Cambridge Assessment International Education

Syllabus

Cambridge IGCSE™

Design & Technology 0445

Use this syllabus for exams in 2023.
Exams are available in the June and November series.

Version 1

Cambridge Pathway

Why choose Cambridge International?

Cambridge International prepares school students for life, helping them develop an informed curiosity and a lasting passion for learning. We are part of the University of Cambridge.

Our Cambridge Pathway gives students a clear path for educational success from age 5 to 19. Schools can shape the curriculum around how they want students to learn – with a wide range of subjects and flexible ways to offer them. It helps students discover new abilities and a wider world, and gives them the skills they need for life, so they can achieve at school, university and work.

Our programmes and qualifications set the global standard for international education. They are created by subject experts, rooted in academic rigour and reflect the latest educational research. They provide a strong platform for learners to progress from one stage to the next, and are well supported by teaching and learning resources.

Our mission is to provide educational benefit through provision of international programmes and qualifications for school education and to be the world leader in this field. Together with schools, we develop Cambridge learners who are confident, responsible, reflective, innovative and engaged – equipped for success in the modern world.

Every year, nearly a million Cambridge students from 10 000 schools in 160 countries prepare for their future with the Cambridge Pathway.

'We think the Cambridge curriculum is superb preparation for university.'

Christoph Guttentag, Dean of Undergraduate Admissions, Duke University, USA

Quality management

Cambridge International is committed to providing exceptional quality. In line with this commitment, our quality management system for the provision of international qualifications and education programmes for students aged 5 to 19 is independently certified as meeting the internationally recognised standard, ISO 9001:2015. Learn more at **www.cambridgeinternational.org/ISO9001**

Contents

Important: Changes to this syllabus

For information about changes to this syllabus for 2023, go to page 39.

The latest syllabus is version 1, published September 2020. There are no significant changes which affect teaching.

Any textbooks endorsed to support the syllabus for examination from 2020 are still suitable for use with this syllabus.

1 Why choose this syllabus?

Key benefits

Cambridge IGCSE is the world's most popular international qualification for 14 to 16 year olds, although it can be taken by students of other ages. It is tried, tested and trusted.

Students can choose from 70 subjects in any combination – it is taught by over 4800 schools in over 150 countries.

Cambridge IGCSE Design & Technology enables learners to identify, consider and solve problems through creative thinking, planning and design, and by working with different media, materials and tools to produce a made product.

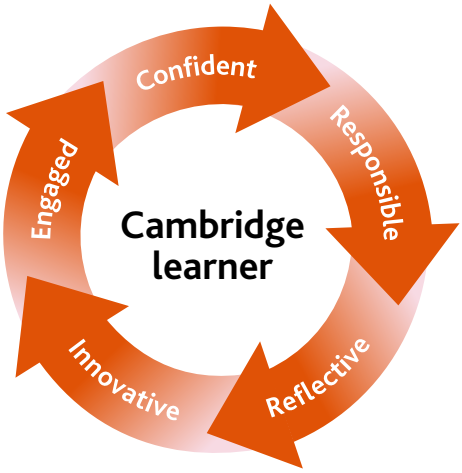
Learners gain technical and design awareness and develop skills such as initiative, resourcefulness, enquiry and ingenuity. They also develop the communication skills central to the design process.

Cambridge IGCSE Design & Technology provides an ideal basis for further study and equips learners with technical knowledge and practical designing and making skills for the world of work.

The syllabus is designed to accommodate a wide range of interests, materials and resources, and allows the different skills of the teaching staff to be fully exploited.

Our programmes balance a thorough knowledge and understanding of a subject and help to develop the skills learners need for their next steps in education or employment.

Our approach encourages learners to be:



'The strength of Cambridge IGCSE qualifications is internationally recognised and has provided an international pathway for our students to continue their studies around the world.'

Gary Tan, Head of Schools and CEO, Raffles International Group of Schools, Indonesia

International recognition and acceptance

Our expertise in curriculum, teaching and learning, and assessment is the basis for the recognition of our programmes and qualifications around the world. The combination of knowledge and skills in Cambridge IGCSE Design & Technology gives learners a solid foundation for further study. Candidates who achieve grades A* to C are well prepared to follow a wide range of courses including Cambridge International AS & A Level Design & Technology.

Cambridge IGCSEs are accepted and valued by leading universities and employers around the world as evidence of academic achievement. Many universities require a combination of Cambridge International AS & A Levels and Cambridge IGCSEs or equivalent to meet their entry requirements.

UK NARIC, the national agency in the UK for the recognition and comparison of international qualifications and skills, has carried out an independent benchmarking study of Cambridge IGCSE and found it to be comparable to the standard of the reformed GCSE in the UK. This means students can be confident that their Cambridge IGCSE qualifications are accepted as equivalent to UK GCSEs by leading universities worldwide.

Learn more at **www.cambridgeinternational.org/recognition**

'Cambridge IGCSE is one of the most sought-after and recognised qualifications in the world. It is very popular in Egypt because it provides the perfect preparation for success at advanced level programmes.'

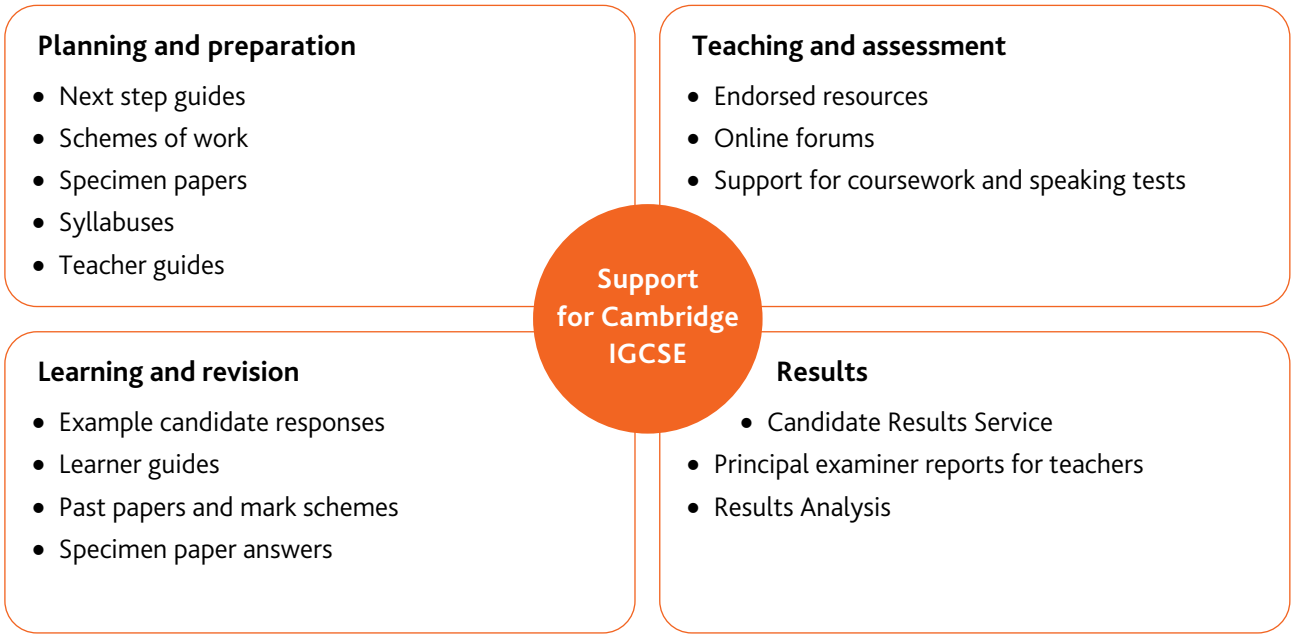
Managing Director of British School in Egypt BSE

Supporting teachers

We provide a wide range of resources, detailed guidance and innovative training and professional development so that you can give your students the best possible preparation for Cambridge IGCSE. To find out which resources are available for each syllabus go to our School Support Hub.

