CONTENTS

Broad Guidelines

The Ministry of Education is committed, in accordance with the National Policy Statement on Education, to provide a Curriculum and Assessment System (Form 4 and Form 5) so that at the completion of secondary education, learners will

- be equipped to meet the changing needs of the Nation, and
- have attained internationally acceptable standards.

Swaziland's National Education Policy Directives

SGCSE syllabuses for studies in Form 4 and Form 5 will individually, and collectively, enable learners to develop **essential skills** and provide a broad **learning experience** which

- inculcates values and attitudes as well as knowledge and understanding,
- encourages respect for human rights and freedom of speech,
- respects the values and beliefs of others, relating to issues of gender, culture and religion,
- develops desirable attitudes and behaviour towards the environment,
- provides insight and understanding of global issues which affect quality of life in Swaziland and elsewhere, e.g., the AIDS pandemic; global warming; maldistribution of wealth; and technological advances.

The National Curriculum for Form 4 and Form 5

Learners will be given opportunities to develop **essential skills** which will overlap across the entire range of subjects studied. These skills are listed below.

- Communication and language skills
- Numeracy skills: mathematical ideas, techniques and applications
- Problem-solving skills
- Technological awareness and applications
- Critical thinking skills
- Work and study skills
- Independent learning
- Working with others

To develop these skills, learners must offer **five compulsory subjects** and at least **three elective subjects** chosen from one or more Field of Study.

Compulsory Subjects
- SiSwati – either First Language or Second Language
- English Language
- Mathematics
- Sciences
- Religious Education

Fields of Study
- Agriculture Field of Study
- Business Studies Field of Study
- Consumer Science Field of Study
- Social Sciences and Humanities Field of Study
- Technical Field of Study

INTRODUCTION

The Swaziland General Certificate of Secondary Education (SGCSE) syllabuses are designed as two-year courses for examination in Form 5. The purpose of the syllabus is to unify teaching and set standards to be achieved by the learners of varied abilities in their Design and Technology programme, through activities that encourage the use of initiative to solve problems. It is intended to cater for the Swaziland's technological and skilled manpower needs including careers for tertiary education. The syllabus attempts to move towards a greater emphasis on design, the reasoned application of knowledge, skills and problem solving.

All SGCSE syllabuses follow a general pattern. The main sections are:
Aims
Assessment Objectives
Assessment
Curriculum Content

Design and Technology is an Elective Subject and falls into the Technical Field of Study which includes: Accounting, Business Studies, Geography and Information and Communication Technology.

AIMS

The aims of this syllabus are the same for all learners. The aims are set out and describe the educational purposes of a course in Design and Technology for the SGCSE Examination. They are not listed in order of priority.

The aims are to enable learners to:

1. stimulate the development of a range of making skills;
2. promote the development of curiosity, enquiry, initiative, ingenuity, resourcefulness, and discrimination of design choice;
3. develop the acquisition of a body of knowledge applicable to solving practical/technological problems operating through processes of analysis, synthesis and realisation;
4. stimulate the exercising of value judgements of an aesthetic, technical, economic, and moral nature;
5. foster awareness, understanding and experience 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;
6. develop a range of communication skills which are central to design, making and evaluation;
7. 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;
8. develop technological awareness, (including appropriate technology), foster attitudes of co-operation and social responsibility, and develop abilities to enhance the quality of the environment;
9. acquire attitudes and values, develop basic skills and understanding to allow the execution of rights and responsibilities as good citizens of Swaziland and the world;
10. develop study skills required for further study and training;
11. acquire knowledge, attitudes and practices that will ensure good family and health practices including awareness and management of epidemics (such as HIV/AIDS) that prepare them for productive life.

ASSESSMENT OBJECTIVES

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.

A KNOWLEDGE WITH UNDERSTANDING

Learners 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;
4. demonstrate a crucial awareness of the interrelationship between design and the needs of society.

B PROBLEM SOLVING

Learners 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 considerations to the constraints of time, cost, skill and resources;
9. develop, refine, test and evaluate the effectiveness of design solutions.

C COMMUNICATION

Learners should be able to:
10. recognise information in one form and where necessary change it to a more appropriate 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 present details of form, shape, construction, movement, size, and structure through graphical representation and three-dimensional modelling.

D REALISATION

Learners 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 showing an understanding of materials and their characteristics in relation to their use.

SPECIFICATION GRID

The approximate weightings allocated to each of the assessment objectives in the assessment model are summarised in the table below.

Assessment Objectives	**Weighting**
A Knowledge with understanding	15%
B Problem solving	45%
C Communication	10%
D Realisation	30%

Paper	**A** Knowledge with understanding	**B** Problem solving	**C** Communication	**D** Realisation
1	16%	40%	24%	20%
2 or 3	44%	20%	16%	20%
4		60%		40%

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

All candidates must enter for three papers. These will be Paper 1 (Design), **one** from either Paper 2 (Graphic Products) or Paper 3 (Resistant Materials) and Paper 4 (Project). Candidates are eligible for the award of Grades A* to G. A description of each paper follows.

