Curriculum Mapping - KS4 - OCR GCSE Design & Technology

Intro: Learning about Design and Technology will encourage learners to develop design and thinking skills that open up a world of possibilities, giving them the tools to create the future. It will generate empathetic learners who have the ability to confidently critique products, situations and society in every walk of their lives now and in the future.
Design and Technology is a subject that brings learning to life, requiring learners to apply their learning to real-life situations. This qualification aims to relate authentic real-world awareness of iterative design practices and strategies used by the creative, engineering and manufacturing industries.
Learners will be required to use critical thinking, leading towards invention and design innovation, to design and make prototypes that solve real and relevant problems, considering their own and others' needs, wants and values.
OCR's GCSE (9–1) in Design and Technology enables learners to progress from their learning in Key Stage 3, developing critical thinking and practical skills that will serve them well in their futures, with A Levels, Further Education, Higher Education or in the workplace. Learners will build and develop their broad knowledge and understanding from Key Stage 3, whilst also having the freedom to focus in more depth on areas of Design and Technology that most interest them.
This qualification will give learners an opportunity to engage with creativity and innovation and understand how they can be enhanced by the application of knowledge from other disciplines across the curriculum such as mathematics, science, art and design, computing and humanities, as well as the practical and technical knowledge and understanding they will learn from Design and Technology.

Course Specification Link: https://www.ocr.org.uk/Images/304658-specification-accredited-gcse-design-and-technology-j310.pdf

Yr 10 **Term 1 & 2** (Subject staff deliver the content in a personalised order throughout Year 10)	Students will learn and demonstrate an understanding of • trends and innovations in design and manufacture, labelling and packaging • social, moral, cultural, economics, environmental and sustainability issues inherent in Design and Technology • product life cycle and life cycle analysis • designing and making quality manufactured products • product planning including consideration of the use of time and resources • performance characteristics of different materials including 'smart' and 'modern' • tools and equipment used to make quality manufactured products, including industrial methods and production • processes and techniques used to make quality products that are both decorative and functional • health and safety issue **Materials** General classification of resistant materials • Commonly used hardwoods.

Year 10 Half Term 3	• Commonly used softwoods. • Commonly used manufactured boards. • Commonly used ferrous metals. • Commonly used non-ferrous metals. • Thermoplastics – including ABS, acrylic, polyethylene (LDPE and HDPE), polystyrene, polypropylene, nylon, PVC and µPVC. • Thermosetting plastics – urea formaldehyde, epoxy resins. • Performance, characteristics of resistant materials • Hardness, toughness, strength (tensile, compressive), elasticity, flexibility, impact resistance, chemical resistance, strength to weight ratio, ductility, malleability, thermal and electrical conductivity and aesthetic qualities. • The conversion or altering of resistant materials into other usable forms • The use of heat treatment to alter the properties of metals, including annealing and hardening. • Composite materials including GRP, carbon fibre and Kevlar. **Finishes** • Metal finishes – primers, paints (acrylic and cellulose), plating (chrome), dip coating, anodising. • Wood finishes – polyurethane and yacht varnish, primer, undercoat and gloss paints, stains, polishes, oils and wax. • Plastics – self-finishing and polishing. • Surface preparation for the application of a finish. • The reasons for the use of specific finishes in particular applications. • The application of finishes by means of brush or spray. **Form of materials and their selection** • Market forms of materials, sizes, shapes and comparative costs. • Recognise the importance of understanding the physical and aesthetic properties of Resistant Materials when selecting a material for a specific use, as well as cultural, moral and cost considerations. **Pre - Manufactured Components** Components needed in the manufacture of a product. • Candidates should be able to identify and suggest an application for a wide range of pre-manufactured components, including: -- screws, nails, nuts and bolts -- knock down fittings and how they are used in furniture production, including flat pack design – including single and two piece blocks, scan fitting, cam lock, leg plate and dowel -- hinges, catches, drawer slides, knobs, locks, etc. **Projects throughout Year 10 embed the learning. Students will make a wood based Automata project. A metals skills based project. A polymer project and a modelling a prototyping project.**
	Students receive the NEA Contexts on or after 1st June and start to work on the 50% Controlled assessment using Google classroom. Students will analyse up to 3 contexts and move forward through the design and make process to analyse and create a solution to their specific context. Generate and record a range of innovative design solutions.

