

DESIGN AND TECHNOLOGY 6043
GCE O Level
2008

Exclusions

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

0445 Design and Technology
0446 Design and Communication (Namibia)
6049 Design and Technology (Singapore)

DESIGN AND TECHNOLOGY

GCE Ordinary Level

Subject 6043

*This syllabus is available for examination in **November only**.*

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INTRODUCTION

This syllabus is designed to lead to an examination for that part of the school curriculum identified as Design and Technology. It offers an examination for pupils who have followed a course of study which centrally features problem-solving design activity involving practical manipulative work using a range of materials. The following aims are assumed to be the major guiding influences in the school syllabus.

AIMS

To promote problem solving design activity.

To develop appropriate technical skills to enable the realisation of solutions to design problems.

To develop knowledge of a range of materials and the appropriate manipulative skills.

To develop an understanding of some aspects of technological activity.

To develop appropriate graphical skills to enable full engagement in design activity.

To develop awareness of possible hazards associated with practical workshop activities and to encourage habits of safe working.

ASSESSMENT OBJECTIVES

The following objectives are presented for the course to realise the above aims and as the reference against which the assessment will be made.

A candidate should be able to:-

1. identify clearly from a problem situation a specific need for which a solution is required;
2. define and analyse a problem by considering any relevant functional, aesthetic, human, economic and environmental factors;
3. investigate, research, collect and record relevant information;
4. demonstrate the ability to apply knowledge to solve problems;
5. exercise judgement relating to appropriate functional, technological and aesthetic factors;
6. develop ideas towards a solution;
7. communicate ideas by using appropriate methods;
8. plan and organise the work procedure involved in the realisation of a solution;
9. realise a solution in appropriate material(s) using suitable techniques;
10. demonstrate a knowledge of materials by showing an understanding of their characteristics in relation to their use;
11. demonstrate an awareness of the technological and cultural environment;
12. test and evaluate a design solution;
13. demonstrate ability in design, communication, craftsmanship and appropriate technology;
14. demonstrate the ability to apply previously learned knowledge.

THE EXAMINATION

PAPER 1 (2½ hrs, 80 marks)

40% of the total marks for the subject.

This paper will be marked out of 95 and then scaled to a mark out of 80

This will be a formal timed examination in which candidates will be required to show their knowledge and understanding of tools, materials and processes associated with the use of metal, wood and plastics in the production of artefacts made to satisfy needs. They will be expected to call upon experience of working these materials (see core content) and to demonstrate that their knowledge of at least one of the identified materials has been extended beyond that of the core experience.

Tools, materials and processes

Candidates are expected to study the three types of material – metal, plastic and wood, with one material being treated as the first discipline. They should also have a good working experience of a second material, and some knowledge of the third is expected.

Part A, carrying 30% of the total marks of the paper

Ten questions requiring short answers will be set based on a wide knowledge of materials, processes, tools, equipment terminology, graphic representation and interpretation.

Part B, carrying 70% of the total marks of the paper

Part B of the paper will contain two sections of subject matter as follows:
Section 1 – Tools and Materials;
Section 2 – Processes.

Candidates will be expected to answer one question from Section 1, two from Section 2 plus one other from either Section.

Candidates are free to make use of colour, other media and materials for the communication of ideas in their answers to all questions. Metric units will be used.

PAPER 2, Design Project

60% of the total marks for the subject.

(completed over a period of two semesters, 120 marks)

Project themes are set by CIE and will be notified to schools in January for examinations taken in November.

The Project will be a personally identified design opportunity within the thematic topic set by CIE.

The project will comprise two interrelated components:

- A The Design Folio
- B The Design Artefact

Part A, Design Folio

The Folio is to show the candidate's brief, analysis, investigation, design proposals and evaluations.

The candidate will be expected to survey the general thematic topic with a view to selecting a particular problem for resolution. The design brief which is to be formulated will lead to further investigation. There is to be evidence of how this information is used and of the basis of judgements made in the development of the design proposal.

The anticipated procedures for realising the artefact are to be identified and set down as a plan for production. This might be in the form of a flow diagram which is further elaborated by sketches to clarify and work out how some of the critical stages will be dealt with.

The candidates should use appropriate graphical methods throughout the Folio including sequential sketches and the use of colouring media. Any notes should generally be succinct and used only to clarify certain details.

