International General Certificate
of Secondary Education

Syllabus

DESIGN AND TECHNOLOGY 0445

For examination in June and November 2010

Design and Technology

Syllabus code: 0445

CONTENTS

Exclusions

This syllabus must not be offered in the same session with any of the following syllabuses:

0595 Design and Technology (Botswana)
6043 Design and Technology
6049 Design and Technology (Singapore)
7048 CDT: Design and Communication

INTRODUCTION

International General Certificate of Secondary Education (IGCSE) syllabuses are designed as two-year courses for examination at age 16-plus.

All IGCSE syllabuses follow a general pattern. The main sections are:

Aims

Assessment Objectives

Assessment

Curriculum Content.

The IGCSE subjects have been categorised into groups, subjects within each group having similar Aims and Assessment Objectives.

Design and Technology falls into Group V, Creative Technical and Vocational, of the International Certificate of Education (ICE) subjects.

The Design and Technology syllabus has been designed for Centres which are attempting to move towards a greater emphasis on design – the reasoned application of the knowledge, skills and discipline normally taught in the subject in problem solving situations.

AIMS

The aims of the syllabus are the same for all students. The aims are set out below and describe the educational purposes of a course in Design and Technology for the IGCSE examination. They are not listed in order of priority.

The aims are to enable students to:

1. foster awareness, understanding and expertise in those areas of creative thinking which can be expressed and developed through investigation and research, planning, designing, making and evaluating, working with media, materials and tools;
2. encourage the acquisition of a body of knowledge applicable to solving practical/technological problems operating through processes of analysis, synthesis and realisation;
3. stimulate the development of a range of communication skills which are central to design, making and evaluation;
4. stimulate the development of a range of making skills;
5. encourage students to relate their work, which should demand active and experimental learning based upon the use of materials in practical areas, to their personal interests and abilities;
6. promote the development of curiosity, enquiry, initiative, ingenuity, resourcefulness and discrimination;
7. encourage technological awareness, foster attitudes of co-operation and social responsibility, and develop abilities to enhance the quality of the environment;
8. stimulate the exercising of value judgements of an aesthetic, technical, economic and moral nature.

ASSESSMENT OBJECTIVES

The four assessment objectives in Design and Technology are:

A Knowledge with understanding

B Problem solving

C Communication

D Realisation.

A description of each assessment objective follows.

Under each assessment objective heading is given a list of the activities a student should be able to carry out.

A KNOWLEDGE WITH UNDERSTANDING

Students should be able to:

1. demonstrate the ability to state facts, recall and name items, recall and describe processes;
2. demonstrate the ability to apply and relate knowledge to designing and making;
3. make reasoned arguments and anticipate consequences about the outcomes of the Design and Technology process;
4. demonstrate a crucial awareness of the interrelationship between Design and the needs of society.

B PROBLEM SOLVING

Students should be able to:

5. recognise problems, identify clearly, from a problem situation, a specific need for which a solution is required and compose a design brief;
6. analyse a problem by considering any relevant functional, aesthetic, human, economic and environmental design factors and draw up a design specification;
7. investigate, research, collect and record relevant data and information;
8. generate a range of outline solutions to a design problem, giving consideration to the constraints of time, cost, skill and resources;
9. develop, refine, test and evaluate the effectiveness of design solutions.

C COMMUNICATION

Students should be able to:

10. recognise information in one form and where necessary change it into a more applicable form;
11. produce or interpret data in a variety of forms such as charts, diagrams, graphs, and flow charts;
12. propose and communicate ideas graphically using a range of media;
13. develop ideas and represent details of form, shape, construction, movement, size, and structure through graphical representation and three dimensional modelling.

D REALISATION

Students should be able to:

14. plan and organise the work procedure involved in the realisation of a solution;
15. select, from a range of resources, those appropriate for the realisation of the product;
16. demonstrate appropriate manipulative skills by showing an understanding of materials and their characteristics in relation to their use;
17. evaluate the process and product in terms of aesthetic, functional and technical quality.

SPECIFICATION GRID

Paper	Assessment Objectives				
	A Knowledge with understanding	**B** Problem solving	**C** Communication	**D** Realisation	Total
1	4%	10%	6%	5%	25%
2, 3 or 4	15%	3%	3%	4%	25%
5	-	30%	-	20%	50%
overall	19%	43%	9%	29%	100%

The assessment objectives are weighted to give an indication of their relative importance. They are not intended to provide a precise statement of the number of marks allocated to particular assessment objectives.