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

Note: The appropriate use of ICT and CAD/CAM is encouraged throughout the curriculum if facilities are available. However, candidates will not be tested on ICT or CAD/CAM in the examination, nor will marks be awarded for the appropriate use of ICT in the project.

Paper 1 Design (1 hour 15 minutes)
This paper will cover Part 1 - Common Core of the syllabus and consist of 50 marks. Candidates will be required to answer **one** of three open ended questions intended to assess the candidates' abilities of analysis and synthesis. The range of questions will reflect the breadth of optional content. Candidates will answer on the question paper.

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

This paper will be weighted at 35% of the final total available marks.

Either	**Or**
Paper 2 Graphic Products (1 hour) Consisting of two sections, and 50 marks. **Section A** consists of compulsory questions testing subject knowledge in Graphic Products. **Section B** consists of two longer structured questions of which the candidates must answer **one**. This paper will be weighted at 35% of the final total available marks.	**Paper 3 Resistant Materials** (1 hour) Consisting of two sections, and 50 marks. **Section A** consists of compulsory questions testing subject knowledge in Resistant Materials. **Section B** consists of three longer structured questions based on woodwork, metalwork and plastic of which the candidates must answer **one**. This paper will be weighted at 35% of the final total available marks.

Paper 4 Project (School based assessment)
Each candidate will undertake a Project based on a given **theme.** The Project, which will be internally marked, internally moderated and externally moderated, is expected to commence at the beginning of March and be submitted to Examinations Council of Swaziland by the last working day of October. While the Project will be option based on the nature of the common core within the subject, Design and Technology is such that candidates' 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 3 dimensional 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 Appendix 'Project Assessment Criteria').

This paper will be weighted to 30% of the final total available marks.

Weighting of Papers

Paper	Weighting
1	35%
2 or 3	35%
4	30%

CURRICULUM CONTENT

The curriculum objectives in Part 1 – Common Core are to be followed by all learners. It is envisaged that this course content will be covered, in an integrated manner in the teaching of the optional specialist area chosen from Part 2 – Options (either Graphic Products or Resistant Materials).

Note: The appropriate use of ICT and CAD/CAM is encouraged throughout the curriculum if facilities are available. However, candidates will not be tested on ICT or CAD/CAM in the examination, nor will marks be awarded for the appropriate use of ICT in the project.

Appropriate teaching time for the Design and Technology syllabus should be equivalent to six (6) periods of forty (40) minutes each over a period of sixty (60) weeks/cycles.

PART 1 COMMON CORE

TOPIC – DESIGN
All learners should be able to:

Observe need/requirement
- identify and describe needs and opportunities for design and technological improvements
- analyse a given theme

Design brief/specification
- state the needs and opportunities for design and technological improvement
- formulate a design brief
- draw up relevant specifications including function, safety, size/capacity/weight, properties of materials, structural consideration, shapes/forms/aesthetics, social and environmental factors, handling and control, health, hygiene and maintenance

Identify/research
- analyse a problem from the situation
- identify and list 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., a diagram, flow charts, graphs, experimental and test results) carry out relevant research that will solve the identified problem

Generate possible ideas
- explore and analyse a variety of possible solutions relevant to the problem
- generate and record ideas as potential solutions to the problems using a range of techniques
- make a list of 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
- demonstrate the need for continuous appraisal of 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

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

Produce plan
- produce a detailed plan of work that includes materials, tools and equipment required to make the product

Realise
- realise the developed design solution from the working drawing

Evaluate
- 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
- suggest any possible modification and improvements (consideration to include functional, safety, aesthetic, ergonomic and economic factors)
- evaluate the performance of the product

TOPIC – MAKING
All learners should be able to:

Make, implement and realise
Through an understanding of the use of a variety of common materials components and media, candidates should be able to:

- use/apply the correct and accurate methods of drawing, marking out and testing in designing
- select appropriate processes for shaping, forming, cutting, joining, fitting assembling and finishing a variety of materials
- demonstrate the correct use of hand and machine tools and equipment
- observe all mandatory and other necessary safety precautions relevant to the use of a variety of tools, machines, materials and other resources
- use materials, components, media, time, energy and other resources economically

TOPIC – COMMUNICATION
All learners should be able to:

Initiate and develop ideas and record data

- extract relevant information from sources (written, graphical, and oral) interpret and record information and data
- use ICT appropriately

Communicate ideas with others

- use technical vocabulary, number skills, colour, texture, line thickness, shading and other media to produce sketches, models, diagrams, and drawings (such as perspective, isometric, orthographic, sequential.) and write materials, which communicate their ideas with precision and clarity

TOPIC – KNOWLEDGE
All learners should be able to:

Energy

- distinguish the different forms of energy sources that exist namely: fossil fuels, nuclear, solar, waterpower and wind power
- state how different sources 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 how through design, all energy sources can be conserved.
- use energy sources effectively and efficiently