The School Support Hub is our secure online site for Cambridge teachers where you can find the resources you need to deliver our programmes. You can also keep up to date with your subject and the global Cambridge community through our online discussion forums.

Find out more at **www.cambridgeinternational.org/support**



Sign up for email notifications about changes to syllabuses, including new and revised products and services at **www.cambridgeinternational.org/syllabusupdates**

Professional development

We support teachers through:

- Introductory Training – face-to-face or online
- Extension Training – face-to-face or online
- Enrichment Professional Development – face-to-face or online

Find out more at **www.cambridgeinternational.org/events**

- Cambridge Professional Development Qualifications

Find out more at **www.cambridgeinternational.org/profdev**

Supporting exams officers

We provide comprehensive support and guidance for all Cambridge exams officers. Find out more at: **www.cambridgeinternational.org/eoguide**

2 Syllabus overview

Aims

The aims describe the purposes of a course based on this syllabus.

The aims are to enable students to:

- develop creative thinking in areas relevant to design and technology
- apply problem-solving skills to practical and technological problems
- develop the communication skills central to design, realisation and evaluation
- gain knowledge and understanding of design and technology
- develop skills in research and investigation
- design and make products, taking into consideration sustainability and the wider impact on society
- develop the ability to make aesthetic, economic, ethical and technical value judgements.

Content overview

Common content – study all topics							
Observe need/ requirement	Design brief/ specification	Identification/ research	Generation of possible ideas	Selection/ organisation	Evaluation	Implementation and realisation	
Health and safety	Initiation and development of ideas, and recording data	Communication of design ideas	Use of technology in design and making	Design & technology in society	Practical design application	Environment and sustainability	Control
Specialist option content – study topics from **one** specialist option							
Resistant Materials OR	Types of material	Preparation of materials	Setting, measuring, marking out, testing	Shaping	Joining and assembly	Finishing	
Systems & Control OR	Systems & Control Key content	Structures	Mechanisms	Electronics			
Graphic Products	Formal drawing techniques	Projections, views and developments	Presenting and communicating information	Materials and modelling	Use of instruments and/or ICT	Manufacture of graphic products	

Cambridge Assessment International Education is an education organisation and politically neutral. The contents of this syllabus, examination papers and associated materials do not endorse any political view. We endeavour to treat all aspects of the exam process neutrally.

Assessment overview

All candidates take three components. Candidates will be eligible for grades A* to G.

Candidates must take Paper 1 and Component 2 plus **one** from Paper 3, Paper 4 or Paper 5.

Compulsory components

All candidates take:

Paper 1 1 hour 15 minutes
Product Design 25%

50 marks

Questions will be based on the Common content: Product Design

Answer **one** question

Written/drawing paper

Externally assessed

and:

Component 2
Project 50%

100 marks

School-based assessment

Internally assessed and externally moderated

Optional components

All candidates take either:

Paper 3 1 hour
Resistant Materials 25%

50 marks

Questions will be based on the Specialist option: Resistant Materials content and the Common content: Product Design

Section A: answer **all** questions

Section B: answer **one** question

Written paper

Externally assessed

or:

Paper 4 1 hour
Systems & Control 25%

50 marks

Questions will be based on the Specialist option: Systems & Control content and the Common content: Product Design

Section A: answer **all** questions

Section B: answer **one** question

Written paper

Externally assessed

or:

Paper 5 1 hour
Graphic Products 25%

50 marks

Questions will be based on the Specialist option: Graphic Products content and the Common content: Product Design

Section A: answer **all** questions

Section B: answer **one** question

Written/drawing paper

Externally assessed

Information on availability is in the **Before you start** section.

Assessment objectives

The assessment objectives (AOs) are:

AO1 Knowledge and understanding

Recall, select and communicate knowledge and demonstrate understanding in design & technology, including its wider effects.

AO2 Application

Apply knowledge, understanding and skills in a variety of contexts and in designing and making products.

AO3 Analysis and evaluation

Analyse and evaluate products, including their design and production.

Weighting for assessment objectives

The approximate weightings allocated to each of the assessment objectives (AOs) are summarised below.

Assessment objectives as a percentage of the qualification

Assessment objective	Weighting in IGCSE %
AO1 Knowledge and understanding	30
AO2 Application	50
AO3 Analysis and evaluation	20
Total	100

Assessment objectives as a percentage of each component

Assessment objective	Weighting in components %		
	Paper 1	Component 2	Paper 3, 4 or 5
AO1 Knowledge and understanding	20	20	60
AO2 Application	60	60	20
AO3 Analysis and evaluation	20	20	20
Total	100	100	100

3 Subject content

This syllabus gives you the flexibility to design a course that will interest, challenge and engage your learners. Where appropriate you are responsible for selecting topics, subject contexts, resources and examples to support your learners' study. These should be appropriate for the learners' age, cultural background and learning context as well as complying with your school policies and local legal requirements.

All candidates must study the Design & Technology Common content below. This Common content provides foundation knowledge and skills for design & technology which are important to all areas of the subject. You may wish to integrate this content with the specialist options throughout your teaching.

Candidates must study one of the three specialist options: either Resistant Materials, Systems & Control or Graphic Products.

Teachers and candidates are encouraged to use CAD/CAM (computer-aided design / computer-aided manufacturing) throughout the curriculum if they have access to the facilities.

1 Common content: Product Design

Candidates should be able to:

Observe need/requirement

- identify and describe needs and opportunities for design and technological improvements

Design brief/specification

- analyse and produce design specifications for problems which they, or others, have identified

Identification/research

- identify the constraints imposed by knowledge, resource availability and/or external sources which may influence proposed solutions
- gather, order and assess information relevant to the solution of practical/technological problems
- produce and/or interpret data (e.g. diagrams, flow charts, graphs, experimental and test results)

Generation of possible ideas

- generate and record ideas as potential solutions to problems using a range of techniques
- identify what resources they need for solving practical/technological problems
- use a variety of media and equipment to produce models and mock-ups as a means of exploring a problem and as a means of testing the feasibility of a solution
- recognise the need for continuous appraisal of their own progress, thinking and decision-making, in order to provide themselves with opportunities for review
- relate self-appraisal judgements to the purpose of their study, in particular the specification which they set themselves

1 Common content: Product Design *continued*

Selection/organisation

- select and develop a solution after consideration of time, cost, skill and resources
- organise and plan in detail the production of the selected solution

Evaluation

- evaluate existing products/systems, the work of others and their own work
- test the performance of the product/solution against the original specification
- use different methods and sources to assess the effectiveness of a product (e.g. sampling, questionnaires, interviews)
- suggest any possible modification and improvements (consideration to include functional, safety, aesthetic, ergonomic and economic factors)

