Specification

Edexcel GCSE in Design & Technology: Systems & Control Technology (1974)

First examination 2003

September 2002

Edexcel

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This specification is Issue 2 and is valid for examination from summer 2003. Key changes to requirements are sidelined. Centres will be informed in the event of changes to this specification. The latest issue can be found on the Edexcel website, www.edexcel.org.uk

Acknowledgements

This specification has been produced by Edexcel on the basis of consultation with teachers, examiners, consultants and other interested parties. Edexcel recognises and values all those who contributed their time and expertise to the development of GCSE specifications.

Authorised by Peter Goff

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Contents

Introduction

Edexcel offers a suite of full and short course GCSEs in Design & Technology. GCSE in Design & Technology: Systems & Control Technology is one of a suite of five endorsed titles. Students should have the opportunity, where appropriate, to incorporate materials from other focus areas. The other endorsed titles are:

- Textiles Technology
- Food Technology
- Resistant Materials Technology
- Graphic Products.

All five endorsed titles are consistent with Edexcel's AS/Advanced GCEs in Design & Technology:

- Product Design (Resistant Materials Technology, Graphics with Materials Technology and Textiles Technology)
- Systems & Control Technology
- Food Technology.

GCSE Design & Technology provides an interesting course for students who do not want to follow the AS/Advanced GCE in Design & Technology.

All specifications in the suite have an identical structure and assessment strategy.

Key features

- Two routes:
  - electronics
  - mechanisms.
- Maximum coursework project (design and make task) weighting (60%) in a single coursework project.
  - A new simple progressive mark scheme aimed to make coursework marking easier.
  - Project is a single design and make task and portfolio (40 hours).
  - Project can be either:
    - ~ electronic products
    - ~ mechanisms product
    - ~ electro-mechanical (integrated) product

    irrespective of which route is studied for the examination.
- Terminal examination worth 40%.
  - Students elect to study either electronics or mechanisms for their examination.
  - Clear links between content of specification, assessment objectives and questions in the terminal examination.
  - A design question and product analysis question appears in the 1½ hour examination.
- The full course can be co-taught with the short course.
- Focused insets provided by senior examiners and specialist technologists.

Summary of the specification content

The content is derived from the Key Stage 4 Programme of Study requirements, which have been grouped under the following titles.

AO1	**Classification and selection of materials and components** **Preparing, processing and finishing materials** **Manufacturing commercial products**
AO2	**Designing and making**
AO3	**Design and market influence (including wider effects of design and technology on society)**

This GCSE specification has been written against the Key Stage 4 Programme of Study for England and Northern Ireland. Students entering for this GCSE in England and Northern Ireland and Wales must be taught all the material required by the National Curriculum in their own country.

Summary of scheme of assessment

The scheme of assessment is as follows.

	External assessment Terminal Examination		**Internal assessment Coursework Project***	
Weighting	40%		60%	
Foundation Tier (G to C)	Paper 2F	Time: 1½ hrs	Paper 01 Coursework Project	Time: no more than 40 hrs
Higher Tier (D to A*)	Paper 2H			

*The coursework project is **not** tiered.

Availability of external assessment

First assessment of this specification will be in June 2003. Assessment will be available in each summer examination session thereafter.

Prior learning and progression

This specification builds on the knowledge, understanding and skills established by the National Curriculum at Key Stages 1, 2 and 3. It provides a foundation for further study at levels 2 and 3 in the National Qualifications Framework, including Edexcel's AS/Advanced GCEs in Design & Technology and Advanced Vocational Certificates of Education in Manufacturing and Engineering.

Forbidden combinations and links with other subjects

Every specification is assigned a national classification code indicating the subject area to which it belongs. Centres should be aware that students who enter for more than one GCSE qualification with the same classification code will have only one grade (the highest) counted for the purpose of the school and college performance tables.

The classification code for this specification is 9060.

The specification provides complementary links with the Edexcel Foundation and Intermediate GNVQs in Manufacturing and Engineering.

Specification aims and assessment objectives

National Qualifications Framework criteria

This specification is based on the common criteria and the GCSE criteria, which are prescribed by the regulatory authorities, including the Qualifications Curriculum Authority (QCA) and are mandatory for all awarding bodies. It is also derived from the prescribed subject criteria for Design & Technology.

Aims

- Specification consistent with National Curriculum requirements.
- Requires students to demonstrate fully their design and technology capability, they need to combine skills with knowledge and understanding in order to design and make quality products.
- Allows students to acquire and apply knowledge, skills and understanding through:
  - analysing and evaluating products and processes
  - engaging in focused tasks to develop and demonstrate techniques
  - engaging in strategies for developing ideas, planning and producing products
  - considering how past and present design and technology, relevant to a designing and making context, affects society
  - recognising the moral, cultural and environmental issues inherent in design and technology.

Knowledge, skills and understanding

Students are expected to:

- acquire and apply knowledge and understanding of:
  - product design and market influence including the wider effects of design and technology on society
  - classification and selection of materials and components
  - preparing, processing and finishing components and materials
  - manufacturing commercial products
- acquire and apply skills of:
  - design development
  - production planning and making
  - communication and product evaluation.

Assessment objectives

All students demonstrate their design and technology capability through acquiring and applying knowledge, skills and understanding:

- AO1 of materials, components, processes, techniques and industrial practice
- AO2 when designing and making quality products
- AO3 when evaluating processes and products and examining the wider effects of design and technology on society.

The assessment objectives will be assessed in the coursework project and terminal written paper in approximately the following proportions.

Assessment objective	Coursework	Written paper	Total
AO1	5%	15%	20%
AO2	50%	10%	60%
AO3	5%	15%	20%

Scheme of assessment

Entry tiers

Students for this qualification must be entered for one of two tiers.

The grades available for each tier are as follows:

Tier	Grades available
Foundation	G to C
Higher	D to A*

A safety net is provided for students entered for the Higher Tier in the form of an allowed grade E . Students failing to achieve grade E on the Higher Tier will be reported as Unclassified.

Assessment of the specification consists of coursework Paper 01 and Paper 2F **or** coursework – Paper 01 and Paper 2H.

Coursework – Paper 01
Portfolio and product – no more than 40 hours

The following tables show the question styles/types candidates should expect to be tested on in the examination. Each question is targeted at a particular assessment objective and specification content as detailed in the tables. Questions may appear on the examination papers in any order to maximise the accessibility of the papers for candidates. The only exception to this is the common product analysis question, which forms the overlap between the two tiers. This will always appear as Question 4 – Foundation Tier and Question 1 – Higher Tier. This question covers the overlap-targeted grades D and C.

Paper 2F			
Question	**Assessment objective tested**	**Content covered by question**	**Question style/type**
1, 2, 3	AO1	Preparing, processing and finishing materials and manufacturing commercial products.	Structured questions on a theme.
	AO1 + AO3	Classification and selection of materials and components. Design and market influence, and the wider effects of design and technology on society, parts (i) and (ii).	Structured questions on a theme.
	AO2	Design question. This question accounts for designing and making assessment criteria.	Design question – students design a product from a specification and evaluate against the specification.
4	AO3	Design and market influence and the wider effects of design and technology on society, part (iii).	Product analysis – students are asked to analyse a product following the analysis process.

Paper 2H			
Question	**Assessment objective tested**	**Content covered by question**	**Question style/type**
1	AO3	Design and market influence and the wider effects of design and technology on society, part (iii).	Product analysis – students are asked to analyse a product following the analysis process.
2, 3, 4	AO1	Preparing, processing and finishing materials and manufacturing commercial products.	Structured questions on a theme.
	AO1 + AO3	Classification and selection of materials and components. Design and market influence, and the wider effects of design and technology on society, parts (i) and (ii).	Structured questions on a theme.
	AO2	Design question. This question accounts for designing and making assessment criteria.	Design question – students design a product from a specification and evaluate against the specification.

Internal assessment moderation procedures

To assist centres and provide all the information required within this document, detailed internal assessment moderation procedures are given in *Appendix 2*. If it proves necessary to amend these procedures in any way in the future, centres will receive separate notification.

Quality of written communication (QoWC)

The quality of written communication will be assessed in the coursework as part of AO2.

Students will be assessed on their ability to:

- present relevant information in a form that suits its purpose
- ensure text is legible and that spelling, punctuation and grammar are accurate, so that meaning is clear
- use a suitable structure and style of writing.

Awarding, reporting and equivalence

The grading, awarding and certification of this specification will comply with the requirements of the GCSE and GCE A/AS Code of Practice for courses starting in September 2001, which is published by QCA. Qualifications will be graded and certificated on an eight grade scale from A* to G.

GCSEs have broad equivalence to General National Vocational Qualifications in the following terms:

- two GCSEs at grade D to G and two GCSEs at grade A* to C are equivalent to one three-unit GNVQ at Foundation and Intermediate level respectively
- four GCSEs at grades D to G and four GCSEs at grade A* to C are equivalent to one six-unit GNVQ at Foundation and Intermediate level respectively.

Assessment language

Assessment of this specification will be available in English only. Assessment materials will be published in English only and all written and spoken work submitted for examination and moderation must be produced in English.

Students with particular requirements

Regulations and guidance relating to students with special requirements are published annually by the Joint Council for General Qualifications and are circulated to examinations officers. Further copies of guidance documentation may be obtained from the following address or by telephoning 0870 240 9800.

Edexcel will assess whether or not special consideration or concession can be made for students with particular requirements. Requests should be addressed to:

Special Requirements
Edexcel Foundation
Stewart House
32 Russell Square
London WC1B 5DN

Private candidates

This specification is **not** available to private candidates.

