Design and Technology provides students with multiple opportunities to develop self directed learning capabilities through the design of innovative products while learning technological concepts and applying practical making skills and a sound awareness of safe working practices. This process involves the investigation of real contexts where technological problems may be identified, analysed and solved through student enquiry.

Innovation and creativity can have a very important role in the student's self development and holistic lifelong education. A creative problem solving based approach is encouraged where students engage in applying technological knowledge and skills in order to design solutions based on their enquiry. This process is structured in a design folio which organises and evidences the students' design work along with their research, design ideas, plans and product models, which are then produced into unique quality products or prototypes.

During the course students will acquire the skills in creating 2D and 3D products by selecting, handling, combining and fabricating with different materials such as card, wood, plastics and metals. Textiles may also be explored as a resistant material for manufacturing. They will also learn the concept of control systems that involve electronic circuits. An introduction to programmable electronic control systems is also being launched, for the first time in this subject, within this document. Additionally students will follow a set of 2 resource workbooks to develop their ability to Communicate Graphically, throughout the 2 year course, embedding these skills in their design project work.

The students are made aware of the importance of the aesthetic and functional values in products designed to satisfy user needs, relating them to technological processes from the manufacturing industry. The constructive design approach allows students to learn-by-doing while learning how to work independently and in groups during the design and make stages. Special emphasis is placed on the students' awareness of health and safety issues and the importance of working safely in the Design and Technology lab environment and using appropriate personal protective equipment (PPE).
This subject is being offered to all students in state secondary Middle schools, at year 7 and Year 8, for a period of 13 weeks each year, when they then alternate with another subject from PHE. This entitlement to creative and innovative Design and Technology education for all ensures that all students are exposed to a learning by doing design approach in problem solving situations through a range of relevant contexts. Consequently, the acquired knowledge will help students develop a critical understanding of the impact of Design and Technology on daily life and the wider world.

Assessment for the 2 year course is based on 1 Design and Technology project on resistant materials and another project based on Electronic systems and control. A percentage of the overall marks is allotted to the completion of the Communicate Graphically workbook each year. The students will gain continuous formative feedback from all their work and receive detailed assessment reports for each project and workbook. Design and Technology, at these levels will not be assessed through summative tests or exams. This course prepares students for further learning through design and make in Design and Technology (option subject), up to MQF level 3, MATSEC certification.

**Mr. Keith Galea**
*Education Officer Design and Technology*

Other contributors in this document:

**Mr. Paul Busuttil**
*Former Education Officer Design and Technology*
Year 7 section, 2014

**Mr. Michael Mallia**
*Education Officer Graphical Communication*
Communicate Graphically units and workbooks

**D.T.L.C. Support Teaching Staff:**
Ms. Silvana Gauci, Ms Anna Zarb, Mr George Camilleri, Mr Carmel Callus
*Support Teachers Design and Technology*

For support, contact the:

Design and Technology Learning Centre

☎ 21431408 / 21422337
✉ dtlc@gov.mt
✉ keith.galea@ilearn.edu.mt

DTLC Room on Fronter:
CONTENTS

Introduction ............................................................................................................. 1
  Rationale ............................................................................................................... 1
  Aims ..................................................................................................................... 1
  Structure ............................................................................................................. 2
  Assessment ......................................................................................................... 2

Curriculum Units

Form 1 & 2 ............................................................................................................ 6
  DT 7/8 Design and Make it ................................................................................. 7

Form 1 ................................................................................................................... 15
  DT 7.1 Communicate Graphically 1 ................................................................. 16
  DT 7.2 Gifts of the Forest .................................................................................. 23
  DT 7.3 Plastic Investigators ............................................................................. 27
  DT 7.4 Treasures from Underground ................................................................. 31
  DT 7.5 A World full of Textiles ........................................................................ 34

Form 2 ................................................................................................................... 39
  DT 8.1 Communicate Graphically 2 ................................................................. 40
  DT 8.2 Going Electronic .................................................................................... 49
  DT 8.3 Electrify your System .......................................................................... 54
  DT 8.4 Programmable Systems and Beyond .................................................. 59

Appendix 1: Examples of possible situations ......................................................... 62

Appendix 2: Health and safety in Design and Technology laboratories ............. 64

Appendix 3: Design Folio Guidelines for Form 1 and 2 ...................................... 65
INTRODUCTION

RATIONALE

Design and Technology is a multi-disciplinary subject on a constant change. It offers opportunities where students can develop creative problem solving techniques which are essential for 21st century education, rather than only acquiring skills related to design, technology and manufacturing which might be useful for the industry. The National Curriculum Framework actually states that:

“The ‘design and make’ process empowers learners, as they progress through the different cycles, to intervene creatively in the manufactured world, manage resources in entrepreneurial manner and integrate knowledge across domains.” (A National Curriculum Framework for All, 2012, p.35)

The fact that the subject is now being offered to all state Middle school students reflects the relevance and importance of Design and Technology in today’s world. This new Form 1 and 2 curriculum was designed with this consideration in mind. It takes into account the unit structure of the previous (2013-14) Form 1 curricula while is also forward looking into future curricular developments with the introduction of an outcome based learning system, the Learning Outcomes Framework, currently under development by the DCM, DQSE.

The focus is on the learning process rather than content, which embraces well the teaching and learning approaches for Design and Technology. Problem solving and innovation shall be taught through designing and making products, while technological contents are experienced hands-on, following safety requirements.

AIMS

The Design and Technology curriculum should give students the opportunity to:

- develop creativity and problem-solving skills through the designing and making quality products which can be unique or modified from existing ones;
- work by specific purposes to meet the needs, wants and values of intended users of particular products;
- select appropriate resources: these being either data/information, material and components, tools and equipment, or techniques and processes, according to the design problem being solved;
- make use of such resources correctly, safely, effectively and efficiently;
- analyse and evaluate Design and Technology activities and products, both their own and of others;
- communicate effectively with different audiences, bearing in mind their values;
- recognise and consider social, moral, economic, environmental and health and safety issues including any market influences that may apply;
- foster personal qualities which help them take a problem towards a possible solution.
STRUCTURE

This programme is projected to be covered over one session of about thirteen consecutive weeks each year, where students are allocated a double-lesson of 80 minutes per week. The Form 1 programme uses the area of resistant materials to reach the goal of problem solving. In Form 2, students study the area of electronic systems so that over the two-year programme both areas are covered.

Students shall therefore produce one project per year, apart from other focus practical tasks performed as the programme progresses. The project for the first year shall be related exclusively to materials: these materials being wood, metals, plastics, textiles, or a combination of two of them. The project for the second year shall be exclusively related to electronic systems, where any casings needed shall be provided beforehand, ready-made or produced through basic modular vacuum forming moulds, requiring the application of students' designs from the Communicate Graphically workbook 2 by the school's technical staff.

There are a number of curriculum units allocated for each year, some of which are compulsory while others are elective or optional. Allocation of number of hours per unit is an estimate, and some units may take longer, or lesser, to complete. Suggested activities inside the units can be adapted to suit the needs of particular classes or students as long as the teaching objectives stated in each unit are satisfied.

Emphasis should be given to hands-on experiences so that students learn by doing, though keeping in mind the problem-solving philosophy of Design and Technology education. The units dedicated for graphical communication skills include a workbook which students should complete as part of the focus practical tasks and a percentage of the overall assessment. Use of CAD/CAM provisions is encouraged throughout the course, especially in schools where these facilities are already available. Health and safety issues remain highly important during all lessons in Design and Technology.

ASSESSMENT

Assessment for Design and Technology in Form 1 and 2 is mostly based on students’ design work presented in the design folio and the product itself. Students will be also awarded some marks for the focus tasks covered in the graphics workbook. There shall be no summative assessment task at the end of the course. Assessment mark is divided as follows:

<table>
<thead>
<tr>
<th>D&amp;T Form 1 &amp; 2 Assessment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Work</td>
<td>“Communicate Graphically” Workbook</td>
</tr>
<tr>
<td>Design Folio + Product</td>
<td>20%</td>
</tr>
<tr>
<td>80%</td>
<td></td>
</tr>
</tbody>
</table>

Since the focus of this curriculum is on the learning process, assessment of the project work shall be continuous. Project assessment should be built up alongside the progression of the project. Assessment of all students’ design work has to be performed according to the set criteria established in pages 3 and 4. Assessment criteria need to be handed and explained to students before they start the project. In this way, students will be aware of the points they will be assessed on. The design folio should be build up along the progression of the project. All evidence of work related to the project including models and the artefact itself, should be kept by the teacher during half-yearly or annual examinations session, so that work is accessible for moderation.
<table>
<thead>
<tr>
<th>Design stage</th>
<th>(46 marks)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem Space</strong></td>
<td><strong>Situation &amp; Design Brief</strong></td>
</tr>
<tr>
<td>1</td>
<td>Identifies the problem with help stating where needs exist.</td>
</tr>
<tr>
<td>2 – 3</td>
<td>Writes a design brief with help, and identifies keywords.</td>
</tr>
<tr>
<td><strong>Research</strong></td>
<td><strong>Problem Analysis</strong></td>
</tr>
<tr>
<td>1</td>
<td>Explores basic problem aspects.</td>
</tr>
<tr>
<td>2 – 3</td>
<td>Explores and communicates various problem aspects.</td>
</tr>
<tr>
<td><strong>Product Analysis</strong></td>
<td><strong>1 – 2</strong></td>
</tr>
<tr>
<td><strong>Product Analysis</strong></td>
<td><strong>3 – 4</strong></td>
</tr>
<tr>
<td><strong>Materials / Components</strong></td>
<td><strong>1</strong></td>
</tr>
<tr>
<td>2 – 3</td>
<td>Researches about various materials/components in relation to the design brief.</td>
</tr>
<tr>
<td><strong>Specifications</strong></td>
<td><strong>Design Specifications</strong></td>
</tr>
<tr>
<td>1</td>
<td>Points out the main criteria of basic product design.</td>
</tr>
<tr>
<td>2 – 3</td>
<td>Considers obvious design criteria to improve a given preliminary specification list.</td>
</tr>
<tr>
<td>4 – 5</td>
<td>Decides upon basic essential design specifications.</td>
</tr>
<tr>
<td><strong>Ideas</strong></td>
<td><strong>Initial Ideas</strong></td>
</tr>
<tr>
<td>1 – 3</td>
<td>Generates one or several similar ideas using sketches/diagrams with some help.</td>
</tr>
<tr>
<td>4 – 6</td>
<td>With guidance, generates two totally different ideas using annotated sketches/diagrams to suggest features and materials/component.</td>
</tr>
<tr>
<td>7 – 8</td>
<td>With guidance, generates more than two different ideas using annotated sketches/diagrams to suggest features and materials/components.</td>
</tr>
<tr>
<td><strong>Chosen Idea</strong></td>
<td><strong>1 – 2</strong></td>
</tr>
<tr>
<td><strong>Development</strong></td>
<td><strong>Materials/Components</strong></td>
</tr>
<tr>
<td>1 – 2</td>
<td>Selects materials/components with help.</td>
</tr>
<tr>
<td>3 – 4</td>
<td>Selects appropriate materials/components and with help, gives reasons for choices made.</td>
</tr>
<tr>
<td><strong>Modelling/Simulation</strong></td>
<td><strong>1 – 2</strong></td>
</tr>
<tr>
<td>3 – 4</td>
<td>Makes a model/sample/simulation with minimum help.</td>
</tr>
<tr>
<td>Development</td>
<td>Detailing for manufacture</td>
</tr>
<tr>
<td>-------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Planning</td>
<td>Planning &amp; safe practice</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Make stage (26 marks)**

<table>
<thead>
<tr>
<th>Make stage</th>
<th>Tools and Equipment</th>
<th>1 – 2</th>
<th>Uses tools and equipment under supervision.</th>
<th>8 marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>3 – 5</td>
<td>Uses tools and equipment with guidance and observes safety precautions.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 – 8</td>
<td>Chooses appropriate tools and equipment with guidance following all safety precautions.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Making</th>
<th>Artefact</th>
<th>1 – 2</th>
<th>Produces an incomplete product or a product that is completely different from the work planned.</th>
<th>18 marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>3 – 6</td>
<td>With guidance, makes a product that matches the planned work.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7 – 10</td>
<td>With guidance, makes a product that matches the planned work using the appropriate materials.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>11 – 14</td>
<td>With guidance, makes a product that matches the planned work using the appropriate materials and taking care of wastages.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>15 – 18</td>
<td>With guidance, makes a good-quality product according to the work planned using appropriate materials and taking care of wastages.</td>
<td></td>
</tr>
</tbody>
</table>

**Validation/ Evaluation Stage (8 marks)**

<table>
<thead>
<tr>
<th>Testing</th>
<th>Product &amp; User Testing</th>
<th>1</th>
<th>Tests the artefact against the Design Brief.</th>
<th>5 marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2 – 3</td>
<td>Tests the functionality of the product.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 – 5</td>
<td>Tests the functionality of the product and gets feedback from prospective users.</td>
<td></td>
</tr>
</tbody>
</table>

| Evaluation | Project Evaluation     | 1 - 3 | Evaluates the completed product against the Design Brief. | 3 marks |

(TOTAL: 80 marks)
Assessment of the “Communicate Graphically” Workbook

The workbook is divided into five sections, each section reflecting a teaching objective. Each objective carries 4 marks. Therefore, a total of 20 marks are allotted for the completion of the workbook. When an objective is completed, the teacher assesses the students’ work and gives a mark in the spaces provided on the workbook, as shown in Figure A.