Control

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

Mechanical control (Static)

- demonstrate the use of common fastenings and fittings applicable to the holding of metal, wood, and card paper

Permanent fastening

- choose sensibly between common and permanent appropriate fastening methods applicable to most common materials including simple joining, the use of adhesives, riveting and welding

Structures and forces

- analyse simple forces using triangle and parallelogram representation; examples will include support wires, tripods, shear legs and frames

- design and construct structures, which withstand stress and take stationery loads

Mechanical control (dynamic)

- demonstrate the method of transmitting motion using simple systems only; examples should include belts, chains, pulleys, gears, cams and cranks

Design and Technology in Society

- show awareness of the effect of design activity on social, environment and economic issues
- demonstrate awareness of the role of designers and craftsmen in industry and society
- take account of human needs in aspects such as aesthetic, ergonomics, environmental, cultural and social values
- use appropriately the 4W + H (what, where, when, who and how) in relation to design

Aesthetics

- justify 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 anthropometrics in their own design work and that of others

PART 2 – OPTIONS
Learners must study
Either Graphic Products
Or Resistant Materials

GRAPHIC PRODUCTS
It is recommended that the approach to the following objectives should be a practical one wherever possible and that their delivery to learners is a vehicle for delivering the Common Core such that the syllabus is seen as a single and integrated area of study.

This area of study is concerned with developing skills used by designers within the context of design activities in the studio. Additionally, it is intended to foster an awareness of the importance of communication techniques concerned with promotion and illustration of ideas and their interrelationship with all stages in commercial manufacture and promotion. It is envisaged that the content of this option will be taught through reference to the role that the design graphics and making have in one of the following areas:

Architectural graphics
Corporate Identity e.g., trademarks, logo's etc.
Display
Interior design manuals
Packaging
Product design
Promotional design
Transport

TOPIC – PRACTICAL APPLICATIONS
All learners should be able to:

Formal Drawing
- understand and use a working drawing of appropriate British Standard (conventions) including the dimensioning of drawings and drawing to recommended scales

Orthographic projection
- understand and use both 1st and 3rd angle projections, and use proper projection symbols

Isometric
- understand and use this form of projection for producing isometric views including circles, arcs, and other curves
- produce freehand drawings of isometric objects

Planometric
- understand and use planometric drawings to communicate ideas graphically (45^O x 45^O and 60^O x 30^O set squares)

Estimated perspective
- understand and produce perspective drawing using one-point and two-point starts and using perspective grids

Sectional views
- select the most suitable section and draw whole, part 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 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

TOPIC – GEOMETRICAL CONSTRUCTION
All learners should be able to:

The use of appropriate and relevant geometrical constructions to determine basic shapes
- construct regular and irregular plane and linear shape, including triangles, quadrilaterals, pentagons, hexagons, and octagons
- bisect, sub-divide, inscribed and circumscribe figures, proportionally divide lines
- construct circles, tangents, arcs and circles to touch arcs

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

Loci
- construct paths of points in the manner of simple plane mechanisms to include the maximum of three links

Ellipses
- construct ellipses using concentric circles and rectangle method

Basic Interpenetration
- to include the combination of the following shapes meeting at right angles: cylinder, square prism, triangular based prism.

TOPIC – COMMUNICATION SKILLS
All learners should be able to:

Use of instruments
- use instruments to achieve good standard of graphical representation

Use of drawing aids
- use drawing aids to develop good drafting techniques, including technical pens, templates, lettering and other stencils, radius curves, flexi curves

Presentation
- demonstrate the following range of techniques:
  (i) thick and thin 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

Layout and planning
- select the most suitable layout to achieve visual impact and to convey information clearly and effectively

Lettering techniques
- use clarity and good proportion as the main judgement criteria to demonstrate that they appreciate the different modes of drawing diagrams and lettering necessary for the communication of information according to content, purpose and user
- 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 if available

Data graphics
- produce line, pie, bar and flow charts from data provided
- produce sequence drawings from given data
- use given symbols to produce drawings showing the flow path or circuit of a medium moving under pressure i.e., water gas, oil, electricity
- use the range and purpose of standardised signs and symbols

Reprographics
- use simple reprographic techniques. Have knowledge of commercial printing methods. e.g., lithography

Making
- select, cut and prepare Graphic Materials: paper, card, foam board, sheet plastic, rigid foam, modern and 'smart' materials as they become available
- join Graphic Materials appropriately using: PVA, spray adhesive, solvent cement, hot melt (glue gun), epoxy resin, single and double sided tape, Velcro, double sided sticky pads
- select and use pre-manufactured components: self-adhesive labels and tapes; drawing and mapping pins; foam board hinges, hooks and hangers; rigid wire

RESISTANT MATERIALS

It is recommended that the approach to the following objectives should be a practical one wherever possible and that the delivery to learners be used as a vehicle for delivering the Common Core such that the syllabus is seen as a single and integrated area of study.

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, technonlogy 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.