ASSESSMENT

SCHEME OF ASSESSMENT

Candidates who have followed this curriculum are eligible for the award of grades A* to G.

Candidates must take Paper 1, one of Papers 2-4, and a Project.

Centres will be required, at the time of entry, to indicate the optional Paper for which each candidate will be entered.

Paper 1 and the optional Paper 2, 3 or 4 will be taken together in one session of 2 hours and 15 minutes.

It should be noted that the content of Part 1 of the syllabus is intended to underlie all components of the assessment scheme and that a knowledge of the chosen option will be demonstrated in Paper 1 in addition to the optional paper and the project.

Component Number	*Title*	*Style of Paper*	*Duration*	*Weighting*	*Marks*
1 Paper 1	Design	Design drawing	1 hour 15 mins	25%	50
2 Paper 2	Graphic Products	Graphic	1 hour	25%	50
3 Paper 3	Resistant Materials	Written	1 hour	25%	50
4 Paper 4	Systems and Control	Written	1 hour	25%	50
5 Project*	School-based assessment		2 terms	50%	100

* Teachers may not undertake school-based assessment without the written approval of CIE. This will only be given to teachers who satisfy CIE requirements concerning moderation and they will have to undergo special training in assessment before entering candidates.

CIE offers school in-service training via Coursework Training Handbooks.

Please note that this syllabus is not available to private candidates.

DESCRIPTION OF PAPERS

Paper 1

This question paper will be set on Part 1 of the syllabus. Candidates will be required to answer one of 3 open ended questions intended to assess the candidates' abilities of analysis and synthesis. The range of questions will reflect the breadth of optional content.

Papers 2-4, Options

Candidates will be entered for **one** of the three optional papers.

In each of these papers there will be a Section A and a Section B. Section A will consist of compulsory questions, testing subject knowledge in the chosen option. Section B will consist of longer structured questions. Paper 2 will provide a choice of one out of two questions in this section. Papers 3 and 4 will provide a choice of one out of three questions in this section.

Paper 5, School-based assessment

Each candidate will undertake a personally identified Project centred on the chosen option from Part 2 of the syllabus. The Project, which will be internally marked and externally moderated, is expected to be worked over the final two terms of the course.

While the Project will be option based, the nature of the Common Core within the subject Design and Technology is such that each candidate's work is likely to be of a cross-optional character. The work presented for assessment will typically be in the form of an A3 size folder and the 'made product'. In the case of work from the Graphic Products option the folder could contain all the preliminary design work, with the 'made product' being in the form of 2 dimension work and models.

The folder must include sufficient photographs of the made product, showing an overall view together with detailed views of evidence to support the award of marks for assessment criterion 6 'Product Realisation'. (See External Moderation section of the Assessment Criteria for coursework).

Candidates whose work is required for external moderation will be selected by CIE. Refer to the Handbook for Centres and Administration Guide for further information.

CURRICULUM CONTENT

The curriculum objectives in Part 1 are to be followed by all students. This will be assessed specifically in Paper 1 (Design) and Coursework. It is envisaged that this core content will also be covered, in an integrated manner in the teaching of the optional specialist area from Part 2.

