

**SEC SYLLABUS (2011)**

**DESIGN AND TECHNOLOGY**

**SEC 33**

**SYLLABUS**

<b>Design and Technology SEC 33 Syllabus</b>	(Not available in September) Paper I (Extended Project 40hrs.) + Paper II (2 hrs)
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This syllabus is designed to form the basis for further studies and intended for both male and female candidates.

The syllabus comprises two compulsory sections, being tested by one written paper and one Extended Project. The written paper includes common elements found in different aspects of the study of Design Process and basic knowledge in the four areas of study: Resistant Materials; Electronics; Textiles and Food. In the Extended Project section, candidates must plan and execute a project that will demonstrate their knowledge and understanding of one or more of the four areas of study.

### Written Paper

- Design Process
- Resistant Materials
- Electronics
- Textiles
- Food

### Extended Project

- Resistant Materials
- Electronics
- Textiles
- Food

### General Aims

A course based on the following aims enables the candidate to acquire a useful range of relevant knowledge and transferable skills that include practical skills and application, investigation and evaluation skills, and attitudes, values and appreciation of design and practical work.

The syllabus aims to give candidates the opportunity to develop their abilities in the area of Design and Technology through:

- activities involving the designing and making of quality products, whether unique or modified from existing items, to meet specific purposes by addressing the needs, wants and values of the intended users;
- the selection of appropriate resources (information, materials, components, tools and equipment, techniques and processes) according to design problem;
- the safe, correct, effective and efficient use of resources;
- the analysis and evaluation of Design and Technology activity, both their own work and the work of others;
- the recognition of social, moral, economic, environmental, and health and safety issues inherent in Design and Technology, including the market influences that may be applied;
- communicating effectively with the different audiences for Design and Technology activity, and to take account of the values of those audiences and market influences through reasoned judgements;
- the encouragement of the personal qualities which are necessary to take a problem to a realised solution.

Note: The above activities are not in a hierarchical order of importance.

### Assessment Objectives

The examination tests the ability to:

1. analyse situations in which aspects of Design and Technology in any of the four areas of study are used to satisfy the various human needs and wants, utilising available material and resources;
2. research, evaluate, recall, select, record and successfully apply knowledge and skills which are relevant to the needs and factors identified;

3. apply knowledge of the design principles, properties of materials, use of tools and equipment to the solution of problems taking into account the moral, cultural and environmental issues and values which affect society;
4. use investigative procedures during the formalising of Design and Technology activity;
5. decide upon and plan a sequential course of action and carry out the set plan, applying the required knowledge, skills and understanding;
6. test and evaluate the Design and Technology product.

### **Scheme of Assessment**

The examination consists of:

- Paper I: Extended Project (50% of the total marks)
- Paper II: Written paper (50% of the total marks)

Candidates can only qualify for Grades 1 to 5 if they obtain at least 45% of the mark allotted to each of Paper I and Paper II.

The subject is limited to candidates who are enrolled in an institution recognised by the MATSEC Board and the Education Division to teach the subject. The Extended Project is to be carried out under the supervision of a Design and Technology teacher.

### **Private Candidates**

Private candidates must be enrolled in an institution recognised by the MATSEC Board and the Education Division to teach the subject. The Extended Project is to be carried out under the supervision of a Design and Technology teacher.

Each candidate must provide an original artefact and a design folio. The artefact should be manufactured with appropriate materials and components in the institution's laboratory/workshop. It should reflect the highest level of manufacturing skills that the candidate is capable of. An artefact will only be assessed if the Design Folio is submitted with it.

The Extended Project (the Artefact and the Design Folio) will be assessed by the Design and Technology teacher and is subject to moderation by the markers' panel according to the assessment criteria outlined in the syllabus.

The institution should submit the assessment marks to the MATSEC Examinations Board as directed by the MATSEC Support Unit.

Private candidates must apply through their institution.

### **Paper I**

#### **Extended Project: (50 % of total marks)**

Extended Project consists of:

- An artefact 23 marks
- A Design Folio 27 marks

The Extended Project, to which approximately 40 hours are to be allotted, is to be carried out by the candidate during the Fifth Form. The MATSEC Board will provide a minimum of three situations for each area of study for selection at least two years prior to the examination. The candidate should submit his/her choice of the situation and area/s to the Design and Technology teacher for approval by the end of the Fourth Form. The quality of the work presented should reflect the candidate's ability and skills in the final stage of SEC Design and Technology Course. This work should demonstrate a range of experiences and show evidence of the Design Process.

Candidates' ability will be assessed in:

1. Designing
2. Making
3. Evaluating

Each candidate must provide an original and definable artefact. The artefact should be manufactured with appropriate materials and components in the school laboratory under the teacher's supervision. It should reflect the highest level of manufacturing skills that the candidate is capable of. An artefact will only be assessed if the Design Folio is submitted.

The evidence to be submitted for this Extended Project must be a three dimensional artefact or photographic evidence (in case of food) and a related Design Folio, in English, that should include the use of ICT. The Design Folio is to be authenticated by the Design and Technology teacher. The project and the design folio are to be presented by not later than the deadline and as per instructions stipulated by the MATSEC Board. The Extended Project (the Artefact and the Design Folio) will be assessed by the Design and Technology teacher and is subject to moderation by the Markers' Panel according to the assessment criteria of the folio and assessment criteria for the making.

The Design Folio and the Artefact are to be made available at the candidates' school for moderation by members of the Markers' Panel.

The Extended Project assessment should reach the MATSEC Examination Board by the date determined by the MATSEC Examination Board.

Candidates may be called for an interview relating to their Extended Project.

Candidates with an Extended Project that is partially authenticated by the Design and Technology will be called for an interview.

Private candidates are required to submit their Extended Project to the MATSEC Board duly endorsed by the teacher and indicating where it was carried out. This should be submitted by the date specified by the MATSEC Board.

The Design Folio should be made up of approximately 15, A3 sheets.