TOPIC – SAFETY

All learners should be able to:

Precautions
- point out and apply all safety rules applicable in a practical workshop
- know the locations of stop buttons, fire extinguishers and First Aid boxes
- deal with possible injuries with due concern and respect for the continued health of the injured and those around them

TOPIC – TOOLS

All learners should be able to:

Setting/Marking out
- measure and/or mark out work using rule, pencil, marker, scriber, try square, bevel, centre punch, dividers, odd leg callipers, marking gauge, cutting and mortise gauge
- accurately produce datum lines by surface plate and scribing block or callipers
- accurately measure using a micrometer and a vernier gauge

Basic tools and machinery
- identify the basic tools and machines (sanding machine, circular saw, band saw, scroll saw, jointer plane, radial arm saw, pillar drill, bench grinder, lathes)
- identify and demonstrate a working knowledge of portable power tools (electric drill, jig saw, router, angle grinder, sander, arc welding machine, planer)
- demonstrate the safe and appropriate use of the tools and basic machines.
- maintain and store tools and basic machine parts appropriately

TOPIC – RESISTANT MATERIALS

All learners should be able to:

Timber
- show a working knowledge of natural timbers, understand their classification and uses.
- understand why timber is seasoned and how to care for timber during storage, construction, and preservation

Manufactured boards

- show a working knowledge of these manufactured boards: plywood, block board, chipboard, hardboard, MDF (super wood), and soft board

Complimentary additional materials

- appropriately select and use the following supplementary materials: glass, leather, and fabrics

Plastics

show a working knowledge of plastics and their classification and uses of the following:

- thermoplastics: nylon, polythene, Polyvinyl Chloride (PVC), acrylic, polystyrene, polypropylene, acrylonitrile-butadine-styrene (ABS) and understand the term plastic memory and its significance
- thermosetting plastics: polyester resin, glass reinforced plastics (GRP), urea formaldehyde, phenol formaldehyde

Ferrous metals and their alloys

- have a working knowledge of the following ferrous metals: high carbon steel, mild steel, cast iron, stainless steel
- understand the alloying of the following to improve the properties of steel: nickel, tungsten, vanadium, manganese, chromium, molybdenum

Non-ferrous metals and their alloys

- have a working knowledge of the following non-ferrous metals: aluminium, zinc, tin, lead, copper and silver
- have a working knowledge of the following non-ferrous alloys: duralumin, brass, bronze, phosphor bronze

Preparation of Materials

- show knowledge of available market forms, types and sizes
- understand methods of cutting by use of hacksaw, guillotine, tenon saw, rip 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

TOPIC – WORKSHOP PROCESSES
All learners should be able to:

Wasting/Addition
- select and perform an appropriate form 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 (jack plane and smoothing plane) and abrasive cutters
- simple hole boring by hand or machine including pilot, clearance, tapping, countersunk and counter bored holes
- use taps and dies for screw cutting by hand
- use special planes (spoke shaves, plough plane) and chisels, gouges, saws, files, rasps and
- use abrasive mops, discs and belts

Deforming/Reforming
- have knowledge of the following processes in shaping materials:
  (i) bending, twisting, forming an eye/loop, flattening, and drawing down
  (ii) hollowing, planishing
  (iii) simple casting, lamination, vacuum forming, press forming, imprinting
  (iv) blow moulding, injection moulding
  (v) extrusion

Temporary and permanent processes of joining and assembly
- use various methods of fabrication and fitting to join parts of a desired structure in common materials including: simple joining, the use of adhesives, riveting, brazing, soft soldering and welding (arc and gas)
- understands methods of carcase, stool, and frame constructions using permanent and temporary joints

Assembly
- use holding devices, formers and jigs to assist drilling, cutting, joining and assembly
- understand the use of KD (knock down) fittings for use with modern materials such as veneered chipboard

Fastening and fitting
- use a variety of fasteners, fittings and adhesives including: hinges, catches, locks, stays, handles and knobs.
- demonstrate the assembly and fitting of knock down furniture

Finishes and finishing
- understand the preparation for and application of surface treatments
- be aware of special treatments including: abrasives, painting, lacquers, staining, varnishing, solvents electroplating, anodising, dip coating, sand blasting, bluing, polishing and buffing
- be aware of surface finishes for both interior and exterior use
- be aware of the special finishes available that will prevent corrosion or stains, or withstand heat or liquids

Special treatments
- understand how the properties of a material can be changed by the following processes: hardening, tempering, case-hardening, normalising, annealing.
- understand steaming and bending of timbers and have knowledge of adhesives, setting times and strengths

GRADE DESCRIPTIONS

The scheme of assessment is intended to encourage positive achievement by all candidates. Grade descriptions are provided to give a general indication of the standards of achievement likely to have been shown by candidates awarded particular grades. The grade awarded will depend on the extent to which the candidate has met the assessment objectives overall and may conceal weakness in one aspect of the examination that is balanced by above-average performance on some other.

Criteria for the standard of achievement likely to have been shown by candidates awarded Grades A, C and G are shown below.