PART 1

	Candidates should be able to:
Observe need/requirement	identify and describe needs and opportunities for design and technological improvement;
Design brief/specification	analyse and produce design specifications for problems which have been self-identified or posed by others;
Identification/research	identify the constraints imposed by knowledge, resource availability and/or external sources which influenced 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 the resources needed for the solution of 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 these judgements to the purpose of their study, in particular the specification which they set themselves;
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;
	check 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 their preparation;
	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;
	show a proper regard for all mandatory and other necessary safety precautions relevant to the use of a variety of tools, machines, materials and other resources;
	show a concern for economy in the use of materials, components, media, time, energy and other resources;
Initiation and development of ideas, and recording of data	extract relevant information from sources (written, graphical, oral, computer based); interpret and record information and data;
Communicating ideas with others	use technical vocabulary, number skills, colour, shading and other media to produce sketches, models, diagrams, drawings (such as perspective, isometric, orthographic, sequential) and written materials, which communicate their ideas with precision and clarity;
Design and Technology in Society	show awareness of the effect of design and technology activity on social, environmental and economic issues;
	demonstrate awareness of the role of designers, craftsmen and technologists in industry and society;
	take account of human needs in aspects as diverse as aesthetic, ergonomic, economic, environmental, cultural and social;
Aesthetics	appreciate the use of line, shape, form, proportion, space, colour and texture as appropriate to their designed solutions and the work of others;
Anthropometrics and Ergonomics	demonstrate an understanding of the concept of ergonomics and the use of anthropometric data in their own design work and that of others;
Energy	recognise that different forms of energy sources exist, namely, fossil fuels, nuclear, solar, water power;
	understand how different sources and forms of energy can be stored, converted and transmitted to produce a work capability and to improve the quality of life;
	understand the inefficiencies of energy conversion methods, e.g. ‘losses’ into by-products such as heat, light and sound;
	understand the difference between the finite and almost finite nature of energy sources and how through design, all energy sources can be conserved;
	use energy sources effectively and efficiently;
Control	identify the features of a control system in terms of input devices, processing elements, output devices, feedback;
Mechanical Control (Static)	understand the use of common fastenings and fittings applicable to the holding of metal, wood, plastics, card and paper;
Permanent Fastenings	choose sensibly between common and appropriate methods applicable to most common materials; this should include simple joining, the use of adhesives, riveting and welding;

Mechanical Control (Dynamic)	understand methods of transmitting motion using simple systems only; examples should include belts, chains, pulleys, gears and cams.

Note that the use of CAD/CAM is encouraged throughout the curriculum if facilities are available. However, candidates will not be tested on CAD/CAM in the examination.

PART 2

Candidates will be expected to have followed a course centred on **one** of the following options:

(i) **Graphic Products**
(ii) **Resistant Materials**
(iii) **Systems and Control**

GRAPHIC PRODUCTS

It is recommended that the approach to the following objectives should be a practical one wherever possible and that their delivery to students be used as the vehicle for delivering the content of Part 1 such that the syllabus is seen as an integrated area of study.

Introduction

This area of study is concerned with developing skills used by designers within the context of design activities in the design studio. Additionally it is intended to foster 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. It is envisaged the content of this option will be taught through reference 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	

	Candidates should be able to:
Practical Applications	
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 (examination questions will be set in both first and third angle orthographic projection);
Isometric	understand and use this form of drawing, including isometric views of circles, arcs and other curves (isometric scale is not required);
Planometric	understand and use this form of drawing at 45° x 45° and 60° x 30°, including circles and arcs (scaling is not required);
Estimated Two-point Perspective	understand and use this form of drawing using one-point and two-point starts and using perspective grids;
Sectional Views	select the most suitable section and draw whole, part, revolved and removed sections;
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 Drawing	use freehand drawing to communicate ideas, thoughts and information from written, visual and tabular data, presenting these ideas in pictorial, plane or orthographic mode;
The 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	construct developments of cubes, prisms, cylinders and cones, including simple truncations;
Ellipses	construct ellipses by any accurate method, including the use of a trammel;
Use of Instruments	use instruments to achieve a good standard of graphical representation;
Use of Drafting Aids	use drawing aids including technical pens, templates, lettering and other stencils, radius aids, flexicurves. Ellipse aids and nut templates will be permitted in the examination unless otherwise stated;
Layout and Planning	select the most suitable layout to achieve visual impact and to convey information clearly and effectively;
Presentation	demonstrate the following range of techniques: (i) thin and thick line; (ii) light and shade to show form and mass; (iii) textural representations to illustrate a range of materials; (iv) colour rendering using a range of materials and aids; emphasise their ability to select the most relevant method to present information for a particular purpose; use clarity and good proportion to 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 an ability to produce varied lettering effects by the use of: (i) different lettering styles; (ii) different letter spacing; (iii) dry transfer methods; (iv) stencils; (v) computer-generated lettering;
Data Graphics	produce Line, Pie, Bar and Flow charts/graphs from data provided; produce sequence drawings from given data; show an understanding of the range and purpose of standardised signs and symbols;
Reprographics	have a knowledge of commercial printing methods such as gravure, lithography;
Modelling	understand the purposes of modelling; have a knowledge of the following materials: paper, card, modelling materials, Styrofoam, foam board, plastics.