**Extended Project Assessment Criteria.**

**1. Designing (21 marks)**

Candidates should present:

- a clearly stated design brief of a marketable product.

Develop a Design Brief	Writes a statement of what is to be made.	1
	Writes some considerations of the need and purpose.	2
	Writes a clear Design Brief of a marketable product.	3

- a report on the analysis and research that they have carried out.

Research and Analysis	Uses only one source of information.	1
	Records and uses information from different sources.	2
	Researches and uses data from a wide range of sources.	3

- a specification of the product.

Develop Detailed Specifications	Writes a specification meeting some basic requirements.	1
	Writes a specification describing some key features.	2
	Writes a detailed Design specification that includes capability for batch production.	3

- a range of realistic and imaginative ideas.

Present Design Ideas	Proposes one or more identical ideas.	1
	Proposes several different ideas.	2
	Proposes a range of realistic and imaginative ideas.	3

- appropriate graphical techniques.

Developing Ideas	Uses a limited number of techniques.	1
	Uses a range of appropriate techniques.	2
	Uses a wide range of high quality appropriate techniques.	3

- a well organized folio which includes the use of ICT.

Communication and Presentation	Presents clear information with care.	1
	Presents clear information in an organised manner and ICT	2
	Presents information in a well organised manner using appropriate vocabulary and ICT.	3

- a feasible work plan.

Planning	Prepares a limited working schedule.	1
	Produces a systematic work plan including input, process and output.	2
	Prepares a work schedule for manufacture, including input, process, output and feedback.	3

## 2. Making (23 marks)

Candidates demonstrate:

- the ability to use appropriate tools, equipment and processes in the making of the product.

Tools and Equipment	Uses tools and equipment with guidance.	1-2
	Selects and uses safely tools, equipment and processes to make a product.	3-4
	Selects and safely uses, with a degree of skill, appropriate tools, equipment and processes to make a quality product.	5-7

- the ability to use appropriate materials to manufacture the product.

Materials	Selects materials with guidance.	1
	Selects the appropriate materials.	2-3
	Selects and makes use of the appropriate materials, taking care of wastage.	4-5

- the ability to produce a good quality product.

Artefact	Produces an unfinished product.	1-2
	Makes a product that matches the Design Idea.	3-5
	Manufactures a high quality artefact that matches all the features of the Design Idea.	6-8

- safety considerations taken.

Safety	Follows given safety instructions.	1
	Considers safety precautions while working with tools and equipment.	2
	Is conscious and observes safety regulations for his safety and that of others.	3

## 3. Evaluating (6 marks)

Candidates demonstrate:

- evidence of tests carried out to check the outcome of the product.

Testing	Makes simple tests to check the final product.	1
	Carries out tests to check the product against some criteria of the specification.	2
	Uses appropriate tests to check the product against all criteria of the specification.	3

- evidence of evaluating the artefact against the specifications and substantiated suggestions and/or modifications of the finished product.

Evaluation	Evaluates the finished product using personal judgement.	1
	Evaluates the product using personal judgement and users views and suggests simple modification.	2
	Evaluates the finished product using evidence from tests results and considering consumers views to suggest and validates any modifications.	3

The highest marks for the three levels are:

LOW	MEDIUM	HIGH
15 marks	32 marks	50 marks

**Paper II**  
**Written Examination Paper (50 % of total marks)**

This consists of one examination paper (**Paper IIA or Paper IIB**) of two hours duration. Candidates are required to indicate on the registration form which of Paper II they would like to opt for. It is to be noted that questions in **Paper IIA** will be more demanding than those in **Paper IIB**. No change in the choice of paper will be allowed after the registration period.

Examination Papers A and B will comprise about ten compulsory questions set in English, that must be answered in English. Two questions on each area will test knowledge on: Resistant Materials, Electronics, Food, Textiles and Design Process.

The two questions on the Design Process will be common for both Papers A and B.

Questions are to be answered within the spaces provided in the examination booklet. This paper is to be taken by ALL candidates registered by the examination.

The Extended Project and the Written Paper will test the candidates' abilities according to the following scheme:

Ability	Extended Project	Paper IIA / IIB	% Mark
Knowledge and Understanding	✓	✓	
Problem Solving	✓	✓	
Design and Planning	✓	✓	
Making (including basic skills in the use of tools and equipment)	✓		
<b>Approximate % of total marks</b>	<b>50%</b>	<b>50%</b>	<b>100%</b>

Questions requiring the application of knowledge will normally refer to common situations and any calculations required will be simple and direct. When reference is made to particular situations or apparatus which might be unfamiliar to candidates, sufficient details will be given to explain the context.

The use of non programmable calculators is allowed.

Standard notation and SI units will be used.

**Grade Descriptions**

Candidates sitting for Paper IIA and for the Extended Project (Paper I) may qualify for Grades 1, 2, 3, 4 or 5. The results of candidates who do not obtain at least a Grade 5 shall remain Unclassified (U).

Candidates sitting for Paper IIB and for the Extended Project (Paper I) may qualify for Grades 4, 5, 6 or 7. The results of candidates who do not obtain at least a Grade 7 shall remain Unclassified (U).

Candidates who obtain 45% or more in the Extended Project but fail in the written paper may carry it forward the following year and re-sit for the written paper the following year.

The following **grade descriptors** indicate the level of attainment characteristic of the given grade at **SEC** level. They provide a general indication of the required learning outcomes. The descriptors should be interpreted in relation to the content outlined in the syllabus.

### **Grade 1**

Candidates demonstrate:

- a critical awareness and thorough understanding of the technological and practical concepts within the syllabus.
- the ability to recall and apply knowledge relevant to different situations.
- the ability to select appropriate material, plan and implement a course of action, interpret their findings and draw relevant and justified conclusions.
- a high level of competence in the selection and control of a wide variety of resources, including tools and equipment.
- the use of appropriate terminology, confidently and accurately, in a concise, logical and relevant manner.
- manufacture a high quality Artefact which matches all the specifications of the Design Brief.