A Grade A candidate should be able to:

A Knowledge with understanding

- (recall knowledge) identify and describe most of the syllabus content presented in a variety of contexts
- (identify, apply and relate procedures) determine, describe fully and apply in an organised safe manner procedures outlined in the syllabus
- (provide explanations) provide a structured and detailed explanation for the majority of the items in the syllabus content
- (reason and predict consequences) predict consequences across a variety of situations, using sound reasoned arguments in a variety of situations
- (show understanding of Design and Technology concepts and principles) recognise, explain and apply Design and Technology concepts and principles across a variety of situations

B Problem solving

- (recall problems) assess a familiar situation and recognise its principal needs and compose a design brief and specification, with some understanding of precision and prescription
- (analyse problems) 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, and compatibility
- (envisage solutions) produce ideas for solutions, which are varied in form and detail and occasionally innovative, and apply sound judgements regarding feasibility and appreciate implications for brief, specification and production
- (refine and develop a solution) 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) accept evaluation as a feature of all design stages and show detachment in making judgements and seeking evaluation techniques as well as offer sensible modifications for improving a feature

C Communication

- (recognise and transform) seek, recognise and transform information in an effective and economical manner across a variety of application forms
- (select means of communication) select and discriminate between those communication methods, which are the most appropriate and effective for transmitting ideas, and information
- (convey information) convey information appropriately, precisely and concisely
- (convey ideas) convey a sequence of ideas in a fluent manner by the most appropriate means
- (represent detail) represent detail of a form with clarity and precision, taking full account of appropriate conventions

D Realisation

- (plan for realisation) 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 the range of resources which she/he judges to be the most appropriate after researching characteristics, investigating suitability and checking availability and cost
- (select tools and processes) 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 manipulative or graphic skills with sufficient precision to make a product which closely reproduces the detail given in the designed solution
- (evaluate process and product quality) make detailed statements demonstrating an insight and awareness of and response to weakness of the aesthetic, functional and technical characteristics of the product, proposing appropriate modifications where required

A Grade C candidate should be able to:

A Knowledge with understanding

- (recall knowledge) identify and describe with accuracy and understanding a wide range of items outlined in the syllabus
- (identify, apply and relate procedures) identify, describe with some detail and relevance and apply a wider range of procedures, including evidence of safe practice, as outlined in the syllabus
- (provide explanations) make detailed explanation, generally substantiated, of aspects covering a range of the syllabus
- (reason and predict consequences) predict consequences with some accuracy, giving reasons, based on evidence available
- (show understanding of Design and Technology concepts and principles) provide simple explanations reflecting an understanding of basic Design and Technology concepts and principles

B Problem solving

- (recall problems) examine a familiar situation and identify some real needs, compose a brief and draw up a specification
- (analyse problems) 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
- (envisage solutions) generate alternative forms of solution and propose some variation within one form
- (refine and develop a solution) show progression in developing a proposal or idea and consider modifications in relation to appearance, cost efficiency and feasibility
- (evaluate and test a solution) evaluate the end product in terms of the brief with respect to function, appearance, cost and overall performance

C Communication

- (recognise and transform) seek readily available and clearly defined information and transfer this information efficiently into other suitable forms
- (select means of communication) select communication methods, which will clearly transmit ideas and information
- (convey information) convey information clearly using an appropriate technical vocabulary
- (convey ideas) convey ideas with clarity in a structured and appropriate manner
- (represent detail) represent details of a form with some accuracy and precision and using a range of conventions

D Realisation

- (plan for realisation) plan for realisation in related stages pursued in a sequence leading to sensible completion when viewed against the designed solution
- (select resources) select from the range of resources which she/he judges to be the most appropriate after consideration of suitability, availability and cost
- (select tools and processes) select from any immediately available range of tools, instruments and processes those which are appropriate to achieve realisation
- (demonstrate transformation skills) apply manipulative or graphic skills accurately enough to make a product which meets a significant proportion of the designed solution
- (evaluate process and product quality) 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

A Grade G candidate should be able to:

A Knowledge with understanding

- (recall knowledge) name, where shown, some of the items outlined in the syllabus and recall knowledge about them
- (identify, apply and relate procedures) name and recall, when shown, some of the procedures, including safety, which are outlined in the syllabus
- (provide explanations) make elementary statements about some aspects of knowledge outlined in the syllabus
- (reason and predict consequences) produce statements based on experience
- (show understanding of Design and Technology concepts and principles) recognise similarities between related aspects of Design and Technology

B Problem solving

- (recall problems) interpret a given brief in a simple manner and recognise rudimentary aspects of a situation
- (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
- (envisage solutions) envisage one type or form of solution
- (refine and develop a solution) suggest modifications to a proposal and be aware of cost as a factor
- (evaluate and test a solution) make simple statements about the end product