RESISTANT MATERIALS

It is recommended that the approach to the following objectives should be a practical one wherever possible and that their delivery to students be used as the vehicle for delivering the content of Paper 1 such that the syllabus is seen as an integrated area of study.

Introduction

This area of study is concerned with developing the skills used by designers within the context of materials and their processing. It is intended that practical experience be used to create a broad understanding of materials and their processing rather than an in-depth knowledge of any particular material, technology or process through the following headings:

the general physical and working properties of common constructural materials, i.e.; 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.

	Candidates should be able to:
Practical Applications	design and make practical products using the concepts, knowledge and skills listed in this syllabus;
Types of Material	understand the physical and working properties and application in relation to plastics, woods and metals;
Plastics	show a working knowledge of the following: (i) thermoplastics - nylon, polythene, polyvinyl chloride (PVC), acrylic, polystyrene, polypropylene; (ii) thermosetting plastics - polyester resin including GRP, melamine, urea formaldehyde and phenol formaldehyde;
Woods	show a working knowledge of natural timbers, understand their classification, properties and uses; understand why timber is seasoned and how to care for timber during storage and construction; show a working knowledge of the following manufactured boards: – plywood, blockboard, chipboard, hardboard and MDF;
Metals	show a working knowledge of the following metals: – ferrous metals (mild and high carbon steels); – non-ferrous metals (aluminium, duralumin and other common casting alloys, copper and its alloys, zinc, lead and tin);
Practical Applications	
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/Marking Out	measure and/or mark out work using rule, pencil, marker pen, scriber, try square, bevel, dot/centre punch, dividers, marking gauge, cutting gauge and mortise gauge; accurately produce datum lines by surface plate and scribing block or callipers; accurately measure using a micrometer and a vernier gauge.
Shaping	
(a) Deforming/Reforming	Have knowledge of the following processes: – bending, simple casting, lamination; vacuum forming; blow moulding; injection moulding; extrusion;
(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, saws, files and rasps; – use abrasive mops, discs and belts;
Special Treatments	understand how the molecular structure of a material can be changed by the following processes, to make it more or less suitable for the task it has to perform: – work hardening, annealing all metals, case hardening of mild steel and hardening and tempering tool steel (HCS); understand the term plastic memory and its significance; understand steaming and bending of timbers and have knowledge of adhesives curing times and strengths;
Joining and Assembly	use various methods of fabrication and fitting to join parts of a desired structure. Allow any required movement, to enable it to perform its task satisfactorily (permanently or temporarily); understand methods of carcase, stool and frame construction using permanent and temporary joints; use holding devices, formers and jigs to assist joining and assembly; understand the use of KD (knock-down) fittings for use with modern materials such as veneered chipboard; use a variety of fittings and adhesives;
Finishing	understand the preparation for and application of surface treatments; be aware of a range of different finishes including oils, paints, laquers, 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.

SYSTEMS AND CONTROL

It is recommended that the approach to the following objectives should be a practical one wherever possible and that their delivery to students be used as the vehicle for delivering the content of Part 1 such that the syllabus is seen as an integrated area of study.

Introduction

This area of study is concerned with developing the skills and knowledge used by designers within the context of a group of related technological resource areas; namely Structures, Mechanisms and Electronics. It is intended that practical experience be used to create a broad understanding of the three resource areas and by identifying how they interrelate, their role in designing and making controlled systems can be appreciated and exploited.

	Candidates should be able to:
Designing and Making	design and make working models and practical products using the concepts, knowledge and skills listed, and resistant materials, components and kits;
	design, make and evaluate a static structure;
	use the principle of levers to design and make a simple machine that is structurally sound;
	use electric motors and solenoids to power simple mechanical models, and both bread-boarded and pcb built electronic circuits to control them;
Testing	use a simple dial gauge to measure the deflection of simple structures;
	be aware of the use of strain gauges for testing, common structural and mechanical members/ components under strain;
Moments (Turning Forces)	define a moment as force x distance (Nm); demonstrate an understanding of the use of moments in simple calculations relating to the loading of beams and levers;
Energy	describe the power sources used to drive mechanical systems and recognise a battery as an electrical energy storage/conversion device;
	be aware of the energy costs of powering systems and how, through good design and manufacture, the potential energy demand can be reduced;
Structure and Forces	calculate and analyse simple forces using triangle and parallelogram representation; examples will include support wires, tripods, shear legs and frames;
	understand the design and construction of structures which withstand stress and take stationary and moving loads;
Types of Structure	identify and classify both natural and man-made structures as they occur in everyday life;
Types of Structural Member	draw, describe and identify various types of member such as beam, strut and tie;

