REVISED GCE

Scheme of Work

Technology and Design

This is an exemplar scheme of work which supports the teaching and learning of the Technology and Design specification

scheme of work

GCE Technology and Design

Content

Introduction

Introduction text

CCEA has developed a new GCE Technology and Design specifications for first teaching from September 2011. This scheme of work has been designed to support you in introducing the new specification and was produced by practicing teachers who will be teaching the specification.

The scheme of work provides suggestions for organising and supporting students' learning activities. It is intended to assist you in developing your own schemes of work and should not be considered as being prescriptive or exhaustive.

Please remember that this scheme of work is intended only as a pathway through the content of the specification, not as a replacement. It is the specification on which assessment is based and which details the knowledge, understanding and skills that students need to acquire during the course. This scheme of work should therefore be used in conjunction with the specification.

Published resources and web references included in the scheme of work have been checked and are correct at the date of issue but may be updated by the time that the specification is introduced. You should therefore check with publishers and websites for the latest versions. CCEA accepts no responsibility for the content of listed publications or websites.

CCEA will be making Word versions of this scheme of work available on the subject micro-site. This will enable you to use them as a foundation for developing your own schemes of work which are matched to your teaching and learning environments and the needs of your students. CCEA are developing a number of web-based support materials to support you introducing the new specification, including PowerPoint presentations, case studies and vod casts.

We hope that you find this aspect of our support package useful in your teaching.

Best wishes

INSERT SIGNATURE

Judith Ryan
Subject Officer
Technology and Design

E-mail jryan@ccea.org.uk
Telephone 028 90 261200 – Ext: 2133

Exemplar Scheme of Work: GCE Technology and Design

Unit AS 1:
Product Design and Systems and Control
Section A:
Product Design and Practice

GCE Technology and Design: Scheme of Work
Unit AS 1: Product Design and Systems and Control Section A: Product Design and Practice

Content	Learning Outcomes	Teaching and Learning Activities
Material Choice and Selection	Students should be able to: • consider the following when selecting a material: - Functional requirements (properties and characteristics); - Manufacturing demands (scale of production and suitability of manufacturing process); - Environment (corrosion resistance and stability); - Availability (common form and sizes); - Cost; and • demonstrate knowledge and understanding of the following: - Physical properties.- Density, electrical and thermal conductivity; - Mechanical properties – Strength, Elasticity, Plasticity, Toughness, Hardness, Durability and Brittleness.	Material Selection and Processes (TEP) Product Design: Resistant Materials Technology, Heinemann. Design and Technology, James Garratt. • Consider a variety of products and systems; identify materials used and justify choice taking into consideration various factors • Produce PowerPoint presentation outlining each property providing relevant examples
Wood	• demonstrate knowledge of hardwoods and softwoods; • demonstrate knowledge and understanding of the properties, working characteristics and uses of the following woods – Pine, Ash, Beech, Oak and Mahogany; • demonstrate knowledge of the available form of supply of woods; • demonstrate an understanding of the main advantages and uses of the following manufactured boards: plywood, blockboard, chipboard, hardboard and medium density fibreboard (MDF); and	Design and Technology, James Garratt. Wood Properties and Uses (DVD) classroom video • Produce a report outlining the range of woods available for use by designers; characteristics; differences; suitable applications and finishes

Content	Learning Outcomes	Teaching and Learning Activities
Wood (cont.)	Students should be able to: • demonstrate an understanding of the main purposes and types of finishes for woods- stains, oils, polishes, paints and synthetic resins.	
Metal	• demonstrate knowledge of the available form of supply of metals; • understand the difference between ferrous and non ferrous metals and alloying; • demonstrate knowledge and understanding of the properties, working characteristics and uses of the following metals – Aluminium, Aluminium alloys, Copper, Brass, Zinc, Steel (Mild, Medium and High) and Stainless Steel; • demonstrate an understanding of the main purposes and types of finishes for metals – painting, plastic coating, electroplating, anodising, enamelling and lacquering; and	Design and Technology, James Garratt. Non Ferrous Metals (DVD) classroom video • Produce a report outlining the range of metals available for use by designers; characteristics; differences; suitable applications and finishes
Plastic	• understand the difference between thermoplastic and thermosetting plastics; and • demonstrate knowledge and understanding of the properties, working characteristics and uses for the following polymers – Polythene, polystyrene, PVC, Acrylic, Nylon, ABS, Melamine-formaldehyde and Epoxy resins.	Design and Technology, James Garratt. Plastics (DVD) classroom video Introducing plastics technology, Education Media Film & video Ltd. • Produce a report outlining the range of plastics available for use by designers; characteristics; differences; suitable applications and finishes

