Rewarding Learning

CCEA GCSE Specification in Technology & Design

For first teaching from September 2011

For first assessment from Summer 2012
For first award in Summer 2013

Subject Code: 8900

technology and design

Foreword

This booklet contains CCEA's General Certificate of Secondary Education (GCSE) Technology and Design for first teaching from September 2011. We have designed this specification to meet the requirements of the following:

- GCSE Subject Criteria for Design and Technology;
- GCSE Qualifications Criteria;
- Common Criteria for all Qualifications;
- GCSE Controlled Assessment Regulations for Design and Technology; and
- GCSE Controlled Assessment Generic Regulations.

We will make the first full award based on this specification in summer 2013.

We are now offering this specification as a unitised course. This development increases flexibility and choice for teachers and learners.

The first assessment for the following units will be available in summer 2012:

- Unit 1: Technology and Design Core; and
- Unit 4: Design Assignment.

We will notify centres in writing of any major changes to this specification. We will also publish changes on our website at www.ccea.org.uk

The version on our website is the most up-to-date version. Please note that the web version may be different from printed versions.

Subject Code	8900
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You may download further copies of this publication from www.ccea.org.uk

Version 1 15 March 2011

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Version 1 15 March 2011

1 Introduction

This specification sets out the content and assessment details for our GCSE Technology and Design course. First teaching begins from September 2011, and we will make the first awards for this specification in 2013. You can view and download the latest version of this specification on our website at www.ccea.org.uk

The specification builds on the broad objectives of the Northern Ireland Curriculum. It is also relevant to key curriculum concerns in England and Wales.

A course based on this specification should help facilitate the study of technology and design-related subjects at a more advanced level, for example Advanced Subsidiary and Advanced Technology and Design and BTEC Nationals in Engineering.

This specification encourages students to be inspired, moved and challenged by following a broad, coherent, satisfying and worthwhile course of study. It allows them to gain insight into related sectors such as manufacturing and engineering. It also prepares them to make informed decisions about further learning opportunities and career choices.

1.1 Aims

This specification aims to encourage students to:

- actively engage in the processes of design and technology to develop as effective and independent learners;
- make decisions, consider sustainability and combine skills with knowledge and understanding in order to design and make quality products and/or systems;
- explore ways in which aesthetic, technical, economic, environmental, ethical and social dimensions interact to shape designing and making;
- analyse existing products and develop practical solutions to needs, wants and opportunities, recognising their impact on quality of life;
- develop decision-making skills through individual and collaborative working;
- understand that designing and making reflect and influence cultures and societies, and that products have an impact on lifestyle; and
- develop skills of creativity and critical analysis through making links between existing solutions, technological knowledge and the principles of good design.

1.2 Key features

The key features of the specification appear below:

- This is now a unitised specification. This means that students have the opportunity to sit two units in the first year of teaching.
- The course offers opportunities to build on the skills and capabilities developed through the delivery of the Key Stage 3 curriculum in Northern Ireland.
- The specification involves a new approach to technology and design at GCSE, incorporating product design and systems and control, including Northern Ireland perspectives.
- The specification has a single tier of entry.

- The specification meets the requirements of GCSE regulations and subject criteria for technology and design, and it contributes to the Northern Ireland Curriculum for Key Stage 4.
- The specification allows students to develop transferable skills which will benefit them in vocational training and employment.
- The specification is accompanied by schemes of work and student guides to support teachers and students. You can download these from our website at www.ccea.org.uk

1.3 Prior attainment

The specification builds on the knowledge, skills and understanding of the Northern Ireland Key Stage 3 Curriculum of Study for Technology and Design. There is no particular level of attainment required; however, before studying this specification, students should have a level of skills in technology, numeracy, literacy and communication commensurate with having studied technology and design to Key Stage 3.

1.4 Classification codes and subject combinations

Every specification is assigned a national classification code that indicates the subject area to which it belongs. The classification code for this qualification is 8900.

Progression to another school/college

Should a student take two qualifications with the same classification code, schools and colleges that they apply to may take the view that they have achieved only one of the two GCSEs. The same view may be taken if students take two GCSE qualifications that have different classification codes but have content that overlaps significantly. Students who have any doubts about their subject combinations should check with the schools and colleges that they wish to attend before embarking on their planned study.

Centres in England

Centres in England should also be aware that, for the purpose of the School and College Achievement and Attainment Tables, if a student enters for more than one GCSE qualification with the same classification code, only one grade (the highest) will count.

2 Specification at a Glance

The table below summarises the structure of this GCSE course. Students **must** be assessed on Units 1, 4 and 5, and **either** Unit 2 **or** Unit 3.

Content	Assessment	Weighting	Availability
Unit 1: Technology and Design Core	**Externally assessed written paper** Examination lasts **1 hour**	20%	Every Summer (beginning in 2012)
Unit 2: Systems and Control Electronic and Microelectronic Control Systems OR Mechanical and Pneumatic Control Systems	**Externally assessed written paper** Examination lasts **1 hour** The exam paper is split into: • Element 1: Electronic and Microelectronic Control Systems; and • Element 2: Mechanical and Pneumatic Control Systems. *Students only complete the element they have studied.*	20%	Summer Terminal
Unit 3: Product Design	**Externally assessed written paper** Examination lasts **1 hour**		
Unit 4: Design Assignment	**Controlled assessment 1** We set the design assignment. Teachers mark the assignment and we moderate it.	20%	Every Summer (beginning in 2012)
Unit 5: Design Project	**Controlled assessment 2** We set the project. Students take either: • Element 1: Systems Design and Manufacturing; or • Element 2: Product Design and Manufacturing. Teachers mark the project and we moderate it.	40%	Summer Terminal

At least 40 percent of the assessment (based on unit weightings) must be taken at the end of the course as terminal assessment.

3 Subject Content

This specification is split into **five units**:

- **three** units are **compulsory**; and
- **one** from **two optional** units is **compulsory**;

Students must complete **Unit 1**: Technology and Design Core, **Unit 4**: Design Assignment and **Unit 5**: Design Project.

Students must also complete either **Unit 2**: Systems and Control or **Unit 3**: Product Design.

In **Unit 2**: Systems and Control, students must complete **either** the Electronic and Microelectronic Control Systems element **or** the Mechanical and Pneumatic Control Systems element.

In **Unit 5**: Design Project, students must complete **either** the Systems Design and Manufacturing Assignment element **or** the Product Design and Manufacturing Assignment element.

Section	Compulsory Unit	Optional Unit	Chosen Element
3.1	Unit 1: Technology and Design Core		
3.2		Unit 2: Systems and Control	Electronic and Microelectronic Control Systems **Or** Mechanical and Pneumatic Control Systems
3.3		Unit 3: Product Design	
3.4	Unit 4: Design Assignment		
3.5	Unit 5: Design Project		Systems Design and Manufacturing Assignment **Or** Product Design and Manufacturing Assignment

3.1 Unit 1: Technology and Design Core

This unit is **compulsory** for all students. It comprises manufacturing, electronics, mechanical control systems, computer control systems, and pneumatic systems and control.

3.1.1 Manufacturing

Content	Learning Outcomes
	Students should be able to:
Range of Materials and Their General, Physical, Aesthetic and Structural Characteristics	• demonstrate an effective working knowledge of the following materials in relation to their categories and the manufacture of technological products: – woods: hardwoods (mahogany, beech); softwoods (pine, redwood); and man-made boards (Medium Density Fibreboard (MDF), chipboard); – plastics: thermosetting plastics (melamine, polyester resin); and thermoplastics (acrylic, rigid polystyrene); and – metals: ferrous metals and alloys (mild steel, stainless steel); and non-ferrous metals and alloys (aluminium, brass);
Tools, Processes and Techniques	• demonstrate an effective working knowledge of how the following processes and techniques are used with the above materials to manufacture technological products; and • demonstrate an understanding of the main features and applications of the following hand tools: – for marking out: rule, engineer's square, try square, scriber, centre punch, spring dividers, marking knife and over head projector (OHP) pen; – for sawing: hacksaw, tenon saw and coping saw; – files: flat, round, and half-round profile, second cut and smooth cut; and – bevelled edge wood chisels.