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, stone, concrete, plastics and composites;
Nature of Structural Members	be aware of how performance is affected by length, shape of cross-section and material selection;
Joints in Structures	apply sound judgement when selecting the appropriate method of joining materials of solid and hollow cross section; select and use different methods of reinforcing such as gussets, ribs, braces and laminating;
Framed Structures	recognise frames in use and identify the use of triangulation to establish rigidity;
Applied Loads and Reactions	apply the concept of equilibrium as a result of applied load and reaction; 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);
Forces	understand Hooke's Law and the relationship between extension and load; understand Stress = $\frac{\text{force}}{\text{cross sectional area}}$ understand Strain = $\frac{\text{change in length}}{\text{original length}}$ understand Young's Modulus of Elasticity as: $\frac{\text{Stress}}{\text{Strain}}$ (N/mm^2) draw and interpret a typical stress/strain graph for mild steel and identify the important features on this graph; understand the significance of these features to structural design; understand the term Factor of Safety and its importance to structural design.
Mechanisms	
General Concepts	explain and use the following terms correctly: – load, effort, fulcrum, mechanical advantage, velocity ratio and efficiency;
Levers	identify and sketch simple examples of first, second and third order levers, and associated linkages;
Transmission of Motion	select appropriately and list the factors influencing the choice of the following for practical applications: Gears – spur, 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 and Lubrication	be aware of the need to reduce friction between two surfaces by design, and describe the types of lubrication, and other methods of application for different situations; compare and contrast the use of plain, roller and ball bearings, and give reasons for their suitability for specific operational conditions;
Conversion of Motion	recognise and give examples of the following types of motion: – rotary, linear, reciprocating and oscillating; understand the terms crank, cam, follower, dwell, stroke, screw thread, pitch; compare and select appropriately crankshafts, crank/slider mechanisms, rack and pinion, ratchet and pawl, eccentrics, simple cams and screw threads as methods of converting motion from one type to another.
Electronics	
Basic Concepts	use correct symbols and conventions when drawing circuit diagrams; describe the operation of a circuit in terms of conventional current flow; identify and compare the following properties when selecting materials: – conductivity and insulation; understand and apply units used to measure current, voltage, resistance and capacitance, including multiple and sub-multiple units; understand the relationship between current, voltage and resistance (Ohm's Law) and use 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 $P = VI$;
Switches	understand the action and application of common switches: – toggle, push button (PTM/PTB), micro, rotary and reed; 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 the collector emitter circuit being controlled by the base bias voltage. Select appropriately the use of NPN 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; use LEDs in circuits and be able to calculate the value of a suitable current limiting resistor to protect LEDs;
Transducers	understand the use of the following transducers: – LDR, thermistor, strain gauge;
Capacitors	explain with the aid of diagrams/graphs, the charging and discharging of a capacitor;
Time Delay Circuits	construct and draw circuit diagrams for time delay circuits (monostable and astable) using capacitors, resistors, transistors and the 555 timer IC; use T = C x R to calculate simple time delays; use graphs and data to be able to select components to achieve a desired time delay;
Logic gates	Have knowledge and understanding of the use of logic gates (AND, OR, NAND, NOR, NOT) and truth tables for simple logic control systems. Give examples of the use of logic control systems in everyday life, e.g. heating control, traffic lights, environmental control in a greenhouse etc.

