velocity ratios using the formula

**OR****Content of specialty field: Mechatronics****Laws and principles and types of circuits*** AC to DC rectification

**Nature of conrol systems*** flowcharts

**Interfacing with a microcontroller*** nature of a microcontroller
* power supply
* digital input
* analogue input
* analogue to digital conversion

**Task 5: Production plan for project one*** working drawings – detailed orthogonal drawings
* lists of materials, parts and components, costing
* develop production plan on a timeline
 |
| 10–12 | **Core content: Engineering design process** **Producing** * solution construction by selecting and using appropriate tools and machines, and following safe work practices
* test solution for correct function and document using checklists and test data

**Task 6:** **Production of proposed project one*** construct and test solution (prototype or working model) using appropriate tools, machines and equipment, and following safe work practices
 |
| 13 | **Externally set task** All students enrolled in the Engineering Studies General Year 12 course will complete the externally set task developed by the AuthoritySchools are required to administer this task in Term 2 at a time prescribed by the Authority |
| 14 | **Task 6: Production of proposed project one continued*** construct and test solution (prototype or working model) using appropriate tools, machines and equipment, and following safe work practices
* record progress in the design folio
 |
| 15 | **Core content: Engineering design process****Evaluating*** final solution in terms of:
	+ meeting the requirements of the design brief
	+ function and finish of the product
	+ variations and changes to the design

**Task 7: Evaluation of completed project one*** written report on, and photographs of, completed project
 |

Semester 2

| **Week** | **Key teaching points** |
| --- | --- |
| 1–2  | Overview of unit and assessment requirements Re-introduction to **Core content: Engineering design process**, and development of a design folio**Investigating** * develop a design brief
* use research skills to identify existing solutions/products
* describe and analyse existing solutions/products
* describe materials and components relevant to the design brief
* appropriate forms of energy supplies

**Task 8:** **Design project two*** develop a design folio
	+ develop a design brief/proposal
	+ identify and assess existing solutions or similar products
 |
| 3–4 | **Core content: Materials** **Physical properties of materials*** define the physical properties of materials as listed in Unit 4 of the syllabus

**Fitness for purpose*** describe the required properties of a material for a specified application

**Fundamental engineering calculations*** volume
* density

**Quantity estimates*** determine volume, mass and density of geometric forms

**Energy and efficiency*** use formula as per Unit 4 of the syllabus

**Unfamiliar formula*** determine unknown factor in an unfamiliar formula, given sufficient data to complete the calculation

**Task 9: Investigate physical properties of materials and their fitness for purposes** * research physical properties of materials
* identify and explain why a material is or is not suited to a particular purpose

**Core content: Engineering in society****Obsolescence*** define and compare forms of obsolescence as per Unit 4 of the syllabus
* advantages and disadvantages for society, business and the environment of forms of obsolescence

**Task 10: Research forms of obsolescence*** define and compare forms of obsolescence listed in Unit 4 of the syllabus
* report on the advantages and disadvantages for society, business and the environment of forms of obsolescence
 |
| 5–6 | **Content of specialty field: Mechanical****Materials*** stress and strain graphs
* definition of terms

**OR****Content of specialty field: Mechatronics****Laws and principles*** analogue inputs
* NPN transistor
* diodes
* voltage regulator

**Core content: Engineering design process****Devising** * annotated pictorial drawings of design ideas
* annotated orthographic drawings of design ideas
* analyse features of the chosen option to be developed as the solution

**Task 11:** **Devise a solution for project two*** apply theory from specialty fields
* annotated pictorial drawings of ideas
* annotated, orthographic concept drawings, either CAD or hand drawn
	+ calculations to estimate design function
 |
| 7–8 | **Content of specialty field: Mechanical****Dynamics*** acceleration
* potential energy
* kinetic energy
* energy conversion

**OR****Content of specialty field: Mechatronics****Interfacing with a microcontroller*** outputs as listed in Unit 4 of the syllabus

**Core content: Engineering design process****Producing** * specifications for the selected solution
	+ dimensioned pictorial and orthographic drawings
	+ orthographic drawings and sketches are 3rd angle projections and include
* lines – outlines, hidden detail and centrelines
* dimensions – linear, radii, circles, holes through or partial depth with flat base
	+ materials selected
	+ parts lists
	+ costing of prototype or working model
* develop and use a timeline to construct and test the solution

**Task 12: Production plan for project two*** working drawings – detailed orthogonal drawings
* lists of materials, parts and components
* develop production plan on a timeline
 |
| 9–14 | **Content of specialty field: Mechanical****Mechanisms*** compound gear train and associated linked mechanisms
* velocity ratios
* output and input rpm
* linear velocity
* velocity, distance and time
* torque

**OR****Content of specialty field: Mechatronics****Types of motion*** types as listed in Unit 4 of the syllabus
* transformations

**Mechanical drive systems*** general characteristics and applications for types listed in Unit 4 of the syllabus
* calculations as listed in Unit 4 of the syllabus

**Core content: Engineering design process****Producing** * solution construction by selecting and using appropriate tools and machines and following safe work practices
* test the solution for correct function and document using checklists and test data

**Task 13:** **Production of proposed project two*** construct and test solution (prototype or working model) using appropriate tools, machines and equipment, and following safe work practices
* record progress in the project folio
 |
| 15 | **Core content: Engineering design process****Evaluating*** the final solution in terms of:
	+ meeting the requirements of the design brief
	+ function and finish of the product
	+ variations and changes to the design

**Task 14: Evaluation of completed project two*** written report on, and photographs of, completed project
 |