C 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
- (select means of communication) select from a previously experienced elementary range of communication methods, those she/he considers to be appropriate for the transmission of ideas and information
- (convey information) convey elementary information with some clarity using simple technical vocabulary
- (convey ideas) convey ideas in an elementary form
- (represent detail) represent form by a recognisable outline

D Realisation

- (plan for realisation) respond to planning suggestions in an order influenced by experience and personal transformation skills
- (select resources) select from a previously experienced range of resources which she/he considers to be appropriate
- (select tools and processes) select from a range of previously experienced tools, instruments and processes those which she/he identifies as adequate to achieve the intended realisation
- (demonstrate transformation skills) apply rudimentary manipulative or graphic skills, resulting in a realisation which meets some aspects of the designed solution
- (evaluate process and product quality) make simple statements demonstrating awareness of some of the aesthetic, functional and technical characteristics of the product

PROJECT ASSESSMENT CRITERIA

Introduction

The project (Paper 4) should be based on the given theme, interests and observations of the candidates to arrive at a project that identifies a real design need and which is within the scope of the candidate in terms of both time and ability. The teacher has a major role in helping learners to formulate ideas and act as an advisor throughout the project. It is essential that the chosen project should test their design and making skills, but also include aspects of planning and evaluation. The Project has a maximum mark of 100 and is assessed by the teacher and then moderated.

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.
- Individual Candidate Record Cards and Coursework Assessment Summary Forms will be provided by the Examinations Council of Swaziland (ECOS) and must be submitted to ECOS by the official deadline, along with a representative sample of work and a teacher's file with the instructions for the practical work and the schemes of assessment.
- If there are ten or fewer candidates, all the work that contributed to the final mark for all the candidates must be submitted. Where there are more than ten candidates, all the work that contributed to the final mark for ten of them will be required. Where more than one teacher is involved in marking the work, the sample must include candidates marked by all teachers. Candidates must be selected so that the whole range is covered, with marks spaced as evenly as possible from the top mark to the lowest mark. **A further sample of coursework may subsequently be required.**

NOTE: All records and supporting written work should be retained at the school until the publication of results.

Marks submitted for the project must be based completely on the candidates own work and not that of others

Folders must include sufficient evidence of the made product showing an overall view together with detailed views of evidence to support the award of marks for Assessment Criteria 6 'Product Realisation' described below.

Assessment Criteria	Level of Response	Mark Range	Max Mark
1. Analysis of the theme	No rewardable response	0	5
	Limited understanding of the theme.	1	
	Analysis of the theme limited to two or three general areas of interest.	2-3	
	A fully expanded analysis of the theme consisting general and specific areas of interest relevant to the theme.	4-5	
2. Identification of a need or opportunity with a brief analysis leading to a design brief	No rewardable response	0	5
	A statement of what is to be made.	1	
	Consideration of the design need or the intended user(s) leading to a design brief.	2-3	
	Consideration of both the design need and the intended user(s) leading to a clear design brief.	4-5	
3. Research into the design brief resulting in a specification	No rewardable response	0	10
	Limited examination of the design brief with a specification identifying some basic requirements.	1-3	
	Meaningful research of the design brief with some data identified. A specification including key features of the intended product.	4-7	
	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.	8-10	
4. Generation and exploration of design ideas	No rewardable response	0	15
	A limited range of ideas with a tendency to focus on a single concept. Little or no evaluation of ideas.	1-5	
	A range of appropriate solutions proposed. Ideas examined with evaluations leading to the identification of possible ideas for development.	6 -10	
	A wide range of appropriate solutions with imaginative interpretation. Detailed evaluation of ideas and consideration of the requirements of the specification.	11-15	
5. Development of proposed solution	No rewardable response	0	15
	Some decisions made about form, materials and/or construction methods.	1-5	
	As a result of investigation, appropriate decisions made about form, materials and construction/production methods. Evidence of some testing and/or trialling.	6-10	
	Appropriate testing and trialling resulting in reasoned decisions about form, materials, construction/production methods and other items.	11-15	
6. Planning for Production	No rewardable response	0	10
	Limited evidence of any forethought. A working drawing with little detail.	1-3	
	A simple plan showing awareness of the main processes involved. A clear working drawing showing overall layout and major dimensions.	4-6	
	Clear and detailed planning showing an effective order for the sequence of operations. Drawings and other information give full details of the final product.	7-10	
7. Production Realisation	No rewardable response	0	30
	The product will exhibit a reasonable standard of outcome, be mainly complete and satisfy some aspects of the specification.	1-10	
	The product may have some minor inaccuracies and blemishes but will be complete and function as intended.	11-20	
	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.	21-30	
8. Testing and Evaluation	No rewardable response	0	10
	Little or no evidence of testing. General overall appraisal with little reference to the specification.	1-3	
	Appropriate reporting and/or comment on simple testing. Reference to the specification with some conclusions leading to possible modifications and improvements.	4-6	
	Objective testing with reference to the specification and user. Detailed and meaningful conclusions leading to proposals for further development.	7-10	

DESIGN AND TECHNOLOGY TERMINOLOGY

Design Process

ANALYSIS	A questioning of the brief to find out what it could mean.
ANTHROPOMETRIC DATA	Body measurements taken from large numbers of people.
BRIEF	A statement of the design problem.
ERGONOMICS	Recommended dimensions of objects based on anthropometric data.
EVALUATION	An assessment of the completed project and the processes involved.
INVESTIGATION/ RESEARCH	Reading and experimenting to gather information about the problem. May also involve 'market research', internet searchers, etc.
MANUFACTURE	The process of making the designed project.
PROTOTYPING	Making models to test design ideas.
SPECIFICATION	A statement of the design problem and all the factors that might be linked to it.