The students' focus tasks in the workbook will be classified as:

- Very Good (4 marks)
- Good (3 marks)
- Fair (2 marks)
- Developing (1 mark)

The marks will be awarded for accuracy, neatness, consistency and completion of the exercises. The marks per section, the total marks attained and the teacher's remarks will be written on the last page in the spaces provided as shown in Figure B.
This unit shall be covered in both the Form 1 (Year 7) and Form 2 (Year 8) since it forms the basis of Design and Technology teaching. It covers the stages related to the design process and should therefore progress along the duration of the whole project.
**Subject:** Design and Technology  
**Unit code and title:** DT 7/8 Design and make it  
**Form 1 & 2**  
**Duration:** 9 sessions of 40 minutes (6 hours)

**Objectives**

The teacher will:
1. teach that designers need to go through a progression of activities collectively known as Design Process to solve a problem.
2. teach how to find out what products are available on the market.
3. teach how to obtain a basic design specification list.
4. teach how to generate ideas and select one idea for development.
5. teach how to develop a design idea.
6. teach how to prepare a parts/components list and work plan.
7. teach how to make artefacts and devices following the planned designs.
8. teach how to test and evaluate a product.

**Keywords**

Design process, situation, design brief, research, product analysis, specification list, initial ideas, chosen idea, development, planning, making, testing, evaluation

**Resources**

- Appendix 1: Examples of possible situations
- Appendix 3: Design Folio guidelines
- Template design folio, project work assessment criteria, pictures of ready-made products, access to the internet and/or library, plain/grid paper, modelling materials/equipment/software and tools required to work with these materials
- Design & Technology Fronter Room  
  https://ilearn.edu.mt/malta/main.phtml
- Textbooks:  
  Nuffield Design & Technology 11-14 Student’s Book (2nd Edition)
- Hyperlinks:
  - General:  
    http://www.techtoutuk.com/knowledge/designprocess.html  
    http://www.spartacus.schoolnet.co.uk/REVdt.htm  
    http://www.technologystudent.com/designpro/despro1.htm
  - Initial ideas:  

---

**Points to note**

<table>
<thead>
<tr>
<th>Keywords</th>
<th>Points to note</th>
</tr>
</thead>
</table>
| Design process, situation, design brief, research, product analysis, specification list, initial ideas, chosen idea, development, planning, making, testing, evaluation | This unit forms the basis of the whole Design and Technology programme for Form 1 and 2.  
                                                                                                           | The teaching objectives of this unit are related to the design process and hence should ideally progress throughout the whole duration of the design project.  
                                                                                                           | This unit does not necessary need to be covered as one whole block. The teaching objectives can be distributed along the progression of the design project. However, their sequence is to be kept as suggested.  
                                                                                                           | Although the unit does not include objectives related to the graphical communication skills, these objectives are covered in the units specifically dedicated to this area.  
<pre><code>                                                                                                       | It is expected that students complete the design folio more autonomously in their second year of study. |
</code></pre>
<table>
<thead>
<tr>
<th>Teaching Objective</th>
<th>Examples of teaching experiences</th>
<th>Indicators of Learning Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>The teacher will:</td>
<td>1. <strong>teach that designers need to go through a progression of activities collectively known as Design Process to solve a problem.</strong> The teacher will briefly explain that problems can be solved or user needs can be met by following a design process which consists of several stages, mainly: designing, making and evaluating. The teacher will distribute copies of past completed design folios. The students will examine the design folios provided to obtain knowledge with regards to the stages of design process involved and start familiarizing with the technical words involved. Others can also produce a set of cards showing the name of each stage of the design process, and/or a picture of an activity that is carried out during each particular stage. Some students can perform this activity by producing a slide-show instead of cards. Other students will be given out ready-made cards to put in the correct order. It is suggested that at this point, teachers explain the criteria on which students’ work will be assessed. A copy of the assessment criteria can be filed as part of the students’ design folio and feedback should be given along the duration of the project. <strong>Situation:</strong> The teacher will introduce a situation as a context for the scholastic year. The situation can be presented and explained through pictures or videos which narrate a story. For some students, the given situation can be simplified or presented in a more focused manner. <strong>Design Brief:</strong> Students will be asked to express verbally what problem is being presented and what they consider doing about it. Other students will be guided to verbally analyse the situation by answering a set of questions. Examples of such questions can be: a. Which product/system is mentioned in the situation? b. What function does the product/system have? c. Who is involved in the problem? Based on students’ verbal responses, the teacher will suggest a design brief. Some students will suggest a slightly different design brief after prompting.</td>
<td>Students will: use the steps involved in the design process to solve a given problem with guidance. (Level 8) know that a problem can be solved through several stages identified as “design process”. (Level 7) recognise that a problem can be solved through a process. (Level 6) be aware that a product needs to be designed before being made. (Level 5)</td>
</tr>
</tbody>
</table>
### 2. teach how to find out what products/systems are available on the market.

**Research:**
The teacher will explain that in order to obtain the best possible solution for a stated problem, students need to find the required information first. The teacher will explain that research is carried out in three stages:
- collecting
- sorting
- using the information

One area to research is existing products/systems. The teacher will display a number of products. Students will be given pictures of existing products on which to label the materials/components they think are being used, i.e.: wood, metal, plastic or textiles. Here annotations are to be introduced. These should focus on the above properties as well as on the features and functions within a product/system.

Other students can go through this same activity by searching for pictures of existing products/systems themselves: either by browsing on the internet or through magazines or by going into shops.

The teacher will explain that, by analysing and evaluating products/systems (Product Analysis) already on the market, one can know more about product design, manufacture and use. Sometimes a product/system is disassembled to see how it has been made and what materials, components and construction methods have been used. This can also help the students to become more selective when buying a product.

The students go into groups and discuss the product analysis of a given product/system with the help of a worksheet. They will also be asked to record their findings.

### 3. teach how to obtain a basic design specification list.

**Specifications:**
As an introduction to the term “specifications”, the students will be grouped in threes to perform a role play where they put up the scene with a parent and son/daughter conversing with a shop assistant to buy a shirt in a retail store. The teacher will guide the students to discuss the important details needed when selecting a shirt, such as: function, size, colour, type of material, type of power supply, cost, etc.

The teacher will explain that several materials/components can be used for a particular product, depending on the properties/ratings of that material/component and its intended use.

<table>
<thead>
<tr>
<th>Record the different types of products/systems available on the market and performs detailed product analysis on one product. (Level 8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Record the different types of products/systems available on the market and performs product analysis on one product/system. (Level 7)</td>
</tr>
<tr>
<td>Record the different types of products/systems available on the market. (Level 6)</td>
</tr>
<tr>
<td>Be aware of products/systems on the market. (Level 5)</td>
</tr>
<tr>
<td>Decide upon basic and essential design specification related to product being designed. (Level 8)</td>
</tr>
<tr>
<td>Consider the most obvious design criteria to improve a given preliminary specification list. (Level 7)</td>
</tr>
</tbody>
</table>
| Understand, respond to and discuss
use. The teacher will ask students to think about certain crucial criteria which have to be considered before starting to design the product.

In order to initiate the thinking process, the whole class will be given a set of questions related to decision making for the specification list. Such questions can be:
- What space will such a product/system occupy?
- Who will use the product?
- Are there any safety issues which need to be considered?
- Are there any limitations for cost?

All students will discuss the issues involved and give out answers. These questions can be presented in a pictorial form. A few students will also be given a ready-made artefact/device in hand to analyse it visually and physically.

Students will then elicit a set of specification key terms from the answers they have given to the above questions. These terms may include material/working parameters, user needs, safety, overall size, product theme, and manufacturing time available.

The teacher will start off a class discussion to decide the parameters for some of the suggested specification key terms.

Students will add a minimum of two other design criteria to the given list. Some will be guided by the teacher to decide only on the overall sizes/parameters.

| 4. teach how to generate ideas and select one idea for development. | Initial Ideas:
The teacher will explain that the design brief and specification criteria provide the information needed to start designing and generate some initial ideas. The teacher shall point out that it is important to present different ideas in order to consider many possible solutions. A designer may come up with totally new designs, or interesting variations/innovations on original designs.

For resistant materials projects, the teacher will ask the students to jot down words or sketch shapes related to the chosen theme.

Students will use this brainstorming session to propose ideas for their product through sketching. Students will present their ideas on plain or grid paper. 3D sketching will be encouraged. A few students will choose from a selection of given templates and collate them to obtain their ideas. | use 3D freehand sketching/block diagrams and annotations to communicate a minimum of three different ideas. (Level 8)

use 2D freehand sketching/block diagrams and annotations to communicate a minimum of two different ideas. (Level 7)

use 2D sketching/block diagrams and few annotations to communicate two similar ideas. (Level 6) |
For electronic systems, the teacher will present the general systems block diagram and ask students what should be the function/s of the system. The teacher will categorize the function of the system into the three blocks of the systems diagram. Students will then suggest, through other block diagrams, which components/sub-systems could be applied to achieve the wanted function/s.

**Chosen Idea:**
The teacher will explain that once the specification list and a range of ideas have been brought up, the designer needs to evaluate all the ideas and choose the most suitable one to be developed. Each idea is compared to the specification to see if it will satisfy all the criteria. This will justify the choice of the best idea. The students will go into groups and evaluate through brainstorming and discussion all the initial design ideas. They are encouraged to carefully consider the ideas against the criteria of the specification list. The students are then asked to clearly identify the final design idea to be developed with supporting evidence.

### 5. teach how to develop a design idea.

**Development:**
The teacher will explain that an idea needs to be developed so that design concepts are tested before the product is actually produced. The teacher will show cardboard models of artefacts that were altered in order to satisfy a concept better. For electronic systems, the teacher will explain how to convert the initial block diagram into a circuit diagram.

Students will produce a model of their chosen design or develop their circuit diagrams. Modelling of artefacts can be achieved through the use of modelling material such as expanded polystyrene foam, modelling dough, cardboard and paper. In case of electronics, circuits can be modelled on simulation software and/or on a breadboard.

Any modifications will be recorded in form of drawing/annotations. A few students will only apply these modifications as they produce the artefact/circuit.

Students will then produce one final labelled drawing/circuit diagram and circuit layout of the product/system with the basic necessary detail for its manufacture.

use 2D sketching/block diagrams and few annotations to communicate one own idea. (Level 5)

produce an orthographic working drawing, detailed circuit diagram and circuit layout and make functional models to develop the main design concept. (Level 8)

produce conceptual drawings/simple two-view orthographic drawing, basic circuit diagram and circuit layout and use models to develop part of a design concept. (Level 7)

express design concepts verbally and apply them as they produce the artefact. (Level 6)

show personal preference on particular design concepts. (Level 5)
6. teach how to prepare a parts/components list and work plan.

**Planning:**
Teacher will show how to make a parts/components list by analysis the final conceptual drawings/circuit diagrams students have made.

Students will produce their own parts/components list according to the product they designed. Some students will be given a fill-in parts/components list which they need to complete accordingly.

Teacher will then prompt students to think about the process of how their artefact can be manufactured in a safe manner. Students, with the help of the teacher, will then decide on a general outline for a work-plan common to all students. This plan shall state a number of sequential activities in form of short and simple sentences. The teacher will then shuffle the sequence and students will put the steps in the correct order and record them in their design folio. Some students will need further guidance to complete the set task. Flowcharts can be used to aid understanding and presentation. Some students can produce a sequence of drawings instead of a write up.

Ultimately, the students can list the tools/equipment required to complete the said work plan. Some students will recall the safety precautions followed during the Focus Practical Tasks and state them in the list.

| produce a parts/components list, tools/equipment list and a work plan. (Level 8) |
| produce a parts/components list and tools/equipment list stating safety precautions with help. (Level 7) |
| produce a parts/components list and a tools/equipment list with help. (Level 6) |
| produce a parts/components list with help. (Level 5) |

7. teach how to make artefacts and devices following the planned designs.