Implementation and realisation

- show an awareness of correct procedures for the preparation of materials
- show an awareness of the correct and accurate methods of drawing, marking out and testing
- select appropriate processes for shaping, forming, cutting, joining, fitting, assembling and finishing a variety of materials

Health and safety

- show an awareness of the correct use of hand and machine tools and equipment
- understand the need to take all mandatory and necessary safety precautions when using a variety of tools, machines, materials and other resources
- understand the responsibilities of designers to ensure that products are safe to use
- understand the importance of personal safety and the safety of others when designing and making products
- recognise basic safety symbols used in the workshop

Initiation and development of ideas, and recording of data

- extract relevant information from sources, and interpret and record information and data

Communication of design ideas

- use technical vocabulary, number skills, colour, shading and other media to produce sketches, models, diagrams, drawings and written materials, which communicate their ideas with precision and clarity

Use of technology in design and making

- research existing products (for example by using the internet)
- understand the benefits of CAD/CAM when designing and manufacturing one-off or batch production
- understand how CAD can be used to generate 2D and 3D images
- understand how CAD/CAM is used in industry
- be aware of a variety of machines that can be controlled by computer, including CNC machines: miller/router/engraver, lathe, laser cutter
- have an awareness and understanding of how computers can enhance stock control and quality control

1 Common content: Product Design *continued*

Design & technology in society

- show awareness of the effect of design & technology activity on social, environmental and economic issues
- demonstrate awareness of the role of designers, artisans and technologists in industry and society
- take a range of human needs into account

Practical design application

- consider how existing products meet the needs of the users
- consider production manufacturing as: one-off, batch and mass production
- generate design proposals:
  - identify the resources needed
  - plan the stages of manufacture
  - evaluate proposals against a specification
  - understand the relevance of function and aesthetics (in terms of the appreciation of the use of line, shape, form, proportion, space, colour and texture) as appropriate to their designed solutions and the work of others
  - understand the importance of anthropometrics and ergonomics
  - use modelling to test proposals

Environment and sustainability

- recognise that different forms of energy sources exist, namely, fossil fuels, nuclear, renewable
- understand the difference between the finite and almost infinite nature of energy sources and how design can help to conserve all energy sources
- use energy sources effectively and efficiently
- be aware of the responsibilities of designers towards sustainability of materials and other resources
- select materials based on environmental and sustainable considerations
- understand the need for recycling
- identify materials that can be recycled and those that cannot, including the use of recycling symbols on products
- understand the importance of disassembly of products and the reuse of parts
- understand that products may be designed with a limited lifetime

Control

- identify the features of a control system in terms of input devices, processing elements, output devices, feedback

2 Common content: Preparing your candidates for the project

This guidance shows what you should encourage all candidates to do when they work on Component 2 Project. The project involves the Common content. Candidates may use knowledge and skills gained in their chosen specialist option.

Candidates should be able to:

Identification of a need or opportunity with a brief analysis leading to a design brief

- explore several possible design needs or design opportunities
- identify and explore the needs of intended user/s
- develop one potential design need/opportunity
- present a full and clear design brief

Research into the design brief resulting in a specification

- complete research into aspects of the design brief
- consider needs of user/s
- analyse data/information generated
- produce a detailed and justified specification

Generation and exploration of design ideas

- identify and sketch a wide range of imaginative solutions which are conceptually different
- develop and clarify each solution with reference to the specification, using annotations
- explore technical aspects of each idea/part idea, e.g. possible materials and constructions
- evaluate ideas/part ideas regarding each specification point

Development of proposed solution

- clarify main features/aspects of proposed solution
- use modelling and trialling where appropriate to test aspects of the proposed solution
- specify details of form, materials and construction/production methods
- evaluate the proposed solutions regarding the specification points

Planning for production

- produce high-quality working drawings which include full details for manufacture
- produce a production plan which includes the stages of manufacture
- specify fittings and finishes, and provide a material list

Product realisation

- produce a product which demonstrates an ability to manipulate materials sensitively and use technologies successfully
- complete and finish the product to a high standard

2 Common content: Preparing your candidates for the project *continued*

Testing and evaluation

- test the product (in the intended environment, where possible)
- make justified comments about the performance of the product regarding the expectation of the specification points
- identify strengths and weaknesses of the product
- evaluate the project overall, making concluding comments about the successes and limitations of the product
- identify proposals for further development of the product

Freehand or computer-generated sketches, drawings or illustrations should be clear and well presented.

3 Specialist option: Resistant Materials

Resistant Materials is one of three specialist options.

Resistant Materials aims to develop the skills which designers use within the context of materials and their processing. Candidates need sufficient practical experience so they can get a broad understanding of materials, processes and technology, in order to become competent in using resistant materials.

This practical experience should include:

- the general physical and working properties of common construction materials (plastics, woods and metals) in relation to specific designing and making tasks
- simple comparative testing leading to the reasoned selection of materials and processes for specific design and making tasks.

It is a good idea to teach the following content in a practical way, wherever possible, and to integrate it with the Common content.

Candidates should be able to:

Types of material

- understand the physical and working properties of plastics, woods and metals and their applications

Smart and modern materials

- develop an awareness and understanding of 'smart' and modern materials, including: thermochromic materials; polymorph; shape memory alloy (SMA); shape memory polymer (acrylic)

Plastics

- show a working knowledge of the following:
  - thermoplastics (nylon, low and high density polyethylene [LDPE and HDPE], polyethylene terephthalate [PET], polyvinyl chloride [PVC], acrylic [PMMA], polystyrene [PS], polypropylene [PP], acrylonitrile-butadiene-styrene [ABS])
  - thermosetting plastics (polyester resin including GRP, melamine formaldehyde [MF], urea formaldehyde [UF] , phenol formaldehyde [PF] and epoxy resin)

Woods

- demonstrate a working knowledge of natural timbers and understand their classification, properties and uses
- understand why timber is seasoned and how to care for timber during storage and construction
- understand steaming and bending of timbers and have knowledge of adhesives' curing times and strengths
- demonstrate a working knowledge of the following manufactured boards: plywood, blockboard, chipboard, hardboard and MDF
- understand the advantages and disadvantages of working with manufactured boards compared with solid wood

3 Specialist option: Resistant Materials *continued*

Metals

- demonstrate a working knowledge of the following metals:
  - ferrous metals (cast iron, mild steel, stainless steel, high speed steel [HSS] and carbon steels)
  - non-ferrous metals (aluminium, duralumin and other common casting alloys, copper and its alloys, zinc, lead and tin)
- understand how the following processes can change the molecular structure of a material making it more or less suitable for the task it has to perform:
  - work hardening
  - annealing all metals
  - case hardening of mild steel
  - hardening and tempering tool steel (HCS)

Composites

- show an understanding of the term *composite* and be aware of the practical applications for each of the following composite materials:
  - Kevlar®
  - carbon fibre reinforced plastic (CFRP)
  - glass reinforced plastic (GRP)

Preparation of materials

- show knowledge of available market forms, types and sizes
- understand methods of cutting by use of hacksaw, guillotine, tenon saw, cross-cut saw, panel saw and portable power tools
- understand the use of datum surfaces/lines/edges and be able to produce them by planing or filing
- explain the preparation for machine processes and safe methods of securing materials to work surfaces, work tables, faceplates, lathe chucks and between centres on a lathe