Content	Learning Outcomes	Teaching and Learning Activities
New Materials **Method of Processing Materials**	Students should be able to: • understand the difference between composites, alloys and combinations when creating new materials; and • demonstrate knowledge and understanding of the characteristics and uses for the following smart materials – shape memory alloys, piezoelectric materials and light-emitting polymers. • demonstrate knowledge and understanding of: - Wasting to involve workshop hand tools, manual and CNC machine tools; - Forming to involve rolling, blanking, press forming and Forging; - Moulding to involve injection moulding, blow moulding, rotational moulding, vacuum forming sand casting and pressure die casting; and - Extrusion.	A fascinating look at SMART materials (TEP) • Use the internet to research and obtain relevant information on new materials and produce a presentation illustrating advances in materials technology Plastics in manufacturing (DVD) classroom video Polymer production techniques, Education Media Film & video Ltd. • Analyse a range of products outlining justification for choice of manufacturing process

Content	Learning Outcomes	Teaching and Learning Activities
Methods of Joining Materials	Students should be able to: • demonstrate knowledge and understanding of permanent and semi-permanent methods used to join materials to include: - Soldering, brazing, welding; - Riveting; - Selection of adhesives; - Nut, bolt and washer and self tapping screws; and - Knock down fittings.	Product Design: Resistant Materials Technology, Heinemann. Design and Technology, James Garratt. • Analyse a range of products outlining justification for choice of manufacturing process
Manufacturing Systems and Production	• demonstrate knowledge and understanding of: - scales of production to include: continuous production, mass production, batch production and one-off production; and - the way manufacturing is organised to include Cell production, flexible manufacturing systems (FMS), Just in-time (JIT) and Concurrent engineering.	Product Design : Resistant Material Technology, Heinemann. Manufacturing and the product life cycle (DVD) classroom video • Analyse a range of products suggesting suitable manufacturing systems
Design and Manufacture	• demonstrate knowledge and understanding of the following: - Computer-aided design (CAD) to include Drawing, solid modelling, Virtual imaging and Rapid prototyping; - Computer-aided manufacture (CAM) Computers used to assist in a manufacturing process; - Computer-integrated manufacture (CIM) Computers used for stock control, quality control, manufacturing, and assembly; and - advantages of using CAD, CAM and CIM.	Product Design: Resistant Materials Technology, Heinemann. Systems in a Factory (Behind the manufacturing process) (DVD) TV choice Production • Observe processes; list characteristics and analyse products suggesting suitable techniques CAM-Revolutionary Design (Classroom design)

Content	Learning Outcomes	Teaching and Learning Activities
Quality Systems	Students should be able to: • demonstrate knowledge and understanding of the use of: - Quality assurance (QA) and Quality control (QC) systems; - Statistical testing methods; - Factor of safety; - Use of tolerances; and • demonstrate knowledge and understanding of the purpose of testing and inspection of components or products.	Product Design, Resistant Material Technology, Heinemann. • Analyse products suggesting appropriate quality assurance systems
Safety	• demonstrate knowledge and understanding of: - risks associated with common manufacturing and hand processes, and methods used to minimise them; - Employee and Consumer safety; - Trades Description Act; and - British Standards and European Kite-marking.	Product Design : Resistant Material Technology, Heinemann. D&T Advanced Manufacturing Design and Technology, Hodder and Stoughton. • Produce a poster outlining current safety regulations

Content	Learning Outcomes	Teaching and Learning Activities
Aesthetics, Ergonomics, Anthropometrics.	Students should be able to: • demonstrate knowledge and understanding of: - the use of anthropometric data and ergonomics in product design; and - the use of aesthetics (shape, form, colour, texture, symmetry and proportion) in product design.	Product Design: Resistant Materials Technology, Heinemann. • Analyse a range of products identifying and evaluating aesthetic and ergonomic features of their designs and the use of anthropometric data Design and Technology, James Garratt. Visual Design (Classroom video)
Influences on Product Design	• demonstrate knowledge and understanding of: - Changes in Fashion; - Cultural and Social Changes; - Scientific Advances; and - Environmental Influences (3Rs Sustainability, Life Cycle Analysis).	D&T Advanced Manufacturing Design and Technology, Hodder and Stoughton. • Produce presentations illustrating influences on the development of a range of products and systems

Unit AS 1: Product Design and Systems and Control
Section B: Electronic and Microelectronic Control Systems

GCE Technology and Design: Scheme of Work
Unit AS 1: Product Design and Systems and Control Section B: Electronic and Microelectronic Control Systems

Content	Learning Outcomes	Teaching and Learning Activities
Systems and Control	Students should be able to: • analyse electronic/microelectronic control systems in terms of input, control, output, on/off continuous control and open and closed loop systems using feedback; and • use appropriate circuit symbols and circuit diagrams for electronic/microelectronic systems.	Advanced Design and Technology, Longman. Success In Electronics, John Murray. • Investigate a series of systems identifying relevant sub-systems • Familiarise with symbols as encountered during the course
Safety	• demonstrate knowledge and understanding of the safety issues and procedures used for electronic and microelectronic control systems.	• Produce a list of safety issues and procedures
Electronic Components	• demonstrate knowledge and understanding of the following components: - Resistors (colour code, E12 series, tolerance and power Ratings); - Capacitors; and - Diodes (circuit protection with inductive loads).	• Practise calculations in examination style questions and in development of practical systems