Specification content

AO1	**Classification and selection of materials and components** **Preparing, processing and finishing materials** **Manufacturing commercial products**
AO2	**Designing and making**
AO3	**Design and market influence (including wider effects of design and technology on society)**

The coursework assessment criteria for AO2, the design and make process, are outlined on pages 26 – 27. These criteria are applied to **both** the design question in the terminal examination and the coursework project.

The following knowledge and understanding of AO1 and AO3 will be assessed through the terminal examination, this will also be assessed in an applied way through the coursework project.

Electronics

a Classification and selection of materials and components (AO1)	
Students should be taught:	**Specific content**
i Components and materials can be classified according to properties and working characteristics	
Knowledge and understanding of components	Components can be classified as follows: • input • process • output.
Knowledge and understanding of materials	Understanding the working properties related to forming and joining that make the following materials suitable for use in product cases. • Woods – pine and manufactured boards, ie MDF. • Plastics – acrylic, rigid polystyrene. • Metals – aluminium sheet, copper, mild steel.

a Classification and selection of materials and components (AO1)	
Students should be taught:	**Specific content**
Knowledge and understanding of power sources	**Power sources** Use selected power supplies safely. Identify and select appropriate power sources for applications from zinc carbon batteries, alkaline batteries, NiCad rechargeable batteries, solar cells and mains power supply units.
Knowledge and understanding of input devices	**Switches** Recognise and use common switch types including toggle slide, rocker, key, micro, reed, rotary, membrane, tilt, push-to-make, push-to-break and the transistor as a switch. Understand the meaning of SPST, SPDT, DPDT. **Sensors** • Thermistors • LDR • Moisture Understand the resistance change of light dependent resistors (LDR), thermistors and moisture sensors in response to altered conditions of light, temperature and moisture respectively.
Knowledge and understanding of process devices	**Resistors** Understand and use resistors to control the flow of current in a circuit and use Ohm's law calculations to determine current flowing through a resistor and voltage acting across a resistor in circuits. Understand and use potentiometers for controlling current and voltage in circuits. Use the resistor colour code to determine resistor values. Understand the terms tolerance and preferred value. Calculate the value of resistor networks in series and parallel. **Capacitors** Understand that capacitors store electric charge, the units of measurement and that there are polarised and non-polarised types.

a Classification and selection of materials and components (AO1)	
Students should be taught:	**Specific content**
Knowledge and understanding of process devices	**Diodes** Understand the action of a diode, ie current is allowed to flow freely in one direction only, and its use to protect other components from back EMF. **Thyristors** Understand and describe the action of a thyristor as a simple latch in circuits. **Operational amplifiers** Understanding an op-amp: • as a comparator (relationship between inverting and non-inverting inputs and the outputs) • as an inverting amp • controlling gain using a feedback resistor • using dual power supply. **Programmable Interface Controllers (PICs)** Understand how PICs can be programmed: • to use flowcharts when designing programs • to switch an output on and off in response to an input • with simple routines to control output devices, including delays • to perform sequential tasks.
Knowledge and understanding of output devices	**Output devices** Understand and use in applications the following: motors, buzzers, bells, solenoids, LEDs, lamps, loudspeakers, relays, 7-segment counter displays with counter decoder/driver ICs. Use LEDs safely in circuits. Calculate the value of a series resistor used to protect an LED.

a Classification and selection of materials and components (AO1)	
Students should be taught:	**Specific content**
ii That to achieve the optimum use of components and materials they need to take into account the relationship between material, form and intended manufacturing process	
How different working properties of materials affect finished products.	Select and use appropriate materials in the manufacture of quality cases to contain electronic circuitry.
How different performance properties of components affect finished products.	Select and use appropriate components in the design of quality electronic circuits using the following criteria: • resistance • electrical insulation/conductivity • tolerance • thermal.

b Preparing, processing and finishing materials (AO1)	
Students should be taught:	**Specific content**
i How components and materials can be combined and processed to create more useful properties and how these changes are used in industry	**Combining and processing** • Use appropriate materials in the manufacture of quality cases to contain electronic circuitry, ie polystyrene, acrylic, MDF and aluminium sheet. • Use of adhesives, ie common wood and plastic adhesives/solvent cements. • Understand and describe the forming and joining processes of injection moulding, vacuum forming, soldering, blow moulding, line bending.
ii How control systems and sub-systems can be designed, used and connected to achieve different purposes including the use of feedback	**Components** • Use potential dividers in circuits and use calculations to determine output values. **Logic** • Understand and describe digital and analogue signals. • Construct truth tables for a NOT gate and the following 2-input logic gates AND, OR, NAND, NOR. • Use NOT gates to create a bistable. • Solve problems using 2-input logic gates in combination. **Timers** • Understand how a capacitor and resistor are used to create a time delay. • Understand how a 555 timer IC can be used to produce a monostable timing action and calculate its time period. • Use a 555 timer IC to create a pulse generator (astable) and be able to adjust its frequency. • Understand equal and unequal mark/space ratios. **Interface devices** • Understand the use of a transistor or Darlington pair as a transducer driver (npn only). • Understand how a field effect transistor is used in circuits. • Understand how a relay is used as an interface between primary and secondary circuits.

b Preparing, processing and finishing materials (AO1)	
Students should be taught:	**Specific content**
iii About a variety of finishing processes and why they are important for functional, safety and aesthetic reasons	**Finishing processes** Understand and use appropriate finishing processes and techniques in the assembly of circuit boards and cases including: • removing unwanted waste • applying surface finishes and details, ie painting, polishing, dip coating, varnishing • twisting together loose or flying leads, using insulation to prevent short circuits.
iv How components and materials are prepared for manufacture and how pre-manufactured standard components are used	**Preparation and manufacture** Understand and use prototyping board (breadboard) in prototyping circuits. Understand and describe the process of designing and manufacturing a photo-sensitive printed circuit board. Use standard components in combination to produce working circuits.
v How materials are cut, shaped and formed to specified tolerances	**Quality of manufacture** Assembly and fitting of electronic components within cases, using critical dimensions and tolerances.
vi The safe use of materials, components, tools, equipment and processes	**Health and safety** Understand safe working practices, ie safe use of electrical supplies, safe use of tools and equipment, risk assessment of manufactured products and systems.
vii How ICT, including CAD, is used to generate, develop, model and communicate in single item production	**Use of ICT and CAD in single item production**, ie: Draw programs, circuit modelling programs, PCB design programs.
viii How ICT, including CAM, is used in single item production	**Use of ICT and CAM in single item production**, ie: Printing PCB pattern designs for use in circuit manufacture.

c Manufacturing commercial products (AO1)	
Students should be taught:	**Specific content**
i The manufacture of single products and products in quantity, eg one-off, batch production, volume production	**Product manufacture** One-off to produce single items, ie prototype bicycle alarm. Batch production, to produce fixed quantities of identical products for stock or to order, ie PCBs. High volume, using a production line to produce large quantities of identical products, ie injection moulding cases.
ii How ICT, including CAD/CAM is used in batch and volume production, including how to simulate production and assembly lines	How ICT and computer systems enable easy and fast communication, ie using electronic links such as e-mail for exchanging information, using the Internet for gathering information, using EPOS tills for collecting product sales information. How CAD/CAM systems enable faster, more flexible manufacturing through: • Computer Integrated Manufacture (CIM) • managing product and design data, managing stock control • 2D modelling, creation of 3D 'virtual' products on screen • fast, accurate and repeatable assembly using pick and place machinery • production control, ie controlling CNC equipment, automatic production • quality control through fast computer testing of electronic circuits.

d Design and market influence (AO3)	
Students should acquire a basic awareness of the following:	**Specific content**
i Consider how technology affects society and their our own lives and learn that new technologies have both advantages and disadvantages	**How technology affects society and their own lives** Consumer issues such as understanding the importance of product reliability and safety standards, ie for mobile phones, personal stereos. New technology, including: • development of dedicated integrated circuits (ICs) plus programmable ICs (PICs) leading to miniaturisation and sophistication, ie control systems in domestic appliances • use of CAD/CAM to produce electronic products in quantity cheaply.
ii Recognise that moral, cultural and environmental issues are inherent in design and technology	**Impact of values issues on design and manufacture** Students should acquire a general understanding of: • moral issues, ie changing fashions and planned product obsolescence • environmental issues, ie sustainable technology, ie renewable energy, solar powered devices; pollution, ie mercury and cadmium elimination from dry batteries; conservation of resources, ie products designed to use recycled materials, ie injection moulded polystyrene cases; waste management, ie reclaiming materials for re-use, use of waste materials as a fuel for power generation • influences of different cultures on design for manufacture, ie designing for specific groups in society – electronic jewellery for teenagers. **Analyse and evaluate products and processes** Analyse more than one electronic product drawn from one-off, batch and high volume products. Use essential criteria to judge the quality of a product, ie how it looks, how it performs, its function, the needs and values of users and the market, moral, cultural and environmental considerations, the materials and processes used, safety and value for money. Analyse sub-systems to determine function, performance, and contribution to the overall system. Consider design for manufacture in quantity, ie simplify the product design and the production processes for ease of manufacture.

d Design and market influence (AO3)	
Students should acquire a basic awareness of the following:	**Specific content**
iii Analyse and evaluate products and processes Recognise the difference between the quality of design and the quality of manufacture	Understand planning for production including quality control and quality assurance, ie use a multi-meter to check: • continuity • voltage • current.