Year 10 Half Term 3	• Evaluate and modify ideas with consideration to creativity and sustainability. • Consider the initial task, the need to be met, function and aesthetics. • Anthropometrics and ergonomics. • Develop and model design proposals. • Justify choice and rejection of ideas. • Select and justify materials when designing and making products. • Understand the purpose of prototyping when designing and making products. • Identify a variety of materials used when prototyping, including card, Plasticard, foam board, Corriflute, MDF and Styrofoam. • Understand the principles of anthropometrics and ergonomics when designing and making products.
Yr 11 Term 1 & 2 (NEA Assessment worth 50 % of the final grade)	Product planning • Produce a detailed plan for manufacturing that includes information about: -- materials and manufactured items -- tools and equipment -- processes -- health and safety -- time schedules. • Choose and prepare materials economically considering cost, sustainability, environmental, moral and cultural issues. • Plan work to make best use of materials, components, equipment and resources, including time and energy. • Be aware of problems that arise during production and have strategies to overcome them. Tools and equipment • Knowledge and understanding of basic equipment; how to select the appropriate tool and use it safely and effectively. • Awareness of alternative tools and equipment which can be used for the same task. • The safety checks to carry out on electrical equipment before use. • Checks before use, including correct settings on machines such as lathes, milling machines and pillar drills. Processes used to make products from resistant materials Candidates should be able to name tools and equipment appropriate to these processes: • Preparing, marking out, measuring and testing; using: a rule, try square, dividers, scriber, punches and templates. • Wasting: using hand methods such as sawing, drilling, chiselling, planing, or using machines such as a router, jigsaw, centre lathe or milling machine. • Deforming: by means of laminating, bending, press moulding, vacuum forming, blow moulding and line bending. • Fabricating: -- using temporary methods such as screws, nuts and bolts and knock-down fittings -- using permanent methods such as adhesive, with nail, dowel, halving, comb, butt, rebate, mortise and tenon, housing and mitre joint, braze, solder, pop rivet and weld. • Re-forming; by means of die casting, injection moulding and extrusion.

	• Systems and control – understand the purpose (and use as appropriate) of jigs, fixtures, templates and patterns to control accuracy in the batch production of products.
Yr 11 - Term 3 Examination (50% of the final grade)	‘Smart’ and modern materials • Understand and be able to select materials including ‘smart’ and ‘modern’ that are both suitable and sustainable. • Shape Memory Alloy (SMA), thermochromic pigment (smart colours) and thermochromic sheet. • Be aware of other ‘smart’ and ‘modern’ materials as they become available. • Various modern wood-based and metal-based materials, including ‘flexi-ply’, flexi-veneer, ‘Hexaboard’, anodised aluminium sheet and alu composite sheet. • Nanotechnology: understand the basic concept of nanotechnology, defined as the creation of functional systems on a molecular scale. • Be aware of the applications of nanotechnology in the construction of products such as tennis racquets, golf clubs and cycle frames and the use of nanotechnology for coatings such as self-cleaning glass and water repellent wood. The 6Rs **Recycle** • Materials that can be recycled – primary, secondary and tertiary. • Products that use recycled materials. • Disassembly – reprocessing materials for use in new products. **Reuse** • Products that can be reused for either the same or a new purpose. • Products that can be adapted to suit an alternative use. **Reduce** • Life cycle of a product(s)/Eco footprint. • Built-in obsolescence. • Energy and waste of production process. • Materials – waste. **Refuse** • Issues relating to sustainable design. • Materials we should refuse to use. **Rethink** • How it is possible to approach design problems differently. • An existing product that has become waste, e.g. utilising the materials or components for another purpose without processing it. **Repair** • Products that can/cannot be repaired. Product analysis and the design of products **Social issues** • Social development, through recognising the need to consider the views of others, including people with disabilities when designing and discussing designed products. • Signs and symbols giving valuable information about materials, products and safety issues. **Moral issues** • Conditions of working. • Protecting the safety of users of products.

Yr 11 - Term 3 Examination (50% of the final grade)	• Ethical trading initiative (ETI). **Cultural issues** • Look at, respond to and value the responses of others to design solutions. • The impact of different cultures on modern products. **Environmental issues** • The reduction in the common use of chemicals and materials dangerous to the environment, i.e. bleaches, CFCs, toxic materials. • Carbon footprint – transportation of materials and goods, energy usage in manufacture. • Carbon offsetting. • The need to dispose of redundant products and their packaging in a safe and environmentally friendly way. Revision and past paper preparation in the weeks running up to the examination.