Content	Learning Outcomes	Teaching and Learning Activities
Calculations	Students should be able to: • use given data and information to complete calculations for the following: - V = I x R and W = V x I; - Power ratings of resistors in circuits; - Rt = R1 + R2 + ….Rn; - Rt = R1 x R2/ (R1 +R2); - Vout = Vin x R2/ (R1 + R2) ; - Time constant = C x R; - LED including maximum current, forward voltage, series resistance and power dissipation for series resistance; - Current flow through output devices; and - Transistors (base resistor).	• Model and investigate systems using software packages such as Crocodile Clips and/or modelling kits
Combining Components as Input Devices	• demonstrate knowledge and understanding of: - Resistors in series and parallel (limited to two in parallel); - Voltage divider circuits incorporating Light Dependent Resistors (LDR), Thermistor (negative temperature coefficient only) and Variable resistors; - Series Resistor Capacitor (RC) circuits for timing purposes only. V/T graphs of charging and discharging RC circuits; - Switches (SPST, SPDT, DPDT); - Switch type (toggle, slide, push to make, push to break, rotary, reed and micro); - A range of switching applications such as position control and logic control;	• Investigate switching systems and suggest suitable circuit arrangements and/or improvements

Content	Learning Outcomes	Teaching and Learning Activities
Combining Components as Input Devices (cont.)	Students should be able to: - Pull up and pull down resistors as inputs to logic circuits; and - Incorporate these devices into applications.	
Output Devices	• demonstrate knowledge and understanding of the following output devices: - Lamps, Relays (including Latching relays), Motors, Heaters, Solenoids (including solenoid valves), Buzzers, Loud speakers, Piezo sounders and LEDs; and - Incorporate these devices into applications with suitable driving circuitry.	• Produce a variety of systems incorporating a range of output devices using software packages and/or proprietary modelling kits
Electronic Systems	• demonstrate knowledge and understanding of the following systems: - AND and OR arrangements of SPST switches; - Truth tables with a maximum of three variables; - Logic gates (AND, OR, EOR, NOT, NAND, NOR, ENOR); - Comparator; - Flip Flop (SR based on NAND gates only); and - Transistor (npn in switching circuits only), including hfe Ic (max) Vbe.	• Analyse and solve a selection of control situations and produce solutions using software packages and/or proprietary modelling kits

Content	Learning Outcomes	Teaching and Learning Activities
Electronic Systems (cont.)	Students should be able to: - Darlington pair; - Thyristor; - Monstable and Astable circuits using 555timer, Mark/space, frequency and period, f = I/T; and - Programmable systems – awareness of the advantages and disadvantages of programmable systems (including PICs) compared with hard-wired solutions.	

Unit AS 1: Product Design and Systems and Control
Section C: Mechanical and Pneumatic Control Systems

GCE Technology and Design: Scheme of Work

Unit AS 1: Product Design and Systems and Control Section C: Mechanical and Pneumatic Control Systems

Content	Learning Outcomes	Teaching and Learning Activities
Systems and Control	Students should be able to: • analyse mechanical and pneumatic control systems in terms of input, control, output, on/off continuous control and open and closed loop systems using feedback; and • use appropriate circuit symbols and circuit diagrams for mechanical and pneumatic systems.	Higher Technology and Design, Hodder & Stoughton. Advanced Design and Technology, Longman. • Investigate a series of systems identifying relevant sub-systems • Familiarise with symbols as encountered during the course
Safety	• demonstrate knowledge and understanding of the safety issues and procedures used for mechanical and pneumatic control systems.	• Produce a list of safety issues and procedures
Calculations	• use given data and information to complete calculations for the following: - Mechanical advantage and velocity ratio; - Efficiency; - Simple and compound velocity ratios and transmission speeds for gears, pulleys and chains and sprockets; and - Force, pressure and area associated with cylinders.	Higher Technology and Design, Hodder & Stoughton. Advanced Design and Technology, Longman. • Practise calculations in examination style questions and in development of practical systems

Content	Learning Outcomes	Teaching and Learning Activities
Pneumatic Components	Students should be able to: • demonstrate knowledge and understanding of the operation of a compressor installation and the use of filter, regulator and lubricator units; • demonstrate knowledge and understanding of the following pneumatic components: - three and five port valves with the following actuators (roller trip, one way trip, plunger, push button, lever, solenoid, diaphragm and pilot operated); - single and double acting cylinders; - shuttle valves; - flow restrictors and reservoirs; - piping and T connections; and • represent these components using relevant standards to create the following: - time delay circuits; - logic circuits (AND, NOT and OR); - speed control of cylinders; - air bleed; - automatic reciprocation; - circuits to control the movement of single and double acting cylinders.	Higher Technology and Design, Hodder & Stoughton. Advanced Design and Technology, Longman. An introduction to fluid power (CD) BFPA The British Fluid Power Association. • Analyse and solve a selection of control situations and produce solutions using software packages and/or proprietary modelling kits