Mechanisms

a Classification and selection of materials and components (AO1)	
Students should be taught:	**Specific content**
i Materials and components can be classified according to properties and working characteristics	
Knowledge and understanding of rigid materials	• Metals, ferrous and non-ferrous. • Hardwood, softwood. • Composite materials. • Plastic, thermo and thermosetting. Properties and working characteristics used in the production of mechanical products. Understand and use the following material properties when selecting mechanical components: • stiffness, hardness, brittleness, toughness, conductivity, ductility, malleability, elasticity, frictional wear, durability.
Knowledge and understanding of mechanical systems	Understand that mechanical systems may contain input, process and output. Analyse and describe mechanisms in terms of input, process and output.
Knowledge and understanding of bearings	Understand the use of basic types of bearing: flat, journal and thrust. Understand the use of common bearing materials, ie bronze, cast iron, nylon.
Knowledge and understanding of transmission of motion	**Levers and linkages** Identify the three classes of lever and their applications, ie scissors, wheelbarrow, shovel. Understand and use in calculations the terms, load, effort and fulcrum. Understand and calculate mechanical advantage and velocity ratio in simple lever systems. Understand the term moments, ie clockwise and anticlockwise moments, equilibrium and use in calculations. Understand that levers and linkages are assembled in a specific way to produce a particular output, ie reverse motion links, push pull links, rotary, linear links, bell cranks and parallel linkages.

a Classification and selection of materials and components (AO1)	
Students should be taught:	**Specific content**
Knowledge and understanding of transmission of motion	**Pulleys and gear systems** Understand simple pulley and sprocket and chain systems. Understand simple and compound gear systems. Understand and calculate mechanical advantage velocity ratio, input/output speeds and efficiency in the above systems. Understand domestic and commercial uses for flat, 'v' and toothed belt drives. Describe applications for spur worm and bevel gears. Recognise uses for rack and pinion gear systems. **Cams**, **cranks and sliders** Give practical examples of the use of linear, rotary, oscillating and reciprocating motion. Recognise and explain the use of cam shapes such as pear, circular and heart and of cam followers such as point, roller, flat, knife. Understand the terms cycle, dwell, rise, fall and stroke. Understand the use of crank and slotted lever mechanisms. **Ratchets** Understand the use of a ratchet and pawl mechanism. **Fixings and couplings** Understand and use methods of fixing wheels and pulleys to shafts, ie keyways, cotter pins, splined shafts and grub screws. Understand and use standard fittings, ie nuts and bolts, washers, screws, pop rivets, panel pins and use of adhesives. **The inclined plane and screwthreads** Understand that the screw thread is an inclined plane wrapped around a cylinder and recognise associated terms, ie pitch, thread form, lead, root, crest. Understand and recognise applications for 'v' form, square and buttress screw threads.

a Classification and selection of materials and components (AO1)	
Students should be taught:	**Specific content**
ii That to achieve the optimum use of components and materials they need to take into account the relationship between material, form and intended manufacturing process	
How different working properties of materials affect finished products.	Select and use components manufactured from appropriate materials to perform as required. **Friction** Understand that friction in mechanical systems can be affected by choice of materials, ie low frictional properties of nylon and brass. Understand that lubrication between two surfaces will reduce friction and wear. Understand the property of viscosity in oil and how this can be effected by temperature change. How grading of lubricants relates to viscosity using a numbering system (SAE) including the concept of multigrade oils.

b Preparing, processing and finishing materials (AO1)	
Students should be taught:	**Specific content**
i How materials can be combined and processed to create more useful properties and how these changed materials are used in industry	**Combining and processing** Understand the benefits to mechanical performance of: • alloying metals, ie steel, brass, bronze • laminating wood • reinforcing plastic with glass or carbon fibre.
ii How control systems and sub-systems can be designed, used and connected to achieve different purposes including the use of feedback	**Systems and control** Using INPUT, PROCESS, OUTPUT sub-systems to design mechanical systems, ie levers/linkages, clutch mechanism, gearbox, output movement.
iii About a variety of finishing processes and why they are important for aesthetic and functional reasons	**Finishing processes** Coating metals to improve frictional properties, wear, ease and safety of use and durability, ie painting, electro-plating, plastic coating and teflon. Wood finishes, painting, staining, varnishing.
iv How materials are prepared for manufacture and how pre-manufactured standard components are used	**Preparation and manufacture** Using standard components to match critical dimensions, tolerances, size and fit. Using standard raw materials to create the support structure for the mechanical components.
v How materials are cut, shaped and formed to specified tolerances	**Joining and fixings** For common resistant materials and components using permanent and temporary fixings, ie soft and hard soldering, welding, riveting, screw threads. **Quality of manufacture** Assembly and fitting using critical dimensions and tolerances.
vi The safe use of materials, components, tools, equipment and processes	**Health and safety** Understand safe working practices, ie safe use of tools and equipment and risk assessment of manufactured products and systems.
vii How ICT, including CAD, is used to generate, develop, model and communicate design proposals in single item production	**Use of ICT and CAD in single item production**, ie: Clip-art libraries, CD ROMs, databases. CAD software to create and modify designs. CAD modelling software, ie Lego Dacta, interface to control/simulate and test designs.
viii How ICT, including CAM, is used in single item production	**Use of ICT and CAM in single item production**, ie: Understand that lathes and milling machines can be controlled by computers.

c Manufacturing commercial products (AO1)	
Students should be taught:	**Specific content**
i The manufacture of single products and products in quantity, eg one-off, batch production, volume production	**Product manufacture** One-off to produce single items, ie made to measure racing bicycle. Batch production, to produce fixed quantities of identical products for stock or to order, ie bicycle brake caliper. High volume, using a production line to produce large quantities of identical products, ie mass production of injection moulded components.
ii How ICT, including CAD/CAM is used in batch and volume production, including how to simulate production and assembly lines	**Use of ICT and CAD/CAM in batch and volume production** How ICT and computer systems enable easy and fast communication, ie using electronic links such as e-mail for exchanging information, using the Internet for gathering information, using EPOS tills for collecting product sales information. How CAD/CAM systems enable faster more flexible manufacturing through: • Computer Integrated Manufacture (CIM) • managing product and design data, managing stock control • 2D modelling, creation of 3D 'virtual' products on screen • fast, accurate and repeatable assembly using pick and place machinery • production control, ie controlling CNC equipment, automatic production • quality control through simulating mechanical processes.

d Design and market influence (AO3)	
Students should acquire a basic awareness of the following:	**Specific content**
i Consider how technology affects society and their own lives and learn that new technologies have both advantages and disadvantages	**How technology affects society and their own lives** Consumer issues such as understanding the importance of product reliability and safety standards, ie heart pacemakers, children's toys. New technology, including: • development of modern and smart materials, ie glass and carbon fibre technology, shape memory alloy (nitinol), metals which change length when subjected to an electric current • use of CAD/CAM to produce mechanical systems in quantity cheaply.
ii Recognise that moral, cultural and environmental issues are inherent in design and technology	**Impact of values issues on design and manufacture** Students should acquire a general understanding of: • moral issues, ie changing fashions and planned product obsolescence • environmental issues, ie sustainable technology, ie the development of the clockwork radio; pollution, ie emission from motor car engines, conservation of resources, ie metal reclamation for re-use in manufacture, waste management, ie use of waste materials for fuel, 'scrubbing' waste gases to neutralise them before entering the atmosphere • influences of different cultures, ie designing for different groups in society – specialist sports equipment, ie roller-blades.
iii Analyse and evaluate products and processes Recognise the difference between quality of design and quality of manufacture	**Analyse and evaluate products and processes** Analyse more than one mechanical product drawn from one-off, batch and high-volume products. Use essential criteria to judge the quality of a product, ie how it looks, how it performs, its function, the needs and values of users and the market, moral, cultural and environmental considerations, the materials and processes used, safety and value for money. Analyse sub-systems to determine function, performance, and contribution to the overall system. Consider design for manufacture in quantity, ie simplify the product design and the production processes for ease of manufacture. Understand planning for production including quality control and quality assurance, ie processing controls, sampling.

Internal assessment

The coursework project covers **all** aspects of designing and making, AO2.

Students must demonstrate their designing and making skills and knowledge and understanding through a design and make task, which should not exceed 40 hours.

Students must place evidence of work relating to the design and make task in an **A3 portfolio** or a hard copy of the equivalent ICT evidence. The A3 portfolio should consist of approximately 15 pages.

The coursework project will be internally assessed and externally moderated by Edexcel using the coursework assessment criteria on pages 26 – 27.

Guidance on the selection and carrying out of coursework projects is provided in the Edexcel Coursework Guide. This will include exemplar material.

Coursework design and make task

The task will be chosen by the student and approved by the student's teacher, who must ensure that the task will provide the opportunity for adequate coverage of the assessment criteria. The teacher may make modifications to a student's design proposal for safety or other reasons, provided the help given is recorded in the student's folio of work.

Students who do not complete all aspects of the coursework project, but show full coverage of all assessment criteria, will not be disadvantaged.

Group work

Students have the opportunity for group work on some aspects of coursework projects. Each student must, however, provide a uniquely definable and assessable contribution. Opportunities for group work include:

- identifying user and market needs
- identifying sources of information
- gathering information
- developing briefs and specifications
- evaluation and testing activities
- making and evidencing part of a larger product.

Guidance for marking of the coursework project

There are six main assessment criteria for designing and making. Each of these main assessment criteria is further divided into three key features.

By matching the key feature statements to a student's work, a mark can be determined.

Candidate Mark Record Booklet (CMRB)

The final marks awarded for each individual candidate must be entered in a Candidate Mark Record Booklet (CMRB) together with the photographic evidence of the artefact(s). An example of the Candidate Mark Record Sheet is shown on page 28, this will form the centre pages of the CMRB. The CMRB will be despatched to centres (1 per candidate) in the year of examination based on the estimated entries. If centres require further copies or require these booklets before this despatch they can be obtained from our publications department.

Marking stages

1 Complete the **annotation column** on the candidate mark record sheet by listing the portfolio page numbers where evidence can be found for each of the assessment criteria

2 Using the key feature statements in the coursework assessment criteria, select the **statements that best fit** the candidate's work ie **low (L)**, **medium (M)**, **high (H)**.