### **Grade 5**

Candidates demonstrate:

- a basic awareness and understanding of the general concepts within the syllabus.
- the ability to recall and apply knowledge with some references to the situation.
- the ability to select appropriate material with limited guidance, plan and implement a basic course of action, present findings in a satisfactory manner and draw conclusions.
- show adequate competence in the selection and use of a variety of resources, including tools and equipment.
- the use of basic terminology that is fairly accurately.
- make an Artefact that responds to the Design Brief.

### **Grade 7**

Candidates demonstrate:

- a fairly limited awareness and understanding of the basic concepts within the syllabus
- a fairly limited ability to recall and apply knowledge with only the most obvious references to the situation
- the ability to select material, plan and implement a course of action, present findings leading to restricted conclusions with continuous guidance and support.
- limited competence in the selection and use of a limited variety of resources, including tools and equipment.
- the use of terminology in a restricted manner.
- the ability to produce an Artefact similar to the Design Idea.

Subject Content – **Design Process**

**1. Design**

Candidates should:

- A) develop a clear Design Brief of a marketable product.
- B) gather, collate, prioritise, present appropriate research material from a wide range of source such as:
  - i. magazines, books etc.
  - ii. existing products.
  - iii. ICT.
  - iv. experienced personnel.
- C) produce a detailed Design Specification.
- D) propose a range of realistic and imaginative ideas that match the specification.
- E) critically choose a proposal by using a selective method.
- F) develop chosen proposal using a wide range of quality appropriate communication techniques.
- G) present design information in a well organised manner using appropriate vocabulary and ICT.
- H) prepare a work schedule for manufacture.

**2. Make**

Candidates should:

- A) safely use with a degree of skill tools, equipment and process to make a quality product.
- B) make use of appropriate material taking care of wastage.
- C) manufacture a quality product that matches all the features of the design proposal.
- D) observe all safety laws, regulations, rules, and codes of practice for his/her safety and that of others.

**3. Evaluate**

Candidates should apply tests to check the product against all criteria of the specification.

- A) evaluate the finished product using evidence from tests results and considering consumers views to suggest and validate any modifications.
- B) substantiate suggestions and/or modifications of the finished product.

Subject Content – **Resistant Materials**

**1. Materials**

Candidates should:

- A) show awareness that materials have different properties.
  - i. Aesthetic: colour, texture, weight, surface finish.
  - ii. Physical: electrical conductivity, thermal properties, Chemical and fusibility.
  - iii. Mechanical: strength, elasticity, plasticity, ductility, malleability, hardness, toughness and durability.
- B) know that the use of materials can have different effects on society.
  - i. Pollution waste.
  - ii. Recyclability.
  - iii. Waste.
- C) know about the classification of materials.
  - i. Ferrous/non ferrous metals.
  - ii. Alloys.
  - iii. Hard/soft woods.
  - iv. Manufactured boards.
  - v. Thermoplastic and thermosetting plastics.
- D) know that different materials come in standard forms and sizes.
- E) know the processes involved in manufacturing.
  - i. One off.
  - ii. Batch production.
  - iii. Mass production.
- F) know that different materials can be shaped and joined in a variety of ways.
  - i. Material preparation: Marking out and using datum edge.



- ii. Wasting: Drilling, sawing, filing, sanding, grinding and machining (facing, parallel turning and centre drilling).
  - iii. Deforming: Bending, laminating, vacuum forming and press moulding.
  - iv. Reforming: Injection moulding, extrusion and casting.
  - v. Fabrication: Soldering, brazing, welding, pop riveting, screws, nuts and bolts, nails, halving joints, knock down joints, dowels and adhesives.
- G) know how to prepare for manufacture.
- i. Ensure economical use of material.
  - ii. Use of appropriate section /size of material.
  - iii. Measure and mark: Rulers, squares (try, centre, mitre), scribes, punches, gauges, callipers (inside, outside, oddleg, vernier) and datum edge.
- H) know how to improve material properties by combining.
- i. Heat treatment: Annealing, hardening and tempering.
  - ii. Alloying of metal: Brass, high speed steel and solder.
  - iii. Manufactured boards: MDF, HDF, chipboard, plywood, blockboard and pineboards.
  - iv. GRP.
- I) know that appearance, durability, aftercare and quality can be achieved by different finishing processes.
- i. Painting.
  - ii. Laminating.
  - iii. Polishing.
  - iv. Dip coating.
  - v. Varnishing.
  - vi. Staining.
  - vii. Waxing.
- J) know how to achieve the best use of materials.
- i. Match material to the desired form.
  - ii. Match the material to the manufacturing process.
  - iii. Ensure minimal waste.
- K) understand the use of pre-manufactured standard components.
- i. Availability of various sizes.
  - ii. Recognise the economic benefits of their use.
- L) make use of ICT.
- i. Clipart libraries.
  - ii. Scanners.
  - iii. Digital cameras.
  - iv. Printers.
- M) know about the use of computer integrated manufacture.
- i. Fast, accurate and repeatable production processes.
  - ii. Recognise that computer systems can control machines and equipment.
- N) know about the products effect on society.
- i. The importance of product reliability.
  - ii. Safety standards.
  - iii. The moral and social impact of a product.
  - iv. Environmental issues: pollution, waste management and economic use of material.
- O) know the criteria how to analyse and evaluate products and processes.
- i. Analyse more than one resistant material.
  - ii. Use criteria to judge the quality of a product: how it looks, its performance, its function, the needs and values of end users, safety and value for money.

## 2. Mechanisms

Candidates should:

- A) know that a mechanism transforms an input motion and force into a desired output motion and force.
- B) know how mechanisms bring about required changes and control movement.
- C) know how to analyse and describe mechanisms in terms of input-process-output.
- D) identify components by their physical appearance and symbols: wheel and axle, gears, cams, followers, levers belts, pulleys and shafts.
- E) know the practical application of levers: first, second and third class.
- F) identify and use symbols to illustrate simple gear trains: Driver, Idler and driven.
- G) know how to calculate simple gear ratio.
- H) know about the use of plate cams: disc, pear and heart and snail.
- I) know about the use of cam followers: knife, roller and flat.
- J) know the importance of control in a production system.
- K) identify and describe the following types of motion in mechanical systems: linear, reciprocating, rotary, and oscillating.
- L) know about the use of single acting cylinders in pneumatics: 2 cylinders in a system.