Content	Learning Outcomes	Teaching and Learning Activities
Mechanical Components	Students should be able to: • demonstrate knowledge and understanding of the following mechanical components: - Gears (spur, bevel, worm, rack and pinion); - Pulleys and belts (single pulley, flat, round, vee and toothed belts); - Fixed and self- adjusting jockey wheel or pulley; - Crank and slider; - Different types of motion (linear, rotary, oscillating and reciprocating); - First, second and third class levers; - Linkages – bell crank and parallel; - Cams (pear, heart, eccentric and plate) and followers to include knife, roller and flat. Cam terminology to include rise, fall, dwell and stroke length; and - Fixings to shafts: Grub screws, cotter pins and keys and keyways.	Higher Technology and Design, Hodder & Stoughton. Advanced Design and Technology, Longman. • Analyse a range of mechanical systems, the technology involved in their operation and the integration of different mechanical components • Analyse and solve a selection of control situations and produce solutions using software packages and/or proprietary modelling kits
Combining Mechanical Components	• demonstrate knowledge and understanding of how to: - Convert motion using mechanical and/or pneumatic components; - Combine simple and compound systems involving gears, pulleys and chains and sprockets; - Use gears, pulleys (belts), chains and sprockets to change speed and/or direction of rotation; • Use levers with linkages to meet specific requirements; and • Combine mechanical components to produce systems with specific requirements.	Higher Technology and Design, Hodder & Stoughton. Advanced Design and Technology, Longman. • Analyse and solve a selection of control situations and produce solutions using software packages and/or proprietary modelling kits

Unit AS 1: Product Design and Systems and Control Section D: Product Design

GCE Technology and Design: Scheme of Work

Unit A2 1: Systems and Control: Product Design Section D: Product Design

Content	Learning Outcomes	Teaching and Learning Activities
Designing	Students should be able to: • demonstrate knowledge and understanding of the Design Process including: - design briefs; - research methods (primary and secondary sources) questionnaires and surveys; - purpose and information included in a Specifications – design and manufacturing specifications; - generation of ideas - thought showers, lateral thinking attribute analysis, SCAMPER and inversion and their use to produce innovative design solutions; - development and refinement of ideas; - modelling; - planning for manufacture using Flow Process charts, Gantt charts and Critical path analysis; - selection of processes and techniques used in manufacture to produce products for different production levels; - formative and summative evaluation techniques used for evaluation and testing; - product review and testing;	Advanced Design & Technology, Longman. Students should produce a report outlining the different stages of the design process explaining each stage and its importance. Ref- Real World Technology Resistant Materials, Collins. ISBN10 0007115326 ISBN13 978-0007115327 Ref- PR Lewis and C. Price, Polymer. Rubber Technology by Maurice Morton. Rubber, Thermoplastic Polyurethanes and Thermoplastic elastomer ISBN10 0442255659 ISBN13 978-0442255657

Content	Learning Outcomes	Teaching and Learning Activities
Materials	Students should be able to: • demonstrate knowledge, understanding and applications for the following compliant materials: - folded boxboard; - corrugated board; - solid white board; - laminated board;	Advanced Design & Technology, Longman. Students should make design models in boxboard and corrugated board. Students should also present a report on the uses of folded boxboard, corrugated board, solid white board and laminated board. Ref- Real World Technology Resistant Materials, Collins. ISBN10 0007115326 ISBN13 978-0007115327 Ref- PR Lewis and C. Price, Polymer. Advance Design and Technology, Longman ISBN10 0582328314 ISBN13 978-0582328310
	• demonstrate knowledge, understanding and applications for the following modern materials; - thermochromic and photochromic materials; - phosphorescent pigments; - reflective films and holograms; - bio-degradable plastics; and • demonstrate knowledge, understanding and applications for the following composites; - carbon fibre reinforced plastic (CFRP); - glass reinforced plastic (GRP); - Kevlar; - tungsten carbide.	Students should use the internet to research and obtain relevant information on new materials and produce a presentation on the following materials. • Thermochromism • Photochromism • Holography • Biodegradable • Carbon fiber-reinforced plastic Glass-reinforced plastic (GRP) • Kevlar • Tungsten carbide