PROJECT ASSESSMENT CRITERIA

Criterion	Level of Response	Mark Range	Max Mark
1. Identification of a need or opportunity with a brief analysis leading to a Design Brief	A statement of what is to be made. Consideration of the design need or the intended user(s) leading to a design brief. Consideration of both the design need and the intended user(s) leading to a clear design brief.	1 2-3 4-5	5
2. Research into the Design Brief resulting in a Specification	Limited examination of the design brief with a specification identifying some basic requirements. Meaningful research of the design brief with some data identified. A specification including key features of the intended product. Thorough research of the design brief with relevant data identified and collected. Analysis of the research leading to a detailed specification for the intended product.	1-3 4-7 8-10	10
3. Generation and exploration of Design Ideas	A limited range of ideas with a tendency to focus on a single concept. Little or no evaluation of ideas. A range of appropriate solutions proposed. Ideas examined with evaluations leading to the identification of possible ideas for development. A wide range of appropriate solutions with imaginative interpretation. Detailed evaluation of ideas and consideration of the requirements of the specification.	1-7 8-13 14-20	20
4. Development of Proposed Solution	Some decisions made about form, materials and/or construction methods. As a result of investigation, appropriate decisions made about form, materials and construction/production methods. Evidence of some testing and/or trialling. Appropriate testing and trialling resulting in reasoned decisions about form, materials, construction/production methods and other items.	1-5 6-10 11-15	15

Criterion	Level of Response	Mark Range	Max Mark
5. Planning for Production	Limited evidence of any forethought. A working drawing with little detail. A simple plan showing awareness of the main processes involved. A clear working drawing showing overall layout and major dimensions. Clear and detailed planning showing an effective order for the sequence of operations. Drawings and other information give full details of the final product.	1-3 4-6 7-10	10
6. Product Realisation	The product will exhibit a reasonable standard of outcome, be mainly complete and satisfy some aspects of the specification. The product may have some minor inaccuracies and blemishes but will be complete and function as intended. The product will be completed to a high standard of outcome with precision and accuracy. It will meet fully the requirements of the product specification.	1-10 11-20 21-30	30
7. Testing and Evaluation	Little or no evidence of testing. General overall appraisal with little reference to the specification. Appropriate reporting and/or comment on simple testing. Reference to the specification with some conclusions leading to possible modifications or improvements. Objective testing with reference to the specification and user. Detailed and meaningful conclusions leading to proposals for further development.	1-3 4-6 7-10	10

MODERATION

(a) Internal Moderation

When several teachers in a Centre are involved in internal assessments, arrangements must be made within the Centre for all candidates to be assessed to a common standard.

It is essential that within each Centre the marks for each skill assigned within different teaching groups (e.g. different classes) are moderated internally for the whole Centre entry. The Centre assessments will then be subject to external moderation.

(b) External Moderation

External moderation of internal assessment will be carried out by CIE.

The internally moderated marks for all candidates must be received at CIE by 30 April for the May/June examination and by 31 October for the November examination. These marks may be submitted either by using MS1 mark sheets or by using Cameo as described in the Handbook for Centres.

Once CIE has received the marks, CIE will select a sample of candidates whose work should be submitted for external moderation. CIE will communicate the list of candidates to the Centre, and the Centre should despatch the coursework of these candidates to CIE immediately. Individual Candidate Record Cards and Coursework Assessment Summary Forms (copies of which may be found at the back of this syllabus booklet) must be enclosed with the coursework.

Further information about external moderation may be found in the Handbook for Centres and the Administrative Guide for Centres.

All records and supporting written work should be retained until after the publication of the results.

On no account should Centres attempt to send made products to CIE for moderation purposes. However, folders must include sufficient photographs of the made product showing an overall view together with detailed views of evidence to support the award of marks for assessment criterion 6 ‘Product Realisation’.

GRADE DESCRIPTIONS

The scheme of assessment is intended to encourage positive achievement by all candidates.

A **Grade A** candidate must show mastery of the core curriculum and an outstanding performance on the more design orientated problems.

A **Grade C** candidate must show his mastery plus ability in answering questions which are pitched at a more design orientated level.

A **Grade F** candidate must show success in a majority of tasks set on the core curriculum.

The grade descriptions are provided to give a general indication of the standards of achievement likely to have been shown or achieved by candidates awarded particular grades or Grades A, C and F.