## 3. Communication

Candidates should:

- A) produce written communication with relevant and clear information that is legible, having the correct spelling, punctuation and grammar.
- B) use the appropriate Design and Make Process terminology.
- C) know and use the appropriate terminology for naming and describing materials, tools, equipment and components.
- D) use sketches, working drawings/component layouts to communicate ideas (free hand sketching, nets, orthographic projection 1<sup>st</sup> and 3<sup>rd</sup> angle, isometric and oblique projections).
- E) use colour and texture to enhance ideas.
- F) make use ICT to present information in graphical and text form.
- G) use ICT to access, store and retrieve information.
- H) present a working drawing with details to enable the manufacture of a product.
- I) present design ideas with the use of models 2D/3D/simulations where appropriate.
- J) know how to present graphically a system in terms of input-process-output.
- K) recognise and use the correct units and symbols.
- L) produce flowcharts, time plans and work schedules.

## 4. Health and Safety

Awareness of health and safety should be shown throughout the Design and Make Process.

Candidates should:

- A) recognise hazards in technology laboratories.
- B) understand and apply safe working practices and regulations.
- C) use protective wear.
- D) know about the use of barrier creams.
- E) consider safety when selecting materials and finishes.
- F) know about safety in terms of function and product maintenance.
- G) store and use materials, tools and equipment safely.
- H) make correct use of machine guards.
- I) make correct use of dust and fume extractors where required.
- J) understand the need to consider risk assessment.
- K) know about the risks of hazardous vapours and other substances.
- L) follow manufacturers' instructions.
- M) read, understand and follow safety symbols.
- N) take the necessary precautions in the use and safe disposal of chemicals.
- O) understand the need for safe disposal of waste.
- P) dispose of disused products, materials and components in a safe and environment friendly way.
- Q) devise a system of control when manufacturing to ensure health and safety.
- R) know the procedure to follow in case of an accident.

### Typical situations for selection

- ‘Sit on’ or ‘push along’ toys are very popular with toddlers. They can help develop the child’s balance and co-ordination.
- Weather vanes/house signs/door furniture provide decorative and functional features to the outside of the property.

### Subject Content – Electronics

#### 1. Electronic components

Candidates should be able to:

- Identify components by appearance.
- Select the appropriate component/s to particular applications.

##### A) Resistors

- i. Know that resistors are used to control voltage and current in a circuit.
- ii. Know the main characteristics of fixed and the following variable resistors: potentiometers, pre-sets, light dependent resistors and thermistors.
- iii. Make use of a resistor colour code to determine the value and tolerance of fixed resistors and select the nearest preferred value.
- iv. Know that thermistors are temperature dependent components.
- v. Know light dependent resistors are light dependent components.

##### B) Capacitors

- i. Know that capacitors are electronic components that store electrical charge.
- ii. Know the main characteristics that is common units and working voltage of polarized and non-polarized capacitors: : ceramic, tantalum, polyester and electrolytic.
- iii. Know the precautions to be taken when using polarized and non polarized capacitors. (i.e. voltage rating, polarity).
- iv. Know that capacitors can be used to provide some form of time control.

##### C) Mechanical and electrical switches

- i. Know that a switch is a means of control to achieve functional results.
- ii. Know that single pole double throw, double pole double throw, single pole single throw, micro, push (push to make that is normally open and push to break normally closed), toggle, reed, rotary, slide, rocker arm, latching (on and off) switches perform different functions.
- iii. Know that switches are current rated.
- iv. Know that relays are used as an interface between electrical circuits.
- v. Know that the relay coil is voltage rated and the contacts are current rated.
- vi. Use relay as a latch.
- vii. Use relay to provide a reverse polarity.
- viii. Know how to use a transistor as a switching component.

##### D) Diodes

- i. Know that diodes operate as a one way device.
- ii. Know typical applications of a diode.
- iii. Know the procedure to identify the anode and cathode of a diode and light emitting diode.
- iv. Know how to check a diode using the digital multimeter.
- v. Know how to connect a diode and light emitting diode in the correct polarity for operation.
- vi. Use a diode as a protection component from back e.m.f.

##### E) Components as output devices.

- i. Know the basic characteristics of the following components: reed and piezo type buzzers, lamps, bells, LEDs, loudspeakers and low voltage d.c. motors.

##### F) Transistors

- i. Identify the leads of a bipolar transistor that is PNP and NPN from diagrams and data sheet.
- ii. Know how a change in the base to emitter voltage affects the flow of current in a transistor.

- iii. Know how to choose transistor main parameters from data sheet:  $I_c(\max)$ ,  $V_{ce}(\max)$ , gain( $h_{fe}$ ). No calculations.
- iv. Be aware of the importance to regulate temperature in power transistors.
- v. Know and apply the use of the 'Darlington Pair' transistor.

G) FET's

- i. Identify the leads of an FET from diagrams and data sheet.
- ii. Know how and when to use an FET.
- iii. Use FETs in simple circuits.

H) Integrated Circuits.

- i. Know what is meant by dual-in-line package.
- ii. Identify the I.C. pin numbers from diagrams and data sheet.
- iii. Know the difference between Monostable and Astable.
- iv. Use the 555 timer to build an Astable to produce output with both equal and unequal mark/space ratio at a range of frequencies.
- v. Use the 555 timer as a Monostable Circuit.

**2. Power supplies**

Candidates should know the advantages and disadvantages of different sources of energy (mains: power supply units: primary, secondary and solar type batteries) including costs and applications.

**3. Logic**

Candidates should:

- A) know the function of the following gates: AND, OR, NOT, NAND, NOR, XOR.
- B) construct simple logic circuits using gates in combination to solve logic problems.