Content	Learning Outcomes
	Students should be able to:
Tools, Processes and Techniques (cont.)	• demonstrate an understanding of the main features and applications of the following machine tools: – pillar drill; – band facer; and – pedestal polisher;
Appropriate Methods of Joining	• demonstrate an understanding of the following permanent joining methods: – soft soldering, brazing and mig welding; – common wood and plastic adhesives and their correct application; – wood joints (butt joints and dowel joints); and – riveting; • demonstrate an understanding of the following semi-permanent joining methods: – nuts and washers, bolts and self-tapping screws; – countersunk and round-headed woodscrews; and – panel pins, oval and wire nails;
Production Methods	• demonstrate an effective working knowledge of the following production methods: – metals: wasting and fabrication; – plastics: wasting and fabrication; and – wood: wasting and joining (limited to the wood joints listed above);
Moulds and Jigs	• demonstrate an understanding of how moulds and jigs are used for the vacuum forming and line bending of thermoplastic sheets; and
CAM and CAD	• demonstrate an understanding of the process of computer aided manufacture (CAM): – a file is generated using a computer aided design (CAD) software package; and – this computer file is used to make a product on a computer numerical control (CNC) machine.

Content	Learning Outcomes
	Students should be able to:
Finishing Techniques	• demonstrate an effective working knowledge of suitable finishing techniques for the following materials, taking account of their function, aesthetics and environment: – metal: painting, polishing, dip coating and galvanising; – wood: painting, varnishing and applying preservative stains; and – plastic: polishing;
Material Efficiency	• reduce material wastage during manufacture, thereby maximising the use of materials to reduce cost;
Designers	• analyse the work of other designers; • discuss how other designers have researched, prepared specifications, developed ideas and reached a final outcome;
Emerging Technologies	• demonstrate an understanding of developments in new technologies, with specific reference to nanotechnology and its everyday applications: – self-cleaning glass; and – nanocomposites in car bumpers;
Health and Safety	• recognise common health and safety symbols and the use of appropriate personal protective equipment; • recognise the importance of safety when using workshop tools, equipment, machines and components; and • recognise potential hazards in products, activities and environments.

3.1.2 Electronics

Content	Learning Outcomes
	Students should be able to:
Construction Techniques	• identify the tools and equipment required to produce a reliable, functioning technological product;
	• select appropriate modelling and construction methods to assemble electronic circuits;
Input–Process–Output	• demonstrate an understanding that electronic systems may contain input–process–output;
Units and Measurements	• apply an understanding of electrical units to measure current, voltage and resistance;
Components	• identify the following components by their circuit symbols and physical appearance: – batteries; – resistors; – variable resistors; – light dependent resistors (LDRs); – thermistors; – diodes; – thyristors; – transistors (NPN); – buzzers; – light-emitting diodes (LEDs); – bulbs; and – motors;
	• select appropriate components to meet the requirements of a circuit diagram;
Conductors and Insulators	• demonstrate knowledge of the use of conductors and insulators;
Resistors	• use the colour coding system to identify values of individual resistors; and
	• calculate the resistance of two or more resistors in series, using: $R_t = R_1 + R_2 + R_n$.

Content	Learning Outcomes
	Students should be able to:
Switching	• demonstrate an understanding of the following types of switch: – toggle; – push button; – microswitch; – membrane; – slide; – reed; – single pole, single throw (SPST); and – single pole, double throw (SPDT);
	• demonstrate an understanding of the action of these switches by recognising and selecting according to application;
Potential Dividers	• use a potential divider to control voltage in a circuit;
LEDs	• use LEDs in circuits;
	• demonstrate knowledge and understanding of the use of current-limiting resistors to protect LEDs (no calculation required);
Thyristors	• use thyristors in circuits;
	• identify gate, anode and cathode from a diagram;
Transistors	• use an NPN transistor as a switch in a sensing circuit; and
	• identify the base, emitter and collector from a diagram.

3.1.3 Mechanical Control Systems

Content	Learning Outcomes
	Students should be able to:
Input–Process–Output	• analyse and describe mechanisms in terms of input–process–output;
Construction Techniques	• build working models and products using resistant materials and discrete components;
Types of Motion	• recognise and give examples of the following types of motion: – rotary; – linear; – oscillating; and – reciprocating;
Components	• identify the following components by their physical appearance and symbols: – wheel and axle; – gears; – cams; – followers; – levers; – belts; – pulleys; and – shafts;
Levers	• explain the practical applications and uses of first, second and third class levers;
Power Transmission	• use symbols to illustrate: – simple gear trains (maximum three gears); and – round and V-belt systems;
	• demonstrate an understanding of how gear systems can be used to change speed and/or direction of rotation;
	• calculate simple gear ratios (limited to three gears);
Cams and Followers	• understand plate cams (limited to eccentric, pear and heart);
	• understand cam followers (limited to knife, roller and flat); and
Safety	• show an awareness of the need for precautions when dealing with moving parts.

3.1.4 Computer Control Systems

Content	Learning Outcomes
	Students should be able to:
Input–Process–Output	• show that computer control systems may contain input–process–output;
Proprietary Interface	• know the importance of the interface as a protection and connection device;
The Function and Application of Flow Charts and Symbol Recognition	• demonstrate knowledge and understanding of the use of flow charts and draw flow chart diagrams to describe a sequence of events, using the symbols for: – START/STOP; – OUTPUT; – PROCESS; and – DECISION; and
Programmable Control	• apply knowledge and understanding of appropriate software to construct programs which contain the following: – loops; – time delay; – decisions; and – increment/decrement.

3.1.5 Pneumatic Systems and Control

Content	Learning Outcomes
	Students should be able to:
Input–Process–Output	• show that a pneumatics system may contain input–process–output;
Cylinders	• identify a single acting cylinder by its physical appearance and circuit symbol;
	• use single acting cylinders (limited to two in any system);
Valves	• identify a 3/2 valve by its physical appearance and circuit symbol;
	• recognise the following types of actuator for a 3/2 valve – roller trip; – push button; – plunger; and – lever;
Logic, AND/OR	• identify and use a shuttle valve in an OR circuit;
	• connect two 3/2 valves to create an AND/OR circuit;
Speed Control	• use a unidirectional flow regulator to incorporate speed control into a system;
Construction	• construct pneumatic systems using discrete components;
Safety	• work safely when building and operating pneumatic systems; and
	• understand the dangers associated with: – unsecured hosing; – compressed air; and – moving components.

3.2 Unit 2: Systems and Control

This unit is **optional** and cannot be taken along with Unit 3: Product Design.
The Systems and Control unit comprises **two** elements.
Students are assessed on only one of these elements: **either** Electronic and Microelectronic Control Systems **or** Mechanical and Pneumatic Control Systems.

3.2.1 Element 1: Electronic and Microelectronic Control Systems

Content	Learning Outcomes
	Students should be able to:
Basic Electronic Concepts	• demonstrate knowledge and understanding of current as a flow of charge carried by electrons; • demonstrate knowledge and understanding of the units we use to measure: – current; – voltage; – resistance; and – capacitance, including multiples and sub-multiple units;
Ohm's Law	• demonstrate knowledge and understanding of the use of the relationship between current, voltage and resistance, and perform simple calculations;
Resistors in Parallel	• draw and interpret circuit diagrams containing resistors in parallel; • use given data and information to calculate the resistance of two resistors in parallel, using: $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$ or $R_T = \frac{R_1 \times R_2}{R_1 + R_2}$;
Pull-Up and Pull-Down Resistors	• demonstrate knowledge and understanding of the use of pull-up or pull-down resistors in a circuit;
Nearest Preferred Values	• demonstrate knowledge and understanding of tolerance, nearest preferred values and the use of the E12 series, and perform relevant calculations;
The NPN Transistor	• demonstrate knowledge and understanding that a switch-on voltage for a transistor is 0.7V at its base; and • demonstrate knowledge and understanding of the use of the transistor in switching circuits.