3 Transfer the selected level on to the candidate mark record sheet, **circle the mark** relating to the identified level of performance.

4 Midpoints for criteria 2 and 5 in the candidate mark record sheet are in place for candidates who have not fully achieved the requirements for level L, M or H but have produced work that falls between two levels, eg in criterion 2 – Ideas, a candidate who has achieved more than is expected of the medium level but has not fully achieved all the requirements of the higher level can be awarded 10 marks.

5 **Total the marks** awarded on each section of the candidate mark record sheet and complete the **Final Total Box**.

6 **Use the back** of the candidate mark record booklet for **further teacher comments** if necessary.

7 The completed candidate mark record booklet should be enclosed with the **candidate's coursework portfolio**.

Coursework assessment criteria

The candidate has demonstrated the ability to:

Assessment/criteria	Key features	Level
1 Identify needs, use information sources to develop detailed specifications and criteria.	**Needs** state a need for a product and outline a limited brief	**L**
	describe a need and produce an appropriate brief	**M**
	justify the needs of a market group and produce a detailed brief	**H**
	Information use only one source of information	**L**
	gather and use information from a range of sources	**M**
	select and use information from a wide range of appropriate sources	**H**
	Specification produce a specification to meet some of the requirements of the stated need	**L**
	produce a specification that describes some aspects of form and function	**M**
	produce a specification that describes form, function, user requirements and budgetary constraints	**H**
2 Develop ideas from the specification, check, review and modify as necessary to develop a product.	**Ideas** present some limited design ideas	**L**
	present a range of realistic design ideas	**M**
	present a range of realistic and imaginative design ideas	**H**
	Develop develop an idea for manufacture	**L**
	develop and model design ideas to produce a realistic design proposal	**M**
	develop, model and test design ideas to produce a realistic design proposal	**H**
	Review review only the final solution against the specification	**L**
	review more than one idea against the specification	**M**
	review ideas as they develop against the specification	**H**
3 Use written and graphical techniques including ICT and computer-aided design (CAD where appropriate) to generate, develop, model and communicate.	**Written communication** present sufficient information with some care and clarity, use limited specialist vocabulary	**L**
	present sufficient information in an organised, clear and coherent manner, use specialist vocabulary	**M**
	clearly communicate information in a logical and well-organised manner, using appropriate specialist vocabulary	**H**
	Other media use graphical techniques, photographs, cut-outs, models and mock-ups to help present ideas and information	**L**
	use graphical techniques, photographs, cut-outs, models and mock-ups appropriately with skills and purpose	**M**
	use graphical techniques, photographs, cut-outs, models and mock-ups appropriately with a high degree of skill and accuracy	**H**
	ICT use limited ICT	**L**
	use ICT appropriately	**M**
	use a range of appropriate ICT techniques skilfully	**H**

The candidate has demonstrated the ability to:

Assessment/criteria	Key features	Level
4 Produce and use detailed working schedules, which include a range of industrial applications as well as the concepts of systems and control. Simulate production and assembly lines using appropriate ICT.	**Systems and control** produce an outline systems diagram for the manufacture of a product(s) explaining the inputs, processes and outputs	**L**
	produce an outline systems diagram for the manufacture of a product(s) explaining the inputs, processes, outputs and feedback	**M**
	produce an outline systems diagram for the manufacture of a product(s) explaining the inputs, processes, outputs and feedback. Show where performance checks are made	**H**
	Schedule produce a limited working schedule for the manufacture of a product(s)	**L**
	produce a working schedule for the manufacture of a product(s) which considers making processes, materials and time	**M**
	produce a working schedule for the manufacture of a product(s) which considers making processes, materials, time and quality control	**H**
	Industrial applications provide limited evidence of having considered industrial methods of manufacture	**L**
	provide clear evidence of having considered industrial methods of manufacture	**M**
	provide clear evidence of having used appropriate industrial methods of manufacture	**H**

5 Select and use tools, equipment and processes effectively and safely to make single products and products in quantity. **Use CAM appropriately.**	**Select and use** use tools, equipment and processes with guidance, to make a product(s)	**L**
	select appropriate tools, equipment and processes and use them with some skill and accuracy, to make a product(s)	**M**
	select a range of appropriate tools, equipment and processes and use them with a high degree of skill and accuracy, to make a product(s)	**H**
	Make product(s) make a product which is similar to the design proposal	**L**
	make a product which matches the design proposal	**M**
	make a high quality product which relates fully to the features of the design proposal	**H**
	Work safely show limited regard for safe working practices, under supervision	**L**
	show some regard for personal safety	**M**
	show high regard for safe working practices, recognising the needs of both themselves and others	**H**

6 Devise and apply tests to check the quality of candidates work at critical control points. Ensure that candidates products are of suitable quality for the intended use. Suggest modifications that would improve candidates performance.	**Tests and checks** use simple tests to check the performance of the final product	**L**
	use testing techniques to check the product against aspects of the specification	**M**
	develop and use appropriate testing techniques to check the product against all aspects of the specification	**H**
	Evaluate evaluate the final product(s) using personal judgement	**L**
	evaluate the final product(s) using personal judgement and evidence from test results	**M**
	evaluate the final product(s) using evidence from test results and considering the users views	**H**
	Modifications use the results of an evaluation to suggest limited modifications	**L**
	use the results of some evaluations to suggest some modifications	**M**
	use the results from evaluations to suggest and justify modifications	**H**

Candidate Mark Record Sheet

Centre no:	Specification no:	Year of entry:
Candidate no:	Candidate name:	

Coursework title:

Assessment criteria	Key feature	Annotation Page number	LEVEL							Edexcel use only
			L			M		H		
1 Identify needs, use information sources to develop detailed specifications and criteria	**Needs**		**0**		**1**	**2**		**3**		
	Information		**0**		**1**	**2**		**3**		
	Specification		**0**		**1**	**2**		**3**		
2 Develop ideas from the specification, check, review and modify as necessary to develop a product	**Ideas**		**0**	2	**4**	6	**8**	10	**12**	
	Develop		**0**	2	**4**	6	**8**	10	**12**	
	Review		**0**		**1**	**2**		**3**		
3 Use written and graphical techniques including ICT and computer aided design (CAD where appropriate) to generate, develop, model and communicate	**Written communication**		**0**		**1**	**2**		**3**		
	Other media		**0**		**1**	**2**		**3**		
	ICT		**0**		**1**	**2**		**3**		
4 Produce and use detailed working schedules, which includes a range of industrial applications as well as the concepts of systems and control. Simulate production and assembly lines using appropriate ICT	**Systems and control**		**0**		**1**	**2**		**3**		
	Schedule		**0**		**1**	**2**		**3**		
	Industrial applications		**0**		**1**	**2**		**3**		
5 Select and use tools, equipment and processes effectively and safely to make single products and products in quantity. Use CAM appropriately	**Select and use**		**0**	3	**6**	9	**12**	15	**18**	
	Make product(s)		**0**	3	**6**	9	**12**	15	**18**	
	Work safely		**0**		**1**	**2**		**3**		
6 Devise and apply tests to check the quality of their work at critical control points. Ensure that their products are of suitable quality for the intended use. Suggest modifications that would improve their performance	**Tests and checks**		**0**		**1**	**2**		**3**		
	Evaluate product		**0**		**1**	**2**		**3**		
	Modifications		**0**		**1**	**2**		**3**		
		FINAL TOTAL								

Exemplification of coursework assessment criteria

Needs

Students recognise a situation for design. They write a detailed design brief that identifies a product and potential users in a target market group.

Information

Students select and use data that is relevant to the product and users. For example they evaluate a similar existing product and use a market survey to collect information about form, function, manufacturing processes and the needs and preferences of potential users in a target market group.

Specification

Students analyse the research data and develop a specification for evaluating and testing the product. They identify realistic criteria such as product form and function, cost constraints and the needs and preferences of users related to moral, social, cultural and environmental issues.

Ideas

Students present a range of realistic and imaginative design ideas, that relate to the needs identified in the specification.

Develop

Students develop, model and test the feasibility of the design ideas. They produce a realistic design proposal, that makes optimum use of available materials and provides details of the product manufacture.

Review

Students review their design ideas as they develop against the specification criteria. They consider how their ideas meet the design brief, taking account of considerations such as user needs, accuracy and ease of making.

Written communication

Students clearly communicate ideas and information in a logical and well-organised manner, using appropriate specialist vocabulary.

Other media

Students use graphical techniques, photographs, cut-outs, models and mock-ups appropriately to present ideas and information with a high degree of skill and accuracy.

ICT

Students use a range of ICT techniques where available and appropriate, such as desk top publishing, CAD modelling, producing accurate drawings, designing circuits or for nutritional analysis.

Systems and control

Students produce an outline systems diagram that shows the manufacture of the product, explaining where inputs, processes, outputs and feedback occur. They show where they will make checks to monitor the performance of the product.

Schedule

Students produce a working schedule for the manufacture of the product, considering the time available, critical dimensions and tolerances when planning the product quality. They match materials and components with tools, equipment and making processes, taking account of working characteristics and ease of manufacture.

Industrial application

Students provide clear evidence of having used appropriate industrial methods of manufacture in their own making. They consider the use of production or assembly lines and explain changes they may need to make in order to manufacture the product in quantity.

Select and use

Students select and use a range of appropriate tools, equipment and processes with a high degree of skill and accuracy to make a product.

Make product(s)

Students apply their skills, knowledge and understanding to make a high quality product that fully meets the features of the design proposal. They modify the making processes as necessary and use computer-aided manufacture (CAM), where available and appropriate to improve their own manufacture.