Part B, Design Artefact

In realising the solution to the personally selected design problem, the candidate is expected to demonstrate refined workmanship, sensitive use of materials and appropriate constructional methods. Candidates need not restrict their design to the three materials within the syllabus but should take any opportunity to make use of their knowledge of the developing technologies.

SYLLABUS

In order to meet the requirements of this examination it is necessary that all candidates should have followed the core syllabus in order to gain a sound working knowledge and understanding of plastics, wood and metal. This syllabus should be completed before the adoption of the final project, which it is expected will call for further research and specialisation. With this in mind, the syllabus aims to encourage the inclusion of other materials and technologies when appropriate.

It is hoped that teachers will endeavour to involve pupils in discussion and debate whenever appropriate.

Safety

It is assumed that a proper and appropriate concern for safety codes and practices will be maintained throughout a course following this syllabus.

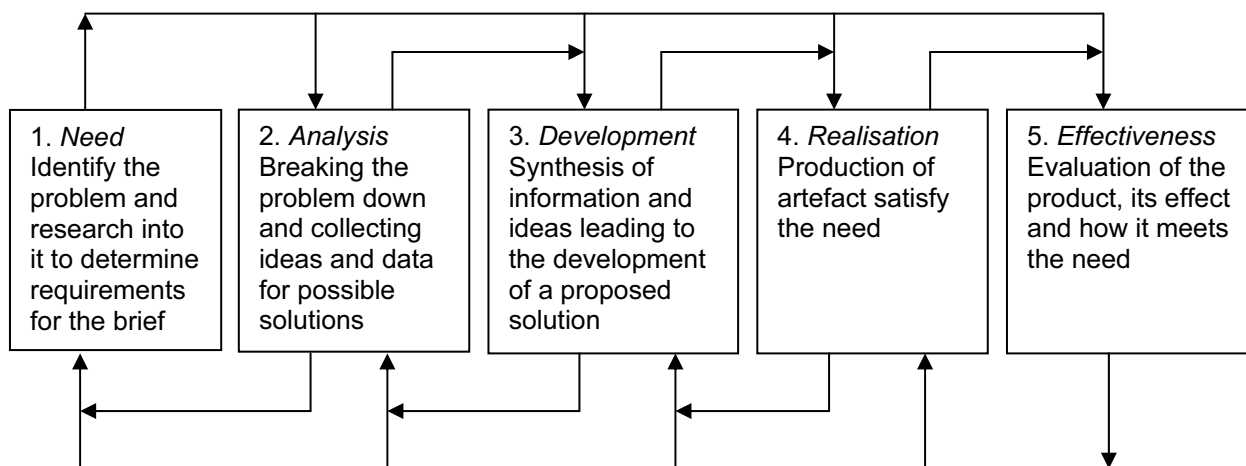
Design and Technology in Society

It is important that candidates obtain an appreciation of aesthetics, a pride in craftsmanship, along with understanding of the responsibility and place of the designer craftsman and technologist in society and industry. Some effects of the rapid developments in technology on the individual, and future trends and expectations should be considered.

DESIGN

Design Method

Designing is concerned with creating change and is undertaken in many different ways. It involves rational thought undertaken in a logical sequence but it also involves intuitive responses. For this examination design is concerned with problem-centred situations calling for solutions that can be realised through manufactured artefacts. The solutions may be arrived at through diverse methods but each will include the statement of a BRIEF, ANALYSIS, SYNTHESIS and EVALUATION. A convenient model to help pupils engage in design activity might be:



The arrows show that it is not always a linear series, that there is frequent looping back, particularly, an ongoing reappraisal of the nature of the need. The arrows at the top showing forward links indicate for example that when considering the nature of the need (box 1) the resources available for realisation (box 4) and the constraints must be kept in mind. Similarly, the likely effects (box 5) need to be anticipated at every stage.

Essential to the activity is the ability to use graphical techniques. There is often a need to model in other ways so as to visualise a possible solution or part solution.

The production stage calls for logical planning of the practical processes and the evaluation must be as objective as possible including, where appropriate, quantifiable testing.

Design Content

<i>Aesthetics</i>	A basic appreciation of the use of line, shape, form, proportion, space, colour and texture.
<i>Anthropometrics and Ergonomics</i>	An appreciation of the concept of ergonomics and the incorporation of anthropometric data in design where appropriate.
<i>Information</i>	Practice in gathering relevant information by searching out data from reference sources and enquiry through research and observation. The influence of natural forms on the man-made environment. The influence of materials and processes upon the shape of man-made artefacts.
<i>Awareness</i>	A basic understanding of common mathematical shapes in product design, the use of triangulation and the modular principle. A basic appreciation of design evolution through a recognition of how designers respond as time progresses to changing pressures and influences.