Setting, measuring, marking out, testing

- measure and/or mark out using rule, pencil, marking knife, marker pen, scriber, try square, bevel, mitre square, centre square, dot/centre punch, dividers, inside/outside/odd-leg calipers, template, marking/cutting/mortise gauge
- produce datum lines by surface plate and scribing block or calipers
- measure using a micrometer, vernier gauge and/or digital caliper

3 Specialist option: Resistant Materials *continued*

Shaping

(a) Deforming/reforming

- understand the following processes: bending, sand casting, die casting, lamination, vacuum forming, blow moulding, injection moulding, extrusion, press forming

(b) Wastage/addition

- select and perform the following forms of cutting and removal of material, and joining and adding to a material to produce the required shape, form or contour:
  - use hand snips, saws, files, basic planes and abrasive cutters
  - simple hole boring by hand or machine including pilot, clearance, tapping, countersunk and counterbored holes
  - use taps and dies for screw cutting by hand
  - use planes, chisels, gouges and rasps
  - use abrasive mops, discs and belts
  - use a centre lathe and wood turning lathe
  - use portable power tools

Joining and assembly

- use various methods of fabrication and fitting to join parts of products, permanently or temporarily
- understand the processes of soldering, brazing, welding, riveting/pop riveting
- understand methods of carcase, stool and frame construction using permanent and temporary joints
- use holding devices, formers and jigs (for sawing, drilling and bending) to assist joining and assembly
- understand the use of knock-down (KD) fittings for use with manufactured boards such as chipboard, including one-piece and two-piece corner blocks, scan fittings, cam lock and leg fastenings
- understand where to use a wide range of pre-manufactured components, including screws, nails, nuts, bolts, hinges and catches
- understand how sizes of screws, nails, nuts and bolts are specified
- be aware of a range of different adhesives to join a variety of materials and any special considerations related to preparation, application, drying times and health and safety

Finishing

- understand the preparation for and application of surface treatments
- be aware of a range of different finishes including oils, paints, lacquers, stains, satin polishes, dipcoating
- be aware of surface finishes available for both interior and exterior use
- be aware of the special finishes available that will prevent corrosion or stains, or withstand heat or liquids
- understand the term *self-finishing* and the processes by which some materials are self-finished
- understand the process of electroplating and anodising

4 Specialist option: Systems & Control

Systems & Control is one of three specialist options.

Systems & Control aims to develop the skills and knowledge used by designers within the context of:

- Structures
- Mechanisms
- Electronics.

Systems & Control candidates **must** study the Systems & Control Key content.

In addition, **one** of these should be studied in depth – Structures, Mechanisms or Electronics.

It is a good idea to teach the following content in a practical way, wherever possible, and to integrate it with the Common content. It is also recommended that teaching of Structures, Mechanisms or Electronics is integrated with the Systems and Control Key content – especially where topics are continued, e.g. Levers are a topic in the Key content and in Mechanisms.

Compulsory for this specialist option:

4.1 Systems & Control – Key content

Candidates should be able to:

Types of structure

- identify and classify both natural and man-made structures as they occur in everyday life

Materials

- describe, compare and contrast the properties of the following structural materials when used in the construction of beams, frames, arches and cables:
  - woods, metals, concrete, plastics and composites

Framed structures

- recognise frames in use and identify the use of triangulation to establish rigidity

Applied loads and reactions

- understand what is meant by the following terms and their relationship to structural design: *tension*, *compression*, *shear*, *bending*, *torsion* and *static load* (simple examples only)

Levers

- identify and sketch simple examples of first, second and third order levers, and associated linkages

Transmission of motion

- list the factors influencing the choice of spur gears for practical applications and know when to select this type of gear mechanism

4.1 Systems & Control – Key content *continued*

Friction and lubrication

- recognise the need to reduce friction between two surfaces by design, and describe the types of lubrication, and other methods of reducing friction for different situations

Conversion of motion

- recognise and give examples of the following types of motion: rotary, linear, reciprocating and oscillating

Basic concepts of electronics

- use correct symbols and conventions when drawing circuit diagrams (see Electrical and electronic symbols list on our website at **www.cambridgeinternational.org/0445**)
- demonstrate understanding of the terms *series* and *parallel* for connecting components in a circuit
- identify and compare conductivity and insulation when selecting materials
- understand and apply units used to measure current, voltage, resistance and capacitance, including multiple and sub-multiple units

Switches

- understand the action and application of the following common switches:
  - toggle, push button (PTM/PTB), micro, reed

Choose **one** section for this specialist option from:

- 4.2 Systems & Control – Structures
- 4.3 Systems & Control – Mechanisms
- 4.4 Systems & Control – Electronics

4.2 Systems & Control – Structures

Candidates should be able to:

Designing and making

- design and make working models and products, applying concepts, knowledge and skills gained through practical experience of using resistant materials, components and kits
- design, make and evaluate a static structure

Moments (turning forces)

- define a moment as force × distance (Nm)
- demonstrate an understanding of the use of moments in simple calculations relating to the loading of beams and levers

Basic concepts of structures and forces

- understand the design and construction of structures which withstand stress and take stationary and moving loads

Types of structural member

- draw, describe and identify various types of member such as beam, strut and tie

Nature of structural members

- understand how length, shape of cross-section and material selection affects performance

Joints in structures

- select and use methods of joining materials of solid and hollow cross-section
- select and use different methods of reinforcing such as gussets, ribs, braces and laminating

Applied loads and reactions

- apply the concept of equilibrium as a result of applied load and reaction

Forces

- understand Stress = $\frac{\text{force}}{\text{cross-sectional area}}$
- understand Strain = $\frac{\text{change in length}}{\text{original length}}$
- understand the term *Factor of Safety* and its importance to structural design

OR

4.3 Systems & Control – Mechanisms

Candidates should be able to:

Basic concepts of mechanisms

- explain and use the following terms: *load*, *effort*, *fulcrum*, *mechanical advantage*, *velocity ratio* and *efficiency*

Levers

- use the principle of levers to design and make a simple machine

Transmission of motion

- list the factors influencing the choice of the following mechanisms for practical applications and know when to select each:
  - gears:
    - bevel, worm, rack and pinion
  - belts and pulleys:
    - flat, toothed, round and vee belts and pulleys
    - sprockets and chains
    - standard systems to maintain tension in drive belts and chains
- calculate simple gear ratios and transmission speed
- determine the Mechanical Advantage (MA), Velocity Ratio (VR), efficiency and rotational direction for the following:
  - wheel and axle, screw jack, compound pulley and gear arrangements

Bearings

- compare and contrast the use of plain, roller and ball bearings, and give reasons for their suitability for specific operational conditions

Conversion of motion

- understand the terms *crank*, *cam*, *follower*, *dwell*, *stroke*, *screw thread*, *pitch*
- compare and select from the following mechanisms for converting motion from one type to another:
  - crankshafts, crank/slider mechanisms, rack and pinion, ratchet and pawl, eccentrics, simple cams and screw threads

OR

4.4 Systems & Control – Electronics

Candidates should be able to:

Basic concepts of electronics

- understand the relationship between current, voltage and resistance (Ohm's Law) and use this to calculate the value of a current limiting resistor
- use ammeters, voltmeters and multimeters to measure current, voltage and resistance
- perform simple power calculations using P = VI

Circuit building techniques

- design and construct printed circuit boards (PCBs)
- make use of:
  - soldering, other methods of connection, appropriate tools
- know and apply health and safety measures for circuit building