Work safely

Students show a high regard for safe working practices and recognise the needs of themselves and others when making a product.

Tests and checks

Students develop and use appropriate tests at critical points to test the quality of design and manufacture against all aspects of the specification criteria.

Evaluate

Students evaluate the final product in response to the views of intended users and the results of tests and checks made during development and manufacture.

Modifications

Students suggest and justify modifications to improve the product performance, in response to the results of evaluations.

Grade descriptions

The following grade descriptions indicate the level of attainment characteristic of the given grade at GCSE. They give a general indication of the required learning outcomes at each specified grade. The descriptions should be interpreted in relation to the content outlined in the specification; they are not designed to define that content. The grade awarded will depend in practice upon the extent to which the student has met the assessment objectives overall. Shortcomings in some aspects of the examination may be balanced by better performances in others.

Grade		Grade		Grade	
A	1 Seek out and use information sources to support their work. Be discriminating in selecting information to help their detailed design thinking. Recognise the needs of a variety of client groups. Investigate form, function and production processes. Identify a broad range of criteria for evaluating and testing their products.	C	1 Use a wide range of appropriate sources of information to develop ideas. Recognise the needs of a variety of users. Investigate form, function and production processes.	F	1 Draw on and use various sources of information.
	2 Use a wide range of strategies to develop appropriate ideas, responding to information they have identified. Recognise the different needs of a range of users when developing fully realistic designs. Identify conflicting demands on their design, explain how their ideas address these demands and use this analysis to produce proposals.		2 Use a wide range of appropriate strategies to develop ideas, responding to information they have identified. Recognise the needs of a variety of users and develop realistic designs.		2 Use understanding of the characteristics of familiar products when developing their own ideas.
	3 Communicate ideas using a variety of appropriate media.		3 Communicate ideas, using appropriate media.		3 Communicate and clarify ideas through discussion, drawing and modelling.

Grade		Grade		Grade	
A	4 When planning, make sound decisions on materials and techniques based on understanding of the physical properties and working characteristics of materials. Work from formal plans that make the best use of time and resources.	C	4 Produce plans that make use of time and resources to carry out the main stages of making products. Organise their work so that they can carry out processes accurately and consistently.	F	4 Work from their own plans, modifying them where appropriate.
	5 Work with a range of tools, equipment, materials and components to a high degree of precision. Make products that are reliable and robust and that fully meet the quality requirements given in the design proposal.		5 Work with a range of tools, materials, equipment, components and processes with precision, taking account of their characteristics. Adapt their methods of manufacture to changing circumstances, providing a sound explanation for any change from the initial specification. Modify their products in the light of ongoing evaluation to improve their performance.		5 Work with a range of tools, materials, equipment, components and processes with some precision. Check their work as it develops and modify their approach in the light of progress.
	6 Test and evaluate products, clearly relating their findings to the purpose for which the products were designed and the appropriate use of resources. Fully evaluate their use of information sources.		6 Select appropriate techniques to test and evaluate how their products would perform when used. Evaluate their use of information sources and their use of resources.		6 Test and evaluate their products, showing that they understand the situations in which their designs will have to function. Evaluate their use of basic information sources and be aware of resources as a constraint.

The wider curriculum

Key skills

This specification will provide opportunities, as appropriate, to develop the key skills of communication, Information technology, application of number, improving own learning and performance, working with others and problem solving.

Examples of such opportunities are signposted throughout the specification. It is important that these opportunities fall naturally into a programme of study, and it may be that not all the examples are appropriate for all programmes. The examples offered may be adapted to suit particular situations, and it will be possible to devise many alternative opportunities and approaches. The development of key skills can enhance teaching and learning strategies and can be a stimulus to new approaches, and increase levels of student involvement.

Key skills opportunities are detailed more fully in *Appendix 1*.

Moral, ethical, social and cultural issues, environmental education, health and safety education and the European dimension

The GCSE in Design & Technology provides opportunities for students to develop moral, ethical, social, cultural, environmental, health and safety and European issues.

Moral, **ethical**, **social**, **cultural**, **environmental**, **health and safety and European issues**	**Internal assessment or classwork that supports evidence of achievement** **Provides opportunity to:**
Ethical/moral issues	take account of the needs of users, related to moral issues, eg changing fashions and planned obsolescence, when developing a specification
Social issues	take account of consumer issues when developing product ideas, eg labelling requirements
Cultural issues	assess lifestyle, image and the use of a traditional theme when designing and making a product
Environmental issues	take account of environmental issues related to the use of recycled materials
Health and safety issues	demonstrate safe working practices when making a product
European issues	develop understanding of the needs of people living in different countries, eg that they need products that are suitable for their lifestyles.

Education for citizenship

The GCSE in Design & Technology provides opportunities for students to develop citizenship issues.

Citizenship programme of study	**Internal assessment or classwork that supports evidence of achievement**
Knowledge and understanding about becoming informed citizens, including:	**Provides opportunity to:**
the origins and implications of the diverse national, regional, religious and ethnic identities in the United Kingdom and the need for mutual respect and understanding	research national, regional, religious or ethnic products when developing product ideas
how the economy functions, including the role of business and financial services	develop understanding of a local business or organisation when undertaking work experience develop understanding about cost and value for money when designing and making products
the importance of a free press and the media's role in society, including the Internet, in providing information and affecting opinion	understand how newspapers, television and the Internet are used to advertise products and influence consumer choice
the wider issues and challenges of global interdependence and responsibility, including sustainable development.	identify the country of origin of an existing product and explore the materials and processes used in its manufacture.
Developing the following skills of enquiry and communication:	**Provides opportunity to:**
research a topical, political, spiritual, moral, social or cultural issue, problem or event, by analysing information from different sources	analyse information from books, CD ROMs or the Internet when researching information about environmental issues
express, justify and defend orally and in writing a personal opinion about such issues, problems or events.	take part in a class discussion about the influence of brands on teenage sports products. Write a report and justify a personal opinion about the topic.
Developing the following skills of participation and responsible action:	**Provides opportunity to:**
use their imagination to consider other people's experiences and be able to think about, express, explain and critically evaluate views that are not their own.	research the views of potential users and analyse a questionnaire to find their needs. Explain how this information will influence design ideas for a product.

Information and communication technology (ICT)

ICT in internal assessment

Students should consider how ICT is used:

- to generate, develop, model and communicate design proposals
- for computer-aided manufacture, where appropriate.

ICT in external assessment

Reference to the application of ICT is found in the theoretical content of the specification in:

- AO1 b, c
- AO3 d i and d ii.

Textbooks and other teaching resources

There is a wide range of textbooks currently available for GCSE in Design & Technology, and most of them will contain useful material for teaching this specification.

A full list of appropriate resources can be found in the Teachers' Guide which supports this specification. It is available from Edexcel Publications, see page 37 for contact details.

Support and training

Training

A programme of INSET courses covering various aspects of the specifications and assessment will be arranged by Edexcel each year on a regional basis. Full details may be obtained from:

Professional Development and Training
Edexcel Foundation
Stewart House
32 Russell Square
London WC1B 5DN

Tel: 0870 240 9800
Fax: 020 7758 5951
E-mail: trainingenquiries@edexcel.org.uk

Website

www.edexcel.org.uk

Please visit the Edexcel website, where further information about training and support for all qualifications, including this GCSE, can be found.

The website is regularly updated, and an increasing amount of support material and information will become available through it.

Edexcel Publications

Support materials and further copies of this specification can be obtained from:

Edexcel Publications
Adamsway
Mansfield
Notts NG18 4FN

Tel: 01623 467467
Fax: 01623 450481
E-mail: publications@linneydirect.com

The following support materials are available:

- specimen papers
- Internal Assessment Guide
- Teachers' Guide.

Regional offices and Customer Services

Further advice and guidance is available through a national network of regional offices. For general enquiries and for details of your nearest office please call Edexcel Customer Services on 0870 240 9800.

Appendices

Appendix 1 – Key skills

The GCSE in Design & Technology: Systems & Control Technology offers a range of opportunities for students to:

- develop their key skills
- generate assessed evidence for their portfolio.

In particular, the following key skills can be developed and assessed through this specification at level 2:

- application of number
- communication
- information technology
- improving own learning and performance
- working with others
- problem solving.

Copies of the key skills specifications can be ordered from Edexcel Publications.

The individual key skills units are divided into three parts:

- Part A: what you need to know – this identifies the underpinning knowledge and skills required of the student
- Part B: what you must do – this identifies the evidence that students must produce for their portfolio
- Part C: guidance – this gives examples of possible activities and types of evidence that may be generated.

This GCSE specification signposts development and internal assessment opportunities which are based on Part B of the level 2 key skills units. For those students working at level 1, these level 2 opportunities can also be used to generate evidence at level 1. Reference should be made to the appropriate level 1 statements in the key skills specifications.

The evidence generated through this GCSE will be internally assessed and contribute to the student's key skills portfolio. In addition, in order to achieve the key skills qualification, students will need to take the additional external tests associated with communication, information technology and application of number. Centres should check the current position on proxy qualifications as some students may be exempt from part or all of the assessment of a specific key skill.

Each assessment objective within the GCSE in Design & Technology: Systems & Control Technology will provide opportunities for the development of all six of the key skills identified. This appendix identifies the key skills evidence requirements and also provides a mapping of those opportunities. Students will need to have opportunities to develop their skills over time before they are ready for assessment. This appendix contains illustrative activities for each key skill that will aid development and facilitate the generation of appropriate portfolio evidence. To assist in the recording of key skills evidence Edexcel has produced recording documentation, which can be ordered from Edexcel Publications.