**4. Basic principles**

Candidates should:

- A) Circuit construction
  - i. identify types of diagrams ie: block, circuit, component layout, logic and flow.
  - ii. classify materials by their properties (insulators, conductors and semiconductors).
  - iii. describe current as a result of electron flow.
  - iv. use Ohm's Law for simple calculations.
  - v. use power formula for simple power calculations.
  - vi. calculate the total resistance of two or more resistors connected in series or in parallel.
  - vii. calculate the required resistance value in a potential divider circuit.
  - viii. know the difference between direct current and alternating current.
  - ix. know the difference between sinusoidal and square waveform.
  - x. state the relationship between Frequency and Periodical Time.
  - xi. distinguish between Peak voltage and Peak To Peak voltage
  - xii. use time constant formula for simple time delays.
  - xiii. use digital meter to measure voltage, current, resistance, capacitance, continuity, diode, and transistor current gain.
  - xiv. know the effect of connecting batteries in series and parallel (excluding internal resistance).
  - xv. read electronic circuits / systems and identify the input, process, output sections.
  - xvi. develop simple circuits to achieve a specified function.
  - xvii. use electronics simulation program to explore the effects of changing the values of components in a circuit.
  - xviii. use circuit simulation software to test systems and electronic circuits prior testing on breadboards.
  - xix. build simple circuits using breadboard, veroboard and printed circuit.
  - xx. design and make PCBs.
  - xxi. mount circuit components appropriately on constructional technique boards using either the loose or soldering method .
  - xxii. construct truth tables for the following gates: AND, OR, NOT, NAND, NOR, XOR.
  - xxiii. solve simple logic problems using the logic functions in combination.

## 5. Communication

Candidates should:

- A) produce written communication with relevant and clear information that is legible, having the correct spelling, punctuation and grammar.
- B) use the appropriate Design and Make Process terminology.
- C) know and use the appropriate terminology for naming and describing materials, tools, equipment and components.
- D) use sketches, working drawings/component layouts to communicate ideas (free hand sketching, nets, orthographic projection 1st and 3rd angle, isometric and oblique projections).
- E) use colour and texture to enhance ideas.
- F) make use of ICT to present information in graphical and text form.
- G) use ICT to access, store and retrieve information.
- H) present a working drawing with details to enable the manufacture of a product.
- I) present design ideas with the use of models 2D/3D/simulations where appropriate.
- J) know how to present a system in terms of input-process-output that is open loop.
- K) know how to present a system with feedback that is closed loop.
- L) recognise and use the correct units and symbols.
- M) produce flowcharts, time plans and work schedules.

## 6. Health and Safety

Awareness of health and safety should be shown throughout the Design and Make process.

Candidates should:

- A) recognise hazards in technology laboratories.
- B) understand and apply safe working practices and regulations.
- C) use protective wear.
- D) know about the use of barrier creams.
- E) consider safety when selecting materials and finishes.
- F) know about safety in terms of function and product maintenance.
- G) store and use materials, tools and equipment safely.
- H) make correct use of machine guards.
- I) make correct use of dust and fume extractors where required.
- J) understand the need to consider risk assessment.
- K) know about the risks of hazardous vapours and other substances.
- L) follow manufacturers' instructions.
- M) read, understand and follow safety symbols.
- N) take the necessary precautions in the use and safe disposal of chemicals.
- O) understand the need for safe disposal of waste.
- P) dispose of disused products, materials and components in a safe and environment friendly way.
- Q) devise a system of control when manufacturing to ensure health and safety.
- R) know the procedure to follow in case of an accident.

### Typical situations for selection

- A small ensemble requires a portable device to help them get the timing of the music correct.
- A keen gardener with a small greenhouse wants to go away on a two week holiday and requires an automatic plant watering system.

## Subject Content – Food

### 1. Materials

Candidates should:

- A) list and explain the national dietary guidelines and the Food Guide Pyramid.
  - i. the World Health Organisation (WHO) Food Guide Pyramid.
  - ii. the four dietary guidelines: eat less fats, eat less sugar, eat less salt, eat more fibre.
- B) identify the four basic food characteristics:
  - i. appearance (e.g. colour, glossy, dull, shiny, pale, dark).

- ii. texture (e.g. crisp, soggy, crusty, soft, tough, hard, lumpy, smooth, squashy, creamy, watery, buttery, light, rich, thick, thin, seedy).
  - iii. taste (e.g. spicy, salty, sweet, fatty, peppery, hot, chilli, fiery, tangy, bitter, herbal, cheesy, tasty, rancid, sour, stale, rotten, fresh).
  - iv. aroma (smell).
- C) understand the nutritional content of foods and the importance of the five nutrients in the diet.
- i. list and describe the five nutrients: proteins (animal, plant including TVP), carbohydrates (sugars, starches and NSP), fats (animal and plant), iv) vitamins (Fat-soluble: A, D, E, K and Water-soluble: B, C), minerals (Calcium, Iron).
  - ii. outline the main function of each nutrient.
  - iii. identify good sources of each nutrient.
  - iv. outline the main deficiencies of each nutrient.
- D) identify the following primary foods their nutritional value and uses and simple production through primary processing: cereals, fruits and vegetables, pulses, milk and dairy products, meat, fish and eggs, fats and oils, sugars .
- E) define secondary foods through secondary processing.
- F) know and scientifically understand the relationship between the composition, structure, characteristics and properties of food and the way in which it is prepared and cooked using different cooking methods:
- i. moist methods of cooking: boiling, simmering, poaching, steaming, pressure cookery, slow cookers, stewing and braising.
  - ii. dry methods of cooking: baking, roasting, grilling and barbecuing.
  - iii. frying: deep frying, shallow frying, dry frying and stir frying.
  - iv. microwave cooking.
  - v. understand the main scientific principles underlying heat transfer by conduction, convection and radiation.
- G) understand the properties and working characteristics of food as a material and how different functional properties affect the finished products:
- i. thickening using thickeners (wheat flour, cornflour, potatoes, eggs).
  - ii. setting using setting agents (gelatine, cornflour, rennet).
  - iii. fermentation (yeast).
  - iv. fortification with vitamins / minerals to enrich product (commercially).
  - v. tenderising (marinating and aging).
  - vi. aeration: mechanical (e.g. beating, sieving, whisking, folding, rubbing-in), chemical using raising agents (baking powder, yeast, bicarbonate of soda), steam.
  - vii. coating (breadcrumbs, batters and sugar).
  - viii. glazing to add attractive finishes to products improving texture and appearance.
  - ix. binding: water and milk (e.g. for pastry and scones), eggs, flour and breadcrumbs.
  - x. shortening (fat in baked goods to make them soft and crumble).
- H) define and understand why food is preserved; name and briefly explain the methods used for preservation of food at an industrial and domestic level:
- i. dehydration: sun drying, spray drying, fluidised-bed drying, roller drying, accelerated freeze drying (AFD).
  - ii. heating: sterilisation, UHT, pasteurisation, canning and bottling.
  - iii. Reduction of temperature: refrigeration, chilling, cook-chilling, freezing (domestic freezing, plate freezing, blast freezing, immersion freezing, cryogenic freezing).
  - iv. addition of chemical preservatives: additives (industrially), salt, acids (vinegar), sugar
  - v. irradiation
  - vi. removal of air: vacuum packing, modified atmospheric packaging
- I) be able to plan suitable meals for people of various age groups and who have different dietary conditions. Planning suitable meals for: young children, pregnant women, adolescents, elderly citizens, people suffering from coronary heart disease (low saturated fat meals), people on a slimming diet, people suffering from hypertension (low salt meals), people suffering from osteoporosis / osteomalacia