Switches

- understand the terms normally closed (NC), normally open (NO), single pole single throw (SPST) and double pole double throw (DPDT) in relation to switches and relays
- use relays to switch higher voltage circuits for motors, solenoids, etc.
- construct and draw circuits which use a two pole change-over relay to give motor reverse control and latched (memorised) switching

Resistors

- make use of the resistor colour code to determine the value and tolerance of a resistor and to select the nearest suitable value
- draw circuit diagrams and perform calculations for resistors in series and parallel
- understand the term potential divider and perform calculations to determine values of resistance and voltage in potential divider circuits

Transistors

- describe the operation of transistors in terms of a small current entering the base being amplified to produce a larger collector/emitter current
- know when to use NPN bipolar transistors as switches in circuits

Diodes

- understand the use of a diode as a one way conductor, and its use in a relay circuit to protect against back emf (electromotive force)
- use LEDs (light emitting diodes) in circuits and be able to calculate the value of a suitable current limiting resistor to protect LEDs
- understand the function of 7 segment displays

4.4 Systems & Control – Electronics *continued*

Transducers

- understand the use of the following transducers: LDR (light dependent resistor), thermistor

Capacitors

- understand the differences between, and applications for, polarised and non-polarised capacitors

Time delay circuits

- construct and draw circuit diagrams for time delay circuits (monostable and astable) using the 555 timer integrated circuit (IC)
- understand the use of programmable integrated circuits such as PIC ICs (programmable interface controllers) for time delays
- calculate time delays from a given formula

Logic gates

- understand the use of logic gates (AND, OR, NAND, NOR, NOT) and truth tables for simple logic control systems
- demonstrate knowledge of 4000 series ICs
- use an operational amplifier (OP AMP) to compare voltages
- give examples of the use of logic control systems in everyday life, e.g. heating control, traffic lights, environmental control in a greenhouse, etc.

5 Specialist option: Graphic Products

Graphic Products is one of three specialist options.

Graphic Products aims to develop the skills that designers use within the context of their design activities in the design studio. It also aims to develop an awareness of the importance of communication and modelling techniques concerned with promotion and illustration of ideas and their interrelationship with all stages in commercial manufacture and promotion. You should refer to the role that graphic products have in one or more of the following or similar areas:

- packaging
- promotional design
- display
- product design
- manuals
- transport
- architectural modelling
- corporate identity
- interior design.

It is a good idea to teach the following content in a practical way, wherever possible, and to integrate it with the Common content.

Candidates should be able to:

Formal drawing

- demonstrate a working knowledge of appropriate British Standards, including the dimensioning of drawings and drawing to recommended scales

Orthographic projection

- identify and use both first and third angle orthographic projection

Isometric

- understand and draw isometric views, including views of circles, arcs and other curves (isometric scale is not required)

Planometric

- understand and draw planometric views at 45° × 45° and 60° × 30°, including circles and arcs (scaling is not required)

Estimated one-point and two-point perspective

- understand and draw estimated perspective, using one-point and two-point starts and perspective grids

Sectional views

- select the most suitable section and draw whole, part, revolved and removed sections

5 Specialist option: Graphic Products *continued*

Exploded views

- draw exploded views of component parts along one axis only

Assembly drawings

- assemble given component parts into a single drawing, including parts lists

Freehand drawings

- use freehand drawing to communicate ideas, thoughts and information from written, visual and tabular data, presenting these ideas in pictorial, plane or orthographic mode

Use of appropriate and relevant geometrical constructions to determine basic shapes

- construct regular and irregular plane linear shapes, including triangles, quadrilaterals, pentagons, hexagons and octagons, and bisect, sub-divide and proportionally divide lines; construct circles, tangents and tangential arcs

Developments (nets)

- construct developments of cubes, prisms, cylinders and cones, including simple truncations

Ellipses

- construct ellipses by any accurate method, including the use of a trammel

Enlarging and reducing

- use graphical methods to enlarge/reduce a shape to fit within a given size or location
- apply one-point perspective to enlarge/reduce a shape
- use a graphical method to enlarge/reduce a line to a given scale or ratio

Use of instruments

- use instruments to produce graphical representations

Use of drafting aids

- use drawing aids including technical pens, flow chart templates, lettering and other stencils, radius aids and flexicurves

Layout and planning

- select the most suitable layout to achieve visual impact and to convey information

5 Specialist option: Graphic Products *continued*

Presentation

- demonstrate the following range of techniques:
  - thin and thick line
  - light and shade to show form and mass
  - textural representations to illustrate a range of materials
  - colour rendering using a range of materials and aids
- select the most relevant method to present information for a particular purpose
- demonstrate the different modes of drawing diagrams and lettering necessary for the communication of information according to content, purpose and user
- demonstrate an awareness of varied lettering effects produced by the use of:
  - different lettering styles
  - different letter spacing
  - dry transfer methods
  - stencils
  - computer-generated lettering

Data graphics

- produce line, pie, bar and flow charts/graphs from data provided
- produce sequence drawings from data provided
- show an understanding of the range and purpose of standardised signs and symbols

Reprographics

- have a knowledge of commercial printing methods such as gravure, screen printing and lithography

Materials and modelling

- use modelling to scale
- have a knowledge of the following materials: paper, card, corrugated card and plastic, Styrofoam and foam board, thin plastic sheet, self-adhesive vinyl, polymorph, shape memory alloy (SMA) and thermochromics
- produce a scale drawing to enable a visual model to be made
- recognise and select methods of making temporary and permanent joints in graphic products using adhesives
- recognise and use non-permanent joining methods including slots, arrow-tabs and flaps
- recognise the use of reinforcing, fold-over locking flaps and lock rudder flaps used in packaging and display

5 Specialist option: Graphic Products *continued*

ICT

- understand and demonstrate awareness of the use of a computer to research shapes, images and letter fonts
- understand and demonstrate awareness that digital images can be captured and stored on a computer
- understand and demonstrate awareness of the use of a computer to alter the size and area of suitable shapes, images and letters for application to a graphical product
- understand and demonstrate awareness of the use of a computer to aid drawing (CAD) and a computer to aid manufacturing (CAM)
- understand and demonstrate awareness that a range of computer output devices can be used to give hard copy or a cut profile suitable for application to a graphic product

Manufacture of graphic products

- use hand tools safely and correctly to produce prototype graphic products
- understand the processes of vacuum forming and blow moulding to create blister packaging
- understand the commercial processes used to cut, crease and shape materials for quantity manufacture of graphic products

4 Details of the assessment

Candidates take three components: Paper 1 Product Design and Component 2 Project plus one specialist option, Paper 3, Paper 4 or Paper 5.

All papers assess the Common content for Design & Technology. Papers 3, 4 and 5 also assess the content for the selected specialist option.

Compulsory components

Paper 1 Product Design

Written/drawing paper, externally assessed, 1 hour 15 minutes, 50 marks

All candidates take this paper. Paper 1 tests the Common content: Product Design. However, candidates also need to make use of their knowledge of the specialist option they have chosen.

Candidates answer **one** of three questions which assess their design understanding and abilities.

The range of questions will reflect the breadth of optional content, with one question primarily focusing on Resistant Materials, one on Systems & Control and one on Graphic Products. Candidates may answer any of the questions, irrespective of the specialist option they have studied.