Mapping of key skills: summary table

Key skills (level 2)	AO1: Materials, components, processes, techniques and industrial practice (Classwork that supports evidence of achievement)	AO2: Designing and making quality products (Internal assessment)	AO3: Evaluating processes and products and examining the wider effects of design and technology on society (Classwork that supports evidence of achievement)
Application of number			
N2.1	✓	✓	✓
N2.2		✓	
N2.3		✓	
Communication			
C2.1a		✓	✓
C2.1b	✓	✓	✓
C2.2	✓	✓	✓
C2.3	✓	✓	✓
Information technology			
IT2.1	✓	✓	
IT2.2		✓	
IT2.3		✓	✓

Key skills (level 2)	AO1: Materials, components, processes, techniques and industrial practice (Classwork that supports evidence of achievement)	AO2: Designing and making quality products (Internal assessment)	AO3: Evaluating processes and products and examining the wider effects of design and technology on society (Classwork that supports evidence of achievement)
Working with others			
WO2.1	✓		✓
WO2.2		✓	
WO2.3		✓	
Improving own learning and performance			
LP2.1		✓	✓
LP2.2		✓	
LP2.3		✓	✓
Problem solving			
PS2.1		✓	
PS2.2		✓	
PS2.3		✓	

Application of number level 2

The GCSE in Design & Technology: Systems & Control Technology provides opportunities for students to develop the key skill of Application of number and also to generate evidence for their portfolio. As well as undertaking tasks related to the three areas of evidence required, students are also required to undertake a substantial activity that includes straightforward tasks. This will involve students obtaining and interpreting information, using this information when carrying out calculations, and interpreting and presenting the results of the calculations.

Key skill portfolio evidence requirement		GCSE	Opportunities for development or internal assessment
N2.1	Interpret information from **two** different sources, including material containing a graph.	AO1 AO2 AO3	Students are required to obtain and use the information required; selecting appropriate methods to get the results required. For example: AO1/AO3: Use product analysis and textbooks to research information about materials or processes. Draw up a star diagram to compare properties of materials. AO2: In response to a design brief, analyse a questionnaire to find out user needs. Read and understand a graph and quantitative information about materials or processes to produce a specification.
N2.2	Carry out calculations to do with: a amounts and sizes b scales and proportions c handling statistics d using formulae.	AO2	Students must carry out their calculations, which could relate to volumes, ratios, averages, formulae etc, and show their methods of working. They must show how they have checked results and corrected their work as necessary. For example: AO2: When developing, modelling and testing design ideas, calculate sizes and amounts of materials and components. Use graphical techniques, photographs, cut-outs, models and mock-ups to calculate accurate requirements for a product. Use formulae to calculate diameters and circumferences of component parts, to ensure accuracy of fit. Work out dimensions from a scale drawing.
N2.3	Interpret the results of your calculations and present your findings. You must use at least **one** graph, **one** chart and **one** diagram.	AO2	Based on their findings, students must select effective methods of presentation using, as appropriate charts, diagrams, and tables. Students should explain how the results of their calculations meet the purpose of the activity undertaken. AO2: Compare the cost of different materials for a product and present findings using a graph, chart or diagram.

Evidence

Student evidence for application of number could include:

- description of the substantial activity
- copies of source materials
- records of calculations showing methods used
- descriptions of findings.

Communication level 2

For the communication key skill, students are required to hold discussions and give presentations, read and summarise information, and write documents. Students will be able to develop all of these skills through an appropriate teaching and learning programme based on this GCSE specification.

Key skill portfolio evidence requirement		GCSE	Opportunities for development or internal assessment
C2.1a	Contribute to a discussion about a straightforward subject.	AO2 AO3	Many of the topics in this specification are suitable for the basis of a group discussion. The discussion should be about a straightforward subject. This may be a subject often met in their studies, etc and the vocabulary should be familiar. During the discussion students should make clear and relevant contributions, listen and respond to others, helping to move the discussion forward. AO2: Contribute to a class brainstorm session and discussion about the requirements of a design brief. Express ideas about the needs of potential users of a product. Ask questions about the deadlines for a project. AO3: Contribute to a class discussion about quality of design and quality of manufacture. Ask questions about the materials and processes used in an existing product. Summarise points made by others about ways to recycle materials.
C2.1b	Give a short talk about a straightforward subject, using an image.	AO1 AO2 AO3	Following a period of research students could be given the opportunity to give a short talk to the rest of their group. During the talk students should speak clearly in a way that suits the subject and situation. They should keep to the subject. The structure of the talk should help listeners follow points made. The talk should include an image to illustrate main points clearly. Images could include charts and diagrams, pictures or models, maps etc. For example: AO1: Research the properties of one material and give a short talk about its suitability for a familiar product, using a chart to show its properties. AO2: In response to a specification, present a range of realistic and imaginative product ideas. Present ideas to peer group, explaining how the ideas were developed. AO3: Present findings from the analysis of an existing product, using a drawing to explain its construction. Use a flowchart to show the order of assembly.

Key skill portfolio evidence requirement		GCSE	Opportunities for development or internal assessment
C2.2	Read and summarise information from **two** extended documents about a straightforward subject. One of the documents should include at least **one** image.	AO1 AO2 AO3	Students will have a number of opportunities to read and synthesise information from two extended documents. For example, as part of their preparation for the discussion and talk or as preparation for a piece of written work for their GCSE. Extended documents may include textbooks, reports and articles of more than three pages. At least one of these documents should contain an image from which students can draw appropriate and relevant information. Students will need to select and read relevant material. From this information they will need to identify accurately the lines of reasoning and main points from the text and images. Students will then need to summarise this information in a form that suits the purpose – eg for a talk, discussion or an essay. For example: AO1: Read relevant sections in a textbook, when researching the properties of a range of materials. Identify key points and draw up a table to match materials, properties with their end-use in a range of products. Explain findings. AO2: Use a database or CD ROM to compare and evaluate different processes for making a product. Create a set of instructions for using the process in the manufacture of own product. AO3: Read and analyse information about recycling materials. Identify key issues and summarise how different materials may be recycled.
C2.3	Write **two** different types of documents about straightforward subjects. One piece of writing should be an extended document and include at least **one** image.	AO1 AO2 AO3	Students are required to produce two different types of document. At least one of these should be an extended document, for example a report or an essay of more than three pages. The document should present relevant information in an appropriate form. At least one of the documents should include an appropriate image that contains and effectively conveys relevant information. The information in the document should be clearly structured eg through the use of headings, paragraphs etc. Students should ensure that the text is legible and that spelling, punctuation and grammar are accurate. AO1: Produce an illustrated report about the working properties of materials. Explain how the choice of materials depends on their aesthetic and functional properties, what processes are to be used and the purpose of the product. AO2: Analyse research information related to the needs of users and the form and function of own product. Write a product specification, identifying realistic criteria. AO3: Present information about the analysis of a product, using a range of criteria to judge its quality of manufacture.

Evidence

Student evidence for communication could include:

- tutor observation records
- preparatory notes
- audio/video tapes
- notes based on documents read
- essays.

Information technology level 2

When producing work for their GCSE in Design & Technology: Systems & Control Technology students will have numerous opportunities to use information technology. The Internet, CD ROM, etc could be used to collect information. Documents can be produced using relevant software, and images may be incorporated in those documents. Early drafts of documents could be e-mailed to tutors for initial comments and feedback.

If students undertaking coursework as part of their GCSE in Design & Technology: Systems & Control Technology use information technology, they will have opportunities to generate evidence for all three sections identified in Part B of the key skills specification.

In addition, students will be able to use information technology to generate evidence for the communication key skill. For example the extended document with images, required for C2.3, could be generated using appropriate software.

As part of their Design & Technology: Systems & Control Technology programme, students may not be able to generate sufficient evidence required for this unit. For example working with numbers through the use of a spreadsheet application, or some aspects of database use. In this situation, students may use stand-alone IT sessions for development and evidence generation and/or other parts of their GCSE course.

Key skill portfolio evidence requirement		**GCSE**	**Opportunities for development or internal assessment**
IT2.1	Search for and select information for **two** different purposes.	AO1 AO2	Students will need to identify suitable sources of information and effectively search for information using multiple criteria. Information selected should be interpreted and students should decide what is relevant for their purpose. For example: AO1: Use a database, the Internet or a CD ROM to research information about materials, processes and products. Present and analyse information and images to compare the features of different products. AO2: Access a database or the Internet to search for information about products and price ranges. Use information to help cost own product. Use software to generate a questionnaire about how much users would pay for a product and to present information collected.
IT2.2	Explore and develop information, and derive new information for **two** different purposes.	AO2	Students are required to bring together information in formats, such as tables, that help development. The information should be explored by, for example, changing information in a spreadsheet model. Information should also be developed and new information derived as appropriate, for example through the use of headings, tables, charts and graphs. New information should be derived from, for example, comparing information from different sources, using formulae to calculate totals or averages. For example: AO2: Use a spreadsheet to analyse research information and generate graphs or charts to explain the results. Use a spreadsheet to compare costs of different materials and components. Use software to explore 'what if' situations, by changing dimensions when developing ideas about products.

Key skill portfolio evidence requirement		GCSE	Opportunities for development or internal assessment
IT2.3	Present combined information for **two** different purposes. This work must include at least **one** example of text, **one** example of images and **one** example of numbers.	AO2 AO3	In presenting combined information students will need to select and use appropriate layouts in a consistent way through, for example, the use of margins, headings, borders, font size etc. Layouts etc should be refined to suit both the purpose and the needs of the audience (early drafts should be kept as portfolio evidence). The final piece of work should be suitable for its purpose and audience eg GCSE coursework, OHTs/handouts for a presentation, etc. The document should have accurate spelling (use of spell-checker) and have been proof-read. AO2: Use software to assemble text, images, diagrams and charts when analysing research information. Use spelling and grammar checking tools to check for accuracy of written work. Enter, edit and save information, graphs and drawings. Move, copy or delete text to produce accurate information. AO3: Use software to produce text and images for a presentation about the results of product analysis.