	Grade F	Grade C	Grade A
The candidate is likely to have shown the ability to:			
A Knowledge with understanding			
Recall knowledge	Name, where shown, some of the items outlined in the syllabus and recall knowledge about them.	Identify and describe with accuracy and understanding a wide range of items outlined in the syllabus.	Identify and describe accurately most of the syllabus content presented in a variety of contexts.
Identify, apply and relate procedures	Name and recall, when shown, some of the procedures, including safety, which are outlined in the syllabus.	Identify, describe with some detail and relevance and apply a wider range of procedures, including evidence of safe practice, as outlined in the syllabus.	Determine, describe fully and apply in an organised and safe manner procedures outlined in the syllabus.
Provide explanations	Make elementary statements about some aspects of knowledge outlined in the syllabus.	Make detailed explanation, generally substantiated, of aspects covering a range of the syllabus.	Provide a structured and detailed explanation for the majority of items in the syllabus content.
Reason and predict consequences	Produce statements based on experience.	Predict consequences with some accuracy, giving reasons, based on evidence available.	Predict consequences across a variety of situations, using sound reasoned arguments in a variety of situations.
Showing understanding of Design and Technology concepts and principles	Recognise similarities between related aspects of DT.	Provide simple explanations reflecting an understanding of basic DT concepts and principles.	Recognise, explain and apply DT concepts and principles across a variety of situations.

	Grade F	Grade C	Grade A
B Design problem solving			
Recall problems	Interpret a given brief in a simple manner; recognise rudimentary aspects of a situation.	Examine a familiar situation. Identify some real needs, compose a brief and draw up a specification.	Assess a familiar situation and recognise its principal needs; compose a design brief and specification, with some understanding of precision and prescription.
Analyse problems	Engage in one of the following typical procedures: (i) gather some relevant information from readily available sources (ii) explore a category of user need (iii) consider aspects of use in a particular location (iv) investigate a range of resource options (v) consider straightforward aspects of the problem.	Gather relevant information and apply it meaningfully to the active exploration of factors such as: (i) a variety of user needs (ii) the influences different environments have (iii) the effect of resources and processes (iv) products with similar or related functions.	Systematically seek to identify and evaluate information and factors in a design situation concerning: (i) user needs, ergonomic and functional modes of use (ii) environments, locations and changes within each (iii) the availability and effect of materials and manufacturing processes (iv) the factors in the identity of a product: appearance, efficiency, compatibility.
Envisage solutions	Envisage one type or form of solution.	Generate alternative forms of solution and propose some variation within one form.	Produce ideas for solutions which are varied in form and detail and occasionally innovative. Apply sound judgements regarding feasibility and appreciate implications for brief, specification and production.
Refine and develop a solution	Suggest modifications to a proposal and be aware of cost as a factor.	Show progression in developing a proposal or idea. Consider modifications in relation to appearance, cost efficiency and feasibility.	Systematically develop and modify proposals or ideas in relation to appearance, cost, efficiency and feasibility, taking into account the manufacturing process.
Evaluate and test a solution	Make simple statements about the end product.	Evaluate the end product in terms of the brief with respect to function, appearance, cost and overall performance.	Accept evaluation as a feature of all design stages; show detachment in making judgements and seeking evaluation techniques. Offer sensible modifications for improving a feature.

	Grade F	Grade C	Grade A
C Design communication			
Recognise and transform	Recognise and change elementary forms of spoken, tactile, visual and written information which are related to everyday examples expressed in concrete and real ways.	Seek readily available and clearly defined information and transfer this information efficiently into other suitable forms.	Seek, recognise and transform information in an effective and economical manner across a variety of applicable forms.
Select means of communication	Select from a previously experienced elementary range of communication methods, those (s)he considers to be appropriate for the transmission of ideas and information.	Select communication methods which will clearly transmit ideas and information.	Select and discriminate between those communication methods which are the most appropriate and effective for transmitting ideas and information.
Convey information	Convey elementary information with some clarity using simple technical vocabulary.	Convey information clearly using an appropriate technical vocabulary.	Convey information appropriately, precisely and concisely.
Convey ideas	Convey ideas in an elementary form.	Convey ideas with clarity in a structured and appropriate manner.	Convey a sequence of ideas in a fluent manner by the most appropriate means.
Represent detail	Represent form by a recognisable outline.	Represent details of a form with some accuracy and precision and using a range of conventions.	Represent detail of a form with clarity and precision, taking full account of appropriate conventions.