Content	Learning Outcomes	Teaching and Learning Activities
	Students should be able to:	Ref- Real World Technology Resistant Materials, Collins. ISBN10 0007115326 ISBN13 978-0007115327 Ref- PR Lewis and C. Price, Polymer. Rubber Technology by Maurice Morton. Rubber, Thermoplastic Polyurethanes and Thermoplastic elastomer ISBN10 0442255659 ISBN13 978-0442255657
	• demonstrate knowledge, understanding and applications for the following elastomers; - natural rubber; - thermoplastic elastomers; - thermoplastic polyurethane;	Discuss the characteristics of each of the following materials, suitable applications and finishes. Students should write a report explaining characteristics, applications and finishes for each of the following materials: • Natural Rubber • Thermoplastic elastomer • Thermoplastic Polyurethanes

Content	Learning Outcomes	Teaching and Learning Activities
Design and Communication	Students should be able to: • illustrate designs using 2D and 3D methods to include freehand sketching, pictorial, orthographic projection (3rd angle only) and use of mixed media; • enhance drawings e.g. use of rendering and texture; • produce quantitative drawings e.g. graphs, pie and bar charts, pictograms and sequential flow charts; • make use of CAD for drafting; • use these to communicate innovative design ideas	Ref- Design Graphics (drawing and presenting your ideas) David Fair. Marilyn Kenny. ISBN10 0340405295 ISBN13 978-0340405195 Students should complete a range of drawing tasks. Students should model different ideas using 3D & CAD. Students should practice sketching techniques and experiment with different drawing materials - pastels, chalks, charcoal, watercolour, pencil and marks.
Processing	In addition to those contained in parts 1.6 and 1.7 of Compulsory Section A of the specification students should be able to: • demonstrate knowledge and understanding of the following processes: - laminating; - steam bending; - die cutting; - laser cutting; - CNC router, milling and lathes; and	Ref- Real World Technology Resistant Materials, Collins. ISBN10 0007115326 ISBN13 978-0007115327 Ref- Advanced Design and Technology, Longman. ISBN10 0582328314 ISBN13 978-0582328310 Students will analyse a range of products outlining justification for choice of the following manufacturing processes. • Laminating. • Steam bending • Die Cutting • Laser Cutting • CNC Router

Content	Learning Outcomes	Teaching and Learning Activities
Safety	Students should be able to: • demonstrate knowledge and understanding of safety requirements to include: - five stage risk assessment; - Health and Safety at Work Act; - COSHH. • and how these relate to contemporary products.	Ref- Health and Safety at Work Act 1974. Ref- www.hse.gov.uk/cosh/index.htm Discussion and introduction of Health and Safety. Discuss what is the Purpose of a Risk Assessment? Students will explain what COSHH is. Students will investigate contemporary products which are made from or involve the use of hazardous substances during their manufacture.

Content	Learning Outcomes	Teaching and Learning Activities
Intellectual Property Rights	Students should be able to: Students should be able to: • demonstrate knowledge and understanding of Intellectual Property Rights to include the key issues of; - design rights; - registered design; - patents; - trademarks; - copyright; and • and how these relate to contemporary products.	Discuss intellectual property in terms of copyright, design rights patents and trademarks. Ref. www.patentsonline.com Ref. www.innovate-design.co.uk Ref www.copyrightservice.co.uk Students will; • Identify what is a design? • Identify who owns design rights? • Show an understanding of registered designs and Copyright in designs by producing a presentation. Students will list the Patent Process. Students search Patent databases for patents that relate to their project. Investigate the possibility of how their design might infringe existing patents or whether their design meets criteria for a patent. Look at well known patents, Dyson, Rechargeable Radio etc.

Content	Learning Outcomes	Teaching and Learning Activities
Product Analysis and improvement	Students should be able to: • analyse, evaluate and produce re-design proposals for existing products under the following headings: - form; - cost; - manufacture; - materials; - function; - performance; - aesthetics; - marketing constraints, target audience; - ergonomics and anthropometrics; - cultural, ethnic, moral and environmental issues; - safety of the user.	**Analysis and Improvement** Ref- Advanced Design and Technology, Longman Students will create presentations evaluating product re-design proposals for existing products using the following headings - Form - Cost - Manufacture - Materials - Function - Performance - Aesthetics - Marketing constraints, target audience - Ergonomics and anthropometrics - Cultural, ethnic, moral and environmental issues - Safety of the user.