Candidates answer Paper 1 on pre-printed A3 insert sheets which set out specific space for each part of the question.

Candidates may use a calculator in the examination.

Drawing equipment

All candidates taking this paper should have access to the required drawing equipment in the examination:

Optional equipment:

- A3 drawing board and tee square (or parallel drafting device)
- 30°/60° and 45° set squares
- 180° protractor
- pencil compass

Required equipment:

- 300 mm rule
- drafting pencils
- coloured pencils
- eraser.

Component 2 Project

School-based assessment, internally assessed, externally moderated, 100 marks

All candidates take this component. Component 2 Project forms a significant part of the teaching and assessment requirements of this syllabus. Candidates usually work on their project over the final two terms of the course.

Guidance on preparing your candidates for their project is given in section 3 Subject content, under part 2 Common content: preparing your candidates for the project.

You must mark your candidates' project work and submit all marks and a sample of the marked folders for moderation. The mark scheme is given in 'Project assessment for Component 2 Project' at the end of this section.

Each candidate must complete an individual project. Candidates should produce a folder of work and a made product. The made product itself is **not** to be submitted unless it is a 2-dimensional (2D) graphic product. All relevant work should be presented in hard copy as an A3-size folder.

The project area is decided by the candidate with advice, as appropriate, from you as their teacher. Cambridge does not prescribe or recommend project areas. The project could focus on the specialist option the candidate has chosen; this approach will allow candidates to further their experience, knowledge and skills in their chosen option. The open nature of design & technology means that a candidate might want to pursue a focus which will involve knowledge, materials and skills from any of the options; this is permissible.

Candidates are encouraged to make full use of the wide range of ICT available in schools for design work. Freehand sketches and hand drawn technical drawings and computer-aided design (CAD) generated drawings are acceptable in the A3 submission folder.

It is important that candidates have the opportunity to access the facilities needed to realise their products. Although many schools will have access to traditional workshop facilities, ICT has increasingly developed to bring computer-aided manufacturing (CAM) into the school workshop. Candidates are encouraged to make full use of this type of equipment, where available, which may include laser cutters, 3-dimensional (3D) printers, and other computer controlled machines and programs. It is important to balance ICT controlled production with hand crafting techniques so that candidates gain experience across all methods of production.

If candidates have chosen the Graphic Products option, their made product could be in 2D or 3D form. If it is 2D, the folder will contain all the preliminary design work and the made product. If the graphic product is 3D, the folder will contain all the preliminary design work and photographs of the made product – 3D made products are not to be submitted for moderation. It is essential that 'camera ready' prints/images which are part of a graphic product should be included in the folder, and if the scale is appropriate, developments/nets should be included.

In the case of architectural design, the made product should be a well-constructed architectural 3D model, which should then be evaluated for its quality and effectiveness as a model. Models are not appropriate as made products in other specialist options. For example, it is inappropriate to produce paper/card models as the final outcome for products that should be manufactured using resistant materials. Candidates must create a product that can be properly tested and evaluated in the environment it is intended for.

All folders must include sufficient photographs of the made product, showing an overall view together with detailed views of evidence which support the award of marks for project assessment criterion 6 'Product realisation'.

Further guidance for teachers on this component is available in the *Coursework Handbook* for this syllabus, and in our online Coursework Training Programme. Please see our School Support Hub at **www.cambridgeinternational.org/support**

Supervising coursework

A general discussion on the progress of coursework is a natural part of the teacher–candidate relationship, as it is for other parts of the course. If plans and first drafts are completed under teacher supervision, you can be sure of the authenticity of the final coursework.

Coursework must be a candidate's own, unaided work.

For further information about supervising coursework, see the *Cambridge Handbook* for the relevant year of assessment at **www.cambridgeinternational.org/eoguide**

Authenticity

It is the centre's responsibility to make sure all assessed work is the candidate's original work. Candidates must **not** submit someone else's work as their own, or use material produced by someone else without citing and referencing it properly. You should make candidates aware of the academic conventions governing quotation and reference to the work of others, and teach candidates how to use them.

A candidate taking someone else's work or ideas and passing them off as his or her own is an example of plagiarism. It is your responsibility as a teacher to prevent plagiarism from happening and to detect it if it does happen. For more information, search for 'Preventing plagiarism – guidance for teachers' on our website at **www.cambridgeinternational.org/teachingandassessment**

Specialist options

Candidates take one of the three specialist optional papers (Paper 3, Paper 4 or Paper 5). Each of these papers tests knowledge of the Common content for the syllabus as well as the specialist option content. Each paper has a Section A and a Section B. Section A consists of compulsory questions. Section B gives a choice of questions.

Paper 3: Resistant Materials

Written paper, externally assessed, 1 hour, 50 marks

Paper 3 assesses the Specialist option: Resistant Materials content as well as the Common content: Product Design.

Section A contains 10 compulsory questions, worth 25 marks. In Section B candidates choose **one** out of three questions, each worth 25 marks. Resistant Materials content and Common content may be assessed in either section of the examination paper.

Candidates may use a calculator in the examination.

Paper 4: Systems & Control

Written paper, externally assessed, 1 hour, 50 marks

Paper 4 assesses the Specialist option: Systems & Control content as well as the Common content: Product Design.

This specialist option is built on three focus areas: Structures, Mechanisms and Electronics. Subject content for Systems & Control is divided into:

- Key content, drawn from across the three focus areas, which will be assessed throughout Paper 4
- In-depth focus areas (Structures, Mechanisms, Electronics) which will be assessed in Section B of Paper 4.

Candidates study **one** of these focus areas in depth, alongside the Key content which all Systems & Control candidates should study.

Section A contains a maximum of 12 compulsory questions, worth 25 marks, which assess the Systems & Control Key content.

In Section B candidates choose **one** out of three questions, each worth 25 marks. Candidates should choose the question on the area they have studied in depth: Structures, Mechanisms or Electronics.

Systems & Control Key content and Common content may be assessed in either section of the examination paper.

Candidates may use a calculator in the examination.

An Electrical and electronic symbols list for Paper 4 Systems & Control is available at **www.cambridgeinternational.org/0445**

Paper 5: Graphic Products

Written/drawing paper, externally assessed, 1 hour, 50 marks

Paper 5 assesses the Specialist option: Graphic Products content as well as the Common content: Product Design.

Section A contains three compulsory questions, worth 25 marks. In Section B candidates choose **one** of two questions, each worth 25 marks. Graphic Products content and Common content may be assessed in either section of the examination paper.

Candidates answer Paper 5 on pre-printed A3 insert sheets which set out specific space for each part question.

Candidates may use a calculator in the examination.

Standard drawing equipment

All candidates taking this option should have access to the following basic drawing equipment in the examination:

- A3 drawing board and tee square (or parallel drafting device)
- 30°/60° and 45° set squares
- 180° protractor
- pencil compass
- 300 mm rule
- drafting pencils
- coloured pencils
- eraser.

Candidates may also use other drafting aids as listed in the Subject content for Graphic Products under the heading 'Use of drafting aids'.

Project assessment for Component 2 Project

Marking the project

Your marking of the project should be positive, rewarding achievement where possible but clearly differentiating across the whole range of marks available.

In approaching the assessment process, you should look at the work and then make a 'best fit' judgement as to which level statement it fits. In practice the work does not always match one level statement precisely so a judgement may need to be made between two or more level statements.