(high calcium meals), high fibre meals for people suffering from constipation and related disorders, vegetarians.

- J) identify the opportunities for recipe development and modification to produce new products and products suitable for individuals with special dietary needs.
- K) be aware of the factors that affect people's choice of food: taste, price, time, cooking skills, cooking equipment available, religion, culture/tradition, environmental factors, special dietary needs and requirements, advertisements/ influence of other people.
- L) name and use a wide range of equipment, appliances, processes and skills hygienically, effectively and safely to: measure/weigh, mix and bind ingredients appropriately, cut, shape (dice, cube, slice etc.), peel, shred, grate and form foodstuffs, apply correct heating and cooling processes, apply appropriate finishing (preservation and garnishing)
- M) know and describe the safe, efficient and correct use of these appliances: refrigerator, freezer, oven and microwave oven.
  - i. different types of these appliances
  - ii. correct and efficient use
  - iii. safety features including prevention food spoilage and contamination
  - iv. symbols associated with these appliances
- N) use appropriate ingredients to produce food products considering: nutritional value, cost, suitability for different groups, various dietary requirements, aesthetics, time management, method of production and packaging.
- O) know the basic skills involved in pastry making and understand the properties of ingredients in the different phases of the making: preparation, accurate weighing of ingredients, sifting, rubbing-in, binding, kneading, resting, rolling out, baking, testing for readiness, cooling.
- P) list, explain and use current legislation with regard to food labelling.
- Q) apply a range of processing techniques to produce food products: assembling of food ingredients, assembling of equipment, heat transference through appropriate methods of cooking, testing for readiness, cooling, packaging, labelling
- R) apply finishing techniques to enhance food appearance, nutritional value, texture and shelf-life.
- S) know the processes involved in manufacturing:
  - i) One off, ii) Batch production, iii) Mass production
- T) modify recipes to produce new products and scale recipes for batch production.
- U) understand the packaging and marketing implications of a product: information about the product, consumer preference, safety legislation (e.g. control of food additives), labelling according to current legislation, storage, distribution, cultural, health influences.
- V) select suitable packaging for food products considering hygiene, aesthetic and environmental factors (reducing, reusing, recycling, refilling).
  - i. know why packaging is necessary
  - ii. list different types of packaging available, their advantages and disadvantages
  - iii. choose the packaging material appropriate to the properties of food to be packed (also considering hygiene and aesthetics)
  - iv. choose cost effective and environmentally friendly packaging
  - v. apply the correct labelling requirements according to local legislation
- W) know that a system has three basic elements: input, process and output.
- X) be aware of basic current Food and Drug Association (FDA), World Health Organisation (WHO), Food Standards Authority (FSA), EU standards and regulations regarding food, safety, hygiene, biotechnology, nutrition and health.

- Y) devise strategies to make effective use of available time and resources: analysing ideas against specification guidelines, list of ingredients (with quantities) and equipment / appliances, work plan, planning, time schedules, costing.
- Z) understand and use quality control as a necessary part of production and marketing: identify quality control points, review work at all quality production points, apply quality assurance techniques.
- AA) simulate production by planning a system of control for the manufacture of a one-off and/or batch production following the Hazard Analysis Critical Control Points (HACCP).
  - i) identify and analyse hazards and critical control points, ii) review work at all critical production points, iii) apply safety assurance techniques
- AB) understand the relevance of function and aesthetics of design ideas: i.e. taste, texture, aroma and appearance.
- AC) evaluate and test the proposed product against: its fitness for purpose, the design need, and the needs of intended user(s).
- AD) use sensory analysis testing: tasting panels, rating tests and star profiling to evaluate food products
- AE) evaluate the design food product/s and their packaging against moral, social, health, cultural and environmental issues.
  - i. evaluate whether materials and resources have been used efficiently, effectively and safely.
  - ii. use criteria to analyse the quality of the product: flavour, colour, shape, volume, texture, health (calculating nutritional analysis of the food product), value for money, fitness for purpose, time management, aesthetics.
  - iii. recognise and suggest possible modifications to the final product.