	Grade F	Grade C	Grade A
D Design realisation			
Plan for realisation	Respond to planning suggestions in an order influenced by experience and personal transformation skills.	Plan for realisation in related stages pursued in a sequence leading to sensible completion when viewed against the designed solution.	Plan for realisation in related stages, pursued in a logical sequence leading to full completion when viewed against the designed solution.
Select resources	Select from a previously experienced range of resources which (s)he considers to be appropriate.	Select from the range of resources which (s)he judges to be the most appropriate after consideration of suitability, availability and cost.	Select from the range of resources which (s)he judges to be the most appropriate after researching characteristics, investigating suitability and checking availability and cost.
Select tools and processes	Select from a range of previously experienced tools, instruments and processes those which s(he) identifies as adequate to achieve the intended realisation.	Select from an immediately available range of tools, instruments and processes those which are appropriate to achieve realisation.	Select from the range of tools, instruments and processes available those which are appropriate and effective to achieve an efficient realisation.
Demonstrate transformation skills	Apply rudimentary manipulative or graphic skills, resulting in a realisation which meets some aspects of the designed solution.	Apply manipulative or graphic skills accurately enough to make a product which meets a significant proportion of the designed solution.	Apply manipulative or graphic skills with sufficient precision to make a product which closely reproduces the detail given in the designed solution.
Evaluate process and produce quality	Make simple statements demonstrating awareness of some of the aesthetic, functional and technical characteristics of the product.	Make statements demonstrating an appreciation of any strengths and weaknesses of some of the aesthetic, functional and technical characteristics of the product, making simple modifications where required.	Make detailed statements demonstrating an insight and awareness of and response to weaknesses of the aesthetic, functional and technical characteristics of the product, proposing appropriate modifications where required.

DESIGN AND TECHNOLOGY
Coursework Assessment Summary Form
IGCSE 2010

Please read the instructions printed overleaf and the General Coursework Regulations before completing this form.

Centre Number		Centre Name		June/November	2 0 1 0

Candidate Number	Candidate Name	Teaching Group/ Set	Analysis of Need, Formulation of Brief (max 5)	Research into Design Brief Resulting in Specification (max 10)	Generation and Exploration of Ideas (max 20)	Developm't of Proposed Solution (max 15)	Planning for Production (max 10)	Product Realisation (max 30)	Testing and Evaluation (max 10)	Total Mark (max 100)	Internally Moderated Mark (max 100)

Name of teacher completing this form		Signature		Date	
Name of internal moderator		Signature		Date	

UNIVERSITY of CAMBRIDGE
International Examinations

A. INSTRUCTIONS FOR COMPLETING COURSEWORK ASSESSMENT SUMMARY FORMS

1. Complete the information at the head of the form.

2. List the candidates in an order which will allow ease of transfer of information to a computer-printed Coursework mark sheet MS1 at a later stage (i.e. in candidate index number order, where this is known; see item B.1 below). Show the teaching group or set for each candidate. The initials of the teacher may be used to indicate group or set.

3. Transfer each candidate's marks to this form as follows:

   (a) Where there are columns for individual skills or assignments, enter the marks initially awarded (i.e. before internal moderation took place).
   (b) In the column headed 'Total Mark', enter the total mark awarded before internal moderation took place.
   (c) In the column headed 'Internally Moderated Mark', enter the total mark awarded *after* internal moderation took place.

4. Both the teacher completing the form and the internal moderator (or moderators) should check the form and complete and sign the bottom portion.

B. PROCEDURES FOR EXTERNAL MODERATION

1. University of Cambridge International Examinations (CIE) sends a computer-printed Coursework mark sheet MS1 to each centre (in late March for the June examination and in early October for the November examination) showing the names and index numbers of each candidate. Transfer the total internally moderated mark for each candidate from the Coursework Assessment Summary Form to the computer-printed Coursework mark sheet MS1.

2. The top copy of the computer-printed Coursework mark sheet MS1 must be despatched in the specially provided envelope to arrive as soon as possible at CIE but no later than 30 April for the June examination and 31 October for the November examination.

3. CIE will select a list of candidates whose work is required for external moderation. As soon as this list is received, send the candidates' work with the corresponding Individual Candidate Record Cards, this summary form and the second copy of MS1 to CIE. Indicate the candidates who are in the sample by means of an asterisk (*) against the candidates' names overleaf.

4. CIE reserves the right to ask for further samples of Coursework.

5. Send, with the sample work, instructions given to candidates and information as to how internal moderation was carried out.