**Making:**
Students will follow the work plan to produce their product. They will recall and practice skills that they have learnt during the focus practical tasks covered in the other units.

| select and use safely a range of tools and equipment with some precision to produce the planned designs. (Level 8) |
| use appropriate tools and equipment safely and with a degree of accuracy under minimum supervision to produce the planned designs. (Level 7) |
| use basic tools and equipment with some degree of accuracy and |
| 8. teach how to test and evaluate a product. | **Testing:**  
Student will test the functionality of their produced artefact/system.  
The teacher will guide students to test the finished product against the Design Brief. Students will verify whether their product/system satisfies the Design Brief and write a reason for their statement.  
Teacher will give out a questionnaire which students will use to comment on and criticise their peer’s work. Some students will ask further questions or give further comments on their peer’s projects.  
**Evaluation:**  
The teacher will explain that evaluation is a continuous process for designers, and emphasize that a final evaluation should be made against certain criteria. The teacher will also explain that the evaluation should be based on the following points:  
- the fitness of purpose  
- design needs  
- needs of the intended users  
- quality with effective use of materials and tools  
- the tests applied to the product  
The teacher will prepare a checklist showing some suggested questions to carry out the final evaluation. These may include:  
- Were the aims of the project reached? Why/why not?  
- Were the results of the tests carried out satisfying?  
- What was the general feedback from others about my artefact? | consideration of health and safety issues under supervision to produce a product/system. (Level 6)  
use basic hand tools to manipulate materials being aware of health and safety issues. (Level 5)  
test the finished product against the Design Brief and the specifications and present their findings graphically and textually.  
evaluate the tests carried out on the product to suggest any improvement. (Level 8)  
perform a simple test for functionality of the product and collects users’ feedback.  
evaluate a finished artefact against the Design Brief. (Level 7)  
perform a simple set test for functionality of the product and test it against the Design Brief.  
evaluate the artefact against the Design Brief with help. (Level 6)  
test the finished product against the Design Brief only.  
evaluate the product on personal judgement. (Level 5) |
- Does the product function properly? If it does not, why that happened?
- Can I improve the product in any way? What would I change if I would do it again?

Students will mainly evaluate their work verbally, but they are to write some comments with respect to evaluating their product against the design brief.
CURRICULUM UNITS FOR FORM 1

Compulsory Unit:
DT 7.1: Communicate Graphically 1

Elective Units:
Teachers should choose any TWO from the following units:
DT 7.2: Gifts of the Forest
DT 7.3: Plastic Investigators
DT 7.4: Treasures from Underground
DT 7.5: A World full of Textiles
Subject: Design and Technology
Unit code and title: DT 7.1 Communicate Graphically 1

Objectives
The teacher will:
1. teach how to print letters and numbers.
2. teach how to mark out simple shapes using different types of lines.
3. teach how to measure and draw horizontal lines, vertical lines and circles.
4. teach how to construct basic 2-D geometric shapes.
5. teach how to draw simple 3-D blocks.

Key Words
- Letters, numbers, printing, grid paper, types of lines, nets, dimensions, measuring, marking out, shapes, 2-D views, 3-D views, oblique views, set squares, compasses, protractor, angles, 2H pencils, coloured pencils.

Points to note
- Graphical communication is an essential tool for completing the design process.
- Throughout this unit, students will learn how to print clear and legible letters and numbers, use of the correct line types, measure and mark out simple profiles and construct basic shapes. They will also be introduced to oblique drawing on grid paper and freehand sketching. To complete the given exercises, the students will require basic mathematical instruments.
- The “Communicate Graphically Year 7 Workbook” has been designed specifically to facilitate the students’ work and to eliminate the need of tee squares and drawing boards. The exercises are student friendly, easy to follow and are meant to instil a sense of fun and enjoyment.
- The recommended teaching method at this stage would be a blend of direct exposition and a dose of learning by discovery.

Resources
- Interactive whiteboard
- Whiteboard, large drawing instruments to be used on the whiteboard.
- Workbook: Communicate Graphically Year 7 Workbook
- Textbooks:
- Hyperlinks:
  - Graphical Communication Website: http://graphicalcommunication.skola.edu.mt/
### Teaching Objective

The teacher will:

1. teach how to print letters and numbers.

### Examples of Teaching Experiences and Activities

The teacher discusses the importance of the clarity of expression required to produce a good drawing with annotations. The teacher demonstrates the correct use of the pencil, its maintenance and the pressure applied to achieve the required line thickness. The teacher also stresses the importance of producing clear and legible annotations of consistent quality. Finally the teacher demonstrates, on the whiteboard, the correct practice of letter and number printing.

**Possible Activities:**

- Students practice letter and number printing on the workbook.
- Students use the grid as a guide to draw letters and numbers as displayed on the workbook.

*Practice and experimentation at home is advisable.*

![Figure C](image)

### Indicators of Learning Outcomes

Students will:

print letters and numbers neatly, accurately and consistently. They will copy the given letters and numbers and print their name and form with minimum support. They will also take the initiative to plan and print other names (such as their favourite sport team) on grid paper. (Level 8)

print letters and numbers with a fair degree of accuracy and neatness. They will occasionally find difficulty to copy the letters and numbers on grid paper and will require some help to plan and print their own name and form. (Level 7)

print letters and numbers with a low degree of accuracy and neatness. They will require frequent support to copy correctly the letters on grid paper and to plan the printing of their name and form. (Level 6)

print letters and numbers with a low degree of accuracy and neatness. They will require continuous support to copy correctly the letters on grid paper and to plan the printing of their name and form. (Level 5)
2. teach how to mark out simple shapes using different types of lines.

The teacher explains the importance of using correct line types and thicknesses to convey the necessary messages. The teacher demonstrates a number of examples and the students identify the types of lines and the context in which these were used.

Possible Activities:
- Students work examples from the workbook, using the appropriate types of lines.
- Students apply the acquired skills to design simple shapes.

![Figure D](image)

- Draw the required lines neatly, accurately and consistently. They will use the correct pencil pressure to draw faint and bold lines. They will also copy accurately the given drawings with minimum support and use the acquired knowledge to design their own drawings. (Level 8)
- Require some help to learn how to exert different pressure to draw faint and bold lines. They will require some support to copy the given drawings fairly accurately and consistently. (Level 7)
- Require frequent support to learn how to exert different pencil pressure to draw faint and bold lines. They will also require frequent support to copy the given shapes using the required lines and to draw the circle by means of compasses. (Level 6)
- Require continuous support to learn how to exert different pencil pressure to draw faint and bold lines. They will also require continuous support to copy the given shapes using the required lines and to draw the circle by means of compasses. (Level 5)
3. teach how to measure and draw horizontal lines, vertical lines and circles.

1. The teacher explains how a ruler is used to measure centimetres and millimetres. The teacher also explains how to write the measured dimensions on a technical drawing.
2. The teacher demonstrates how a ruler, pencil and compasses are used to mark out simple profiles.

Possible Activities:

- Students measure drawn objects and write down (print) the numbers on the dimension lines.
- Students mark out the profile of the jeep on the workbook.

measure vertical and horizontal lines accurately to the nearest millimetre and print neatly, legibly and consistently the dimensions above the dimension lines. The students will also mark out accurately and neatly the given shapes using the correct line thickness. (Level 8)

measure vertical and horizontal lines fairly accurately and print fairly legible dimensions on the dimension line. They will require some support to mark out the given drawing by using the correct line thickness. The students will also require some support to draw the circles. (Level 7)

measure vertical and horizontal lines with a low degree of accuracy. They will have to be supported to write the dimensions on the dimension lines. They will also require continuous support to maintain consistent line thickness and to mark out the given shape which includes lines and circles. (Level 6)

require continuous help to measure vertical and horizontal lines. They will need continuous support to write the dimensions on the dimension lines and to maintain consistent line thickness to mark out the given shape which includes lines and circles. (Level 5)
4. teach how to construct basic 2-D geometric shapes.

The teacher demonstrates how to use compasses and/or protractor to construct equilateral triangles and pentagons. The teacher also explains their use for structural and aesthetic purposes.

Possible Activities:

- Students construct equilateral triangles and pentagons.
- Students develop the basic shapes into coloured geometric patterns.

Possible Activities:

- Students construct equilateral triangles and pentagons. They complete the given shapes with minimum support and colour neatly the constructed shapes. (Level 8)
- Students develop the basic shapes into coloured geometric patterns. They require intermittent support to construct the equilateral triangle and the pentagon while using the proper line thickness. They may require help to derive the geometric figures and colour the constructed shapes. (Level 7)
- Students construct accurately the equilateral triangle and polygon while using the correct line thickness for construction lines and outlines. They require frequent support to construct the equilateral triangle and the pentagon. They will also require some support to maintain the proper line thickness, derive the geometric figures and colour the constructed shapes. (Level 6)
- Students construct accurately the equilateral triangle and polygon while using the correct line thickness for construction lines and outlines. They require continuous support to construct the equilateral triangle and the pentagon. They will also require frequent support to maintain the proper line thickness, derive the geometric figures and colour the constructed shapes. (Level 5)
The teacher demonstrates how to use compasses and/or protractor to construct hexagons and octagons. The teacher also explains their use for structural and aesthetic purposes.

**Possible Activities:**

- Students construct hexagons and octagons.
- Students develop these basic shapes into coloured geometric patterns.

**Figure G**

Students will construct accurately the equilateral triangle and polygon while using the correct line thickness for construction lines and outlines. They complete the given forms with minimum support and colour neatly the constructed shapes. (Level 8)

require intermittent support to construct the equilateral triangle and the pentagon while using the proper line thickness. They may require help to derive the geometrical forms and to colour the constructed shapes. (Level 7)

Students will require frequent support to construct hexagons and octagons. They will also require support to maintain the proper line thickness, derive the geometrical shapes and colour the constructed shapes. (Level 6)

require continuous support to construct the hexagon and octagon. They will also require frequent support to maintain the proper line thickness, derive the geometric figures and colour the constructed shapes. (Level 5)
5. **Teach how to draw simple 3-D blocks.**

The lesson starts off with a set induction consisting simple solid blocks which the students are asked to observe and describe. The teacher draws the blocks on the white board by following the descriptive verbal instructions given by the students. The teacher explains the basic principles of oblique drawings and describes how to use the grid paper to draw these three-dimensional representations.

**Possible Activities:**

The students complete the oblique drawings on the workbook.

- **Copy accurately the given oblique shapes while maintaining the correct line thickness.** They will also use the acquired knowledge to design their own oblique shapes. (Level 8)

- **Require minimum support to copy correctly the given views.** They will work fairly accurately and maintain fairly consistent line thickness. (Level 7)

- **Require intermittent support to copy correctly the given views.** They will also require support to maintain uniform line thickness. (Level 6)

- **Require continuous support to copy correctly the given views.** They will also require support to maintain uniform line thickness. (Level 5)
### Objectives

The teacher will:

1. teach the origin of natural and manufactured wood
2. teach that the use of wood depends on its properties and available standard forms
3. teach the basic skills required for the manipulation of wood

### Keywords

- Classification, properties, standard form, processes, wood, hardwood, softwood, manufactured, grain, texture, density, marking, smoothing, finishing

### Points to note

- The teaching approach should involve the three main stages of designing, making and evaluating. However, the emphasis of this unit is on knowledge and understanding of wood and its manipulation processes.

- The experiences which students will pass through in this unit will help them in decision making during design work at Forms 3, 4 and 5.

- Students are encouraged to use their previous experiences of materials to explore new concepts. Ideally, students should explore as many different materials as possible. However, for safety reasons, this discovery approach should be put aside during making, until the student becomes familiar with the use of tools and equipment.