Content	Learning Outcomes
	Students should be able to:
Inputs	• demonstrate knowledge and understanding of the difference between analogue and digital signals; • demonstrate knowledge and understanding of the use of the following input devices: – LDRs; – thermistors; – moisture sensors; – variable resistors; and – switches, including reed switches;
Outputs	• demonstrate knowledge and understanding of the use of the following output devices: – motors; – lamps; – buzzers; – relays; – LEDs; and – 7-segment displays;
Protective Resistors	• demonstrate knowledge and understanding of the use of current-limiting resistors to protect LEDs, and calculate values from given data;
Potential Dividers	• demonstrate knowledge and understanding of the use of variable resistors to adjust sensitivity in a potential divider;
Relays	• demonstrate knowledge and understanding of the use of a relay as an electrically operated switch; • draw circuits which use a relay for switching, for example to use with motors and solenoids;
Integrated Circuits	• demonstrate knowledge and understanding of the use of dual in-line (DIL) packages and identify pin one; and
Timers	• demonstrate knowledge and understanding of the use of a 555 timer integrated circuit to provide astable and monostable outputs (formulae will be provided for any 555 timer calculations; derivations are not required).

Content	Learning Outcomes
	Students should be able to:
Capacitors	• demonstrate knowledge and understanding of the use of non-polarised and polarised capacitors;
	• select appropriate capacitors to suit applications;
Time Constant	• demonstrate knowledge and understanding of the relationship between capacitance, resistance and time when selecting components for timers;
Interface	• demonstrate knowledge and understanding of the need for interfacing between computer systems and control devices;
Digital Signals	• demonstrate knowledge and understanding of how 1 represents a 'high' voltage level and 0 a 'low' voltage level in binary notation;
Counting	• demonstrate knowledge and understanding of the use of binary in counting;
	• convert decimal numbers from 0 to 255 into binary and vice versa;
Use and Function of Microcontrollers (PICs)	• demonstrate knowledge and understanding of the use of PICs;
	• explain and draw flow chart diagrams to implement control situations using a PIC;
	• demonstrate an understanding of the use of bit patterns in flow charts to show the states of input and output devices;
Designing Circuits that Incorporate a PIC	• design and interpret circuits which incorporate a PIC with analogue and digital inputs and digital outputs; and
	• demonstrate knowledge and understanding of the need for amplification in order to drive some output devices.

3.2.2 Element 2: Mechanical and Pneumatic Control Systems

Content	Learning Outcomes
	Students should be able to:
General Concepts	• explain the terms: – load; – effort; – fulcrum; – mechanical advantage; and – velocity ratio; • do simple calculations involving the above concepts;
Transmission of Motion Using Gears	• demonstrate knowledge and understanding of the following types of gears and the factors involved in their choice for practical applications: – spur; – bevel; – worm; and – rack and pinion; • demonstrate knowledge and understanding of applications for simple and compound gear trains (limited to four gears); • use given information to complete calculations involving simple and compound gear transmissions (using a maximum of four gears) for: – velocity ratio; – gear ratio; and – transmission speeds; • demonstrate knowledge and understanding of the use of an idler gear to change direction without affecting the overall ratio of a gear train;
Other Transmission Systems	• demonstrate knowledge and understanding of the factors influencing the choice of: – flat belts; – toothed belts; and/or – sprockets and chains for practical applications; and • demonstrate knowledge and understanding of the use of jockey pulleys and motor mount adjustment to tension belts.

Content	Learning Outcomes
	Students should be able to:
Conversion of Motion	• sketch, describe and compare simple cams and common followers (limited to knife, roller and flat);
	• demonstrate knowledge and understanding of the conversion of linear motion to rotary motion and vice versa using: – eccentric, pear, heart and snail cams; and – crank and slider mechanisms;
	• demonstrate knowledge and understanding of the use of screw threads to transmit motion;
	• demonstrate knowledge and understanding of ratchet and pawl mechanisms;
Levers and Linkages	• use given information to complete simple calculations involving moments of forces (limited to one effort and one load);
	• demonstrate knowledge and understanding of the use of bell crank levers and parallel linkages in mechanical products;
Pneumatic Principles	• demonstrate knowledge and understanding of the relationship between the force of a piston in a cylinder, its bore diameter and air pressure: force = pressure × area where pressure is measured in N/mm^2 (0.1 N/mm^2 = 1 bar) and area is measured in mm^2 (*we acknowledge that while these are not SI units, they are the industry standard*);
Cylinders	• identify a double acting cylinder by its physical appearance and circuit symbol;
	• use double acting cylinders (limited to two per system); and
Bidirectional and Unidirectional Flow Control Valves	• demonstrate knowledge and understanding of the operation and application of the following flow control valves: – unidirectional (one-way restrictor valve); and – bidirectional (two-way restrictor valve).

Content	Learning Outcomes
	Students should be able to:
Systems and Control	• demonstrate knowledge and understanding of the concepts of input, process and output and the importance of feedback in controlling systems;
Sensors: Feedback Signal	• demonstrate knowledge and understanding of the use of a range of 3/2 valves and 5/2 valves to produce controlled motion for semi-automatic and automatic circuits with the following actuators: – lever; – push button; – roller trip; – plunger; and – pilot;
Time Delay	• demonstrate knowledge and understanding of the use of a reservoir and flow regulators to create a time delay; and
Automatic Reciprocation	• design circuits with positional feedback to activate a pilot air operated 5/2 valve, controlling it to two double acting cylinders incorporating speed control (no more cylinders are required).

3.3 Unit 3: Product Design

This unit is **optional** and cannot be taken along with Unit 2: Systems and Control. It comprises designing and innovation, materials, components and fabrication, manufacturing practices, and social responsibility of product design and market influences.

3.3.1 Designing and Innovation

Content	Learning Outcomes
	Students should be able to:
Market/Demand Pull and Technology Push	• take account of the origin of new or improved products, considering: – the growth in consumer demand (market/demand pull); and – advances in technology which stimulate new design (technology push);
Role of the Client, User, Designer and Maker	• demonstrate an understanding of the main roles of the client, user, designer and maker and how they interact in: – commissioning; – design; – manufacture; and – evaluation of a product;
Idea Generation and Development Techniques	• understand the main features of the following techniques for generation and development of ideas: – brainstorming; – morphological analysis; and – disassembly of existing products;
Product Analysis	• analyse the fitness for purpose of a product; • develop a specification; • design a product to meet specification criteria; • evaluate a product against detailed specification criteria; and • appreciate the main effects that historical influences and trends can have on the design of a product.

Content	Learning Outcomes
	Students should be able to:
Modelling	• appreciate the main benefits and limitations of the following modelling types: – mock-ups; – prototypes; and – computer modeling;
Communication of Ideas	• demonstrate an understanding of the following communication methods: – freehand sketching; – formal presentational drawings; – working drawings; – mood boards; – photography; – modelling; and – ICT;
Aesthetics	• demonstrate an understanding of the main visual elements of product design, including: – line, shape and form; – texture; – colour; – proportion; and – balance;
Ergonomics and Anthropometrics	• understand the relationship between people and products when considering the following ergonomic factors: – sight; – touch; – taste; – smell; – sound; – temperature; – movement; and – body dimensions;
	• appreciate how anthropometric data is used; and
Intellectual Property	• demonstrate knowledge and understanding of the main features of copyrights, trademarks and patents.

3.3.2 Materials, Components and Fabrication

Content	Learning Outcomes
	Students should be able to:
Selection of Materials	• select material and surface finish on the basis of a product's: – intended use; – the properties of its materials; – the shapes of available materials; and – the function of its finish;
Properties of Materials	• demonstrate knowledge and understanding of the following properties of materials: – strength (tensile, compressive, bending, shear and torsion); – hardness; – plasticity; – brittleness; – toughness; – durability; – heat/electrical conductivity; and – elasticity;
Shapes of Available Materials	• show an awareness of commonly available shapes of materials: – sheet; – bar; – tube; – angle; – U-shaped channel; and – I-shaped sections;
Wood	• demonstrate an understanding of the main characteristics and uses of the following: – hardwoods: ash and oak; – softwoods: parana pine and cedar; – manufactured boards: plywood and blockboard; and – application of veneer to manufactured boards; and • appreciate the causes and effects of wood shrinkage and expansion.