Teachers and candidates are asked to take particular note of the Assessment Objectives, the Teacher's Guide to Assessment, and the Criteria for the Assessment of the Project.

Graphics

The ability to show ideas and constructions by pictorial drawing, exploded and sectional views by recognised methods, the principle aim being to achieve fluency. This does not preclude the ability to produce measured orthographic drawings where appropriate.

The use of ink, colouring media, line, shape, form and texture should be encouraged so that students come to understand the importance of good presentation. Explanations using sequential sketches and flow diagrams.

TECHNOLOGY

Materials, Knowledge and Processes

General physical and working properties and the applications of common constructional materials especially plastics, wood and metal. Simple comparative testing leading to the reasoned selection of materials. A broad understanding with practical experience rather than an in-depth knowledge of any particular material, technology or media. Examples of areas which should be covered are given as guidance.

Theoretical Knowledge

<i>Plastics</i>	Thermoplastics - nylon, polythene, polyvinylchloride, acrylic and polystyrene. Thermosets - polyester resin including G.R.P., melamine, urea and phenol formaldehyde.
<i>Wood</i>	Natural timbers - classification advantages and disadvantages in use. Seasoning, storage and care of timber during use and construction Processed wood - plywood, blockboard, chipboard, veneer and hardboard.
<i>Metals</i>	Ferrous - mild steel and high carbon steels. Non ferrous - Aluminium and the alloy Duralumin along with the common casting alloys. Copper and its alloys. Zinc, Lead and Tin. A knowledge of different and appropriate properties and uses rather than of methods of manufacture.

Practical Processes

Experience in the use of hand and machine tools, operations and processes should cover the major materials - metal, plastic and wood - in sufficient detail to enable candidates to fulfil the realisation of their designs with sensitivity and manipulative skill, to produce artefacts showing a high degree of design awareness and of craftsmanship.

Area of Activity

1. **Preparation of Materials**
knowledge of available forms, types, sizes - conversion/cutting ready for use - datum surfaces/lines for future use - preparation for machine processes.
2. **Setting/Marking Out**
measuring and/or marking of work so that future operations can be carried out successfully, accurately and speedily.
3. **Shaping**
 - (a) **Deforming/Reforming**
methods which rely on a rearrangement of material, rather than its removal, to give the desired shape, form or contour.
 - (b) **Wastage/Addition**
various forms of cutting and removal of, or joining and adding to, a material to give the desired shape, form or contour.
4. **Special Treatments**
those which so change the molecular structure of a material as to make it more suitable for the work it is needed to perform.
5. **Joining and Assembly**
those methods of fabricating and fitting together with the various parts of a job to form the desired structure, or give the required movement, to enable it to perform its task satisfactorily, both permanent and temporary.
6. **Finishing**
the preparation for, and application of, the surface treatment necessary for the material to perform its designed role most satisfactorily.

Core

- Hacksaw, guillotine, tenon saw, cross-cut and panel saws.
- Rule, try-square, scribe, chinagraph pencil, marking knife and pencil. Centre punch.
- Hollowing, bending, forming by heating/pressure, simple casting, steam bending and lamination.
- Hand snips, saws, files, rasps, basic planes and abrasive cutters. Simple hole boring by hand and machine. Hand threading and tapping.
- Annealing, case hardening, hardening and tempering.
- Methods of frame and box (carcase) construction. Permanent and temporary fixtures. Fittings and adhesives.
- Surface finishes available, or made, to withstand both interior and exterior use.

Expansion

- Purpose built portable tools. Securing work to face-plates, lathe chucks or between centres. Filing/Planing of datum edge/surface.
- Marking of datum line, by surface plate and scribing block or calipers. Vernier gauge. Micrometer. Dividers, marking gauge and mortise gauge.
- Use of moulds, formers and dies, vacuum, blow or adhesive assisted. Casting to form by heat, pressure, chemical process or in combination.
- Pilot, clearance, tapping, countersunk and counterbored holes. Screw cutting. Special purpose planes, chisels, gauges, saws; abrasive mops, discs and belts in addition to special files and rasps.
- Annealing of all metals during working. Heat treatment of mild steel and tool steel (HCS). Plastic memory. Steaming and bending times for timbers. Adhesive curing time and strengths.
- Use of jigs, formers and holding devices to assist these methods. Later developments in use of fixing aids, particularly in 'newer' materials. Locking and pinning methods and friction fixings.
- Special finishes available to withstand corrosion, heat, liquids, stains, etc. Applied finishes as well as the role of 'as bought' finishes (oils, paints, lacquers, stains, dip-coating, satin polishes, etc.).