Once a 'best fit' level statement has been identified the following guide should be used to decide on a specific mark:

- Where the candidate's work **convincingly** meets the level statement, the highest mark should be awarded.
- Where the candidate's work **adequately** meets the level statement, the most appropriate mark in the middle of the range should be awarded.
- Where the candidate's work **just** meets the level statement, the lowest mark should be awarded.

Recording and submitting candidates' marks and folders

Please refer to the samples database at **www.cambridgeinternational.org/samples** for information, dates and methods of submission of candidates' marks and work.

You should record candidates' marks for Component 2 on the Individual Candidate Record Card and the Coursework Assessment Summary Form which you should download each year from the samples database at **www.cambridgeinternational.org/samples**. The database will ask you for your country/territory and the syllabus code (i.e. 0445) after which it will take you to the correct forms. Follow the instructions on the form to complete it.

The marks on these forms must be identical to the marks you submit to Cambridge International.

Project mark scheme

All three assessment objectives are tested in each of the seven marking criteria.

Criterion 1: Identification of a need or opportunity with an analysis leading to a design brief

Level	Description	Marks
Level 3	Comprehensive investigation and full analysis of the design need, the identification of the intended user/s and a clear and full design brief.	4–5
Level 2	Relevant investigation with appropriate analysis of the design need, the identification of the intended user/s and a functional design brief.	2–3
Level 1	Limited investigation with an attempt at some analysis of the design need which results in a simple and unqualified design brief.	1
Level 0	No creditable response.	0

Criterion 2: Research into the design brief resulting in a specification		
Level	**Description**	**Marks**
Level 3	Full and objective research into the design brief and intended user/s with thorough analysis of the data/information leading to a detailed and justified specification for the product.	7–10
Level 2	Relevant research into the design brief and intended user/s with appropriate analysis of the data/information leading to a clear and partly justified specification for the product.	4–6
Level 1	Minimal examination and research into the design brief and intended user/s resulting in a limited specification for the product.	1–3
Level 0	No creditable response.	0

Criterion 3: Generation and exploration of design ideas		
Level	**Description**	**Marks**
Level 4	A wide range of imaginative solutions which are conceptually different. Ideas are developed and clarified with reference to the specification. Appropriate drawing techniques are used and are clear and well presented. Detailed and concise annotations explore technical aspects of each idea including consideration of possible materials and constructions. Ideas are evaluated with clear reference to each specification point.	16–20
Level 3	A range of imaginative solutions which are conceptually different. Main ideas are developed and clarified with reference to the specification. Appropriate drawing techniques used with annotations to explore most of the technical aspects including consideration of possible materials and constructions. Ideas are evaluated with some reference to the specification points.	11–15
Level 2	A limited range of solutions. Some ideas are clarified with reference to the specification. Use of appropriate drawing techniques with limited annotations to explore some aspects of each idea. Main ideas are evaluated with some reference to the specification points.	6–10
Level 1	A narrow range of ideas with a tendency to focus on one or two ideas with little or no reference to the specification. Basic sketching skills used. Little or no reference to the evaluation of ideas.	1–5
Level 0	No creditable response.	0

Criterion 4: Development of proposed solution		
Level	**Description**	**Marks**
Level 3	Comprehensive evidence of modelling and trialling to assist decisions about form, materials, fixings and construction/production methods. Excellent use of appropriate drawing methods which assist the clarification of the technical specification of the item to be manufactured. Evidence of evaluative comments or references to the specification where appropriate.	11–15
Level 2	Adequate evidence of modelling and trialling or sketches with annotations to assist decisions about form, materials, fixings and construction/production methods. Good use of appropriate drawing methods which assist the clarification of the technical specification of the item to be manufactured. Evidence of some evaluative comments or references to the specification.	6–10
Level 1	Some evidence of development towards a single solution. Superficial or limited information on decisions about form, materials, fixings and construction/production methods. Basic use of various drawing methods which assist the clarification of the technical specification of the item to be manufactured. Limited or no reference to the specification.	1–5
Level 0	No creditable response.	0

Criterion 5: Planning for production		
Level	**Description**	**Marks**
Level 3	High-quality working drawings which include full details for manufacture. Clear and detailed evidence of production planning leading to a logical, clearly communicated, sequence of the stages of manufacture including material lists, fittings and finishes.	7–10
Level 2	Working drawings which include most details for manufacture, e.g. overall layout and major dimensions. Adequate evidence of production planning leading to a logical sequence of the stages of manufacture including most of the details required for material lists, fittings and finishes.	4–6
Level 1	Basic working drawings which may include some details for manufacture, e.g. overall layout and major dimensions. Limited evidence of production planning. Some of the details required for material lists, fittings and finishes.	1–5
Level 0	No creditable response.	0

Criterion 6: Product realisation		
Level	**Description**	**Marks**
Level 6	The product will be complete and finished to a very high standard. The overall outcome will be made with precision and accuracy, and will function well. The product will fully meet all the requirements of the specification.	26–30
Level 5	The product will be complete and finished to a high standard. The overall outcome will be well made, and will function well, but may have some parts with minor inaccuracies and blemishes. The product will meet most of the requirements of the specification.	21–25
Level 4	The product will be complete and finished to a good standard. The overall outcome will be well made, and will function well, but may contain some inaccuracies and blemishes. The product will meet many of the requirements of the specification.	16–20
Level 3	The product will be mainly complete and finished to a fair standard. The overall outcome will be adequately made, and will partially function, but may contain significant inaccuracies and blemishes. The product will meet some of the requirements of the specification.	11–15
Level 2	The product may not be complete. The overall outcome will be adequately made and will partially function, but may contain significant mistakes, inaccuracies and/or blemishes. The product will meet a few of the requirements of the specification.	6–10
Level 1	The product will not be complete with parts at a poor level of finish. The overall outcome will be basic and it may not function as intended. The work will contain significant mistakes, inaccuracies and blemishes. The product will meet few or none of the requirements of the specification.	1–5
Level 0	No creditable response.	0

Criterion 7: Testing and evaluation		
Level	**Description**	**Marks**
Level 3	Objective testing and evaluation of the product with systematic reference to its performance, the specification and user. Where appropriate, testing will be carried out in the environment for which the product was intended. Clear identification and analysis of strengths and weaknesses of the product leading to detailed and meaningful conclusions with proposals for further development.	7–10
Level 2	Adequate testing and evaluation of the product with some reference to its performance, the specification and user. Identification of simple strengths and weaknesses of the product leading to some conclusions with proposals for further development.	4–6
Level 1	Little or no evidence of the testing and evaluation of the product with general reference to its performance. Little or no reference to the specification and user. Superficial identification of a limited number of strengths and weaknesses of the product leading to limited proposals for further development.	1–3
Level 0	No creditable response.	0

Internal moderation

If more than one teacher in your centre is marking internal assessments, you must make arrangements to moderate or standardise your teachers' marking so that all candidates are assessed to a common standard. You can find further information on the process of internal moderation on the samples database at **www.cambridgeinternational.org/samples**

You should record the internally moderated marks for all candidates on the Coursework Assessment Summary Form and submit these marks to Cambridge International according to the instructions set out in the *Cambridge Handbook*.

External moderation

Cambridge International will externally moderate all internally assessed components.

- You must submit the marks of all candidates to Cambridge International.
- You must also submit the marked work of a sample of candidates to Cambridge International.