Content	Learning Outcomes
	Students should be able to:
Metal	• demonstrate an understanding of the main characteristics and uses of the following types of metal: – ferrous: high carbon steel and stainless steel; – non ferrous: aluminium and copper; and – alloy: the use of alloying to produce different properties and working characteristics; • demonstrate an understanding of the following heat treatments: – annealing; – hardening; and – tempering;
Plastic	• demonstrate an understanding of the main characteristics and uses of: – thermoplastics: acrylonitrile butadiene styrene (ABS) and nylon; and – thermosetting: epoxy resin and urea formaldehyde;
Smart Materials	• demonstrate an understanding of the main properties and uses of: – biodegradable plastic; – thermochromic pigments; – shape memory alloy (nithinol); and – polymorph; and
Jointing Forms	• demonstrate knowledge and understanding of the following forms of jointing: – mitred; – mortice and tenon; – lap; – housing; and – dovetail joints.

3.3.3 Manufacturing Practices

Content	Learning Outcomes
	Students should be able to:
Scale of Production	• compare the advantages and disadvantages associated with the following types of production: – one-off/jobbing; – batch; – mass; and – continuous;
Planning for Production	• demonstrate an understanding of the Gantt Chart methods used to plan and manage production;
Processes	• demonstrate an understanding of the main features and applications of the following: – reforming: injection moulding, die casting and extrusion; and – deforming: blow moulding, vacuum forming, line bending, metal folding, laminating and press moulding;
Hand Tools	• demonstrate an understanding of the main features and applications of the following types of: – saws: tenon saw, coping saw, ripsaw and hacksaw; – drills: hand drill, chuck and key, bradawal, drill bit, flat bit and countersunk bit; – hammers: claw, pin and ball pein; – planes and files: bench plane, flat file, round file and half-round file; and – chisels: wood chisel, gouger and cold chisel;
Machine and Power Tools	• demonstrate an understanding of the main features and applications of the following: – machine tools: circular saw, band saw, pillar drill, band facer, milling machine and lathe; and – power tools: jigsaw, drill, sander, circular saw and planer;
Computerised Production	• show an awareness of the main features of CAD and CAM; and • appreciate the main characteristics of coordinating stages in the production process using Computer Integrated Manufacture (CIM).

Content	Learning Outcomes
	Students should be able to:
Manufacturing Systems	• show an awareness of the main features of the following: – in-line assembly; – flexible manufacturing systems; and – just-in-time manufacture;
Industrial Practices	• show an awareness of the main features of the following: – standardised components and assemblies and bought in components; and – sub-contracting;
Quality Assurance and Control	• understand the main characteristics of quality assurance and quality control; and • be familiar with sample testing and tolerances.

3.3.4 Social Responsibility of Product Design and Market Influences

Content	Learning Outcomes
	Students should be able to:
Consumer Protection	• show an awareness of the main purpose of each of the following: – The Trades Descriptions Act (making it illegal to make false claims about products); – The Consumer Safety Act (enabling the government to ban or restrict the sale of dangerous products); and – The Sale of Goods Act (ensuring that a product is fit for its intended purpose);
Health and Safety	• show an awareness of the main purposes of safety standards and safety labelling (BSI/CE); • demonstrate an understanding of risk assessment: – What is the potential hazard? – Who could be harmed and how? – What can be done to prevent it from happening?
Sustainability of Resources	• consider the sustainability of the Earth's resources: – use of fossil fuels; and – sustainable hardwood and softwood plantations.

Content	Learning Outcomes
	Students should be able to:
Reduce, Reuse and Recycle	• appreciate the advantages and disadvantages of energy efficiency: – energy efficient lighting; – fuel efficiency in vehicles; and – home insulation; • demonstrate an understanding of the environmental benefits of recycling; • consider how the design of products can influence the problem of wastage (for example reducing packaging and a product's potential for reuse and recycling);
Ethical, Moral and Social Considerations	• consider ethical and moral implications associated with the design, manufacture and use of products; • demonstrate an understanding of the influence that trends can have on the design and eventual success of a product;
Marketing	• appreciate the importance of market research and the target audience; • show an awareness of the importance of advertising and publicity; and • demonstrate an understanding of the life cycle of a product: – inception; – introduction; – growth; – maturity; and – decline.

3.4 Unit 4: Design Assignment

This unit is **compulsory** for all students. Students are advised to spend **approximately 15 hours** on the Unit 4: Design Assignment. Students must ensure that their work does not exceed the page limits illustrated below. It carries a weighting of **20%**. The assignment enables students to demonstrate their capability to design a product under controlled conditions.

We issue **up to three** comparable tasks each year in September of the first year of study. Centres select the task that is best suited to their needs.

A medium limit of control applies to this unit.

Unit 4: Design Assessment	
Research Sheets	Three A4 pages
Design Sheets	Four A3 pages

Centres must submit students' research and reference materials along with their design sheets.

Please refer to Section 6.5 (Task taking) and Appendix 4 (Glossary of Terms for Controlled Assessment Regulations) for further guidance on the requirements for controlled assessment.

Guidance	**Evidence**
Students should provide reasons for their choice of research materials. They should include a range of graphical techniques, such as two dimensional, sectional view(s), pictorial and exploded views, and annotation. They should show attention to detail in their constructional design, with clarity in graphic details and using exploded sketches where appropriate. They should give reasons for their choice of materials and finish.	Students should show evidence of: • the appropriateness and quality of their reference/research materials; • their initial ideas or thoughts, concepts sketches, notes, and how they used their reference materials as a stimulus for inspiration; • designing for manufacture, highlighting how the parts are assembled and fit together; and • their selection of material(s) and preferred finish.

3.5 Unit 5: Design Project

This unit is **compulsory** for all students. However students must complete **either** Element 1: Systems Design and Manufacturing **or** Element 2: Product Design and Manufacturing. The design project carries a weighting of **40%** and has an approximate time limit of **30 hours**.

The project enables students to demonstrate their ability to design and manufacture a product in either a **Systems Design and Manufacturing** or a **Product Design and Manufacturing** element under controlled conditions.

We issue **up to three** comparable tasks each year in September of the first year of study, for each of the two elements. Centres select the task that is best suited to their needs. Students are advised to spend **approximately 15 hours** to produce their design portfolio, which they must complete under informal supervision. They also have **approximately another 15 hours** to produce their manufactured product or system, which they must complete under informal supervision.

If candidates complete the design portfolio element of the Unit 5 task in less time than the allocated 15 hours, they can use the remaining time for the production of their manufactured product or system.

Students must ensure that their work does not exceed the page limits illustrated below.

Unit 5: Design Portfolio	
Design Portfolio	Ten A3 pages

Please refer to Section 6.5 (Task taking) and Appendix 4 (Glossary of Terms for Controlled Assessment Regulations) for further guidance on the requirements for controlled assessment.

In each design project, the design portfolio is worth 20% and the manufactured product or system is worth 20%.

Design Portfolio (20%)

Element 1: Systems Design and Manufacturing Assignment

The **design portfolio** is an integral part of the design project. Each design project will have its own characteristics and relevant processes, but all design portfolios should cover all of the areas outlined below.

The design portfolio should include:

1) a description of the design opportunity or the problem identified, including a specification;
2) research and analysis of system(s) appropriate to the problem situation;
3) concept sketches or initial designs of system(s), whether mechanical, electronic, pneumatic or a combination of these;
4) development details communicating understanding of the proposed system(s), including modelling, assembly and display/housing details;

5) drawings explaining input–control–output, including diagrams that explain how the system(s) work; and
6) an evaluation and/or suggested modifications.

The portfolio size is limited to a **maximum of ten A3 sheets** or equivalent. There is a maximum text size; this size is comparable to a font size 14 using ICT.

Teachers must make students aware that their quality of written communication (QWC) in the design portfolio is assessed.