Curriculum Mapping - KS4 - OCR Cambridge National - Engineering Manufacture

Intro: Engineering manufacture is a discipline of engineering dealing with different manufacturing practices and processes using machines, tools and equipment that turn raw materials into new products.
The Cambridge Nationals in Engineering Manufacture is aimed at learners who wish to study the processes involved in manufacturing new engineered products. Learners are provided with the knowledge and skills required to operate manufacturing tools and equipment used to make products from the requirements of a design specification.
Learners will develop their understanding of the processes and systems required to transfer a design concept into a product.

Course Specification Link: https://www.ocr.org.uk/Images/150707-specification.pdf

Component 1	**Unit R109: Engineering materials, processes and production** This unit will develop learners' knowledge and understanding of engineering materials and processes, and their application in the manufacture of engineered products. The content of this unit includes basic engineering processes, allowing for a practical approach to be taken in the delivery of the unit. This unit also covers types of engineering materials such as ferrous and non-ferrous metals, alloys, polymers, thermosetting plastics, ceramics, composites, smart materials and new and emerging materials. Learners will understand properties of engineering materials and learn the theory of hand and machine skills to engineer a product. On completion of this unit, learners will understand how the properties and characteristics of materials impact on the design specification for the development of a new product and appreciate the different production methods available to produce engineered products. **Learning Outcome 1: Know about properties and uses of engineering materials** ***Learners will be taught:*** ● Types of engineering materials ○ Metals ■ Ferrous metals and alloys ■ Non-ferrous metals and alloys ○ Polymers ■ Thermoplastics ■ Thermosetting plastics ○ other materials ■ Ceramics ■ Composites ■ Smart materials ○ new and emerging materials ○ properties of engineering materials ○ materials testing processes ○ characteristics of engineering materials ○ uses of specific materials

Component 1	**Learning Outcome 2: Understand engineering processes and their application** ***Learners will be taught:*** ● basic engineering processes ○ material removal ○ hand forming ○ joining methods ○ heat treatment ○ surface finishing ● machine processes ○ material removal ○ Forming ○ Moulding ● safe use of tools and equipment **Learning Outcome 3: Know about developments in engineering processes** ***Learners will be taught:*** ● applications of computer controlled production processes ○ Computer Numerical Control (CNC) machining processes ○ laser applications ● additive manufacturing and rapid prototyping processes **Learning Outcome 4: Understand the impact of modern technologies on engineering production** ***Learners will be taught:*** ● the impact of modern technologies in engineering production ○ Automation ■ Output ■ Quality ■ Workforce ■ Costs ○ digital communications ■ uses in research and development ■ material supply and control ○ global manufacturing
Component 2	**Unit R110: Preparing and planning for manufacture** This unit develops learners' knowledge and understanding of procedures used during the planning and preparing stages in the manufacture of engineered products. Learners are required to plan and make a pre-production product by conventional (non-Computer Numerical Control (CNC)) methods to develop a suitable product. This unit enables learners to have the opportunity to apply appropriate processes for making pre-production products using hand-held tools, measuring and marking equipment safely. Learners will also carry out manually controlled machining operations such as drilling, turning and milling and perform quality control checks to review finished pre-production products. On completion of this unit, learners will understand, and be able to apply, the processes for making pre-production products, using a range of hand tools, measuring and marking equipment safely. **Learning Outcome 1: Be able to plan for the making of a pre-production product** ***Learners will be taught:*** ● interpretation of 2D and 3D engineering drawings