- The importance of health and safety and environmental issues should be stressed on throughout all lessons. *(Refer to Appendix 2.)*

### Resources

- Access to the internet, assortment of hardwood/softwood leaves, weighing scales, samples of wood of same size, Pictures of wooden objects, steel rules, pencils, try squares, compasses, woodworking bench vices, bench hooks, G-clamps, smoothing planes, files, back saws, coping saws, abrasive paper, PVA glue, paint/varnish/stain, paintbrushes

### Hyperlinks

- **Hardwoods:** [http://www.mr-dt.com/materials/hardwoods.htm](http://www.mr-dt.com/materials/hardwoods.htm)
  
  [http://www.design-technology.org/lesson5b.htm](http://www.design-technology.org/lesson5b.htm)
- **Softwoods:** [http://www.mr-dt.com/materials/softwoods.htm](http://www.mr-dt.com/materials/softwoods.htm)
  
  [http://www.design-technology.org/lesson5e.htm](http://www.design-technology.org/lesson5e.htm)
- **Plywood production:** [http://www.youtube.com/watch?v=oux_vd1aS4Q](http://www.youtube.com/watch?v=oux_vd1aS4Q)
- **Manufacture of chipboard desk:** [http://www.youtube.com/watch?v=GBrgZihZhjs&NR=1](http://www.youtube.com/watch?v=GBrgZihZhjs&NR=1)
- **Manufacture of MDF:** [http://www.youtube.com/watch?v=ps36jM6pzK8&feature=related](http://www.youtube.com/watch?v=ps36jM6pzK8&feature=related)
- **Environmental issues:**
  
<table>
<thead>
<tr>
<th>Teaching Objective</th>
<th>Examples of teaching experiences</th>
<th>Indicators of Learning Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. teach the origin of natural and manufactured wood.</td>
<td>A batch of different wood samples of the same size will be given out to different groups of mixed-abilities students. The samples will be labelled with the name of the wood. Each group will have to divide the wood into two categories: this can be done as a form of competition. Students will be asked about the criteria on which they performed the categorization. The teacher will then show the answer to this activity to introduce the terms “natural” and “manufactured/man-made”. Students will be asked to record the results of the categorization in a table and also take note of the visual differences between the two categories. Some students will produce this note by using their own sketches; others will present notes in written form. Other students will find pictures and label them in order to illustrate these differences. Teacher will prepare a slide-show or a video clip to portray the impact of wood use on the environment and society – for example the felling of trees and deforestation – and how it affects product design. A class discussion will take place to raise environmental issues and how they relate to the process of design. All the class will participate in this activity, although some students will need some probing statements in order to get active in the discussion.</td>
<td>classify wood according to their properties. (Level 8) name and visually select natural and manufactured wood. (Level 7) know that there are different types of wood. (Level 6) show awareness that wood is one of the materials used to produce products. (Level 5)</td>
</tr>
<tr>
<td>2. teach that the use of wood depends on its properties and available standard forms.</td>
<td>The students will have access to the world-wide web where they search for pictures of hardwood and softwood trees. The list will be determined according to the range of wood samples given. The teacher will point out that the shape of the leaf makes it easy to classify timber as softwood and hardwood. Students will match the name on the given wood samples to its tree of origin and decide whether it is a hardwood or softwood. The teacher will give different samples of natural and manufactured wood of identical size to different groups of mixed-ability students. Students will analyse each sample according to density, colour and texture. Students will</td>
<td>select wood according to their properties and available standard forms. (Level 8) recognise wood according to their properties and know about available standard forms. (Level 7) know that different types of wood are used for different purposes. (Level 6) show awareness that wood is used to make certain products. (Level 5)</td>
</tr>
</tbody>
</table>
record findings by ticking the correct column on a worksheet. Other students will compose a table themselves, and others will use drawings and notes to show the properties of the wood.

Students can also use ICT to tabulate information obtained from this exercise, and also from the internet, into a database which can be referred to when designing with materials. Examples of headings can be: classification, properties, standard forms and standard sizes.

Teacher will give out pictures of different wooden objects. Students in groups will match the objects with the wood they are made of. Some students will add reasons to the choice of material. Other students will also search around the house / garage and find other objects made from each particular wood.

The teacher will show what types of wood are available in the schools' workshop. Students will take note of the different forms and sizes of the different wood types.

<table>
<thead>
<tr>
<th>3. teach the basic skills required for the manipulation of wood.</th>
<th><strong>Focus Practical Task</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher will demonstrate methods of:</td>
<td></td>
</tr>
<tr>
<td>1. marking out straight lines on wood using datum edge and try-square. The teacher will emphasise that in marking out procedures one must be aware that lines may be permanently (e.g. use of marking knives, scribers or permanent markers) or temporarily (e.g. use of pencil) marked on a material. Whilst cutting lines may be permanently marked, others like centre lines, bending lines and diagonals should be of a temporary nature.</td>
<td></td>
</tr>
<tr>
<td>2. holding material using vice, bench hook and G-clamp</td>
<td></td>
</tr>
<tr>
<td>3. cutting along straight lines using back saw on natural wood</td>
<td></td>
</tr>
<tr>
<td>4. smoothing edges by planing, filing and sanding</td>
<td></td>
</tr>
<tr>
<td>select and use safely a range of tools and equipment with some precision. (Level 8)</td>
<td>use basic hand tools safely with a degree of accuracy and minimum supervision. (Level 7)</td>
</tr>
<tr>
<td>use basic hand tools with some accuracy under supervision. (Level 6)</td>
<td>use basic hand tools under continuous supervision. (Level 5)</td>
</tr>
</tbody>
</table>
Students will be provided with pieces of wood which they need to cut down to size. Some students will need further explanation and guidance from the teacher. Others will complete the task successfully on their own and in less time. These will be asked to write down the steps carried out in this focus task in a logical sequence to serve as training for planning work at a later stage. Other students will be given a handout with a list of steps in an incorrect order which they need to put in a logical sequence.

**Making:**
If during the Focus Practical Task, the teacher did the demonstration using natural wood, this second demonstration should make use of manufactured board, or vice-versa, so that students can experiences both categories of wood.

Teacher will demonstrate methods of:
1. Marking out curved lines on wood
2. Cutting along curved lines using back saw and coping saw
3. Smoothing edges by planing, filing and sanding
4. Joining wood together by PVA adhesive
5. Finishing using paint, varnish or stain

Students will be provided with their selected pieces of wood which they need to cut down to the size and shape according to their designs. Some students will need further explanation and guidance from the teacher.
### Objectives:
The teacher will:
1. teach the difference between thermosets and thermoplastics
2. teach that the use of plastics depends on their properties and available standard forms
3. teach the basic skills required for the manipulation of thermoplastics

### Keywords
- Thermosetting, thermoplastic, thermoforming, thermal & electrical conductivity, recyclable, cutting, drilling, joining, standard sizes

### Points to note
The teaching approach should involve the three main stages of designing, making and evaluating. However, the emphasis of this unit is on knowledge and understanding of plastics. Students will acquire the basic skills required for the manipulation of thermoplastics.

There should be a focus on the use of the correct nomenclature of common plastics and how these classify under thermosets and thermoplastics.

The experiences which students will pass through in this unit will help them in decision making during design work at Forms 3, 4 and 5. Students are encouraged to use their previous experiences of materials to explore new concepts. Ideally, students should explore as many different materials as possible. However, for safety reasons, this discovery approach should be put aside during making, until the student becomes familiar with the use of tools and equipment.

The importance of health and safety and environmental issues should be stressed on throughout all lessons. *(Refer to Appendix 2.)*

### Resources
- Samples of plastic objects, hot-air blower, PVC sheets, blocks of straight wood, steel rules, try squares, compasses, template, masking tape, wood workers/engineers vices, vice grips, utility/craft knives, junior hacksaws, hacksaws, fret saws, files, abrasive paper, strip heater, hand drill, twist drills, bradawl, screws, screw driver, cyanoacrylate (super glue), vacuum former, sample moulds, sample vacuum formed shells.

### Reference Books:
- Nuffield Design & Technology 11-14 Student’s Book (2nd Edition)

### Hyperlinks:
- [http://www.design-technology.org/lesson4a.htm](http://www.design-technology.org/lesson4a.htm)
- Thermosetting: [http://www.design-technology.org/lesson4b.htm](http://www.design-technology.org/lesson4b.htm)
- Plastics Recycling: [http://www.youtube.com/watch?v=5-wq92CQp4U](http://www.youtube.com/watch?v=5-wq92CQp4U)
<table>
<thead>
<tr>
<th>Teaching Objective</th>
<th>Examples of teaching experiences</th>
<th>Indicators of Learning Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>The teacher will:</td>
<td>The teacher will distribute different types of plastic items or products such as pieces of drain pipes, food containers and 3-pin plug casings to the students and asks them to find out about their uses and why they think that particular plastic was used. Students will analyse the objects and express their conclusions on a given handout that depicts the analysed products. Some will produce own images using a digital camera and printer and add on annotations either hand written or using ICT. <strong>Ability of a plastic to be reshaped:</strong> The ability of plastics to be reshaped or not can be elicited by the students, after the teacher gives them samples of strips or scraps of different plastics to be heated. All samples are to be identifiable by a label. For the following exercise, the teacher will emphasise that the samples should not be overheated or burned. Hazards such as those associated with fumes, spatters, burns and fires should be taken care of. Therefore, one must use personal protective wear, the lab should be well ventilated, combustible materials are to be kept at a safe distance and fire extinguishers are to be within reach. In groups, students will heat the samples with a hot air blower, try to bend them into a new shape and notice results. The students will elicit that some plastics such as melamine formaldehyde or GRP cannot be bent to a desired shape even after it is heated. Other plastics such as PVC can be heated and reshaped. Results from this task should be recorded in a table. Some students will do research to determine how the plastics used during this task are classified and record results in textual form. Others are asked to find out the meaning of the terms “thermosetting” and “thermoplastic” to match the outcomes of their last task accordingly and record results by presenting a web diagram. A few will have the terms “thermosetting” and “thermoplastic” explained by the teacher or a fellow student so that the outcomes of their last task are matched accordingly and results are recorded in a fill-in table or web diagram.</td>
<td>Students will: classify plastics according to their properties. (Level 8) know that there are two types of plastics. (Level 7) demonstrate awareness that there are different types of plastics. (Level 6) show awareness that plastic is one of the materials used to produce products. (Level 5)</td>
</tr>
</tbody>
</table>

1. teach the difference between thermosets and thermoplastics. |

| Students will: | classify plastics according to their properties. (Level 8) |
| know that there are two types of plastics. (Level 7) |
| demonstrate awareness that there are different types of plastics. (Level 6) |
| show awareness that plastic is one of the materials used to produce products. (Level 5) |
Focus Practical Task:
Teacher will demonstrate methods of:
1. Making a simple cardboard model of required form.
2. Marking out straight lines on a plastic sheet making use of masking tape were necessary.
3. Holding material using vice and G-clamp.
4. Cutting along straight lines using junior hack saw. Soft and thin plastics can be cut using a utility / craft knife in conjunction with a safety steel ruler.
5. Smoothing edges by filing, sanding and polishing.
6. Bending sheet plastic along a line using hot-air blower and former / jig.

Students are asked to mark out, cut and bend a strip of PVC sheet to produce a simple bended plastic product such as a wall mounted coat hanger, a clip to secure a pile of paper or card, or similar.

| 2. teach that the use of plastics depends on their properties and available standard forms. | The teacher will show different types of plastics available in standard forms such as sheet, rods and tubes. Different colours are available as solid and transparent finish. The teacher will distribute a selection of samples of plastics such as stationery items, insulated wires, plastic cups and packaging and ask the students to analyse the plastics products focusing on density, thermal and electrical conductivity, colour, texture and recyclability. Students will analyse the plastic products and record their findings accordingly. The teacher will show a video on the recycling of plastics to point out environmental issues which affect the process of design. A brief class discussion will follow. | select plastics according to their properties and available standard forms. (Level 8) recognise plastics according to their properties and know about available standard forms. (Level 7) know that different types of plastics are used for different purposes. (Level 6) show awareness that plastic is used to make certain products. (Level 5) |
| 3. teach the basic skills required for the manipulation of thermoplastics. | Making: The teacher will provide pieces of acrylic or PVC sheets out of which students will realize their developed idea for their project. The teacher will stress again important health and safety issues that should be observed throughout this making phase. | select and use safely a range of tools and equipment with some precision. (Level 8) use basic hand tools safely with a degree of |
Every student will produce the product according to own developed design.

Throughout this stage, the teacher will need to go round the workshop to give personal attention to students so that they can choose the correct hand tools for the job in hand and check that these are being used safely and with a degree of accuracy.

The teacher will also help students creating opportunities to experience:

1. marking out straight and curved lines using steel rule, try square, compass, template and masking tape
2. holding plastics using bench vice, bench hook and vice grips
3. cutting using fret saw and hacksaw
4. smoothing edges using files and abrasive paper
5. bending using line bender
6. Drilling using twist drills and hand drill
7. Joining using screws and adhesives

**Additional Demonstration:**
The teacher can show a video demonstrating the process of vacuum forming as reinforcement on the application of thermoforming and an introduction to further products obtainable with thermoplastic materials. The mould used in this demonstration should be a basic form.

<table>
<thead>
<tr>
<th>Accuracy and minimum supervision. (Level 7)</th>
<th>Use basic hand tools with some accuracy under supervision. (Level 6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use basic hand tools with help. (Level 5)</td>
<td></td>
</tr>
</tbody>
</table>
Subject: Design and Technology
Unit Code and title: DT 7.4 Treasures from underground

Duration: 6 sessions of 40mins. (4 hours)

Objectives
The teacher will:
1. teach the difference between ferrous and non-ferrous metals
2. teach that the use of metals depends on their properties and available standard forms
3. teach the basic skills required for the manipulation of metals

Keywords
Classification, metals properties, ferrous, non-ferrous, standard size, marking, cutting, smoothing, drilling, joining, development

Points to note
Though the teaching approach should involve the three main stages of designing, making and evaluating, the emphasis of this unit is on the acquisition of knowledge and understanding related to metal and its manipulation processes.

The experiences which students will pass through in this unit will help them to take design decisions at a later stage. Students are encouraged to use their previous experiences of materials to explore new concepts. Ideally, students should explore as many different materials as possible. However, this discovery approach should be restrained when using tools and equipment.