In Unit 5 Element 1, students should be able to develop their knowledge and understanding in the areas detailed below. In the portfolio, they are assessed on how they demonstrate the learning outcomes listed.

Design Portfolio: Systems Design	**Learning Outcomes**
	Students should be able to:
A design opportunity described or problem identified, including a specification	• clearly identify the problem or describe the design opportunity; • write a detailed and relevant specification;
Research/Analysis appropriate to the system(s)	• demonstrate research and analytical skills that are relevant to the client's brief or identified problem;
Concept sketches/ Systems design	• demonstrate a range of concept sketches/initial designs that show creativity, understanding and knowledge; • show how they have used their reference materials to good effect; • communicate using a range of graphical techniques;
Development of the proposed system(s) design	• show the design development and understanding of the chosen system(s); • show the development of the system, including modelling of assembly and display/housing details;
Drawings and/or models explaining how the system(s) works	• produce drawings explaining the input–control–output, including clear diagrams and annotation to explain how the system(s) work(s); • model the assembled system(s);
An evaluation and/or suggested modifications	• include an evaluation that highlights the key experiences; and • suggest modifications where appropriate.

In compiling their portfolios, students should aim to demonstrate the specific skills in designing, communicating and manufacturing detailed below.

Design Portfolio: Systems Design	**Mark Indicators**
	Students should be able to:
Designing	• clearly identify the problem or describe the design opportunity;
	• write a detailed and relevant specification;
	• demonstrate research and analytical skills that are relevant to the client's brief or identified problem;
	• show how research/reference materials are used to good effect;
	• demonstrate a range of concept sketches that show creativity, understanding and knowledge;
Communicating	• use a variety of sketching techniques to illustrate their ideas clearly, demonstrating 2D, pictorial and exploded drawings;
	• use annotation where appropriate to help explain their ideas or diagrams;
	• use solid modelling in 2D, 3D CAD or systems software, where appropriate;
	• produce drawing(s) to show the necessary detail, including dimensions for product manufacture;
Manufacturing Consider the manufacturing quality of the finished system(s) model	• demonstrate manufacturing capability, showing a range of modelling/making processes;
	• show manufacturing competence and techniques that reflect the standard and complexity expected at this level;
	• show quality of finish, accuracy and attention to detail;
	• demonstrate that they have given consideration to the safety of the users of the system(s); and
	• demonstrate the working performance of the system(s) under test conditions.

Design Portfolio: Systems Design	Mark Indicators
Energy and Control	Students should be able to: • design an appropriate operating system that includes understanding of input–control–output; • demonstrate an understanding of how the system(s) work(s); • clearly illustrate graphically the operating system(s); and • model the system to demonstrate its full operational use. The control system should demonstrate the required complexity expected at this level, for example 555 IC and PIC in electronics.

Element 2: Product Design and Manufacturing Assignment

The **design portfolio** is an integral part of the design project. Each design project will have its own characteristics and relevant processes, but all design portfolios should cover all of the areas outlined below.

The design portfolio should include:

1) a description of the design opportunity or the problem identified, including a specification;
2) research and analysis;
3) concept sketches;
4) development of idea(s), including fabrication details;
5) a working drawing, including details of jigs/templates; and
6) an evaluation and/or suggested modifications.

The portfolio size is limited to a **maximum of ten A3 sheets** or equivalent. There is a maximum text size; this size is comparable to a font size 14 using ICT.

Teachers must make students aware that their quality of written communication (QWC) in the design portfolio is assessed.

In Unit 5 Element 2, students should be able to develop their knowledge and understanding in the areas detailed below. In the portfolio, they are assessed on how they demonstrate the learning outcomes listed.

Design Portfolio: Product Design	**Learning Outcomes**
	Students should be able to:
Description of the design opportunity or the problem identified, including a specification	• clearly identify the problem or describe the design opportunity; • write a detailed and relevant specification;
Research and analysis	• demonstrate research and analytical skills that are relevant to the client's brief or identified problem;
Concept sketches	• demonstrate a range of concept sketches that show creativity and imagination; • show how they have used their reference materials to good effect; • communicate using a range of graphical techniques;
Development of idea(s), including fabrication details	• show the development of an idea or ideas, designing for creativity; • show the development of an idea when designing for manufacture;
A working drawing including details of jigs/templates	• show evidence of an orthographic drawing in 3rd angle; • model ideas and use templates where appropriate;
An evaluation and/or suggested modifications	• include a brief evaluation that highlights the key experiences; and • suggest modifications where appropriate.

In compiling their portfolios, students should aim to demonstrate the specific skills in designing, communicating and manufacturing detailed below.

Design Portfolio: Product Design	**Mark Indicators**
	Students should be able to:
Designing	• clearly identify the problem or describe the design opportunity; • write a detailed and relevant specification; • demonstrate research and analytical skills that are relevant to the client's brief or identified problem; • show how research/reference materials are used to good effect; • demonstrate a range of concept sketches that show creativity and imagination;
Communicating	• use a variety of sketching techniques to illustrate their ideas clearly, demonstrating 2D, pictorial and exploded drawings; • use annotation where appropriate to help explain their ideas; • use solid modelling in 3D CAD where appropriate; • produce orthographic drawing(s) to show the necessary detail, including dimensions for product manufacture;
Manufacturing Consider the manufacturing quality of the finished product/system	• demonstrate manufacturing capability, showing a range of making processes; • show manufacturing competence and techniques that reflect the standard and complexity expected at this level; • show quality of finish, accuracy and attention to detail; • show that they have given consideration to the safety of the users of the product/system; and • demonstrate the working performance of the product/system under test conditions.

Manufacturing (20%)

The following requirements refer to **both** the Product Design and the Systems Design options.

Manufacturing: Product or Systems Design	**Mark Indicators**
Consider the quality of the manufactured product or system The use of modelling, where appropriate, is to be encouraged	Student's work should shows evidence of: • manufacturing techniques that reflect the standard and complexity expected at this level; • the use of appropriate materials, processes and techniques that satisfy the design specification; • the use of templates, patterns, jigs and formers to assist in production; • the quality of finish, accuracy and attention to detail; • having given consideration to the safety of the users of the product; and • working performance of the product or system under test conditions.

4 Scheme of Assessment

4.1 Assessment opportunities

The availability of examinations and controlled assessment appears in Section 2 of this specification.

Candidates can choose to resit individual assessment units once. The better result for each assessment unit counts towards the GCSE qualification. Results for individual assessment units remain available to count towards a GCSE qualification until we withdraw the specification.

4.2 Assessment objectives

Below are the assessment objectives for this specification. Students must:

- recall, select and communicate their knowledge and understanding of technology and design in a range of contexts (AO1);
- apply skills, knowledge and understanding, in a variety of contexts and in designing and making products (AO2); and
- analyse and evaluate products, including their design and production (AO3).

4.3 Assessment objective weightings

The table below sets out the assessment objective weightings for each examination component and the overall GCSE qualification:

Assessment Objective	Component Weighting				Overall Weighting
	Unit 1	Unit 2 or Unit 3	Unit 4	Unit 5	
AO1	14%	8%	2%	4%	28%
AO2	4%	10%	12%	24%	50%
AO3	2%	2%	6%	12%	22%
Total	**20%**	**20%**	**20%**	**40%**	**100%**

4.4 Quality of written communication

In GCSE Technology and Design, students must demonstrate their quality of written communication. In particular, students must:

- ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear;
- select and use a form and style of writing appropriate to their purpose and to complex subject matter; and
- organise information clearly and coherently, using specialist vocabulary where appropriate.

The quality of students' written communication is assessed in their responses to questions or tasks that require extended writing. Teachers and examiners assess the quality of written communication within all assessment objectives and units in this specification.

4.5 Reporting and grading

We report the results of individual assessment units on a uniform mark scale that reflects the assessment weighting of each unit. We determine the grades awarded by aggregating the uniform marks obtained on individual assessment units.

We award GCSE qualifications on an eight grade scale from A*– G, with A* being the highest. For students who fail to attain a grade G, we report their results as unclassified (U).

The grades we award match the grade descriptions published by the regulatory authorities (see Section 5).

