Government of **Western Australia**
School Curriculum and Standards Authority

SAMPLE COURSE OUTLINE

ENGINEERING STUDIES
GENERAL YEAR 12

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.**

Week	Key teaching points
	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 o lines – outlines, hidden detail and centrelines o 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

Week	Key teaching points
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 Authority Schools 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

Week	Key teaching points
	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
	  o lines – outlines, hidden detail and centrelines
	  o 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

Week	Key teaching points
	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