The Developing Technologies

The developing technologies of Structures, Pneumatics, Mechanisms, Electronics, Materials Processing and Micro Computing are increasingly being used in Design and Technology departments as aids in graphics, design, control and realisation. Students should, whenever possible or appropriate, be given the opportunity to keep abreast of developments in these areas both within school and industry and to make use of that knowledge within their Projects.

ORGANISATION OF ASSESSMENT

PAPER 1

The timed paper will be despatched to CIE for marking.

PAPER 2

Part A, Design Folio

Part A is to be marked internally, with external moderation. A selection of the Design Folios from each centre will be sent direct to an external examiner, together with the teacher's assessment based on given criteria.

Part B, Design Artefact

Part B is also to be marked internally using given criteria. The teacher's assessment is to be sent to the Examiner.

There will be external moderation by Examiners and, at the discretion of the Chief Examiner, some schools each year may be required to send a selection of marked work to CIE for the purpose of correlating standards.

It is expected that practical work will be completed by 15 October.

Schools to be visited by Examiners will be notified in good time, Teachers are not precluded from acting as advisers to their candidates. Candidates will not be penalised if working drawings show evidence of use.

The teacher's assessment for both Part A and Part B should be made on an assessment form which will be provided by CIE. Instructions for the dispatch of this form, and of samples of the Design Folios from the centres, will be sent to each centre during September of the year of the Examination.

ASSESSMENT OF PAPER 2 (PROJECT)

The criteria upon which the marking scheme will be built include:-

The extent of research and ability shown to use the material realistically in response to the problem being confronted.

The appropriateness and quality of the techniques employed in the resolution of practical project work.

Assessment scheme

	Marks
<i>Part A - The Folio</i>	
General analysis of the topic	10
Formulation of design brief and specification	5
Exploration of ideas	10
Detailed development of proposed solution	15
Suitability of chosen materials and construction	10
Production planning	10
Communication	10
Total (Part A)	70
<i>Part B - The Artefact</i>	
Suitability of proposed solution	10
Workmanship	30
Evaluation	10
Total (Part B)	50
Total (Paper 2)	120

TEACHER'S GUIDE TO ASSESSMENT

The assessment is to reflect:-

- (i) the extent of research and the ability to use the material realistically in response to the problem confronted;
- (ii) the appropriateness and quality of the techniques employed in the resolution of the practical project work.

The following guidance is given to teachers for making the assessment and completing the Syndicate's form.

PART A-The Folio

<i>General analysis of topic</i>	Candidates should: show, through a general examination of the theme, sensitivity to possible problems and the ability to analyse situations.
<i>Formulation of design brief and specification</i>	demonstrate the ability to define the problem and formulate a design brief and list a detailed specification.
<i>Exploration of ideas</i>	record the investigation made and show an ability to explore a variety of existing and possible solutions.
<i>Detailed development of proposed solution</i>	show engagement in the development of ideas towards a working solution which should be shown in the form of a working drawing.
<i>Suitability of chosen material(s) and construction</i>	show through reasoned judgement the ability to select materials, technologies and construction methods appropriate to the selected project.
<i>Production planning</i>	produce a plan setting out a sequence for the technical production of the artefact. The plan which may be in the form of a flow chart or list should identify and describe the more complex tasks.
<i>Communication</i>	have used appropriate techniques for achieving clarity of communication. These might include e.g. the use of colour, 'mock-ups', and models. An understanding of suitable drawing techniques as revealed in the formal presentation of the final solution (assembly drawing, etc.). The use of words should be succinct.