5 Grade Descriptions

Grade descriptions are provided to give a general indication of the standards of achievement likely to have been shown by candidates awarded particular grades. The descriptions must be interpreted in relation to the content in the specification; they are not designed to define that content.

The grade awarded depends in practice upon the extent to which the candidate has met the assessment objectives overall. Shortcomings in some aspects of candidates' performance in the assessment may be balanced by better performances in others.

Grade	Description
A	Candidates recall, select and communicate detailed knowledge and thorough understanding of design and technology, including its wider effects. They apply relevant knowledge, understanding and skills in a range of situations to plan and carry out investigations and tasks effectively. They test their solutions, working safely and with a high degree of precision. They analyse and evaluate the evidence available, reviewing and adapting their methods when necessary. They present information clearly and accurately, making reasoned judgements and presenting substantiated conclusions.
C	Candidates recall, select and communicate sound knowledge and understanding of design and technology, including its wider effects. They apply knowledge, understanding and skills in a range of situations to plan and carry out investigations and tasks. They test their solutions, working safely and with precision. They review the evidence available, analysing and evaluating some information clearly, and with some accuracy. They make judgements and draw appropriate conclusions.
F	Candidates recall, select and communicate knowledge and understanding of basic aspects of design and technology, including its wider effects. They apply limited knowledge, understanding and skills to plan and carry out simple investigations and tasks, with an awareness of the need for safety and precision. They modify their approach in the light of progress. They review their evidence and draw basic conclusions.

6 Guidance on Controlled Assessment

6.1 Controlled assessment review

We review our controlled assessment tasks every year to ensure that they continue to set an appropriate challenge and remain valid, reliable and stimulating.

6.2 Skills assessed by controlled assessment

Teachers must assess the following skills through controlled assessment:

- design creatively;
- make products;
- apply systems and control, digital media and new technologies; and
- analyse and evaluate processes and products.

In addition, elements of these skills may be assessed externally.

6.3 Level of control

Rules for controlled assessment in GCSE Technology and Design are defined for the three stages of the assessment:

- task setting;
- task taking; and
- task marking.

6.4 Task setting

There are two tasks for GCSE Technology and Design:

- Unit 4: Design Assignment (20% of overall award); and
- Unit 5: Design Project (40% of overall award).

Students should complete all aspects of the tasks.

The level of control for the setting of these tasks is high. We, therefore, provide a number of comparable tasks (up to three) for each unit and centres must choose the most appropriate task for their candidates. For example, the themes of the tasks might be 'A safe environment', 'Child safety', 'Safety on our roads' or 'Recycling for an improved environment'.

We issue the tasks in September of each year for candidates starting their first year of study. Centres **may** submit the completed tasks for Unit 4 in May of their first or second year. For Unit 5, centres **must** submit the completed tasks in May of their final year.

Centres wishing to contextualise the tasks to better suit their specific circumstances must contact us to obtain approval for their proposals.

6.5 Task taking

For Unit 4 and Unit 5, the level of control for task taking is medium. Information in the table below applies to both the Unit 4 and Unit 5 tasks except in instances where only one unit is specified:

Areas of Control	Detail of Control
Authenticity	Teachers must be able to authenticate the work as being the candidate's own. Teachers must ensure that candidates acknowledge and reference any ideas and sources used.
Feedback	Teachers must guide and supervise candidates in relation to the following: • monitoring progress; • preventing plagiarism; • ensuring compliance with health and safety requirements; • ensuring work is completed in accordance with the specification requirements; and • ensuring work can be assessed in accordance with the procedures and marking criteria. Candidates should reach their own conclusions. Teachers must record any support or guidance they give to candidates on the Candidate Record Sheet and adjust the marks appropriately.

Areas of Control	Detail of Control
Time Limit/Page Limit **Candidates work must not exceed the page limits**	**Unit 4: Design Assignment Portfolio** Research – **Three A4 pages** Design Sheets – **Four A3 pages** Candidates are advised to spend approximately 15 hours in total on the Design Assignment. Candidates may submit their work in May of their first year of study. Otherwise, they must submit their work in May of their final year of study.
	Unit 5: Design Project Portfolio – **Ten A3 pages** Manufacture product – **Ten A3 pages** Candidates are advised to spend approximately 15 hours on the portfolio component of unit 5 and approximately a further 15 hours on the production of their manufactured product or system. Candidates must submit their work in May of their final year.
Collaboration	Candidates' work may be informed by working with others, but each candidate must provide an individual response.
Resources	Candidates' access to resources is determined by those available to the centre. Centres with limited resources or with candidates who need to use special equipment must contact us for advice on how to proceed before offering this course to their candidates.

6.6 Task marking

For both tasks, the level of control for task marking is medium.

Teachers must mark the controlled assessment tasks for both units in accordance with the supplied marking criteria and mark bands in Appendices 1, 2 and 3.

Candidates work must be marked at least two weeks prior to the CCEA submission date to allow teachers time to annotate and complete candidate record sheets appropriately.

Teachers must ensure that the work they mark is the candidate's own. For up-to-date advice on plagiarism or any other incident in which candidate malpractice is suspected,

please refer to the Joint Council for Qualifications' *Suspected Malpractice in Examinations and Assessments: Policies and Procedures* on the JCQ website at www.jcq.org.uk

6.7 Internal standardisation

Centres with more than one teaching group must carry out internal standardisation of the controlled assessment tasks before submitting them to us. This is to ensure, as far as possible, that each teacher has applied the assessment criteria consistently when marking assessments.

6.8 Moderation

This qualification is subject to visiting moderation. We will provide instructions on the details of moderation in advance of first teaching.

6.9 Drafting/redrafting

Teachers must not correct candidates' work in detail and return it to them to write up a fair copy. Responsibility for drafting a piece of work towards completion lies entirely with the candidate. Once a candidate has submitted the assignment and it has been awarded a mark, that mark is final. The candidate may not carry out further work.

See Appendix 4 for a glossary of terms for controlled assessment.

7 Links

7.1 Support

We provide the following resources to support this specification:

- our website;
- a subject microsite within our website;
- specimen papers and mark schemes; and
- controlled assessment tasks.

Some support material from the previous specification may also remain useful.

We intend to expand our range of support to include the following:

- past papers;
- mark schemes;
- Chief Examiner's reports;
- Principal Moderator's reports;
- guidance on progression from Key Stage 3;
- schemes of work;
- centre support visits (on request);
- support days for teachers;
- agreement trials;
- student guides;
- controlled assessment guidance for teachers; and
- exemplification of standards.

You can find our Annual Support Programme of events and materials for Technology and Design on our website at www.ccea.org.uk

7.2 Curriculum objectives

This specification addresses and builds upon the broad curriculum objectives for Northern Ireland, England and Wales. In particular, it enables students to:

- develop as individuals and contributors to the economy, society and environment;
- progress from Key Stage 3 Northern Ireland Curriculum requirements;
- focus on spiritual, moral, ethical, social, legislative (including equality and disability discrimination), economic and cultural issues through the study of the social responsibility of product design and market influences, designing, systems and production;
- learn about sustainable development, health and safety considerations and European developments through the study of processes, innovation, design and development;
- address aspects of the 'skills agenda' and employability; and
- develop skills in the effective use of technology.

For further guidance on how this specification enables progression from the Northern Ireland Curriculum at Key Stage 3, go to our subject microsite, which you can access at www.ccea.org.uk

7.3 Key Skills

This specification provides opportunities for students to develop and generate evidence for assessing the following nationally recognised Key Skills:

- Application of Number
- Communication
- Improving Own Learning and Performance
- Information and Communication Technology
- Problem-Solving
- Working with Others.

You can find details of the current standards and guidance for each of these skills on the QCA website at www.qca.org.uk

7.4 Examination entries

Entry codes for this subject and details on how to make entries are available on our Examinations Administration Handbook microsite, which you can access at www.ccea.org.uk

Alternatively, you can telephone our Examination Entries, Results and Certification team using the contact details provided in this section.

7.5 Equality and inclusion

We have considered the requirements of equalities legislation in developing this specification.