Component 2	● standard drawing conventions on engineering drawings ● production of plans for the making of a pre-production product **Learning Outcome 2: Be able to use processes, tools and equipment safely to make a pre-production product** ***Learners will be taught:*** ● appropriate processes for making pre-production products ● how to use tools and equipment when making products ● how to follow safe working procedures when using tools and equipment ● how to use appropriate use Personal Protective Equipment (PPE) appropriately ● use of appropriate quality control checks to review finished pre-production products **Learning Outcome 3: Be able to modify a production plan for different scales of production** ***Learners will be taught:*** ● consideration of scales of manufacture ● impact of quantities of production on production plans
Component 3	**Unit R111: Computer aided manufacturing** This unit covers computer applications in the design and manufacture of engineered products. Learners will produce Computer Aided Design (CAD) drawings of a product to produce a batch of Computer Numerical Control (CNC) manufactured examples. Also, learners will understand how computer control can be used in the high-volume/mass production of engineered products. Learners will develop knowledge and understanding of computer applications in the design and manufacture of engineered products and know the procedures for setting up CNC equipment to produce a batch of products to the required specification. Learners will also investigate methods used to compare items manufactured by manually controlled and CNC production. On completion of this unit, learners will be able to use computer applications to manufacture engineered products and produce CAD drawings of a product. Learners will understand how computer control is used to produce engineered products in high-volume. **Learning Outcome 1: Be able to plan the production of components on Computer Numerical Control (CNC) machines** ***Learners will be taught:*** ● factors to consider when producing plans for CNC machining operations in the production of components ○ planning of operations ○ scale of manufacture – waste minimisation ○ type of machine ○ tools required ○ Materials **Learning Outcome 2: Be able to interpret information from Computer Aided Design (CAD) to manufacture components on CNC equipment** ***Learners will be taught:*** ● use of Computer Aided Design (CAD) packages ● factors to consider when performing CNC machine programming operations **Learning Outcome 3: Be able to set-up and use CNC equipment to**

Component 3	**manufacture components** ***Learners will be taught:*** ● procedures for setting up CNC equipment ● procedures to produce products to required specification ● methods used to compare items manufactured by manually controlled and CNC production **Learning Outcome 4: Know about applications of computer control processes used to manufacture products** ***Learners will be taught:*** ● applications of computer control ○ rapid prototyping ○ manufacturing processes ○ Robotics ● computer controlled processes used for different scales of manufacture ○ one-off/prototype manufacture ○ batch production ○ high-volume manufacturing
Component 4	**Unit R112: Quality control of engineered products** This unit will develop learners' knowledge and understanding of techniques and procedures used to ensure the quality of engineered products. Learners will be required to produce and carry out a detailed set of procedures for the quality control of engineered products which will be used in a 'real world' situation involving high-volume manufacture of products. Learners will also gain an understanding of the principles of lean manufacture and how they are applied to improving the quality of the manufacturing process. On completion of this unit, learners will understand the techniques and procedures used to ensure the quality of engineered products. **Learning Outcome 1:Understand the importance of quality control** ***Learners will be taught:*** ● **reasons for implementing quality control in production** ● **quality procedures** **Learning Outcome 2: Be able to assess product quality from inspection and quality control techniques** ***Learners will be taught:*** ● quality control techniques used in stages of production ● application of basic inspection checks in stages of production ● use of inspection equipment in stages of production ● techniques for evaluating product from quality control checks Learning Outcome 3: Know how modern technologies can be used in quality control ***Learners will be taught:*** ● applications of modern technologies **Learning Outcome 4: Know the principles of lean manufacturing** ***Learners will be taught:*** ● *causes of waste in manufacturing* ● *categories of waste (7 lean wastes – TIMWOOD)* ● *methods of reducing waste*

Curriculum Mapping - KS4 - OCR Cambridge National - Systems Control in Engineering

Intro: Systems control in engineering uses sensors to measure the output performance of a device being controlled and feedback to operate actuators that constantly adjust for a desired performance.
This qualification is aimed at learners who wish to study the range of computer and microprocessor applications in engineering, and learn how systems are used across a range of engineering environments such as product design, automated manufacturing, maintenance and stock control.
Learners will use computer-based simulation software to produce printed circuit boards (PCB) and practical skills to test the operation of circuits. Through review, learners will evaluate the completed circuits to suggest improvements in design.
The Cambridge Nationals in Systems Control in Engineering will develop learners' understanding of computer and microprocessor applications in engineering and their knowledge of basic electronic principles, applying these to the manufacture of electronic and electrical circuits.
Learners will develop knowledge and understanding of the design, simulation and testing of microprocessor / microcontroller control systems and consider how a systems design problem is best solved through the use of appropriate sensors, transducers and programmable devices.
Learners are required to test the performance of their design system and be able to transfer their program to a programmable device such as programmable logic controllers (PLC) or programmable interface controllers (PIC).