Design Graphics

ASSEMBLY DRAWING	One or a series of drawings indicating how and in what order the parts are assembled.
CUTAWAY DRAWING	A drawing in which a part is removed to show the inner detail.
ELEVATION	An orthographic view of the front, rear, or end of an object.
EXPLODED DRAWING	A drawing in which the parts are separated so that each can be clearly seen.
ISOMETRIC PROJECTION	An isometric drawing shows two sides of the object and the top or bottom of the object. All vertical lines are drawn vertically, but all horizontal lines are drawn at 30 degrees to the horizontal. Isometric is an easy method of constructing a reasonable '3 dimensional' images.
OBLIQUE PROJECTION	A 3D drawing system which views one face of the object as a 'true shape' and projects parallel lines from it to suggest solidarity.
ORTHOGRAPHIC PROJECTION	An organised series of flat views of an object, drawn so that all the details can be clearly seen. There are two types 1st and 3rd angle. These will show a plan view and, usually, front and side elevations.
PERSPECTIVE	A3D drawing system which produces a realistic image of the object. This appears to get smaller as it recedes into the picture space. There are three types - single point, two point, and three point.
PLAN	An orthographic view of the object seen from above.
PLANOMETRIC PROJECTION	(also known as Axonometric) works by drawing a plan view at a 45 degree angle with the depth added vertically. All lengths are drawn as their true lengths unlike when you use oblique. This gives the impression that you are viewing the objects from above.
RENDERING	Making a line drawing appear more realistic by applying tone, line, texture, or colour shading.
SECTIONAL VIEWS	These are used to show hidden detail more clearly. They are created by using a cutting plane to cut the object. A section is a view of no thickness and shows the outline of the object at the cutting plane. Visible outlines beyond the cutting plane are not drawn.

Aesthetics

COLOUR THEORY	An explanation as to how colours are (hues) are related to each other and how they are made darker (shaded) or lighter (tinted).
FINISH	The surface treatment of a material. This ranges from matt (dull) to glossy (shiny) and can include the application of materials such as paint, lacquer or varnish.
FORM	A 3D shape.
PATTERN	This usually refers to surface decoration which can be applied using colour or texture.
PROPORTION	The relative size of objects or the relationship of their parts.
SHAPE	An area enclosed by an outline. This can be geometric (drawn with instruments) or organic (based on natural object).
STYLISING	Emphasising a feature of a shape or form.
TEXTURE	The surface quality of a material, this can be coarse (rough) or fine (smooth).

Resistant Materials

ALLOY	A mixture of two or more metals.
BLOW MOULDING	Can be Injection or Extrusion Blow Moulding. Both involve the use of compressed air to form hollow objects within a mould.
DEFORMING	Also called forming, shaping a material by pushing or pulling it into a three dimensional form.
EXTRUSION	A method of forming long continuous sections of metal and thermoplastic.
FERROUS METAL	A metal which contains iron (Non-ferrous metals contain no iron).
INJECTION MOULDING	Hot plastic is injected into a mould where it cools and solidifies into the required shape.
LAMINATING	Thin strips of material are glued together to form thick sections or shaped objects.
THERMOPLASTICS	A plastic that can be softened by heat.
THERMOSET	A plastic that cannot be softened with heat.
VACUUM FORMING	A thermoplastic sheet is heated until soft then sucked onto a mould by pumping out the air from the mould chamber.
VENEER	A thin sheet of timber.

GLOSSARY OF TERMS

It is hoped that the glossary will prove helpful to candidates as a guide i.e., it is neither exhaustive nor definitive. The glossary has been deliberately kept brief with respect to the number of terms included but also to the descriptions of their meanings. Candidates should appreciate that the meaning of a term must depend, in part, on its context.

In all questions, the number of marks allocated is shown on the examination paper, and should be used as a guide by candidates to how much detail to give or time to spend in answering. In describing a process the mark allocation should guide the candidate about how many steps to include. In explaining why something happens, it guides the candidate on how many reasons to give, or who much detail to give for each reason.

CALCULATE Used when a numerical answer is required. In general, working should be shown, especially where two or more steps are involved.

COMPLETE Usually refers to a drawing to which more detail and/or notes need to be added.

DEFINE (the term(s) ...) is intended literally, only a formal statement or equivalent paraphrase being required.