GCSE qualifications often require the assessment of a broad range of competences. This is because they are general qualifications and, as such, prepare students for a wide range of occupations and higher level courses.

The revised GCSE and qualification criteria were reviewed to identify whether any of the competences required by the subject presented a potential barrier to any students with disabilities. If this was the case, the situation was reviewed again to ensure that such competences were included only where essential to the subject. The findings of this process were discussed with disability and equality groups and with people with disabilities.

During the development process, we carried out an equality impact assessment. This was to ensure that we identified any additional potential barriers to equality and inclusion. Where appropriate, we have given consideration to measures to support access and mitigate against barriers.

Reasonable adjustments are made for students with disabilities in order to reduce barriers to access assessments. For this reason, very few students will have a complete barrier to any part of the assessment. Learners with a physical disability may be limited in the range of designing and making contexts they can use, but this should not pose a barrier to assessment. For example, students may use CAD/CAM for the making process, and practical assistants may be used to support students with physical disabilities in this process. Students with a visual impairment may find elements of the assessment difficult, such as graphics; however, there should be no additional barriers to assessment.

It is important to note that where access arrangements are permitted, they must not be used in any way that undermines the integrity of the assessment. **You can find information on reasonable adjustments in the Joint Council for Qualifications' document *Access Arrangements and Special Consideration: Regulations and Guidance Relating to Candidates Who Are Eligible for Adjustments in Examinations*.**

7.6 Contact details

The following list provides contact details for relevant staff members and departments:

- Specification Support Officer: Nuala Braniff
  (telephone: (028) 9026 1200, extension 2292, email: nbraniff@ccea.org.uk)

- Officer with Subject Responsibility: Judith Ryan
  (telephone: (028) 9026 1200, extension 2133, email: jryan@ccea.org.uk)

- Examination Entries, Results and Certification
  (telephone: (028) 9026 1262, email: entriesandresults@ccea.org.uk)

- Examiner Recruitment
  (telephone: (028) 9026 1243, email: appointments@ccea.org.uk)

- Distribution (past papers and support materials)
  (telephone: (028) 9026 1242, email: cceadistribution@ccea.org.uk)

- Support Events Administration
  (telephone: (028) 9026 1401, email: events@ccea.org.uk)

- Information Section (including Freedom of Information requests)
  (telephone: (028) 9026 1200, email: info@ccea.org.uk)

- Business Assurance (appeals)
  (telephone: (028) 9026 1244, email: appealsmanager@ccea.org.uk).

Appendix 1

Assessment Criteria and Mark Bands for Unit 4: Design Assignment

External Design Assignment (20%)	Mark Descriptors	Mark Bands
Appropriateness and quality of the reference/research materials	Understanding of the design context Good quality relevant research Appropriate annotation	7–10
	Some understanding of the design context Research which has some relevance Some annotation	4–6
	Limited understanding Research with limited relevance Little or no annotation	1–3
How reference materials have been used as a stimulus Initial ideas/thoughts and concept sketches, including notes/annotation	Annotation included Effective use of reference materials Evidence of connections to quality design outcomes	16–20
	Some annotation included Good use of reference materials Some evidence of connections to outcomes	8–15
	Little or no annotation included Limited use of reference materials Little evidence of connections to outcomes	1–7
Using graphics and annotation to communicate ideas and fabrication details Designing for manufacture showing all assembly details	A range of freehand sketching techniques demonstrating good skills including detailed annotation	16–20
	A limited range of freehand sketching techniques demonstrating a degree of skills with some annotation	8–15
	Few freehand sketching techniques demonstrating limited skills and with little or no annotation	1–7
Material(s) selection and reasons for use	Appropriate materials selected with good justification for their use	7–10
	Some appropriate materials selected with some reasons to justify their use	4–6
	Inappropriate materials selected with few reasons justifying their use	1–3

When a student has not provided evidence for any of the criteria above and their work is not worthy of credit a zero, 0, mark should be awarded.

Appendix 2

Assessment Criteria and Mark Bands for Unit 5: Design Project – Systems Design

Design Portfolio (20%)	Mark Descriptors	Mark Bands
1) A design opportunity described or problem identified, including a specification The problem clearly identified or the design opportunity described A detailed and relevant specification	A clear understanding and full description of the design opportunity/problem situation A detailed specification which identifies the main points Spelling, punctuation, grammar and legibility are excellent The form and style of writing are of a high standard and specialist terms are used appropriately at all times	5–6
	Some understanding shown with a description of the key aspects of the problem situation A specification with some of the key points identified Spelling, punctuation, grammar and legibility are good in most cases The form and style of writing are good and specialist terms are used appropriately in some cases	3–4
	A limited understanding and description of the design opportunity A specification with a few points identified Spelling, punctuation, grammar and legibility are limited The form and style of writing are generally inappropriate as is the use of specialist terms	1–2

Design Portfolio (20%)	Mark Descriptors	Mark Bands
2) Research/Analysis appropriate to the System(s) Evidence of research and analytical skills that are relevant to the client's brief or identified problem	Good research and analytical skills appropriate to the problem including clear and detailed annotation Good use of reference materials showing connections to the problem Spelling, punctuation, grammar and legibility are excellent The form and style of writing are of a high standard and specialist terms are used appropriately at all times	5–6
	Some appropriate research with a degree of analytical skills showing some understanding and annotation A limited use of reference materials showing some connections to the identified problem Spelling, punctuation, grammar and legibility are good in most cases The form and style of writing are good and specialist terms are used appropriately in some cases	3–4
	Weak research skills, few analytical skills and limited understanding Limited use of reference materials showing little or no connections to the problem Spelling, punctuation, grammar and legibility are limited The form and style of writing are generally inappropriate, as is the use of specialist terms	1–2
3) Concept Sketches/Systems Design Graphics and annotation used to communicate ideas clearly	A range of quality concept sketches that show creativity, knowledge and understanding of the system(s) including detailed annotation	15–20
	A range of concept sketches that show some creativity and some understanding of the system(s) with annotation	9–14
	Few concept sketches showing little creativity or understanding and little or no annotation	1–8

Design Portfolio (20%)	Mark Descriptors	Mark Bands
4) Development of the proposed system(s) design Showing the development of the proposed system(s) design	Good development of the chosen system(s) design showing detailed understanding	7–10
	Some development of the chosen system(s) design with some understanding evident	4–6
	Little or no development of the chosen design and with limited understanding	1–3
5) Drawings/Models Explaining how the system(s) works	Detailed drawings explaining the Input–Control–Output; quality diagrams and annotation that fully explain how the system(s) work(s)	8–12
	Drawings with some detail explaining the Input–Control–Output; diagrams and some annotation that explains to an extent how the system(s) work(s)	4–7
	Drawings with little detail and explanation of the Input–Control–Output; few diagrams and little annotation to explain how the system(s) work(s)	1–3
6) Evaluation and/or suggested modifications	A detailed evaluation that demonstrates a depth of thought with valid modifications Spelling, punctuation, grammar and legibility are excellent The form and style of writing are of a high standard and specialist terms are used appropriately at all times	5–6
	An evaluation that demonstrates some thought with modifications Spelling, punctuation, grammar and legibility are good in most cases The form and style of writing are good and specialist terms are used appropriately in some cases	3–4
	A weak evaluation that demonstrates little thought and few quality modifications Spelling, punctuation, grammar and legibility are limited The form and style of writing are generally inappropriate as is the use of specialist terms	1–2

When a student has not provided evidence for any of the six criteria above and their work is not worthy of credit a zero, 0, mark should be awarded.