The importance of health and safety and environmental issues should be passed on throughout all lessons. (Refer to Appendix 2.)

Resources
Sample of metals of same sizes, permanent magnet, steel rules, scribers, engineers squares, dividers, centre punches, engineers vices, files, emery cloth, tin snips, junior hacksaws, hacksaws, hammers, machine vice, grippers, bench/pillar drills, twist drills, safety glasses

Reference Books:
Nuffield Design & Technology 11-14 Student’s Book (2nd Edition)

Hyperlinks:
Metals in everyday life:
http://www.youtube.com/watch?v=XlJdG2OFDQBA&feature=related
Extraction and Recycling of Metals:
http://video.google.com/videoplay?docid=1525818288411361820#
http://science.howstuffworks.com/iron.htm
Properties of metals:
http://www.design-technology.org/CDT10metalsproperties.htm
http://videos.howstuffworks.com/discovery/34879-howstuffworks-show-episode-6-properties-of-lead-video.htm
Metal sections:
http://www.eural.com/
<table>
<thead>
<tr>
<th>Teaching Objective</th>
<th>Examples of teaching experiences</th>
<th>Indicators of Learning Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>The teacher will:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. teach the difference between ferrous and non-ferrous metals.</td>
<td>The teacher will show a video clip to the whole class as an introduction to metals used in everyday life. The class will be divided into groups according to the students’ abilities. A number of samples of different metals such as copper, aluminium, cast iron, mild steel and stainless steel will be distributed to each group together with a permanent magnet. The samples given to every group shall be labelled with the name of the metals. All students will categorize the metals into two groups by testing whether each sample is attracted by a permanent magnet or not. Some students will find out why certain metals were attracted by the magnet while other metals did not. They do this by recalling from their own experiences or by researching on the internet or books and therefore can deduce whether a sample is ferrous or non-ferrous. With other students, the teacher will explain that those metals that were attracted by the magnet contain iron and are therefore classified as ferrous, while the remaining metals are classified as non-ferrous because they do not contain iron.</td>
<td>Students will: classify ferrous and non-ferrous metals according to their properties. (Level 8) select metals and classify them as ferrous and non-ferrous. (Level 7) know that there are different types of metals. (Level 6) show awareness that metal is one of the materials used to produce products. (Level 5)</td>
</tr>
<tr>
<td>2. teach that the use of metals depends on their properties and available standard forms.</td>
<td>The samples of different metals will be distributed again to the different groups divided according to ability. A few students will again be given labelled samples. All groups will be given a weighing scales and a file. Students will record data regarding colour and weight of each sample. Students will also test the ability of the metal to resist abrasion by using a file and classify it as hard, medium or soft. Students will fill in a given worksheet. The teacher will show a short video clip about the extraction and recycling of metals. The teacher will then show metals sections and forms available in the school stores and ask students to comment on any application which these have as recalled from past experience or observation. Some students will be asked to find out other standard forms of metals and common applications of each.</td>
<td>select metals according to their properties and available standard forms. (Level 8) recognise metals according to their properties and know about their common available standard forms. (Level 7) know that different types of metals are used for different purposes. (Level 6) show awareness that metals are used to make certain products. (Level 5)</td>
</tr>
</tbody>
</table>
All students will pick up metal objects (or parts of objects) found in the D&T workshop or at home and jot down its name, type of metal and standard form used for its manufacture.

| 3. teach the basic skills required for the manipulation of metals. | Making: Students will go through the following experiences to turn what they designed on paper into real three-dimensional artefact. Certain students will need further individual attention in handling tools and manipulating metals. During this making phase, the teacher will find time to demonstrate methods required for the manipulation of sheet metal and wire. The teacher will stress important health and safety issues that should be observed throughout the following processes:  
1. marking out straight and curved lines on sheet metal making use of steel rule, try square, dividers and template
2. marking centres for holes using try square and centre punch
3. holding work for cutting using vice and grippers
4. cutting using snips and junior hacksaw
5. smoothing edges using a selection of files and emery cloth
6. bending and shaping sheet metal and wire to a desired shape
7. drilling using vice, grippers, twist drill and bench / pillar drill
8. joining by using screws or bolts and nuts | select and use safely a range of tools and equipment with some precision. (Level 8)  
use basic hand tools safely with a degree of accuracy and minimum supervision. (Level 7)  
use basic hand tools with some accuracy under supervision. (Level 6)  
use basic hand tools with assistance. (Level 5) |
### Subject: Design and Technology

**Unit code and title:** DT 7.5 A World full of Textiles

**Duration:** 6 sessions of 40 minutes (4 hours)

<table>
<thead>
<tr>
<th>Key words</th>
<th>Points to note:</th>
<th>Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fabric adhesives, environmental issues, bonded fabrics, iron-on, bond-a-web, pressing symbols, decorative components, functional components, Heat transfer imaging, performance characteristics.</td>
<td>The experiences which students will pass through in this unit will help them in decision making during design work at Forms 3, 4 and 5. The focus of this unit is on knowledge and understanding of textiles and some of its manipulation processes.</td>
<td>Cutting shears, pinking shears, trimming scissors, dry iron, steam iron, heat press, ironing board, fabrics, adhesives, tailors’ chalk, try square, video clips, swatches of fabrics, fusible interfacings, threads, yarns, zips, buttons, toggle, eyelets and lace, hooks and eyes, press studs, Velcro, linings and interlinings, Dacron, bias binding tape, ribbons, embroidery, appliqué, beads, braids, fringes, lace, piping, sequins, computer, printer</td>
</tr>
<tr>
<td></td>
<td>The teacher will explain the correct and safe use of tools and equipment and the use of glues. The teacher will assist students in cutting fabrics correctly and economically.</td>
<td>Reference Book: Nuffield Design &amp; Technology 11-14 Student’s Book (2nd Edition)</td>
</tr>
<tr>
<td></td>
<td>Students are encouraged to use their previous experiences and findings on materials to explore new concepts. However, for safety reasons, this discovery approach should be put aside during making, until the student becomes familiar with the use of tools and equipment.</td>
<td>Hyperlinks: <a href="http://www.bbc.co.uk/schools/gcsebitesize/design/textiles/productiontechniquesrev5.shtml">http://www.bbc.co.uk/schools/gcsebitesize/design/textiles/productiontechniquesrev5.shtml</a></td>
</tr>
<tr>
<td></td>
<td>The importance of health and safety and environmental issues should be stressed on throughout all lessons. <em>(Refer to Appendix 2.)</em></td>
<td>[<a href="http://www.nationalstemcentre.org.uk/elibrary/file/3833/textile">http://www.nationalstemcentre.org.uk/elibrary/file/3833/textile</a> ضد ابويات.pdf](<a href="http://www.nationalstemcentre.org.uk/elibrary/file/3833/textile">http://www.nationalstemcentre.org.uk/elibrary/file/3833/textile</a> ضد ابويات.pdf)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><a href="http://www.bbc.co.uk/schools/gcsebitesize/design/textiles/productiontechniquesrev3.shtml">http://www.bbc.co.uk/schools/gcsebitesize/design/textiles/productiontechniquesrev3.shtml</a></td>
</tr>
<tr>
<td>Teaching objectives</td>
<td>Examples of teaching experience and activities</td>
<td>Indicators of learning outcomes</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>The teacher will:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. teach how to use the cutting shears for the cutting of fabrics.</td>
<td>The teacher will introduce some cutting tools such as a pair of cutting shears, pinking shears and trimming scissors. The teacher will make use of a chart or slide-show to show the students, using the correct terminology, the various parts of the cutting shear. It should be emphasized that a clean and flat working surface is required in order to obtain the best results. The students will be asked to name the cutting shears, pinking shears and trimming scissors and identify their various parts using the correct terminology. A work sheet may be given to help students record the knowledge acquired.</td>
<td>Students will: select and use safely a range of cutting tools and equipment with some precision. (Level 8) use basic cutting tools safely with a degree of accuracy and minimum supervision. (Level 7) use basic cutting tools with some accuracy under supervision. (Level 6) use basic cutting tools under continuous supervision. (Level 5)</td>
</tr>
<tr>
<td></td>
<td>Example Practical Task:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The teacher will demonstrate how the cutting shears and pinking shears are used safely: 1. Marking out straight parallel lines on a piece of fabric using a tailors’ chalk and a try-square or a ruler. 2. Place fabric flat over cutting surface 3. Cutting along straight lines using the cutting shears. Students will be provided with pieces of fabrics which they need to cut to the given dimensions. Some students will need further explanation and guidance from the teacher.</td>
<td>select and use safely a range of pressing tools and equipment with some precision. (Level 8) use basic pressing tools safely with a degree of accuracy and minimum supervision. (Level 7) use basic pressing tools with some accuracy under supervision. (Level 6) use basic cutting tools under continuous supervision. (Level 5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. teach how to use the dry and steam Iron.</td>
<td>The teacher will introduce the dry and steam iron as pressing tools and explain the importance of ironing (pressing) in the manufacture of textiles items. The teacher will also indicate the number of tasks which can be done with an iron and also emphasize on the importance of having a good pressing working surface. The teacher will make use of a video clip or slide-show to show the students the various parts of the dry/steam iron using the correct terminology. The students will be asked to name the dry/steam iron and identify the various parts. The teacher will indicate the symbols used for pressing and explain their meanings. The students will be asked to interpret the pressing symbols, some will sketch the symbols and write the meaning, others will be given a worksheet to fill in and some others will be given a worksheet to match the symbols on.</td>
<td>select and use safely a range of pressing tools and equipment with some precision. (Level 8) use basic pressing tools safely with a degree of accuracy and minimum supervision. (Level 7) use basic pressing tools with some accuracy under supervision. (Level 6) use basic cutting tools under continuous supervision. (Level 5)</td>
</tr>
</tbody>
</table>
### Focus Practical Task:
The teacher will demonstrate how the dry/steam iron is used safely and correctly. The teacher will explain the effect that heat/steam has when applied onto fabrics:
1. Iron on a wrinkled piece of fabric
2. Press edges and seams
3. Fusing bonded fabrics (and/or any other iron-on decorations)
4. Press permanent fold on fabrics
5. Iron to remove wax from fabrics

Students will be provided with pieces of fabrics which they need to press neatly. They will also be given samples of fabric edges, seams, and bonded fabrics and/or decorations to work on using the iron. Some students will need further explanation and guidance from the teacher.

| 3. teach the application of various fabric adhesives. | The teacher will explain that some textiles products manufacturers use fabric adhesives in industry. They are a group of products that attach fabrics without the use of sewing techniques. These adhesives may be used for temporary or permanent attachment of the fabrics. The teacher will show different types of glues and explain that these are applied in different circumstances e.g. bond-a-web used for hems.

The students will go into groups and identify the different types of adhesives used on fabrics and suggest where and when best they can be applied. The students will be given a worksheet to record their findings on to be able to compare them with other groups.

**Focus Practical Task:**
The teacher will demonstrate the application of various adhesives mainly:
1. Liquid/gel adhesive applied with a brush.
2. Spray adhesives applied with a spray gun or spray can.
3. Fusible web applied with the use of heat (dry iron or press).
4. Fusible interfacings also applied with the use of heat.

The students will be provided with pieces of fabrics which they will attach together using the various adhesive application techniques explained above. Students are asked to keep samples of each application technique and record the steps involved in each process. |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>apply a wide range of adhesive to attach fabrics to various materials. (Level 8)</td>
<td>apply adhesives in various forms and use their application techniques. (Level 7)</td>
<td>be aware that fabrics can be attached together by means of adhesives. (Level 5)</td>
</tr>
</tbody>
</table>
While most of fabric adhesives are safe to use indoors, attention should be given to the manufacturer’s instruction for any given warnings. Precautions should be taken when using the dry iron or the heat press.

4. teach how to apply decorative and functional components and apply heat transfer image onto fabrics by means of adhesives.