Unit A2 1:
Systems and Control: Product Design
Section A:
Electronic and Microelectronic Control Systems

GCE Technology and Design: Scheme of Work

Unit A2 1: Systems and Control: Product Design **Section A: Electronic and Microelectronic Control Systems**

Content	Learning Outcomes	Teaching and Learning Activities
Systems and Control	Students should be able to:	
	• analyse electronic/microelectronic control systems in terms of input, control, output, on/off continuous control and open and closed loop systems using feedback; and	Advanced Design and Technology, Longman. Success In Electronics, John Murray.
	• use appropriate circuit symbols and circuit diagrams for electronic/microelectronic systems.	• Investigate a series of systems identifying relevant sub-systems • Familiarise with symbols as encountered during the course
Safety	• demonstrate knowledge and understanding of the safety issues and procedures used for electronic and microelectronic control systems.	• Produce a list of safety issues and procedures
Input Components	• demonstrate knowledge and understanding of the properties and applications for the following components: - Strain gauge; - Phototransistor; - Optical switches; - Switches to include reed switch; and - LDR, thermistor and variable resistor.	• Investigate the fundamental principles of input components and apply their use to real life situations using software packages and/or proprietary modelling kits

Content	Learning Outcomes	Teaching and Learning Activities
Calculations	Students should be able to: • use given data and information to complete calculations for the following: - Voltage divider circuits; - Bridge circuits for strain gauge; and - Op amp in inverting, non-inverting and differential modes (Formula will be provided for any calculations, derivations will not be required).	• Practise calculations in examination style questions and in development of practical systems • Analyse and solve a selection of control situations and produce solutions using software packages and/or proprietary modelling kits
PICs	• demonstrate knowledge and understanding of flow charting incorporating: - Input – output, Loops, Time delays, Increment, Flow Control and Subroutines; - Awareness of commonly used PICs with digital I/O and with mixed digital and analogue I/O; - Interfacing with electronic systems employing a PIC; and - Employ PICs to control systems to meet specified Requirements.	• Design a series of PIC bases systems using available packages e.g PIC Logicator to solve a range of control situations
Output Devices	• demonstrate knowledge and understanding of: - Seven segment display; - LED bar array and LCD displays; - DC and Stepper motors; and • incorporate these devices into applications with suitable driving circuitry.	• Use these devices in conjunction with solutions designed to solve a range of problems

Content	Learning Outcomes	Teaching and Learning Activities
Electronic Systems	Students should be able to: • demonstrate knowledge and understanding of: - Karnaugh maps to simplify truth tables with a maximum of three variables in logic systems; - Op amp circuits for various applications including calculation of appropriate component values; - Binary/BCD and up/down counters; and - Binary counter as a frequency divider.	• Solve a range of combinational logic problems requiring the derivation of simplified solutions using the Karnaugh mapping method • Practise calculations in examination style questions and in development of practical systems

Unit A2 1: Systems and Control: Product Design Section B: Mechanical and Pneumatic Control Systems

GCE Technology and Design: Scheme of Work

Unit A2 1: Systems and Control: Product Design Section B: Mechanical and Pneumatic Control Systems

Content	Learning Outcomes	Teaching and Learning Activities
Systems and Control	Students should be able to: • analyse mechanical and pneumatic control systems in terms of input, control, output, on/off continuous control and open and closed loop systems using feedback; and • use appropriate circuit symbols and circuit diagrams for Mechanical and Pneumatic systems.	Higher Technology and Design, Hodder & Stoughton. Advanced Design and Technology, Longman. • Investigate a series of systems identifying relevant sub-systems • Familiarise with symbols as encountered during the course
Safety	• demonstrate knowledge and understanding of the safety issues and procedures used for Mechanical and Pneumatic control systems.	Higher Technology and Design, Hodder & Stoughton. Advanced Design and Technology, Longman. • Produce a list of safety issues and procedures
Calculations	• use given data and information to complete calculations for the following: - Mechanical advantage and velocity ratio; - Efficiency; - Torque; - Moments;	Higher Technology and Design, Hodder & Stoughton. Advanced Design and Technology, Longman. • Design a range of systems to satisfy criteria requiring the use of numerical techniques and analysis

Content	Learning Outcomes	Teaching and Learning Activities
Calculations (cont.) **Pneumatic Components and Systems**	Students should be able to: - Work, energy and power; - Simple and compound velocity ratios and transmission speeds for gears, pulleys and chains and sprockets; - Force, pressure and area associated with cylinders; and - Air consumption of cylinders. • demonstrate knowledge and understanding of the following pneumatic components: - Vacuum pumps and vacuum lifting cups; - Proximity sensors; - Use of 5/3 valves; • design Sequential circuits to control up to four cylinders using positive feedback techniques; • design Sequential/interlocking circuits using cascades; and • represent these components using appropriate symbols.	Higher Technology and Design, Hodder & Stoughton. Advanced Design and Technology, Longman. An Introduction to Fluid Power (CD) BFPA The British Fluid Power Association • Analyse and solve a selection of control situations and produce solutions using software packages and/or proprietary modelling kits