Manufacturing (20%): System Design	**Mark Descriptors** General Description	**Mark Bands**
The assessment of the project should be based on holistic marking, given the subjective nature of this type of work.	**Excellent** The product/system incorporates a wide range of processes Excellent skills demonstrating precision and accuracy of fabrication techniques High quality and appropriate finishing techniques	17–20
	Very Good The product/system incorporates a wide range of processes Very good skills demonstrating precision and accuracy of fabrication techniques Very good quality and appropriate finishing techniques	13–16
	Good The product/system incorporates an appropriate range of processes Good skills demonstrating some precision and accuracy of fabrication techniques Good and appropriate finishing techniques	9–12
	Satisfactory The product/system incorporates a satisfactory range of processes Satisfactory skills demonstrating limited precision and accuracy of fabrication techniques Satisfactory finishing techniques	5–8
	Limited The product/system incorporates only a few manufacturing processes Limited skills demonstrating limited precision and accuracy of fabrication techniques Limited finishing techniques	1–4

When a student's work is not worthy of credit, a zero, 0, mark should be awarded.

Appendix 3

Assessment Criteria and Mark Bands for Unit 5: Design Project – Product Design

Design Portfolio (20%)	Mark Descriptors	Mark Bands
1) A design opportunity described or problem identified, including a specification The problem clearly identified or the design opportunity described A detailed and relevant specification	A clear understanding and full description of the design opportunity/problem situation A detailed specification which identifies the main points Spelling, punctuation, grammar and legibility are excellent The form and style of writing are of a high standard and specialist terms are used appropriately at all times	5–6
	Some understanding shown with a description of the key aspects of the problem situation A specification with some of the key points identified Spelling, punctuation, grammar and legibility are good in most cases The form and style of writing are good and specialist terms are used appropriately in some cases	3–4
	A limited understanding and description of the design opportunity A specification with a few points identified Spelling, punctuation, grammar and legibility are limited The form and style of writing are generally inappropriate, as is the use of specialist terms	1–2

Design Portfolio (20%)	Mark Descriptors	Mark Bands
2) Research/Analysis Evidence of research and analytical skills that are relevant to the client's brief or identified problem	Good research and analytical skills appropriate to the problem, including clear and detailed annotation Good use of reference materials showing connections to the problem Spelling, punctuation, grammar and legibility are excellent The form and style of writing are of a high standard and specialist terms are used appropriately at all times	5–6
	Some appropriate research with a degree of analytical skills showing some understanding and annotation A limited use of reference materials showing some connections to the identified problem Spelling, punctuation, grammar and legibility are good in most cases The form and style of writing are good and specialist terms are used appropriately in some cases	3–4
	Weak research skills, few analytical skills and limited understanding Limited use of reference materials showing little or no connections to the problem Spelling, punctuation, grammar and legibility are limited The form and style of writing are generally inappropriate, as is the use of specialist terms	1–2
3) Concept Sketches Graphics and annotation used to communicate ideas clearly	A range of quality concept sketches that show creativity and imagination including detailed annotation	15–20
	A range of concept sketches that show some creativity and imagination with annotation	9–14
	Few concept sketches showing little creativity or imagination and little or no annotation.	1–8

Design Portfolio (20%)	Mark Descriptors	Mark Bands
4) Development of idea(s) including fabrication details Designing for manufacture showing the assembly details	Development of the chosen idea showing most of the assembly detail	7–10
	Some development of the solution showing some of the assembly details	4–6
	Little or no development of the idea and limited assembly details shown	1–3
5) Working Drawing(s) including details of jigs/templates	Quality working drawing(s) showing most of the details necessary for manufacture	8–12
	A working drawing showing some of the detail necessary for manufacture	4–7
	A working drawing showing few details and not suitable for manufacture	1–3
6) Evaluation and/or suggested modifications	A detailed evaluation that demonstrates a depth of thought with valid modifications Spelling, punctuation, grammar and legibility are excellent The form and style of writing are of a high standard and specialist terms are used appropriately at all times	5–6
	An evaluation that demonstrates some thought with modifications Spelling, punctuation, grammar and legibility are good in most cases The form and style of writing are good and specialist terms are used appropriately in some cases	3–4
	A weak evaluation that demonstrates little thought and few quality modifications Spelling, punctuation, grammar and legibility are limited The form and style of writing are generally inappropriate, as is the use of specialist terms	1–2

When a student has not provided evidence for any of the six criteria above and their work is not worthy of credit a zero, 0, mark should be awarded.

Manufacturing: Product Design (20%)	**Mark Descriptors** General Description	**Mark Bands**
The assessment of the project should be based on holistic marking, given the subjective nature of this type of work.	**Excellent** The product/system incorporates a wide range of processes Excellent skills demonstrating precision and accuracy of fabrication techniques High quality and appropriate finishing techniques	17–20
	Very Good The product/system incorporates a wide range of processes Very good skills demonstrating precision and accuracy of fabrication techniques Very good quality and appropriate finishing techniques	13–16
	Good The product/system incorporates an appropriate range of processes Good skills demonstrating some precision and accuracy of fabrication techniques Good and appropriate finishing techniques	9–12
	Satisfactory The product/system incorporates a satisfactory range of processes Satisfactory skills demonstrating limited precision and accuracy of fabrication techniques Satisfactory finishing techniques	5–8
	Limited The product/system incorporates only a few manufacturing processes Limited skills demonstrating limited precision and accuracy of fabrication techniques Limited finishing techniques	1–4

When a student's work is not worthy of credit, a zero, 0, mark should be awarded.

Appendix 4
Glossary of Terms for Controlled Assessment Regulations

Term	Definition
Component	A discrete, assessable element within a controlled assessment/qualification that is not itself formally reported and for which the awarding body records the marks May contain one or more tasks
Controlled assessment	A form of internal assessment where the control levels are set for each stage of the assessment process: task setting, task taking, and task marking
External assessment	A form of independent assessment in which question papers, assignments and tasks are set by the awarding body, taken under specified conditions (including detailed supervision and duration) and marked by the awarding body
Formal supervision (High level of control)	The candidate must be in direct sight of the supervisor at all times. Use of resources and interaction with other candidates is tightly prescribed.
Informal supervision (Medium level of control)	Questions/tasks are outlined, the use of resources is not tightly prescribed and assessable outcomes may be informed by group work. Supervision is confined to: • ensuring that the contributions of individual candidates are recorded accurately; and • ensuring that plagiarism does not take place. The supervisor may provide limited guidance to candidates. 'Whatever arrangements are made, the teacher or supervisor must be able to state that what the candidate has presented for assessment is the candidate's own work. This can be assured by close supervision of portfolio work which may have been started in class and completed in the candidate's own time or, alternatively, started beyond the classroom and completed in class. Analytical discussion with the candidate about his/her work would be one method of ensuring authenticity.' (Regulatory statement) This means that in technology and design were it may be necessary for candidates to complete part of the assessment outside the classroom the teacher should

Term	Definition
	ensure that they can authenticate the work as the candidates own. The amount of work carried out during class time should be sufficient for the teacher/supervisor to determine each candidate's capability in relation to what is presented for assessment, for example through analytical discussion with the candidate about his/her work. A medium level of control is intended to ensure that candidates have every opportunity to produce their own, creative work and that teachers can confirm its validity.
Limited supervision (Low level of control)	Requirements are clearly specified, but some work may be completed without direct supervision and will not contribute directly to assessable outcomes.

Term	Definition
Mark scheme	A scheme detailing how credit is to be awarded in relation to a particular unit, component or task Normally characterises acceptable answers or levels of response to questions/tasks or parts of questions/tasks and identifies the amount of credit each attracts May also include information about unacceptable answers
Task	A discrete element of external or controlled assessment that may include examinations, assignments, practical activities and projects
Task marking	Specifies the way in which credit is awarded for candidates' outcomes Involves the use of mark schemes and/or marking criteria produced by the awarding body
Task setting	The specification of the assessment requirements Tasks may be set by awarding bodies and/or teachers, as defined by subject-specific regulations. Teacher-set tasks must be developed in line with awarding body specified requirements.
Task taking	The conditions for candidate support and supervision, and the authentication of candidates' work Task taking may involve different parameters from those used in traditional written examinations. For example, candidates may be allowed supervised access to sources such as the internet.
Unit	The smallest part of a qualification that is formally reported and can be separately certificated May comprise separately assessed components

Summary of Changes since First Issue

(all document changes are marked in red)

Revision History Number	Date of Change	Page Number	Change Made
Version 1	N/A	N/A	First issue

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