<table>
<thead>
<tr>
<th>Task</th>
<th>Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>The teacher will explain that components are additional pieces that are added to a product to enhance its use and appearance. The teacher will also explain that they are mainly divided into: Functional and Decorative and again split into other categories namely: Thread, Fastening, Linings and interlinings, Structural and Decorative. The teacher will distribute different types of components such as, threads, yarns, zips, buttons, toggle, eyelets and lace, hooks and eyes, press studs, Velcro, linings and interlinings, Dacron, bias binding tape, ribbons, embroidery, appliqué, beads, braids, fringes, lace, piping, sequins etc. Students will analyse the above samples, classifying them and establishing their use. This should help students to select the correct components according to the product being manufactured and the type of fabrics being used. Making: The teacher will demonstrate how to attach some components (choosing the ones which students chose in their designs) by means of different types of adhesives. Students will use adhesives to attach different types of component to fabrics. Some will do this focus task tidily on their own; others will need some assistance to work tidily while a few will need continuous attention and assistance to carry out the focus task. The teacher will explain what heat transfer imaging/printing is and how it is applied in industry. Video clips and/or power point presentations should be prepared in this regards. The teacher will also explain that nowadays, it is possible to make these prints at home on a domestic basis. The students are asked to suggest where one can find or apply heat transfer imaging/printing on products. The teacher will demonstrate how the computer is used to create a design using any suitable program. The students will go to their computers and create a design suitable for printing. Some will work on their own; others will need some encouragement and help while a few will need continuous assistance and help to carry out the focus task. Identify and select components according to their functional and decorative use, and apply them tidily onto fabrics by means of adhesives while considering the safety measures required. Select the correct transfer paper and apply heat transfer imaging/printing safely onto fabrics with precision. (Level 8) Identify different types of suitable components and apply them onto fabrics by means of adhesives with care, tidily and effectively. Apply heat transfer imaging/printing onto fabrics safely with a degree of accuracy and minimum supervision. (Level 7) Recognise that components enhance a textile product and with help apply them onto fabrics by means of adhesives. Apply heat transfer imaging/printing with some accuracy under supervision. (Level 6) Be aware that components enhance a textile product. Be</td>
<td></td>
</tr>
</tbody>
</table>
The teacher will explain that a normal printer can be used to print the design created on the computer. Special purpose paper has to be used. The teacher will show that there are two types of paper; one for white or very light coloured fabrics and another for dark coloured fabrics.

Students will be asked to examine and identify the two different types of transfer paper used for this process.

The teacher will explain that printing on white/light coloured fabrics paper should be in mirror image whereas on dark coloured fabrics it should be standard.

The students are organised in groups to print their designs on the required transfer paper. They may be grouped so as to make good economical use of paper.

The teacher will demonstrate how the print is transferred from the paper to the fabric by means of a heat press or a normal dry iron. The teacher will distribute pieces of fabrics to the students.

Students will transfer their designs produced earlier on pieces of fabrics by means of a heat press or a dry iron.

Aware that printing can enhance a textile product. (Level 5)
CURRICULUM UNITS FOR FORM 2

**Compulsory Units:**
- DT 8.1: Communicate Graphically 2
- DT 8.2: Going Electronic
- DT 8.3: Electrify your System

**Optional Unit:**
- DT 8.4: Programmable Systems and Beyond
Subject: Design and Technology
Unit code and title: DT 8.1 Communicate Graphically 2

Unit Duration: 6 sessions by 40 minutes (4 hours)

Objectives
The teacher will:
1. teach how to draw 3D shapes by using the isometric grid lines.
2. teach how to draw and colour orthographic drawings of basic 3D shapes.
3. teach how to draw and apply symbols in basic electrical/electronic circuit diagrams.
4. teach how to apply graphics to develop D&T projects.
5. teach how to apply 2D and 3D geometry to draw and colour patterns and nets.

Key Words
Isometric, Isometric grid, solid blocks, hollow blocks, assembled blocks, room drawings, orthographic projection, front elevation, end elevation, plan, electrical/electronic circuits, electrical/electronic symbols, pictorial circuit diagrams, schematic circuit diagrams, soldering equipment, strip-board, working drawings, freehand sketching, tessellations, nets, shading

Points to note
Graphical communication is an essential tool for communicating a design idea. Throughout this unit, students will learn graphical communication skills which are related to completion of an electronics project.

The “Communicate Graphically Year 8 Workbook” has been designed specifically to facilitate the students’ work and to eliminate the need of t-squares and drawing boards. The exercises are student-friendly, easy to follow and are meant to instil a sense of fun and enjoyment. To complete the given exercises, the students will require basic mathematical instruments.

The recommended teaching method at this stage would be a blend of direct exposition and a dose of learning by discovery.

Some exercises on the workbook should be completed at home after an explanation of the concepts so as to maximize contact time available. Further exercises are encouraged to consolidate students’ learning. Such exercises can be found on the Graphical Communication website.

Resources
Interactive whiteboard
Whiteboard, large drawing instruments to be used on the whiteboard
3D models of solid blocks

Workbook:
Communicate Graphically Year 8 Workbook (M.Mallia)

Textbooks:
Understanding Technical Graphics Workbook

Hyperlinks:
Graphical Communication Website: http://graphicalcommunication.skola.edu.mt/
### Teaching Objective

The teacher will:

1. teach how to draw 3D shapes by using the isometric grid lines

### Examples of Teaching Experiences and Activities

The teacher refers to the oblique drawings which were covered in the Year 7 workbook, reminds them that the colours indicate the angle of viewing and discusses the differences between oblique and isometric drawing. The teacher uses the whiteboard and markers or the interactive whiteboard to demonstrate the process of drawing an isometric drawing by using the isometric grid.

**Possible Activities:**
- Students copy the isometric shapes on the given grid lines.
- Students colour the facets of the drawings.
  
  *Practice and experimentation at home is advisable.*

### Indicators of Learning Outcomes

Students will:

- draw and colour correctly and accurately the given isometric blocks on the isometric grid lines with no assistance. (Level 8)
- draw and colour correctly and accurately the given isometric blocks on the isometric grid lines with minimum assistance. (Level 7)
- require frequent support to draw and colour correctly the given isometric blocks on the isometric grid lines. (Level 6)
- require continuous support to draw and colour the given isometric blocks on the isometric grid lines. (Level 5)

![Figure 1](image-url)
2. teach how draw and colour orthographic drawings of basic 3D shapes

The teacher explains the concept of orthographic projection and how the identification of angle of viewing has been facilitated by means of the three different colours denoting the front view, the end view and the plan.

**Possible Activities:**

- Students draw the orthographic views on the square grid.
- Students colour the orthographic views as per the isometric drawings.

<table>
<thead>
<tr>
<th>3-D Isometric drawing</th>
<th>Orthographic Projection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure J**

<table>
<thead>
<tr>
<th>3-D Isometric drawing</th>
<th>Orthographic Projection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Project and colour correctly and accurately orthographic views from given isometric drawings with no assistance. (Level 8)

Project and colour correctly and accurately orthographic views from given isometric drawings with minimum support. (Level 7)

Require frequent support to project and colour, with a fair level of accuracy, orthographic views from given isometric drawings. (Level 6)

Require continuous help to project and colour orthographic views from given isometric drawings. (Level 5)
3. teach how to draw and apply symbols in basic electrical/electronic circuit diagrams

The teacher refers to the workbook and explains the difference between a pictorial diagrams and the symbols of electrical/electronic components. The teacher also explains the difference of a wiring layout diagram and a schematic diagram.

**Possible Activities:**

- Students copy the electrical/electronic symbols on the workbook.
- Students convert the given circuit layout diagrams into schematic circuit diagrams.

Figure K

copy correctly and accurately the given electrical/electronic symbols, insert the correct symbols in the pre-started schematic diagram, label the circuit layout diagram and draw the schematic circuit diagram without the starter lines. (Level 8)

require minimum support to copy correctly the given electrical/electronic symbols, insert the correct symbols in the pre-started schematic diagram, label the circuit layout diagram and draw the schematic circuit diagram without the starter lines. (Level 7)

require frequent support to copy the given electrical/electronic symbols, insert the correct symbols in the pre-started schematic diagram, label the circuit layout diagram and draw the schematic circuit diagram without the starter lines. (Level 6)

require continuous support to copy, with a low degree of accuracy, the given electrical/electronic symbols, insert the correct symbols in the pre-started schematic diagram, label the circuit layout diagram and draw the schematic circuit diagram without the starter lines. (Level 5)
4. teach how to prepare the working drawing for the D&T project

The teacher refers to pages 12 and 13 of the workbook to explain a possible layout of the D&T project working drawing which consists of pictorial and schematic circuit diagrams and an orthographic view of the casing.

Possible Activities:
- Students use pages 10 and 11 to draw the circuit diagrams and orthographic views of a possible D&T project.

Possible Activities:
- Students use pages 12 and 13 to create a working drawing for a D&T project.

Possible Activities:
- Students use page 10 to draw the circuit diagram and orthographic view of a possible D&T project.

Figure L

analyse a working drawing worked example and produces a correct, neat and accurate D&T project working drawing. (Level 8)

require minimum support to analyse a working drawing worked example and to produce a correct and neat D&T project working drawing. (Level 7)

require frequent support to analyse a working drawing worked example in order to be able to produce their D&T project working drawing on pages. (Level 6)

require continuous support to analyse the working drawing worked example in order to be able to produce their D&T project working drawing. (Level 5)
The teacher explains process assembling and soldering components on to Vero boards. *(Refer to Unit 8.3).*

**Possible Activities:**
- The students label the indicated items on the drawings shown on page 14 on the “Communicate Graphically” Workbook.
- The students draw the necessary components on the Vero board shown on page 15.
- The students make a freehand sketch of a soldering iron and label three main parts.

*Figure M*
5. teach how to apply 2D and 3D geometry to draw and colour patterns and nets

The teacher introduces tessellations as a pattern of shapes that fit perfectly together. Tessellations can either be composed of repetitions of identical shapes or of a mixture of different shapes. The teacher also refers to examples of tessellations from everyday life such as honey combs, chicken wire, mosaic floor and tiles.

Tessellations may offer the basis for modular design particularly for developing electronic devices that work in patterns or groups. An example is an LED floodlight that uses a honeycomb array of LED. These may also be used as a geometric graphic embellishment.

Possible Activities:
- The students draw and colour the tessellations on pages 16 and 17 of the workbook.
- copy accurately and colour neatly the given tessellations. The students will also try to create their own tessellations by combining a number of polygons and triangles. (Level 8)
- require minimum support to copy and colour neatly the given tessellations. (Level 7)
- require intermittent support to copy and colour the given tessellations. (Level 6)
- require continuous support to copy and colour the given tessellations. (Level 5)
The teacher revises the surface development topic covered in the previous year in Book 1 and refers to pages 18 and 19 of the Year 8 workbook. The teacher defines the geometric term 'PRISM' and their respective nets. The teacher discusses with the students the similarities between the nets and together with the students will conclude that the folding lines that form the prism will always be parallel.

The teacher explains that these prisms are also shell forms (empty inside) and may offer the possibility to contain electronic devices such as components and circuits and be used as casing for electronic prototypes.

**Possible Activities:**
- The students label the types of prisms, the net and the related terms.

label neatly the prisms, their nets and their respective fold lines and flaps. The students will also cut and fold the nets. (Level 8)
require minimum support to label neatly the prisms, their nets and their respective fold lines and flaps. (Level 7)
require intermittent support to label neatly the prisms, their nets and their respective fold lines and flaps. (Level 6)
require continuous support to label neatly the prisms, their nets and their respective fold lines and flaps. (Level 5)
The teacher discusses the different types of geometric solids and asks the students how these relate to everyday life. The teacher explains and demonstrates the enhancement techniques by means of coloured pencils and explains that this is used to make the solid geometric blocks look more like real objects. The teacher explains the term value as the lightness and darkness of colour. The teacher also explains that the sun at the upper left-hand corner denotes the light source and that this, together with the form of the object, determines the areas of lightness and darkness.

Possible Activities:
- The students are encouraged to practice their shading technique at home.
- The students colour and shade the geometric solids on the workbook.

Possible Activities:
- The students are encouraged to practice their shading technique at home.
- The students colour and shade the geometric solids on the workbook.

Figure P

Recognise and name the different geometric solids. They will also neatly and sensitively colour and shade the given solids as per the given examples. (Level 8) require minimum support to recognise and name the different geometric solids. They will also neatly colour and shade the given solids as per the given examples. (Level 7) require intermittent support to recognise and name the different geometric solids. They will also colour and shade the given solids as per the given examples. (Level 6) require continuous support to recognise and name the different geometric solid and colour the given solids as per the given examples. (Level 5)
**Subject:** Design and Technology  
**Unit code and title:** DT 8.2 Going electronic  
**Form 2**  
**Duration:** 6 sessions of 40 minutes (4 hours)

### Objectives
The teacher will:
1. teach how to identify parts in an electronic system
2. teach how to use switches to input signals in a system
3. teach the basic principles of electronic circuits

### Keywords
- System, input, process, output, circuit diagram, block diagram, electrical conductivity, closed/open loop, switch, make, break, pole, throw, normally-open (NO), normally-closed (NC), latching, push, toggle, slide, rocker-arm, micro, reed, tactile, tilt, voltage, current, resistance, Ohm’s Law

### Points to note
Since this unit introduces electronics in D&T, the teaching should involve the three main stages of designing, making and evaluating within a systems approach.

The knowledge and understanding covered in this unit should be passed on through hands-on activities not only by the use of theory. Students are to comprehend well the basics of electrical theory so as to have a solid foundation for the senior secondary years.

The range and depth of the knowledge covered should be gauged according to students’ level of attainment.