Course Specification Link: https://www.ocr.org.uk/Images/150709-specification.pdf

Component 1	**Unit R113: Electronic principles** This unit will develop learners' knowledge of basic electronic principles. Learners will consider how these can be applied to the design, maintenance and repair of electrical/electronic systems used within engineering products. Learners will understand the fundamentals of electronic circuits and be able to design, construct and test a range of electronic circuits. Learners will use techniques to identify potential electrical hazards and apply fault-finding procedures using appropriate test equipment. On completion of this unit, learners will have knowledge of how basic electronic circuits operate, and understand how to measure and calculate circuits and their component values as well as how to test circuits. **Learning Outcome 1: Understand basic electronic principles** ***Learners will be taught:*** ● principles, units and measurement ● values for voltage, current, resistance and power by calculation ● circuit components, symbols and diagrams ● series and parallel circuits ● the operation of a potential divide ● types of power sources available

Component 1	• reasons for selection of suitable power sources • function and application of voltage regulators in power supply circuits **Learning Outcome 2: Understand the operating principles of electronic components** ***Learners will be taught:*** • appropriate cable types for specific applications giving reasons for their use • identification and application of resistors used in electronic circuits • identification and application of capacitors used in electronic circuits • application and function of resistor/capacitor circuit and RC time constant • identification, application and function of switches • application, function and benefits of circuit protection • systems approach • identification, function and application of input devices • identification, function and application of process devices • identification, function and application of output devices • application and function of DC electric motor control • identification of smart and modern materials **Learning Outcome 3: Know test methods for electronic circuits** ***Learners will be taught:*** • techniques to identify potential electrical hazards and the reasons for their use • fault-finding procedures • appropriate test equipment **Learning Outcome 4: Understand commercial circuit construction methods** ***Learners will be taught:*** • discrete, through hole and surface mount components • benefits and drawbacks to the manufacturer of using surface mount components and using alternatives • the manufacturing processes used within commercial circuit construction • quality assurance methods used during commercial printed circuit board (PCB) production
Component 2	**Unit R114: Simulate, construct and test electronic circuits** This unit covers construction techniques and processes used in the manufacture of electronic and electrical circuits. It uses computer based simulation software to prototype and test the operation of circuits and produce designs for printed circuit boards (PCB). Learners will develop knowledge and understanding of the construction techniques and processes used in the manufacture of electronic and electrical circuits. On completion of this unit, learners will understand how to build and evaluate the performance of a simple electronic circuit. **Learning Outcome 1: Be able to use CAD for circuit simulation and design** ***Learners will be taught:*** • circuit schematic diagram drawing using CAD software • circuit simulation and test using CAD software

Component 2	• PCB layout production to include both track and component views (e.g. export of schematic diagrams, use of component libraries) **Learning Outcome 2: Be able to construct circuits** ***Learners will be taught:*** • safe use of manually-operated hand tools • circuit construction following circuit diagram(s) • safe construction of PCBs • circuit construction using appropriate methods • construction techniques for joining external components **Learning Outcome 3: Be able to test electronic circuits** ***Learners will be taught:*** • techniques for testing electronic circuits
Component 3	**Unit R115: Engineering applications of computers** This unit covers a range of computer and microprocessor applications within engineering and considers how systems are used across a range of engineering activities from product design and development to automated manufacturing, maintenance and stock control. Learners will develop knowledge and understanding of the range of computer and microprocessor applications within engineering and will consider how computer systems are used across a range of engineering activities. This unit will explore how computers are used within engineering industries to design and manufacture new products with Computer Aided Design (CAD) and Computer Aided Manufacture (CAM) and the use within automated manufacturing such as Programmable Logic Controllers (PLC), Programmable Interface Controller (PIC). On completion of this unit, learners will understand the specific processes involved in electronic systems control and have an appreciation of how computers communicate and transfer data in Human Machine Interface (HMI) and expert systems. **Learning Outcome 1: Understand how computers are used in engineering design, manufacture and process control** ***Learners will be taught:*** • how computers are used within engineering industries to design new products • how computers are used within engineering industries to manufacture products, monitor production andmanage process control • features of computer controlled automation **Learning Outcome 2: Understand how computers are used for maintenance of engineering systems** ***Learners will be taught:*** • how computers are used within engineering system maintenance - HMI and Expert Systems **Learning Outcome 3: Know how computers are used to communicate and use data for production and maintenance** ***Learners will be taught:*** • the use of computers to communicate and exchange data during production operations • how data from production operations is used in maintenance • how computers are used to communicate and exchange data for maintenance operations