The sample you submit to Cambridge International should include examples of the marking of each teacher. The samples database at **www.cambridgeinternational.org/samples** explains how the sample will be selected.

The samples database also provides details of how to submit the marks and work.

External moderators will produce a short report for each centre with feedback on your application of the mark scheme and administration of the assessment.

Command words

Command words and their meanings help candidates know what is expected from them in the exams. The table below includes command words used in the assessment for this syllabus. The use of the command word will relate to the subject context.

Command word	What it means
Analyse	examine in detail to show meaning, identify elements and the relationship between them
Calculate	work out from given facts, figures or information
Compare	identify/comment on similarities and/or differences
Contrast	identify/comment on differences
Define	give precise meaning
Describe	state the points of a topic / give characteristics and main features
Develop	take forward to a more advanced stage or build upon given information
Discuss	write about issue(s) or topic(s) in depth in a structured way
Evaluate	judge or calculate the quality, importance, amount, or value of something
Explain	set out purposes or reasons / make the relationships between things evident / provide why and/or how and support with relevant evidence
Give	produce an answer from a given source or recall/memory
Identify	name/select/recognise
Justify	support a case with evidence/argument
Outline	set out main points
Sketch	make a simple freehand drawing showing the key features, taking care over proportions
State	express in clear terms
Suggest	apply knowledge and understanding to situations where there are a range of valid responses in order to make proposals / put forward considerations

5 What else you need to know

This section is an overview of other information you need to know about this syllabus. It will help to share the administrative information with your exams officer so they know when you will need their support. Find more information about our administrative processes at **www.cambridgeinternational.org/eoguide**

Before you start

Previous study

We do not expect learners starting this course to have previously studied design & technology.

Guided learning hours

We design Cambridge IGCSE syllabuses based on learners having about 130 guided learning hours for each subject during the course but this is for guidance only. The number of hours a learner needs to achieve the qualification may vary according to local practice and their previous experience of the subject.

Availability and timetables

All Cambridge schools are allocated to one of six administrative zones. Each zone has a specific timetable.

You can view the timetable for your administrative zone at **www.cambridgeinternational.org/timetables**

You can enter candidates in the June and November exam series.

Check you are using the syllabus for the year the candidate is taking the exam.

Private candidates cannot enter for this syllabus. For more information, please refer to the *Cambridge Guide to Making Entries*.

Combining with other syllabuses

Candidates can take this syllabus alongside other Cambridge International syllabuses in a single exam series. The only exceptions are:

- Cambridge IGCSE (9–1) Design & Technology (0979)
- Cambridge O Level Design & Technology (6043)
- Cambridge O Level CDT: Design & Communication (7048)
- syllabuses with the same title at the same level.

Cambridge IGCSE, Cambridge IGCSE (9–1) and Cambridge O Level syllabuses are at the same level.

Group awards: Cambridge ICE

Cambridge ICE (International Certificate of Education) is a group award for Cambridge IGCSE. It allows schools to offer a broad and balanced curriculum by recognising the achievements of learners who pass exams in a range of different subjects.

Learn more about Cambridge ICE at **www.cambridgeinternational.org/cambridgeice**

Making entries

Exams officers are responsible for submitting entries to Cambridge International. We encourage them to work closely with you to make sure they enter the right number of candidates for the right combination of syllabus components. Entry option codes and instructions for submitting entries are in the *Cambridge Guide to Making Entries*. Your exams officer has a copy of this guide.

Exam administration

To keep our exams secure, we produce question papers for different areas of the world, known as administrative zones. We allocate all Cambridge schools to one administrative zone determined by their location. Each zone has a specific timetable. Some of our syllabuses offer candidates different assessment options. An entry option code is used to identify the components the candidate will take relevant to the administrative zone and the available assessment options.

Support for exams officers

We know how important exams officers are to the successful running of exams. We provide them with the support they need to make your entries on time. Your exams officer will find this support, and guidance for all other phases of the Cambridge Exams Cycle, at **www.cambridgeinternational.org/eoguide**

Retakes and carrying forward marks

Candidates can retake the whole qualification as many times as they want to. Information on retake entries is at **www.cambridgeinternational.org/entries**

Candidates cannot resubmit, in whole or in part, coursework from a previous series. To confirm if an option is available to carry forward marks for this syllabus, refer to the *Cambridge Guide to Making Entries* for the relevant series. Regulations for carrying forward internally assessed marks can be found in the *Cambridge Handbook* for the relevant year at **www.cambridgeinternational.org/eoguide**

Equality and inclusion

We have taken great care to avoid bias of any kind in the preparation of this syllabus and related assessment materials. In our effort to comply with the UK Equality Act (2010) we have taken all reasonable steps to avoid any direct and indirect discrimination.

The standard assessment arrangements may present barriers for candidates with impairments. Where a candidate is eligible, we may be able to make arrangements to enable that candidate to access assessments and receive recognition of their attainment. We do not agree access arrangements if they give candidates an unfair advantage over others or if they compromise the standards being assessed.

Candidates who cannot access the assessment of any component may be able to receive an award based on the parts of the assessment they have completed.

Information on access arrangements is in the *Cambridge Handbook* at **www.cambridgeinternational.org/eoguide**

Language

This syllabus and the related assessment materials are available in English only.

After the exam

Grading and reporting

Grades A*, A, B, C, D, E, F or G indicate the standard a candidate achieved at Cambridge IGCSE.

A* is the highest and G is the lowest. 'Ungraded' means that the candidate's performance did not meet the standard required for grade G. 'Ungraded' is reported on the statement of results but not on the certificate.

In specific circumstances your candidates may see one of the following letters on their statement of results:

- Q (PENDING)
- X (NO RESULT).

These letters do not appear on the certificate.

On the statement of results and certificates, Cambridge IGCSE is shown as INTERNATIONAL GENERAL CERTIFICATE OF SECONDARY EDUCATION (IGCSE).

How students and teachers can use the grades

Assessment at Cambridge IGCSE has two purposes:

- to measure learning and achievement

  The assessment:

  – confirms achievement and performance in relation to the knowledge, understanding and skills specified in the syllabus, to the levels described in the grade descriptions.
- to show likely future success

  The outcomes:

  – help predict which students are well prepared for a particular course or career and/or which students are more likely to be successful

  – help students choose the most suitable course or career.

Grade descriptions

Grade descriptions are provided to give an indication of the standards of achievement candidates awarded particular grades are likely to show. Weakness in one aspect of the examination may be balanced by a better performance in some other aspect.

Grade descriptions for Cambridge IGCSE Design & Technology will be published after the first assessment of the syllabus in 2020. Find more information at **www.cambridgeinternational.org/0445**

Changes to this syllabus for 2023

The syllabus has been updated. This is version 1, published September 2020.

There are no significant changes which affect teaching.

You must read the whole syllabus before planning your teaching programme.

Changes to assessment (including changes to specimen papers)	• For Paper 1 Product Design, we have clarified the wording for the drawing equipment (see page 26).

Any textbooks endorsed to support the syllabus for examination from 2020 are still suitable for use with this syllabus.

‘While studying Cambridge IGCSE and Cambridge International A Levels, students broaden their horizons through a global perspective and develop a lasting passion for learning.’

Zhai Xiaoning, Deputy Principal, The High School Affiliated to Renmin University of China

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