Content	Learning Outcomes	Teaching and Learning Activities
Combining Mechanical Components	Students should be able to: • accurately draw cam profiles and performance diagrams: - to achieve Dwell, Uniform velocity, Uniform acceleration and Retardation and Simple harmonic motion; - if the line of stroke of the follower is offset or in line with the centre of the cam; - using a range of followers including knife edge, flat and roller; • accurately draw cam profiles and performance diagrams to achieve a range of outcomes; • demonstrate knowledge and understanding of: - Gears to include Pitch circle diameter, Pitch point, Metric Module, Pinion wheel, Simple and compound gear trains; - Pulleys to include simple and compound pulley systems, Multiple pulley block and Lifting systems; - Chain and Sprockets to include simple and compound Systems; - Ratchet and pawl; - Levers and Linkages to include Bell crank, Toggle and Treadle; - Shafts and Couplings to include Aligned shafts, Flexible Couplings, Universal joints, Ball and socket, Constant velocity joints and Sliding couplings; - Friction to include static and dynamic; - Brakes to include cantilever, band, disc and drum;	Higher Technology and Design, Hodder & Stoughton. Advanced Design and Technology, Longman. • Practise mathematical and drawing techniques using examination style questions • Draw profiles and diagrams to meet pre-specified criteria • Investigate and analyse systems to illustrate the use of the named components • Design systems to meet pre-specified criteria

Content	Learning Outcomes	Teaching and Learning Activities
Combining Mechanical Components (cont.)	Students should be able to: - Clutches to include cone, single plate, diaphragm and Centrifugal; - Methods employed to activate clutches and brakes; - Bearings to include plain, rolling element, self-aligning, thrust, taper and bearing housings; - Lubrication to include mechanics of lubrication, viscosity, classification of lubricants and applications; - Seals to include O-ring, gasket, garter and seal housings; and • Combine mechanical and/or pneumatic/hydraulic components to produce systems with specific requirements.	Fluid power Technology at Work, Educational Media Film & Video Ltd.

Unit A2 1:
Systems and Control: Product Design
Section C:
Product Design

GCE Technology and Design: Scheme of Work

Unit A2 1: Systems and Control: Product Design Section C: Product Design

Content	Learning Outcomes	Teaching and Learning Activities
Environmental Issues	Students should be able to: • demonstrate knowledge and understanding of environmental issues relating to product design to include; - environmental impact at different stages of the product life cycle; - climate change and greenhouse gases; - reducing environmental impact by design, - the 6Rs rethink, reuse, recycle, repair, reduce and refuse with practical examples; - environmental audits and life-cycle assessment; - reducing material use; - renewable Energy sources to include wind, wave, solar, tidal, geothermal, biomass; - new technology and environmentally friendly manufacturing processes; - management of waste, the disposal of products and pollution control; - examples of National government and EU influence; and • develop product design proposals which reflect the potential impact on the environment.	http://www.sda-uk.org/ http://www.sustainability.c Advanced Manufacturing D&T RCA Hodder & Stoughton 0 340 70528 0 Real World Technology RM Chapman Collins 0 00 711532 6 http://www.reducetheuse.co.uk/ http://www.d4s-de.org/ http://www.cfsd.org.uk/ General group discussion on sustainability on a local level, extend to global implications Focus on types of energy available, discuss issues relating to availability, conservation and pollution. Students will fully research issues surrounding selected energy type and present back to class electronically or on an A4 sheet. Students will list products that are easy to recycle and those that are not.

Content	Learning Outcomes	Teaching and Learning Activities
The Market and Products leading to the development of product specifications	Students should be able to: • demonstrate knowledge and understanding of the role of markets in product design; - innovation in the market; – marketing strategy, market research; – Needs and demands; – How and why new products arise; - key aspects of Market pull and Technology push; - key aspects of Radical and Incremental products; - market strategy – Key concepts of market penetration, market development, product development and diversification; • demonstrate knowledge and understanding of researching markets; - the work of the marketing information systems (MIS). The six main tasks to include market analysis, product research, distribution research, price research, promotional research and market testing; - the market environment to include demographic trends, family roles, life style changes, economic trends and government legislation;	Advanced Design and Technology Longman ISBN 0-582-01463-8 Students will use the internet to research and investigate the development of product specifications with particular reference to; market strategies, market research, and key aspects such as demand pull and technology push. Students will produce a presentation which illustrates the key aspects of radical and incremental products. Produce presentations demonstrating knowledge and understanding of the term research markets and the work of market information systems (MIS) reference should be made to the six main tasks.

Content	Learning Outcomes	Teaching and Learning Activities
The Market and Products leading to the development of product specifications (continued)	Students should be able to: • demonstrate knowledge and understanding of the process of market research**;** - the nature and purpose of market research; - market research projects to include exploratory, descriptive, explanatory and predictive; - the need for market research to be valid, reliable and representative; - the use of probability and non-probability sampling in market research; - the use of personal interviews, Hall test and product clinics, retail audits, fixed consumer panels and omnibus surveys; - the advantages and disadvantages of telephone interviews and postal questionnaires; • demonstrate knowledge and understanding of techniques employed to develop detailed product design specifications based on the outcome of market research activities; and demonstrate knowledge and understanding of the use of ICT to implement market research activities and in analysis of the outcome of research.	Students will analyse the process of market research and demonstrate and understanding through the creation of marketing campaign for a product of their choice. Pupils to carry out extensive market research activities on a product of their choice and from this develop a detail product design specification. Student should make effective use of ICT to collate their gathered information.