Evidence

Student evidence for information technology could include:

- tutor observation records
- notes of sources used
- print-outs with annotations
- draft documents.

Working with others level 2

To achieve this key skill, students are required to carry out at least **two** activities. One example must show that they can work in one-to-one situations and one example must show that they can work in-group situations. Students will plan their work with others and confirm working arrangements; work cooperatively towards achieving identified objectives, and exchange information on progress.

Key skill portfolio evidence requirement		GCSE	Opportunities for development or internal assessment
WO2.1	Plan straightforward work with others, identifying objectives and clarifying responsibilities, and confirm working arrangements.	AO1 AO3	Students should identify the objectives of working together and the tasks, resources and timescales required to meet these objectives. Information should be exchanged to clarify responsibilities. For example suggesting ways help can be given, asking what others can do, checking their own and others' responsibilities. The group needs to confirm responsibilities and working arrangements. For example: AO1: In pairs, plan the investigation of a range of materials and processes, to enable the sharing of information with others in the peer group. AO3: In small groups, plan the analysis of a product, agreeing targets and areas of responsibility. Plan a presentation about the product to the peer group.
WO2.2	Work cooperatively with others towards achieving identified objectives, organising tasks to meet your responsibilities.	AO2	Students will need to organise tasks so that responsibilities can be met. For example obtaining resources, completing tasks on time etc. Tasks should be completed accurately and safely. Cooperative ways of working should be supported through, for example, anticipating the needs of others, avoiding actions that offend etc. Advice from others, including group members, tutor etc should be sought when needed. For example: AO2: Working as a small team, plan the batch production of a simple product. Agree targets, areas of responsibility and deadlines. Select appropriate resources, identify quality control, carry out shared tasks accurately and safely, using appropriate processes to produce products of the required quality.
WO2.3	Exchange information on progress and agree ways of improving work with others to help achieve objectives.	AO2	Once completed, the full group needs to review outcomes against the agreed objectives. In doing this they should identify what has gone well and what has gone less well. Students should listen and respond to progress reports from others and agree ways of improving work with others to help achieve objectives. For example: AO2: Evaluate what went well or less well when working with others on batch production. Evaluate how the group worked together and the quality of products made. Agree how to adapt ways of working together to improve individual and group performance.

Evidence

Student evidence for working with others could include:

- tutor observation records
- preparatory notes
- records of process and progress made.

Improving own learning and performance level 2

Within GCSE in Design & Technology: Systems & Control Technology programmes, students will have opportunities to develop and generate evidence that meets part of the evidence requirement of this key skill.

To achieve this key skill, students will need to provide at least **two** examples of meeting the standard required. Students are also required to improve their performance through studying a straightforward subject and through learning by carrying out a straightforward practical activity. This GCSE in Design & Technology: Systems & Control Technology will provide opportunities for students to study a straightforward subject. Evidence for learning through a practical activity may come from other GCSEs in the students' programme or from enrichment activities.

Activities that generate evidence for this skill should take place over a period of a few weeks. Over the period of the activity there will be times when the students should work without close supervision. However, students should seek and receive feedback, from tutors and others, on their target setting and performance.

Any project work (including coursework) is a suitable learning activity and may be used to generate evidence for this key skill.

Key skill portfolio evidence requirement		GCSE	Opportunities for development or internal assessment
LP2.1	Help set short-term targets with an appropriate person and plan how these will be met.	AO2 AO3	Students plan how they are to meet short-term targets with an appropriate person eg agreeing a project with their tutor. This will include setting realistic targets and action points. Review dates agreed with, for example, their tutor should be built into the plan. AO2: In response to a design brief, discuss a project plan with others and agree achievable targets and deadlines. Use a Gantt chart to plan the project, taking into account previous experience of working to deadlines, available resources and personal skills. Write a working schedule and show where to make performance checks. AO3: In small groups, plan the analysis of a product, agreeing targets and areas of responsibility. Identify tasks for each group member and deadlines for the completion of the work. Review the work against targets and deadlines.
LP2.2	Take some responsibility for some decisions about your learning, using your plan and support from others to help meet targets. Improve your performance by: • studying a straightforward subject • learning through a straightforward practical activity.	AO2	The plan should be implemented with performance reviews and should include working for short periods without close supervision. AO2: Follow a working schedule, monitoring work as it progresses. Respond to unexpected problems, related to availability of materials or equipment and revise the schedule where necessary. Identify when support from others is needed, respond to feedback and use this to help meet targets. Improve the quality of work by taking responsibility for learning about and practising skills and processes.

Key skill portfolio evidence requirement		GCSE	Opportunities for development or internal assessment
LP2.3	Review progress with an appropriate person and provide evidence of your achievements, including how you have used learning from one task or activity to meet the demands of a new task.	AO2 AO3	Students should review their own progress with the help, for example, of their tutor. They should identify, with evidence, what and how they have learned and provide information on what has gone well and what has gone less well. They should show targets they have met, providing evidence of achievements from relevant sources. They should identify with, for example, their tutor, action for improving their performance. For example: AO2: Evaluate the final product against specification criteria, identifying what went well and less well. Identify where and how the specification was met, the knowledge and skills learned and how own learning helped achieve a successful final product. Suggest and justify modifications to the product. AO3: In a small group, review the analysis of a product against targets and deadlines. Identify how well individuals and the group met the targets and what was achieved in the time available. Suggest how to improve working methods to help meet new targets and deadlines.

Evidence

Student evidence for improving own learning and performance could include:

- tutor records
- annotated action plans
- records of discussions
- learning log
- work produced.

Problem solving level 2

To achieve this key skill, students will need to provide at least **two** examples of meeting the standard required. They need to show that they can identify problems, plan and try out options and check whether the problem has been solved. For this GCSE, students may not be able to try out options and check results as there may be difficulties in implementing practical solutions in a school or college context.

Key skill portfolio evidence requirement		GCSE	Opportunities for development or internal assessment
PS2.1	Identify a problem and come up with **two** options for solving it.	AO2	Students will need to identify the problem and describe its main features and show how it has been solved. They need to identify different ways of tackling the problem and ways of identifying success. They should use the help of others, for example their tutor, as appropriate. AO2: In response to a design brief, identify the needs of users and a product that that will solve a problem. Identify realistic specification criteria for evaluating and testing the product. Use different approaches to solve the problem, such as brainstorming ideas with others, using research information or specialist advice from teachers or tutors. Present a range of realistic and imaginative ideas. Develop, model and test design ideas against specifications and use feedback from others to help make decisions.
PS2.2	Plan and try out at least **one** option for solving the problem, obtaining support and making changes to your plan when needed.	AO2	Students should confirm with their tutor, for example, their chosen option and how they will implement it. Upon implementation relevant tasks should be organised and changes made as necessary. Support should be obtained when needed. For example: AO2: Write a working schedule and set realistic deadlines, showing where performance checks will be made. Monitor the production plan, modifying the making processes as necessary. Use support where necessary and record any changes made to the product or processes.
PS2.3	Check if the problem has been solved by applying given methods, describe results and explain your approach to problem solving.	AO2	Students should check if the problem has been solved using agreed methods, for example by test, observation, inspection etc. The results of this should be described with an explanation of decisions taken. Students should identify the strengths and weaknesses of their approach and how they would do things differently if they met a similar problem. For example: AO2: Practise processes and techniques to ensure the production of a quality product. Apply quality control, develop and use appropriate tests to check the quality of design and manufacture. Evaluate the final product in response to test results and the views of intended users. Suggest and justify modifications to the product.

Evidence

Student evidence for problem solving could include:

- description of the problem
- tutor records and agreement of standards and approaches
- annotated action plans
- records of discussions
- descriptions of options
- records of reviews.

Appendix 2 – Procedures for moderation of internal assessment

All centres will receive Optically-read Teacher Examiner Mark Sheets (OPTEMS) for each coursework component.

Centres will have the option of:

EITHER

- recording marks on an Optically-read Teacher Examiner Mark Sheet (OPTEMS), Section 1

OR

- recording marks on computer for transfer to Edexcel by means of Electronic Data Interchange (EDI), Section 2.

Sections 3 and 4 apply whichever option is selected and deal with Coursework Record Sheets and the sample of work required for moderation.

1 Centres using OPTEMS

1.1 OPTEMS will be pre-printed on three-part stationery with unit and paper number, centre details and candidate names in candidate number order. A number of blank OPTEMS for candidates not listed will also be supplied.

The top copy is designed so that the marks can be read directly by an Optical Mark Reader. It is important therefore to complete the OPTEMS carefully in accordance with the instructions below. **Please do not fold or crease the sheets**.

1.2 Before completing the OPTEMS please check the subject, paper and centre details, to ensure the correct sheet is being completed.

1.3 All candidates entered by the deadline date will be listed on the OPTEMS, except those carrying forward their centre-assessed marks from the previous year. Such candidates will be listed on a separate OPTEMS coded T for Transferred. Any OPTEMS coded T should be checked, signed to confirm the transfer, and the top copy returned to Edexcel. No mark should be entered.

1.4 Late entries will need to be added in pencil either in additional spaces on the pre-printed OPTEMS or on one of the blank OPTEMS which will be supplied. Please note that full details of the centre, specification/unit, paper, candidates' names and candidate numbers must be added to ALL blank OPTEMS.

1.5 The OPTEMS should be completed **using an HB pencil**. Please ensure that you work on a firm flat surface and that figures written in the marks box go through to the second and third copies.

1.6 For each candidate, first ensure you have checked the arithmetic on the Coursework Record Sheet, then transfer the **Total Mark** to the box of the OPTEMS labelled 'Marks' for the correct candidate (Please see exemplar).

