**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 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   **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 |