Content	Learning Outcomes	Teaching and Learning Activities
Product life cycle **ICT in Manufacture**	Students should be able to: • demonstrate knowledge and understanding of the product life cycle to include : - Inception, Introduction, Growth, Maturity and Decline; - Life cycle for Fad, Fashion and Basic Products; • employ CAD and CAM systems and other ICT systems where appropriate in the design and manufacture of products;	Analyse a range of products describing the product life cycle of each. Students will look at web sites and literature of major school CAD/CAM suppliers • http://www.denford.co.uk http://www.suregrave.com/ • http://www.boxford.co.ukwww.techsoftuk.co.uk Students will list the range of CAD/CAM available in schools and industrial applications. Looking at: • Complexity. • Accuracy. • Speed. • Global communication, • Cost implications Understanding Industry Marcouse Hodder & Stoughton 0340679271 Advanced Manufacturing D&T RCA Hodder & Stoughton 0340705280

Content	Learning Outcomes	Teaching and Learning Activities
Selling the product	Students should be able to: • demonstrate knowledge and understanding of the four P's: - **Product** to include; – variable product life cycles; – variation between the life cycles of products; – the five types of consumers who emerge at each stage of the life cycle, namely fashion innovators, opinion leaders, masses, late adopters and laggards; - **Price** to include; – determining the price and the elasticity of demand; – pricing methods to include cost-plus, contribution pricing and perceived value; – the pricing strategy for each of the stages of the life cycle of the product; - **Place** to include; – geographical placing – Internationally and regional differences difficulties and barriers to trading; – physical placing – getting the product to the right place at the right time;	Students to investigate role of marketing, identify and compare ways of assessing customer need. Discuss the 4 P's- Product,Price, Place, Promotion in terms of presenting product to customer.

Content	Learning Outcomes	Teaching and Learning Activities
Selling the product	Students should be able to: - **Promotion** to include; – sales promotion, advertising processes, publicity, personal selling and exhibitions and trade fairs; – development of promotional strategies for a range of products; and • demonstrate knowledge and understanding of the use of ICT to implement the four P's.	Students will investigate products and how they are marketed and sold in different regions throughout out the world http://www.advertising.com/index.php Students to consider advertising methods and develop a promotional strategy for a given product
Quality Control and Assurance	• develop an understanding of the various processes and strategies employed in quality control and assurance systems e.g. The use of measuring devices, jigs, templates and fixtures; • devise appropriate tests for products to meet specific requirements; • describe the use of ICT in Quality Control and Assurance;	Advanced D&T 3rd Edition. Norman, Urry et al. Longman 0 582 32831 4 Advanced Manufacturing D&T RCA Hodder & Stoughton 0 340 70528 0 Real World Technology RM Chapman Collins 0 00 711532 6 Students will clearly distinguish between: • Quality assurance – planned systems and procedures to ensure that product meets quality standards; • Quality control – applying techniques for checking against required tolerance or standard. Use, where possible, details of real life quality control systems.

Content	Learning Outcomes	Teaching and Learning Activities
Quality Control and Assurance (continued)	Students should be able to:	• There are a range of inspection systems, sampling and tolerance checks employed. • Consider automatic, computer controlled quality check systems. And clearly distinguish between :
Design for use	• design for maintenance and repair; • design to be inclusive for all society; • redesign for a changing length in life cycle;	Produce a report outlining how a product has been designed with key features such as maintenance and repair considered and how this product can be incorporated into society. Reference should be made to a changing length of life cycle for the product.
Design for Manufacture	• formulate proposals for product design and development taking account of the need for scale production; • design to minimise materials, components, processes and the environmental impact; • design to minimise packaging material and wasted packaging space;	Students to investigate the need for, and importance of scale of production. Use the internet to research and obtain relevant information on the impact materials, components packaging and processes have on the environment and how designers have reduced the use of these materials throughout the design process.

Content	Learning Outcomes	Teaching and Learning Activities
Design and Communication	Students should be able to: • use appropriate communication methods and rendering techniques to communicate innovative design ideas; • use text size and style to communicate impact, product information and appeal to a variety of audiences; • design graphical information used on product design; and	Sketching drawing techniques for product designers Koos eissen and roselien steur ISBN 978-90-6369-177-4 Students will use a range of communications methods and rendering techniques to communicate innovative designs
The Work of Product Designers	• develop knowledge and understanding of the influence of the following designers and movements in product design: - Dyson; - Bayliss; - Memphis.	Select a product from one of these designers and analyse how the design as influenced product design thinking