Emphasis should be put on health and safety issues related to the use of electricity. *(Refer to Appendix 2)*

### Resources
Access to the internet, electrical/electronic devices, pictures of electrical/electronic devices, batteries, battery clips, china connectors, 22-gauge single/multi strand wire, lamps/buzzers, materials which are electrically conductive or insulative, cardboard, aluminium foil, paper clips, butterfly clips, different types of mechanical switches, multimeter, fixed resistors of different values, LEDs

### Reference Books:

### Hyperlinks:
- Systems approach for teachers: [http://homepages.shu.ac.uk/~b0049150/index.htm](http://homepages.shu.ac.uk/~b0049150/index.htm)
- General: [http://www.nationalstemcentre.org.uk/dl/039ca6d0feee7b8e7b747d51fe40c67c167ae468d/3624-ks3_ecrts.pdf](http://www.nationalstemcentre.org.uk/dl/039ca6d0feee7b8e7b747d51fe40c67c167ae468d/3624-ks3_ecrts.pdf) (requires log-in)
- [http://www.bbc.co.uk/schools/gcsebitesize/design/electronics/](http://www.bbc.co.uk/schools/gcsebitesize/design/electronics/)
- [http://faraday.theiet.org/resources/index.cfm](http://faraday.theiet.org/resources/index.cfm)
- [http://www.edutek.ltd.uk/GCSE_resources.html#BasicElectricity](http://www.edutek.ltd.uk/GCSE_resources.html#BasicElectricity)
- [http://electronicsclub.info/](http://electronicsclub.info/)
- [http://www.technologystudent.com/elec1/elecex.htm](http://www.technologystudent.com/elec1/elecex.htm)
<table>
<thead>
<tr>
<th>Teaching Objective</th>
<th>Examples of teaching experiences</th>
<th>Indicators of Learning Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>The teacher will:</td>
<td>The teacher will choose an electronic/electrical/mechanical device for systems analysis. Students will be asked the following questions: - What is the function of the device? - From where does the device get the energy to function? - What is needed for the device to start functioning? - What is the outcome of the device? - What is there inside the device which makes the initial input change to an outcome? The teacher will put students’ responses in the form of a block diagram so as to later elicit a generic linear system diagram as the one below, where blocks represent functions and arrows represent messages passing from a block to the other. For electronic systems, this generic block diagram can be explained as follows: The teacher can briefly mention that some systems have their processing done by means of an integrated circuit (IC) which contains a miniature processing circuit referred to as sub-system. Some other systems have their processing done by a program and such systems are in fact called programmable systems (refer to Unit 8.4). Students will be then divided into groups, with each group given pictures of a number of electronic/electrical devices. Students will analyse the system of each device and report their analysis in the form of block diagrams. As a conclusion, students will relate which basic circuit components are normally classified as input, process, or output components.</td>
<td>Students will: identify and name the main parts of a linear system and a closed system. (Level 8) identify and name the main parts of a linear system. (Level 7) name the main parts of a linear system. (Level 6) know that a system is made of up several parts connected together. (Level 5)</td>
</tr>
</tbody>
</table>
| 2. teach how to use switches to input signals into a system | **Electrical Conductivity**  
Students will be given a battery holder/clip, battery, china connectors, two lengths of wire and a lamp with holder or a buzzer. Students are to connect the components together in such a way so as to make the output component function.  
Students will be then divided into groups and given a number of materials to test for electrical conductivity. Students will disconnect one of the joints as to introduce the test material. Students will reports results on a worksheet.  
Teacher will use this exercise to introduce the terms conductor and insulator, together with closed and open circuit.  
**Switches**  
Students will be divided in small groups to build their own push-to-make and/or SPST switches using cardboard, aluminium foil, paper clips and butterfly clips. Students can test the built switches using the continuity function on a multimeter.  
The teacher will then ask students to design a graphical symbol for the switches they made. The teacher will then elicit the standard symbol for both switches.  
The teacher will show other types of switches to elicit their functions (NO, NC, poles and throws, latching), methods of operation (push, toggle, slide, rocker-arm, reed, tactile, micro, tilt) and graphical symbols.  
Students will find different electronic devices they commonly use and identify the type of mechanical switches they use. Teacher will also highlight that each switch has its specific parameters. | know about and use different types of switches to input signals into a system.  
(Level 8)  
know about and use several mechanical switches to input signals into a system.  
(Level 7)  
know about and use basic mechanical switches to input signals into a system.  
(Level 6)  
makes use of a switch to turn on a system.  
(Level 5) |
|---|---|---|
| 3. teach the basic principles of electronic circuits | **Voltage, Current and Resistance**  
The teacher can use the illustration in *Error! Reference source not found.* to introduce the terms voltage, current and resistance. These terms are to be explained within the following parameters:  
- Voltage – the driving force that makes current flow in a circuit, measured in Volts (V)  
- Current – the flow of electricity (electrons), measured in Amperes/Amps (A)  
- Resistance – the force that limits the flow of electricity, measured in Ohms (Ω) | apply Ohm’s Law to select suitable components for a particular electronic system.  
(Level 8)  
understand the basic principles of electronic circuits and with assistance, apply Ohm’s Law.  
(Level 7) |
Analogy with pulley and belt mechanism
The teacher can briefly explain how electric circuits work by using an analogy with a pulley and belt mechanism as shown in Figure R. The force needed to run the system is equivalent to voltage. The function of the mechanism is to drive the output pulley, in the same way as the function of a circuit is to generate an output signal. The belt going around pulleys is equivalent to the wire in a circuit. So if the belt is joined and force is given to one of the pulleys, the belt will move. Therefore, the belt is “flowing” around the path of the belt is the same way as electrons will flow through a circuit. If an obstruction “resists” the flow of the belt, for example the belt is held by a hand, the belt will move slower. In the same way, current in an electric circuit will be reduced if a resistor is introduced in a circuit.

appreciate that electricity has its parameters by reading ratings on electrical components. (Level 6)

know that certain devices function by means of electrical energy. (Level 5)
**Ohm’s Law**

Students will build the circuit shown in Figure S to visualize the effect of different resistor values on the current in the circuit.

![Circuit Diagram]

Students will be given a number of resistors. Students will find the value of each resistor using the ohmmeter and/or the resistor colour code chart and then put it in the circuit instead of R1. Students will record the effect of the different resistors on LED1 and the readings from the ammeter. They will also try to make their own conclusions about the relation between resistance and current in the circuit.

The teacher will ask student what happens if R1 and the ammeter are swapped. The teacher will then conclude the lesson by explaining that voltage, current and resistance are related to each other in an electric circuit by the function:

\[ V = I \times R \]
### Objectives
The teacher will:
1. Teach the basic characteristics of common output devices
2. Teach how to choose the most suitable electric power source for an electronic system
3. Teach how to model and build an electronic system

### Keywords
- lamp, buzzer, LED, d.c. motor, mains power supply, primary/secondary cell/battery, photovoltaic cell, series/parallel connections, schematic diagram, breadboard, circuit simulation software, computer-aided design (CAD), soldering, stripboard, multimeter

### Points to note
- This unit is a follow-up of Unit 8.2 and is therefore suggested to be completed sequentially after it.
- Each objective should still be passed on through hands-on activities as with all other units. The range and depth of the knowledge covered during this unit should be gauged according to students' level of attainment.
- This unit includes the manufacturing of a circuit and therefore health and safety issues will be put into practice.

### Resources
- Access to the internet; electrical/electronic devices; different types of batteries and their respective battery clips; 22-gauge single/multi strand wire; china connectors; lamps; buzzers; low-voltage d.c. motors; different sizes and forms of LEDs – flashing, bi/tri-colour, rainbow; switches; resistors; components’ datasheets; multimeter; breadboard; circuit simulation software; strip-board; solder and soldering iron

### Reference Books:

### Hyperlinks:
- General:
  - [http://www.nationalstemcentre.org.uk/dl/039ca6d0fee7b8e7b747d51fe40c67c167ae468d/3624-ks3_ecrts.pdf](http://www.nationalstemcentre.org.uk/dl/039ca6d0fee7b8e7b747d51fe40c67c167ae468d/3624-ks3_ecrts.pdf) (requires log-in)
  - [http://www.bbc.co.uk/schools/gcsebitesize/design/electronics/](http://www.bbc.co.uk/schools/gcsebitesize/design/electronics/)
  - [http://faraday.theiet.org/resources/index.cfm](http://faraday.theiet.org/resources/index.cfm)
  - [http://www.edutek.ltd.uk/GCSE_resources.html#BasicElectricity](http://www.edutek.ltd.uk/GCSE_resources.html#BasicElectricity)
  - [http://electronicsclub.info/](http://electronicsclub.info/)
  - [http://www.technologystudent.com/elec1/elecex.htm](http://www.technologystudent.com/elec1/elecex.htm)
- Datasheets:

---

Subject: Design and Technology
Unit code and title: DT 8.3 Electrify your system
Duration: 6 sessions of 40 minutes (4 hours)
### Teaching Objective

The teacher will:

1. **teach the basic characteristics of common output devices**

### Examples of teaching experiences

Teacher will ask students about common output devices which they are acquainted with so as to identify the type of output energy they give: for example lamps output light, buzzers emit sound, etc.

The teacher will use one particular output device to show that each component has its ratings and parameters. The teacher will also show that some components, such as LEDs, are called semi-conductors because they are conductors under certain conditions but insulators under other conditions. Student will be divided into four groups, each to research about a particular output component and to present their research to peers in the next lesson.

**Focus Practical Task:**

*D.C. Motor*

Students will be shown the circuit shown in Figure T to analyse and deduce how it works when different combinations of switches are pressed.

![Figure T](image_url)

Students will be given the necessary components to build the circuit and verify their deductions. They will report results in grid form.

As part of the research, students can find out another method of obtaining the same forward-and-reverse motor output by using a SPDT switch.

### Indicators of Learning Outcome

Students will:

- efficiently use a number of different output devices. (Level 8)
- know about and use a number of output devices. (Level 7)
- identify and name a number of output devices. (Level 6)
- know that certain components give out light, sound or movement. (Level 5)
2. **teach how to choose a suitable electric power source for an electronic system**

<table>
<thead>
<tr>
<th>Teacher will explain that any system needs a source of power to function. Students will identify examples of power sources they usually use.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The teacher will explain that a block thrown vertically from a height of 240cm from ground has the “potential” of doing more damage than a block thrown from 24cm. Likewise, an electric potential difference (voltage) of 240V will do more harm than 24V. Consider power consumption when choosing power sources for their systems. (Level 8)</td>
</tr>
<tr>
<td>Students will</td>
</tr>
<tr>
<td>know that certain power supplies are suitable for certain electronic/electrical systems. (Level 6)</td>
</tr>
<tr>
<td>know that electronic/electrical systems need a power supply to function. (Level 5)</td>
</tr>
</tbody>
</table>

[Diagram of a block being thrown from different heights with corresponding voltage values]

**Figure U**

Teacher will go through health and safety issues when using high-voltage supplies.

**Alternating and Direct Current**

The teacher can show a sine wave to student on the oscilloscope. Using very low frequency, the teacher can connect the signal to an output device so that the students can visualize it.

The teacher can then connect a battery to the same output device and show the supply voltage signal on the oscilloscope so that students can visualize the difference.

The teacher will briefly explain why a power station generates a.c. instead of d.c.
**Cell and Batteries**
The teacher will give out a number of different cells/batteries so that students can find out their voltage in V, capacity in Ah and physical dimensions in mm. Students will report results in table form.

Student will then put a number of similar batteries in series and measure the total voltage using a voltmeter. Teacher will elicit the following equation for voltage source in series:

\[ V_T = V_1 + V_2 + V_3 + \ldots \]

Students will be given a number of electronic devices for students to suggest a suitable power supply for them, giving a reason for their choice.

3. teach how to model and build an electronic system

Students will be asked to choose an output component and match a suitable power supply for the device to function properly. Students will draw a schematic diagram of the circuit with two SPST switches in series as inputs. Students will try to deduce how the circuit work when the different combination of switches are pressed as in the grid below.

<table>
<thead>
<tr>
<th>Switch S1</th>
<th>Switch S2</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
</tbody>
</table>

**Circuit Simulation Programs**
Teacher will introduce students to the term “Computer-Aided Design (CAD)” and use circuit-simulation software to simulate the circuit that students have just designed. Students will simulate their circuit on the software to test their previous conclusions.

**Circuit Prototyping**
The teacher will briefly explain how prototyping board (breadboard) functions. Students will test their conclusions by modelling the circuit on a breadboard. Students will then re-draw and re-wire the circuit on the breadboard so as to have the two SPST switches in parallel as inputs. They will again report results.

model and simulate an electronic system before constructing a circuit on a printed-circuit board. (Level 8)
model and/or simulate an electronic system before constructing a circuit on a strip-board. (Level 7)
bUILD A simple circuit by twisting wires and using china-connectors without soldering. (Level 6)
bUILD A simple circuit by joining components together using prepared wires with crocodile clips on the ends. (Level 5)
**Soldering**
The teacher will show and explain the soldering technique by initially joining two wires and then by joining a wire to a strip-board. Health and safety issues are to be pointed out during the demonstration. Students will then be given the equipment and material to solder two wires together and then solder them onto a strip-board.