DESCRIBE Requires the candidate to state in words (using diagrams where appropriate) the main points of the topic. It is often used with reference to data or information given in a graph, table or diagram, requiring the candidate to state the key points that can be seen in the stimulus material. Where possible, reference should be made to numbers drawn from the stimulus material. It can also require a candidate to give a step by step written statement of what happens during a particular process. In other contexts, describe should be interpreted more generally (i.e., the candidate has greater discretion about the nature and the organisation of the material to be included in the answer). “Describe and explain” may be coupled, as may “State and explain”.

DESIGN Produce ideas and/or drawings showing how a product is to be made and how it will work and look.

DETERMINE Often implies that the quantity concerned cannot be measured directly but is obtained by calculation, substituting measured or known values of other quantities into a standard formula (e.g., the Young modulus, relative molecular mass).

DRAW Make a picture or illustration

ESTIMATE Implies a reasoned order of magnitude statement or calculation of the quantity concerned, making such simplifying assumptions as may be necessary about points of principle and about the values of quantities not otherwise included in the question.

EVALUATE To judge or calculate the quality, importance, amount or value of something based on the evidence.

EXPLAIN May imply reasoning or some reference to theory, depending on the context. It is another way of asking candidates to give reasons for. The candidate needs to leave the Examiner in no doubt why something happens.

FIND Is a general term that may variously be interpreted as “Calculate”, “Measure”, “Determine”, etc.

GIVE A reason or reasons is another way of asking candidates to explain why something happens.

LIST Requires a number of points, generally each of one word, with no elaboration. Where a given number of points is specified this should not be exceeded.

MEASURE Implies that the quantity concerned can be directly obtained from a suitable measuring instrument (e.g., length, using a rule, or mass, using a balance).

NAME Requires a short answer, often just one word and is sometimes used in place of ‘State’.

OUTLINE	Implies brevity (i.e., restricting the answer to giving essentials).
PREDICT	Implies that the candidate is not expected to produce the required answer by recall but by making a logical connection between other pieces of information. Such information may be wholly given in the question or may depend on answers extracted in an earlier part of the question. Predict also implies a concise answer with no supporting statement required.
SKETCH	In diagrams, sketch implies that simple, freehand drawing is acceptable; nevertheless, care should be taken over proportions and the inclusion of important details.
STATE	Implies a concise answer with little or no supporting argument (e.g., a numerical answer that can readily be obtained 'by inspection').
SUGGEST	Used in two main contexts (i.e., either to imply that there is no unique answer (e.g., in Chemistry, two or more substances may satisfy the given conditions describing an 'unknown'), or to imply that candidates are expected to apply their general knowledge to a 'novel' situation, one that may be formally 'not in the syllabus').
USE SKETCHES AND NOTES	Frequently used in design or graphics question where drawings with descriptive or explanatory notes are required.
WHAT	"What do you understand by"/"What is meant by" (the term (s) ...) normally implies that a definition should be given, together with some relevant comment on the significance or context of the term(s) concerned, especially where two or more terms are included in the question. The amount of supplementary comment intended should be interpreted in the light of the indicated mark value.

DESIGN AND TECHNOLOGY
Coursework Assessment Summary Form
SGSCE 6902

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

Centre Number	**S**	**Z**				**Centre Name**		**November**	**2**	**0**		

Candidate Number	Candidate Name	Teaching Group / Set	Analysis of the theme (max 5)		Analysis of Need, Formulation of Brief (max 5)		Research into Design Brief Resulting in Specification (max 10)		Generation and Exploration of ideas (max 15)		Development 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)
			T	M	T	M	T	M	T	M	T	M	T	M	T	M	T	M		

Name of teacher		Contact	Signature	Date
Name of internal moderator		Contact	Signature	Date
Head of Centre (Name)		Contact	Signature	Date

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 mark sheet MS1 at a later stage (i.e. in candidate index number order, where this is known; see item 1 under Procedures for external moderation). Show the teaching group or set for each candidate. The initials of the teacher may be used to indicate group or set.
3. Centres are required to mark **only** the **product realization**.
   (a) Teacher should enter marks for the product realization under column **T** (Teacher).
   (b) Internal moderator should enter marks for product realisation under column **M** (Moderator).
4. The teacher completing the form, the internal moderator and Head of Centre should check the form and sign the bottom portion.

PROCEDURES FOR EXTERNAL MODERATION

1. Examinations Council of Swaziland (ECOS) sends a computer-printed Coursework mark sheet MS1 to each Centre early October showing the names and index numbers of each candidate. Transfer the total internally moderated mark for each candidate from the Coursework Summary Form to the computer-printed Coursework mark sheet MS1.
2. The computer-printed Coursework mark sheet MS1 together with Coursework Assessment Summary Form must be dispatched in the specially provided envelope to arrive as soon as possible at ECOS but no later 31st October.
3. Centres should send the **Product Realisation Assessment Form to ECOS** not later than 31st October.
4. Centres should send **all** candidates' **Folios** to reach ECOS not later than 31st October.