## **2. Biotechnology**

Candidates should:

- A) define biotechnology.
- B) understand the different biotechnological processes in food production: natural and artificial.
- C) be aware of the basic biotechnological processes underlying the production of yoghurt, cheese, bread, wine and beer.
- D) hygienically produce foodstuffs that require a biotechnological process cheeselets, yoghurt and yeast products using appropriate ingredients and equipment.
- E) be aware of recent developments and innovations (even locally) in food biotechnology and their nutritional properties. (e.g. genetic engineering, cloning, biofarming).
- F) consider the impact of biotechnological developments on the consumer, global food supply and the general health status.
- G) recognise the moral, cultural and environmental issues inherited in food biotechnology.
- H) be aware of current FDA standards and regulations.

## **3. Communication**

Candidates should:

- A) produce written communication with relevant and clear information that is legible, having the correct spelling, punctuation and grammar.
- B) use the appropriate Design and Make Process terminology.
- C) plan their work using lists of ingredients and equipment and work plans (identifying quality checks and safety checks {according to HACCP}).
- D) know and use the appropriate terminology for naming and describing the function of ingredients, equipment, appliances and cooking skills.
- E) use sketches, working drawings/component layouts to communicate ideas (free hand sketching, nets, orthographic projection 1st and 3rd angle, isometric and oblique projections).
- F) use colour and texture to enhance ideas.
- G) make use ICT to present information in graphical and text form.
- H) use ICT to access, store and retrieve information.
- I) present a working drawing with details to enable the manufacture of a product.



- J) present design ideas with the use of models 2D/3D/simulations where appropriate.
- K) know how to present graphically a system in terms of input-process-output.
- L) recognise and use the correct units and symbols for calculating nutritional information and ingredients.
- M) interpret and use symbols appropriately e.g. freezer star rating, microwave symbols, food labels symbols (e.g. special claims), E numbers).

#### 4. Health and Safety

Awareness of health and safety should be shown throughout the Design and MakeProcess.

Candidates should:

- A) describe in detail through scientific principles the process of food spoilage: explain the contamination of food through natural decay and through micro organisms.
- B) identify the differences between the three main micro organisms causing food spoilage (bacteria, moulds, yeasts).
- C) list the four conditions required for the growth of micro organisms (food, time, adequate temperature, moisture) and how changes in these conditions will affect the growth and reproduction rate of micro organisms.
- D) describe how chemicals and acids react with micro organisms.
- E) describe and explain how food poisoning occurs and ways of how to prevent it through safe and hygienic practices in food labs and following current legislations in this regard.
- F) Define the following terminology: cross contamination, danger zone, high-risk foods, low-risk areas, high-risk areas, hazard analysis, critical control points, HACCP.
- G) recognise possible hazards in the food lab.
- H) understand and apply safe working practices and regulations for the food lab
- I) use protective wear: headgear, apron, overgloves
- J) define and follow the different datemarks of food items: use by, best before, display by, expires by
- K) choose safe:
  - i. ingredients (e.g. datemarks, freshness, good quality, avoidance of unsafe foodstuffs such as dented / rusted tins)
  - ii. equipment (e.g. colour-coded chopping boards, selecting appropriate utensil for specific jobs, avoidance of unsafe equipment)
  - iii. appliances (e.g. kitemark / safety symbols, reading manual instructions)
- L) understand the importance of safe and hygienic practices in the preparation, cooking, cooling, packaging, storage and transportation of food stuffs.
- M) store food, equipment and appliances safely.
- N) understand the need to consider risk assessment.
- O) identify all the critical control points (CCP's) according the HACCP regulations in the work plan.
- P) applying meticulous health and safety principles throughout the entire process of food preparation, production, serving, cooling, storage, packaging and preservation according to 7 steps of HACCP:
  - i) Analyse the hazard, ii) Identify the Critical Control Points (CCP s),
  - iii) Establish preventive measures, iv) Check the Critical Control Points,
  - v) Act to correct problems, vi) Ensure safety checks are correct, vii) Keep records
- Q) follow manufacturers' instructions when using particular equipment and appliances.
- R) read, understand and follow safety symbols.
- S) choose and know about environmentally friendly products: minimum packaging, recycled packaging, ozone friendly, CFC free sprays, biodegradable products.
- T) take the necessary precautions in the use and safe disposal of certain foodstuffs and chemicals.
- U) understand the need for safe and environmental friendly disposal of waste.
- V) dispose of disused products, materials and components in a safe and environment friendly way through separation of waste at source (compost, metal, glass, plastic, paper and cardboard).
- W) devise a system of control in the workplan prior to production to ensure health and safety.
- X) know the procedure to follow in case of an accident of: Burns and scalds, cuts.

#### Typical situations for selection

- Many people celebrate special occasions. Food manufacturers are always keen for new ideas to increase their sales for novelty foods.
- The market for between-meal snacks grow continuously. A food manufacturer is keen to meet this demand.

## Subject Content – Textiles

### 1. Materials

Candidates should:

- A) classify materials
- i. The origin and structure of natural and manufactured fibres such as cotton, linen, wool, silk, regenerated cellulose fibres, acrylics, polyamides, polyesters and elastanes.
  - ii. The conversion of fibres into yarn and fabric, processes such as spinning, weaving, knitting, bonding and laminating.
  - iii. How the method of construction can affect the way the fabric reacts.
  - iv. Fibres and yarns can be mixed and blended, and fabrics can be bonded to enhance both physical and aesthetic properties.
- B) identify the properties that materials need to have to fulfil the identified purpose for a particular situation.
- i. Strength, durability, absorbency, elasticity, resilience and insulation, flammability, reaction to heat, reaction to chemicals, enzymes and bacteria.
  - ii. The chemical processes applied to fabrics such as shower or water proofing, flame proofing, moth proofing, strengthening, crease resistance, stain resistance and permanent pressing.
  - iii. Physical processes such as texturing, bulking and piling.
  - iv. Choosing the most suitable fabric for a process such as absorbing dyes and paints.
- C) understand the importance of fabric testing.
- i. Simple tests can be carried out on fabric for colour fastness, resistance to abrasion, flammability, absorption and stretch.
- D) know that the use of materials can have different effects on society
- i. Pollution waste
  - ii. Recycling textiles materials
  - iii. The use of waste to create new fabrics.
- E) understand how products affect society.
- i. The importance of product reliability.
  - ii. Safety standards.
  - iii. Moral and social impact of a product.
  - iv. Environmental issues such as pollution, waste management and economic use of material.
- F) understand the processes involved in manufacturing and how manufacturing companies are organised.
- i. Custom production (one-off)
  - ii. Batch production
  - iii. Mass production
- G) identify the following textile components and their functions.
- i. Fasteners: buttons, toggles, hook and eye, zips, press fasteners (press studs), Velcro, laces and eyelets and clips/buckles.
  - ii. Structural components: threads, Vilene, interlinings, linings, shoulder pads, elastic bands, bias binding tape, webbing, bond-a-web and boning.
  - iii. Decorative components: lace, braids, beads, fringes, embroidery and appliqué motifs and sequins.
- H) cut, join and shape various materials (fabrics and components) in a variety of ways.
- i. Pattern making: taking the measurements, pattern drafting, pattern markings.
  - ii. Lay planning: open lay, v-fold and one way.
  - iii. Cutting out.
  - iv. Joining fabric: seams, adhesives and staples.
  - v. Edge finishes: hems, overlock, facings, binding, waistband, collars and cuffs.
  - vi. Adding shape: darts, tucks, pleats, gathering and the use of interfacings.
  - vii. Pressing: Top pressing, under pressing, the use of steam and vacuum.
- D) select the finishing process for appearance, aftercare and quality.
- i. Dye: tie and dye, tritik and batik.

- ii. Fabric paints: brush, airbrushes, stencilling, block printing and silk painting.
  - iii. Appliqué' and Embroidery: fabric, beads and sequins.
  - iv. Dimensional fabric paints (image transfer).
  - v. Final pressing: use of steam and vacuum.
- J) make use of ICT in single item.
- i. Clipart libraries.
  - ii. Scanners.
  - iii. Digital cameras.
  - iv. Printer.
- K) know about the use of computer integrated manufacture.
- i. How ICT can be used in various stages of manufacture.
  - ii. How a designer in the textiles industry uses CAD.
  - iii. How CAD/CAM to decorate the surface of fabrics (Direct Digital Printing).
- L) know that mechanical or computerised equipment can be used on a production line system.
- i. How CAM can help to speed up the production process in the cutting room, assembly line and pressing room.
  - ii. The need to process information database for systems to function.
  - iii. Stock control.
- M) understand that a variety of assembly line systems are used in the production of textile products
- i. The use of a ticketing system to ensure correct assembly of product parts.
  - ii. The correct colour and weight match of components to satisfy production demands of a product.
  - iii. Systems of production.
- N) know that a system may have costs involved in its operation, including labour cost, energy and overheads.
- O) know the importance of Market Research involving:
- i. Use of statistics based on scientific principles.
  - ii. Testing and analysing the materials and components.
- P) know the standards that can be set during manufacture, to ensure quality control and methods to monitor them.
- Q) know the importance of accuracy when:
- i. Taking measurements.
  - ii. Preparing and making a pattern.
  - iii. Assembling textile products.
- R) know the care requirements of textile products including the legal standards in industry to protect consumer.
- i. Care labels; the symbols used and their meaning.
  - ii. Legislation standards to be followed when launching a product into the market.

## 2. Communication

Candidates should:

- A) produce written communication with relevant and clear information that is legible, having the correct spelling, punctuation and grammar.
- B) use the appropriate Design and Make process terminology.
- C) know and use the appropriate terminology for naming and describing materials, tools, equipment and components.
- D) use sketches, working drawings/component layouts to communicate ideas (free hand sketching, nets, orthographic projection 1st and 3rd angle, isometric and oblique projections).
- E) use colour and texture to enhance ideas.
- F) make use ICT to present information in graphical and text form.
- G) use ICT to access, store and retrieve information.

- H) present a working drawing with details to enable the manufacture of a product.
- I) present design ideas with the use of models 2D/3D/simulations where appropriate.
- J) know how to present graphically a system in terms of input-process-output.
- K) recognise and use the correct units and symbols.
- L) produce flowcharts, time plans and work schedules.

### 3. Health and Safety

Awareness of health and safety should be shown throughout the Design and Make Process.

Candidates should:

- A) recognise hazards in technology laboratories.
- B) understand and apply safe working practices and regulations.
- C) use protective wear.
- D) consider safety when selecting materials and finishes.
- E) know about safety in terms of function and product maintenance.
- F) store and use materials, tools and equipment safely.
- G) make correct use of machine guards.
- H) make correct use of dust and fume extractors where required.
- I) understand the need to consider risk assessment.
- J) know about the risks of hazardous vapours and other substances.
- K) follow manufacturers' instructions.
- L) read, understand and follow safety symbols.
- M) take the necessary precautions in the use and safe disposal of chemicals.
- N) understand the need for safe disposal of waste.
- O) dispose of disused products, materials and components in a safe and environment friendly way.
- P) devise a system of control when manufacturing to ensure health and safety.
- Q) know the procedure to follow in case of an accident.

#### Typical situations for selection

- Sports and leisure equipment often have to be carried or stored when not in use.
- The owner of a local retail outlet that specialises in the manufacture of items for special occasions has asked you to design an item of clothing or an accessory.

#### Textbooks and other teaching resources

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

To give teachers maximum support the following textbooks have been produced.

- Heinemann for Edexcel GCSE Design and Technology: Resistant Materials Technology
- Heinemann for Edexcel GCSE Design and Technology: Textiles Technology
- Heinemann for Edexcel GCSE Design and Technology: Food Technology
- Mawson, Bell, Poole and Sheppard – Design and Make it. Electronic Products (Nelson Thornes, 1997).
- Bishop O – Practical Electronics for GCSE (John Murray, 1989).
- Sage Jard Thompson D – Design and Technology: Electronics and Control Systems (Cambridge UP, 1996).
- Rick Davis – Revise GCSE Design and Technology.