PART B-The Artefact

<i>Suitability of proposed solution</i>	show that he/she has responded to the aesthetic and technical requirements of the design brief and specification.
<i>Workmanship</i>	demonstrate an ability to manipulate materials sensitively and apply technologies with accuracy of workmanship and quality of finish.
<i>Evaluation</i>	write a succinct evaluation of the realised solution. The candidate should refer back to the requirements, originally specified, to assess how well the solution satisfies the brief. The evaluation should include: <ol style="list-style-type: none"> (a) an assessment based on objective testing of how well the specification has been satisfied; (b) a reappraisal of the brief, including amendments to the brief where appropriate; (c) comments on the modifications made as the Project developed; (d) comments on any possible improvements that would improve the solution as made; (e) any effects brought about by the solution that were not foreseen.

CRITERIA FOR THE ASSESSMENT OF THE PROJECT

A THE FOLIO

General analysis of Topic	A wide ranging analysis with many aspects of the theme considered.	7-10	10
	A relatively sound analysis with a range of aspects of the theme considered.	4-6	
	An analysis with aspects of the theme considered.	1-3	
Formulation of Design Brief and Specification	A concise brief with a comprehensive specification.	4-5	5
	A clear brief with a statement of some of the specific requirements.	3	
	An unclear brief without relevant specification.	1-2	
Exploration of Ideas	A wide range of ideas combined with imaginative interpretation.	7-10	10
	A fair range of ideas with some ideas examined.	4-6	
	Little variety of ideas with a tendency to misdirect efforts.	1-3	
Detailed Development of Proposed Solution	Thorough and thoughtful development with attention to fine detail.	11-15	15
	A developed idea with sufficient attention to detail only.	6-10	
	An undeveloped idea lacking in attention to detail.	1-5	
Suitability of chosen Materials and Construction	Deep knowledge well applied with reasoned selection of materials and construction.	7-10	10
	Adequate knowledge to recognise main options and make the necessary selection.	4-6	
	Basic knowledge only. Considerable guidance needed in the selection of materials and methods of construction.	1-3	
Production Planning	Good insight to processes, clear detailed planning.	7-10	10
	Some anticipation and awareness of main processes.	4-6	
	Adequate overall planning, but lacking in detail.	1-3	
Communication	Clear.	7-10	10
	Competent graphic presentation but lacking in detail.	4-6	
	Lacking both quality and detail.	1-3	

B THE ARTEFACT

Suitability of Proposed solution	Good match to specification, refined aesthetic and technical features.	7-10	10
	Sound in most aspects and has some good features.	4-6	
	Little match to main requirements of specification.	1-3	
Workmanship	Overall judgement required, how range of skills contained have been applied. Typically:		30
	Precise, accurate, well finished. Mastery of most aspects, refinement of detail.	21-30	
	Competent, some minor inaccuracies, blemishes, some degree of mastery.	11-20	
	Working product marred by limited skill control.	1-10	
Evaluation	Detailed appraisal related to specification, objective, modifications proposed, tests applied where possible.	7-10	10
	Main aspects of specification critically appraised, some objectivity.	4-6	
	General overall appraisal with little reference to specification.	1-3	

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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 at a later stage (i.e. in candidate index number order, where this is known).
3. Enter each candidate's marks on this form as follows:
 - a) In the individual skills columns, enter the marks awarded.
 - b) In the column headed 'Total Mark', enter the total mark awarded.
4. Ensure that the addition of marks is independently checked.
5. Both the teacher completing this form and the internal moderator should check the form and complete the bottom portion.

B. PROCEDURES FOR EXTERNAL MODERATION

1. University of Cambridge International Examinations (CIE) sends a computer-printed Coursework mark sheet to each centre in October showing the name and index number of each candidate. Transfer the total internally moderated mark for each candidate from this Coursework Assessment Summary form to the computer-printed Coursework mark sheet.
2. Despatch the top copy of the computer-printed Coursework mark sheet (MS1) to the Ministry or CIE, as appropriate in time to allow external moderation to take place. The deadline for receipt of this completed document is 31 October for the November examination.
3. Send samples of the candidates' work covering the full ability range, together with this form and the second copy of MS1, by 31 October for the November examination.
4. If there are 10 or fewer candidates submitting Coursework, send all the Coursework that contributed to the final mark for every candidate.
5. If there are more than 10 candidates, send the Coursework that contributed to the final mark for the number of candidates as follows. The marks of the candidates' work selected should cover the whole mark range with marks spaced as evenly as possible from the top mark to the lowest mark.

number of candidates entered	number of candidates whose work is required
11-50	10
51-100	15
above 100	20

6. If different teachers have prepared classes, select the samples from the classes of different teachers.
7. CIE reserves the right to ask for further samples of Coursework