1.7 Encode the component mark on the right-hand side by drawing a line to join the two dots inside the ellipses on the appropriate marks. Clear, dark **HB pencil** lines must be made but they must not extend outside the ellipses on either side of the two dots. Take care to remember the trailing zeros for candidates scoring 10, 20 etc and the leading zero for single figures, as shown.

1.8 If you make a mistake rub out the incorrect marks completely. Amend the number in the marks box and in the encoded section, but **please remember to amend separately the second and third copies** to ensure that the correct mark is clear.

1.9 Every candidate listed on the OPTEMS must have either a mark or one of the following codes in the marks box.

a 0 (zero marks) should be entered only if work submitted has been found to be worthless. It should **not** be used where candidates have failed to submit work.

b ABS in the marks box and an A in the encoded section for any candidate who has been absent or has failed to submit any work, even if an aegrotat award has been requested.

c W should be entered in the marks box and the encoded section where the candidate has been withdrawn.

Exemplar

Encoded section

Candidate name	Number	Marks												
NEW ALAN* SP	3200	0	~~(•0•)~~ ~~(•0•)~~	(•10•) (•1•)	(•20•) (•2•)	(•30•) (•3•)	(•40•) (•4•)	(•50•) (•5•)	(•60•) (•6•)	(•70•) (•7•)	(•80•) (•8•)	(•90•) (•9•)	(•100•) (•A•)	(•200•) (•W•)
OTHER AMY* SP	3201	5	~~(•0•)~~ (•0•)	(•10•) (•1•)	(•20•) (•2•)	(•30•) (•3•)	(•40•) (•4•)	(•50•) ~~(•5•)~~	(•60•) (•6•)	(•70•) (•7•)	(•80•) (•8•)	(•90•) (•9•)	(•100•) (•A•)	(•200•) (•W•)
SMITH JOHN AW	3202	47	(•0•) (•0•)	(•10•) (•1•)	(•20•) (•2•)	(•30•) (•3•)	~~(•40•)~~ (•4•)	(•50•) (•5•)	(•60•) (•6•)	(•70•) ~~(•7•)~~	(•80•) (•8•)	(•90•) (•9•)	(•100•) (•A•)	(•200•) (•W•)
WATTS MARK* SP	3203	ABS	(•0•) (•0•)	(•10•) (•1•)	(•20•) (•2•)	(•30•) (•3•)	(•40•) (•4•)	(•50•) (•5•)	(•60•) (•6•)	(•70•) (•7•)	(•80•) (•8•)	(•90•) (•9•)	(•100•) ~~(•A•)~~	(•200•) (•W•)
STEVEN JANE AW	3204	102	(•0•) (•0•)	(•10•) (•1•)	(•20•) ~~(•2•)~~	(•30•) (•3•)	(•40•) (•4•)	(•50•) (•5•)	(•60•) (•6•)	(•70•) (•7•)	(•80•) (•8•)	(•90•) (•9•)	~~(•100•)~~ (•A•)	(•200•) (•W•)
JONES ANN* AW	3205	40	(•0•) ~~(•0•)~~	(•10•) (•1•)	(•20•) (•2•)	(•30•) (•3•)	~~(•40•)~~ (•4•)	(•50•) (•5•)	(•60•) (•6•)	(•70•) (•7•)	(•80•) (•8•)	(•90•) (•9•)	(•100•) (•A•)	(•200•) (•W•)
PATEL RAJ* AW	3206	98	(•0•) (•0•)	(•10•) (•1•)	(•20•) (•2•)	(•30•) (•3•)	(•40•) (•4•)	(•50•) (•5•)	(•60•) (•6•)	(•70•) (•7•)	(•80•) ~~(•8•)~~	~~(•90•)~~ (•9•)	(•100•) (•A•)	(•200•) (•W•)
WEST SARA SP	3207	W	(•0•) (•0•)	(•10•) (•1•)	(•20•) (•2•)	(•30•) (•3•)	(•40•) (•4•)	(•50•) (•5•)	(•60•) (•6•)	(•70•) (•7•)	(•80•) (•8•)	(•90•) (•9•)	(•100•) (•A•)	(•200•) ~~(•W•)~~

1.10 Where more than one teacher has assessed the work, the teachers' initials should be given to the right of each candidate's name as illustrated.

1.11 The authentication and internal standardisation statement on the OPTEMS must be signed. **Centres are reminded that it is their responsibility to ensure that internal standardisation of the marking has been carried out**.

1.12 Once completed and signed the three-part sets should then be divided and despatched, or retained as follows:

a **top copy** to be returned direct to Edexcel in the envelope provided **to be received by 1 May for the May/June examination series**. Please remember this form **must not be folded or creased**.

b **Second copy** to be sent **with the sampled coursework** as appropriate (see Section 4) to the moderator. The name and address of the moderator will either be printed on the OPTEMS or supplied separately.

c **Third copy** to be retained by the centre

2 Centres using EDI

2.1 Marks must be recorded on computer and transmitted to Edexcel by **1 May for the May/June examination series**. They must be recorded in accordance with the specifications in the booklet 'Formats for the Exchange of Examination Related Data using Microcomputers'. Each mark has a status as well as a value. Status codes are:

V – valid non-zero mark recorded; candidate not pre-selected as part of the sample for moderation

S – valid non-zero mark recorded and candidate included in sample for moderation (refer to OPTEMS and Section 4)

Z – zero mark recorded for work submitted

N – no work submitted but candidate **not** absent

A – absent for component

M – missing mark; no information available about the candidate's previous performance

F– mark carried forward from a previous examination series. (If the mark status is 'F', then no mark follows.)

The OPTEMS provided will indicate, with asterisks, the candidates whose work is to be sampled, where this is pre-selected (see Section 4).

2.2 **Printout**

Centres are required to produce a printout of the centre-assessed marks and annotate it as described below, before forwarding it **together with the sampled coursework** as appropriate (see Section 4) to the moderator, **to be received by 1 May for the May/June examination series**. The name and address of the moderator will either be printed on the OPTEMS or supplied separately.

ABS – absent

W – withdrawn

* – sampled candidate

✔ – additional sampled candidates.

Where more than one teacher has assessed the work the teachers' initials or the set number should be given beside each candidate's name.

Centres are reminded that it is their responsibility to ensure that internal standardisation of the marking is carried out. The following **authentication** and internal standardisation statement should be written at the bottom of the printout and signed by the teacher responsible:

'*I declare that the work of each candidate for whom marks are listed is, to the best of my knowledge, the candidate's own and that where several teaching groups are involved the marking has been internally standardised to ensure consistency across groups*.'

Signed . . . . . Date . . . . . .

Centres are advised to retain a copy of the annotated printout.

3 Candidate mark record sheets

A copy of the candidate mark record sheet is provided on page 28 for centres to photocopy. The candidate mark record sheet, to be completed for each candidate, provides details for the moderator of how each candidate's total mark is reached. It is the teacher's responsibility to ensure that:

- all marks are recorded accurately and that the arithmetic is correct
- the total mark is transferred correctly onto the OPTEMS or via EDI.

Where a candidate's work is included in the sample the candidate mark record sheet should be attached to the work.

4 Sample of work for moderation

4.1 **Where the pre-printed OPTEMS is asterisked** indicating the candidates whose work is to be sampled, this work, together with the second copy of the OPTEMS, should be posted to reach the moderator by 1 May for candidates seeking certification in the summer series. The name and address of the moderator will either be printed on the OPTEMS or supplied separately.

In addition, the centre must send the work of the candidate awarded the **highest** mark and the work of the candidate awarded the **lowest** mark, if these are not already included within the initial samples selected. The centre should indicate the additional samples by means of a tick (✔) in the left-hand column against the names of each of the candidates concerned.

For all sampled work the associated record sheet must be attached to each candidate's work.

If the pre-selected sample does NOT adequately represent ALL parts of the entire mark range for the centre, additional samples in the range(s) not covered should also be sent to the moderator. As above, additional samples should be indicated by means of a tick (✔).

For centres submitting marks by EDI the candidates in the sample selected on the OPTEMS should be marked with an asterisk (*) or a tick (✔), as appropriate, on the EDI printout. The annotated printout must be sent to the moderator with the sample of work.

4.2 **In all cases** please note that the moderator may request further samples of coursework, as required and the work of all candidates should be readily available in the event of such a request.

4.3 **Internal standardisation**

Centres are reminded that it is their responsibility to ensure that where more than one teacher has marked the work, internal standardisation has been carried out. This procedure ensures that the work of all candidates at the centre is marked to the same standards. The statement confirming this on the OPTEMS or the EDI printout must be signed.

5 Sampling and despatch of candidates' work

5.1 Should an absent or withdrawn candidate be pre-selected, a substitute candidate's work should be sent for moderation. Please write 'substitute' against the substitute's name and mark the absent candidate 'absent' or 'withdrawn'.

5.2 **Photographic evidence of the outcome** of the design and make task **MUST** be securely attached to the sampled candidates' folios. The photograph should not have been subject to digital enhancement. The signatory of the authentication statement (see 2.2) will be deemed to have ensured that no enhancement has taken place.

5.3 The final **outcome** of the design and make task **must not be sent to the moderator but must be kept by the school in case it needs to be seen by the moderator**. The folios containing the paperwork associated with the coursework **must be sent**.

5.4 Please ensure that the coursework is presented in an orderly fashion. The use of plastic wallets and folders is not recommended.

5.5 The moderator may request further samples as necessary.

5.6 Edexcel reserves the right to visit any centre to moderate the outcomes produced. Centres selected for such a visit will be notified in advance of the visit.

5.7 When sending work to the moderator please ensure that the work of all candidates is clearly identifiable.

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