Component 3	● the use of hand-held computer devices in manufacturing and maintenance systems
Component 4	**Unit R116: Process control systems** This unit will develop learners' knowledge of microprocessor/microcontroller control systems in engineering systems such as production, engine control, domestic appliances and office equipment. Learners will study a range of systems designs and consider how each system uses appropriate input and output devices. Learners will develop knowledge and understanding of the design, simulation and testing of microprocessor/microcontroller control systems and consider how a systems design problem is best solved through the use of appropriate sensor, transducer and programmable logic controllers (PLC)/ programmable interface controllers (PIC) devices. Learners are required to test the performance of their design system and be able to transfer their program to a programmable device. On completion of this unit, learners will understand how microprocessor/microcontroller control systems are used in engineering systems and be able to design and test a simple control system. **Learning Outcome 1: Understand the application and operation of microcontrollers and microprocessors in engineered products** ***Learners will be taught:*** ● simple layouts of microcontroller/ microprocessor in products or systems ● applications of microcontroller/ microprocessor in products or systems ● the basic function of component parts of a control system ● the operation of a control system within a product or system that use microprocessor, microcontroller control **Learning Outcome 2: Be able to design, develop and simulate a control system solution** ***Learners will be taught:*** ● techniques used to produce a control system solution ● use of simulation for a control system solution ● transfer of control programs to programmable devices **Learning Outcome 3: Be able to test control systems** ***Learners will be taught:*** ● development of test plans to ensure functionality of control systems ● control system testing using a test plan to evaluate the performance of the system ● interpretation of test results to refine control systems

Curriculum Mapping - KS4 - OCR Cambridge National - Engineering Design

Intro: Engineering design is a process used to identify market opportunities and solve problems which contribute to the development of new products and systems. This qualification is aimed at learners who wish to study the processes involved in designing new engineered products and the requirements of a design specification. Through research and practical activities, learners will understand how market requirements and opportunities inform client briefs and will use practical skills such as drawing, computer modelling and model making to communicate design ideas.
The Cambridge Nationals in Engineering Design encourage learners to communicate and consult with a client to develop a viable and innovative product. Learners will apply practical skills to produce a prototype in the form of a model and test design ideas to inform further product development. Through reflection learners evaluate the prototype, making a comparable outcome against specification points, and assess possible, practical solutions and improvements to their prototype design.
A practical approach to teaching and learning will provide learners with knowledge in engineering technology and develop critical thinking, creativity and dextrous skills through engaging practical experiences.

Course Specification Link: https://www.ocr.org.uk/Images/150704-specification.pdf

Component 1	**Unit R105: Design briefs, design specifications and user requirements** This unit provides the opportunity for learners to develop their understanding of the requirements of design briefs and design specifications for the development of new products. Through research and practical activities, learners will understand how consumer requirements and market opportunities inform design briefs. Learners will understand the overall design process through study of the design cycle, existing product and life cycle analysis, study of new and improved materials and manufacturing processes, and how these and other factors influence a design solution. On completion of this unit, learners will understand the design cycle, the requirements for a design brief and design specification for the development of a new product and how effective research data is necessary to inform the development of a design solution. **Learning Outcome 1: Understand the design cycle and the relationship between design briefs and design specifications** ***Learners will be taught:*** ● the design cycle ○ identify phase ○ design phase ○ optimise phase ○ validate phase ● identification of design needs ○ initial design brief from the client ○ information which may inform the design brief ● the relationship between a design brief and a design specification ○ client provides initial brief

Component 1	○ discussion between client and designer ○ further research ○ 'final' brief from which design specification will be developed **Learning Outcome 2: Understand the requirements of design specifications for the development of a new product** ***Learners will be taught:*** ● requirements of a design specification ○ user needs ○ product requirements ○ manufacturing considerations ○ production costs ○ regulations and safeguards **Learning Outcome 3: Know about the wider influences on the design of new products** ***Learners will be taught:*** ● wider influences on new products ○ market pull / technological push ○ cultural and fashion trends ○ legislative design requirements ○ links to inspirational / iconic products ○ Life Cycle Analysis (LCA) ○ sustainable design ○ new and emerging technologies and materials ○ environmental pressures
Component 2	**Unit R106: Product analysis and research** This unit will enable learners to perform effective product analysis. They will research existing solutions and assess the development of engineered products. Learners will develop dextrous skills and gain practical experience of product assembly and disassembly to appreciate manufacturing processes, design features and materials used. This unit develops learner's creativity and critical analysis through an understanding of the principles behind good design. They will consider what makes a good product sell by analysing existing solutions. On completion of this unit, learners will understand how to perform effective product analysis and evaluation through research and product assembly and disassembly procedures to appreciate product design features. **Learning Outcome 1: Know how commercial production methods, quality and legislation impact on the design of products and components** ***Learners will be taught:*** ● commercial production methods that impact on product /component design ○ Production ○ Automation ● impact of manufacturing processes on product design ● considerations for product end of life ● importance of conformity to legislation, quality and safety standards **Learning Outcome 2: Be able to research existing products** ***Learners will be taught:*** ● research methods used to inform product analysis

Component 2	● strengths and weaknesses of existing products ● methods used to summarise research outcomes **Learning Outcome 3: Be able to analyse an existing product through disassembly** ***Learners will be taught:*** ● the use of sources and procedures for disassembly ● disassembly procedures using appropriate tools and instruments safely ● analyse an existing product through disassembly ○ Components ○ assembly methods ○ Materials ○ production methods ○ maintenance considerations
Component 3	**Unit R107: Developing and presenting engineering designs** This unit develops techniques in generation, concept development and the communication of design ideas using hand rendering and computer-based presentation techniques including computer aided design software. Learners will generate design ideas using a mixture of detailed hand rendering and computer-based presentation techniques including computer aided design in 2 and 3 dimensions. Learners will gain skills in annotation and labelling techniques, such as showing key features, functions, dimensions, materials, construction/manufacture methods. On completion of this unit, learners will have developed knowledge and understanding of how to communicate design ideas through hand rendering and computer-based techniques. **Learning Outcome 1: Be able to generate design proposals using a range of techniques** ***Learners will be taught:*** ● hand-drawing techniques to design and present ideas and concepts ○ freehand sketching in 2D and 3D ○ rendering using shade, tone and texture ● annotation and labelling techniques that demonstrate design ideas ● the use of ICT software to produce, modify and enrich design proposals **Learning Outcome 2: Know how to develop designs using engineering drawing techniques and annotation** ***Learners will be taught:*** ● techniques to produce technical drawings ○ 3D engineering drawings (e.g. isometric and oblique, exploded views, assembly drawings) ○ 2D engineering drawings (e.g. 3rd angle orthographic, scale, dimensions, materials) **Learning Outcome 3: Be able to use Computer Aided Design (CAD) software and techniques to produce and communicate design proposals** ***Learners will be taught:*** ● CAD applications to produce and communicate design proposals ● techniques used to communicate design proposals

Component 4	**Unit R108: 3D design realisation** This unit requires learners to apply practical skills to produce a prototype product or model using craft-based modelling materials alongside computer-controlled or rapid-prototyping processes. Learners will produce a prototype product in the form of a model and test design ideas in a practical context, to inform further development utilising more complex production processes. Learners will evaluate the prototype making a comparison of the outcome against the product specification and evaluate potential improvements in design such as features, function, materials, aesthetics and ergonomics and make suggestions on improvements to the final product. On completion of this unit, learners will be able to use knowledge gained to apply practical skills in the use of tools and equipment to produce a prototype. **Learning Outcome 1: Know how to plan the making of a prototype** ***Learners will be taught:*** ● key considerations when making a prototype ○ interpretation of a product specification ○ processes for making a prototype model ○ use of planning tools ○ resources when making a prototype ○ planning stages used in the making a prototype **Learning Outcome 2: Understand safe working practices used when making a prototype** ***Learners will be taught:*** ● identification and consideration of risks in production plans ● production and use of risk assessments for production activities ● how to assess hazards and take precautions when using tools and machines ● safe use of hand tools and machines ● use of personal protective equipment (PPE) during production processes ● safe working procedures when using materials, chemicals, finishes and solvents **Learning Outcome 3: Be able to produce a prototype** ***Learners will be taught:*** ● selection and use of appropriate materials to produce a prototype ● use of tools and processes to cut and shape materials ● use of preparation and assembly methods ● methods of recording key stages of making the prototype **Learning Outcome 4: Be able to evaluate the success of a prototype** ***Learners will be taught:*** ● how to evaluate a prototype ○ comparison of prototype and production plan against product specification ○ potential improvements in design ● how to evaluate own performance ○ management of time and resources ○ planning and preparation ○ precision and accuracy achieved in making processes ○ quality of outcome