The teacher will then show how to desolder a joint. Students will do the same procedure to desolder the joint they had previously made.

**Building a circuit on strip-board (Veroboard *)**
The teacher will use a simple circuit to show how to make a circuit layout on a strip-board within the minimum possible space. The teacher will also explain how to find faults in a circuit both visually and by using the continuity function on the multimeter.

Students will use one of the circuits they have previously made and draw its circuit layout on a strip-board. They can refer to the exercise on the “Communicate Graphically Year 8 Workbook” (pages 14-15). They will also solder the circuit on a strip-board.
### Objectives

The teacher will:

1. teach that the processing of a system can be achieved by using a PIC microcontrollers
2. teach that the vacuum-forming process can be used to produce a shell for an electronic product

### Keywords

<table>
<thead>
<tr>
<th>integrated circuits, PIC microcontrollers (Peripheral Interface Controller), programming language, flowcharts, printed-circuit board (PCB), vacuum forming, shell form, casing</th>
</tr>
</thead>
</table>

### Points to note

The time allocated for this unit may not be necessary available in the time-frame of the curricular programme. This is the reason why such unit is an optional one. However, time-permitting, teacher are encouraged to cover or mention some of the contents of this unit.

One objective gives an introduction to the world of programmable systems. There are a number of micro-controllers and respective programming software which are suitable for educational settings. Teachers are recommended to evaluate all options before selecting a particular system. Since this unit is just an introduction, it is suggested to opt for the most basic systems and kits. Students are not necessary required to practice programming skills during lessons but are to be encouraged to explore and experiment themselves at home.

The other objective introduces the use of the vacuum-forming process to produce a shell for the electronic system which students designed. Since time is limited, it is suggested that students only obtain an awareness of such process. Teachers and students are not to limit their projects in order to use vacuum-formed plastic shells. In case such process will be used, teachers are encouraged to use the multi-purpose vacuum-forming frames already available in schools to as to maximize use of material.

### Resources

Access to a computer, control board from an electronic device, PIC microcontrollers, PIC programming software, PIC educational kits, vacuum-forming machine, thermoplastic sheets, vacuum-forming moulds, multi-purpose vacuum-forming frame

### Reference Books:


### Hyperlinks:

Programmable systems:
[https://docs.google.com/presentation/d/15ZxBYXNIXmY9TxFkioEwC0GeO5LVL5xQJQ6QVgoxtG4/present?slide=id.i59](https://docs.google.com/presentation/d/15ZxBYXNIXmY9TxFkioEwC0GeO5LVL5xQJQ6QVgoxtG4/present?slide=id.i59)

Vacuum Forming:
[http://www.technologystudent.com/equip1/vacform1.htm](http://www.technologystudent.com/equip1/vacform1.htm)
[https://www.youtube.com/watch?v=DnYMbExC_oE](https://www.youtube.com/watch?v=DnYMbExC_oE)
<table>
<thead>
<tr>
<th>Teaching Objective</th>
<th>Examples of teaching experiences</th>
<th>Indicators of Learning Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>The teacher will:</td>
<td>The teacher will ask students to recall what they saw when then analysed particular systems during an exercise in Unit 8.2, highlighting the processing parts.</td>
<td>Students will:</td>
</tr>
<tr>
<td>teach that the processing of a system can be achieved by using a PIC microcontrollers</td>
<td>The teacher will show a control board of an electronic device and highlight the many ICs soldered on the printed-circuit board (PCB). Teacher will explain that these ICs contain miniature circuits, some of which can be programmed according to the users need. Teacher will then show a PIC microcontroller and briefly explain how it can be applied to create a simple electronic system. The teacher will show which pins are used as inputs or output. Students will mark out the pinouts of the IC on a handout and mention components which can be connected to the input and output pins of the IC. The teacher can use one of the circuits which students encountered as an example. The teacher will briefly explain how to program the IC using apposite software which makes use of flowcharts for programming. The teacher will download a program into the PIC. Students will test the electronic system which the teacher just programmed. They will be given a handout with another flowchart so as to analyse it and try to find out its function. The teacher will load the program onto the PIC for students to validate their conclusions. Students can continue to explore PIC microcontrollers at home.</td>
<td>create and implement a simple electronic system using PIC microcontrollers. (Level 8) understand that PIC microcontrollers can be used as processors in electronic systems. (Level 7) have an awareness of microcontrollers. (Level 6) use electronic devices which have substantive processing units. (Level 5)</td>
</tr>
<tr>
<td>teach that the vacuum-forming process can be used to produce a shell for an electronic product</td>
<td>The teacher can use the worked example of a shell casing in the “Communicate Graphically Year 8 Workbook” (pages 12-13) to introduce the topic. The teacher will also refer back to Unit 7.3, especially in cases where students covered it the previous year. The teacher will show an already formed plastic shell and suggest that it can be used as a casing to their design electronic system. The teacher will show the corresponding mould and briefly explain how it was made. Then, the teacher will demonstrate the vacuum-forming process, highlighting health and safety considerations. Students can design a form which can be produced by vacuum-forming, putting into</td>
<td>make use of the vacuum-forming process to produce products. (Level8) appreciate that vacuum-forming process can be used to construct a shell for an electronic product. (Level 7) know that electronic systems are usually contained within a casing. (Level 6)</td>
</tr>
</tbody>
</table>
practice the 2D geometry learnt during Unit 7.2. Students are to limit the size of their shell to a maximum of 150×120×50 as to maximize the use of material. Considering time limitations, it is suggested that the student do not produce their shell designs themselves.

Teachers can make use of the multi-purpose vacuum-forming frames, as the one shown in Figure V, to facilitate the manufacturing process.

<table>
<thead>
<tr>
<th>Figure V</th>
</tr>
</thead>
</table>

appreciate that electronic devices contain electronic circuits inside them. (Level 5)
APPENDIX 1

Examples of possible situations

The following examples of situations are adequate for Form 1 projects:

1. A Maltese childcare centre is searching for new particular toys to be used by the children attending the centre. These toys need to have a link with the local culture. As a designer, you are interested in presenting a new toy to this centre.

2. Nowadays, almost every teenager has a mobile phone, many a times being one of the latest models. It is useful to have a safe and adequate place where to store such appliances. A company is planning to launch a mobile-phone holder aimed at teenagers.

3. A particular voluntary organisation will hold fund-raising activities to support the work it does with stray animals. As part of these activities, a number of collection boxes shall be distributed to commercial premises to be put onto cashier desks. You are asked to create a sample of such collection boxes.

4. Many parents are conscious about their children’s health and prepare snacks for them to take at school. Sometimes, these snacks require a container which maintains the temperature of the food constant until in it is eaten during break time.

5. Your school library is currently using metal bookends to keep books tidily organized on shelves. These bookends are starting to rust, damaging the books which they come in contact with. Being Design and Technology students, the headmaster/headmistress asked you to create a set of new bookends.

The following examples of situations are adequate for Form 2 projects:

6. Greeting cards sometimes include a small system which outputs a tune when the receiver opens up the card or pushes an area on the card. A company producing such cards wants to diversify its range of products by producing greeting cards which have light output rather than sound. You were asked to design the system for one such greeting card.
7. A young entrepreneur is aiming at producing electronic devices which work with batteries and include low-voltage d.c. motors as output devices. You have been commissioned to design a simple electronic system for one such device. The entrepreneur has specified that the electronic system should be energy-efficient and easy to operate.

8. The government has launched a competition for school-aged students to use electronics in order to solve problems which they encounter in their everyday lives. Your class shall focus on one particular theme: that of teenager safety. Some ideas could include cycling-safety devices or wearable signalling devices. You are to design the electronic system for one device.

9. A primary school would like to invest in a number of educational but entertaining games which interact electronically with the students in order to facilitate the learning process. You are to choose a particular curricular topic and accordingly design an electronic system for one game.

10. Many people keep some of their most precious personal belongings in special boxes. You were asked to design an electronic alarm or security code system for such boxes.
APPENDIX 2

Health and Safety in Design & Technology Laboratories

Students will:

- recognise hazards in the D&T laboratories;
- Have a copy of lab safety rules all the time
- understand and apply safe working practices during all stages of making;
- use PPE personal protective equipment (overall/apron, headgear, dust mask, safety glasses/goggles, welding visor, gloves, brazing goggles);
- consider safe material selection;
- make use of safety guards on machines/equipment;
- store and use materials, components, tools and equipment safely;
- make use of dust collectors and fumes extractions;
- know about the risks of hazardous vapours and fumes when soldering and using adhesives;
- follow manufacturers’ instructions;
- adhere to safety symbols exposed in the D&T workshops and school environment;
- dispose of disused products, materials and components with a safe and environmental friendly manner (separation of waste at source);
- know the procedures to follow in case of accidents or emergencies (cuts, burns and splinters, fire).
Form 1 and 2 students will complete two design folios over two scholastic years: one focused on Resistant Materials in Form 1 and the other focused on Electronics in Form 2. Each folio will be fully completed over four units. All folios should be presented on A3 landscape format. Attention should be given to presentation, emphasizing on techniques that are covered in the graphical communication units. It is suggested that for the first project, a template of the design folio is handed to the students so that they can fill it in as the project progresses.

The following are guidelines for the teachers about the work expected to be done for each stage of the design process.

<table>
<thead>
<tr>
<th>Situation:</th>
<th>The situation will be decided by the teacher and one class should follow the same situation. Because of differentiated needs, the teacher may require to reword the same situation making it more focused. This means that students of different abilities can be presented with differently worded situations.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Brief:</td>
<td>After analysing the situation with the whole class, the teacher will lead the students to develop a common design brief unless students have the ability to compose a basic design brief on their own. Differentiation can be achieved by using simpler terms to describe what is going to be made. Students will highlight the keywords of the design brief. The Design Brief should be revisited after ideas are chosen to refine the focus.</td>
</tr>
<tr>
<td>Research:</td>
<td>Research will consist mainly of product analysis. Other research related to subject content can be included, but it has to be related to the aims of the design brief. Extent of research expected depends on the students’ level of ability.</td>
</tr>
<tr>
<td>Specifications:</td>
<td>For Form 1 and 2, the design criteria will be kept to the basic essentials. The main specifications, like those related to size limitations and material properties, should be elicited with the help of the teacher while the rest can be decided by the students. The number of specifications that the students decide depends on their level of ability. The specifications can be presented in a list or web-diagram mode.</td>
</tr>
<tr>
<td>Initial Ideas:</td>
<td>All students have to present a minimum of two different ideas. At this level there is no need for a student to present more than three initial ideas. For Materials projects, the ideas have to be presented in sketch form. Different sketches can be used to explore the same one idea. The graphical representation mode used can either be 2D or 3D, depending on the students’ abilities in graphical communication. Whichever method used, all sketches have to include labelling indicating at least part name and its function in the project, proposed overall dimensions</td>
</tr>
</tbody>
</table>
and material/components. Meaningful use of colour is to be encouraged. **Ideas should focus on proposing and describing solutions that were explored in the specifications**, not just aesthetic form.

For Electronics projects, the conceptual ideas will be presented in a block diagram form. From the block diagram the student will determine the components required at the input, process / control and output stages. Ideas for the form of the device for the use of the electronic system (casing for device prototype) should be explored through ‘Device sketches’. These may be projecting the optimal way to produce this device but later only produced as a model prototype only due to restricted time for fabrication.

**Chosen Idea:** This section needs to consist only of a short note stating which idea was chosen and a reason why it was regarded as the best idea for further development. Here students are evaluating ideas and need to base their choices on reasons linking to the specifications.

**Development:**

For Materials projects, students will present their own designs in 2D showing different views and essential information. The use of grid paper is encouraged. Students who are able to draw in 3D can also add other views and annotations to communicate further details.

For Electronics projects, students will present their own designs as labelled schematic diagrams of the circuit including any calculations when required. In both cases, evidence of modelling should be presented as part of the design folio.

**Planning:**

The students are expected to present a component/parts list with necessary quantities. Students are to include a work plan showing:

- the main activities needed to be performed to make the product (prepared with the help of the teacher)
- tools needed for each step
- safety precautions which need to be considered

The work plan can be presented in different ways: in grid form or a flow chart.

**Making:**

The students will record any changes performed on the planned sequence of work or on the artefact. Photos can also be included as proof of work. Refer to Health and Safety procedures used in the making of this device.

**Testing:**

Testing will be performed against design brief, functionality or user feedback. The teacher can decide on a common test which students will follow. Students will then record results according to their level of ability. Pie chart or bar graph can be included.

**Evaluation:**

Some evaluation notes can be made also throughout some of the stages of the project like for example when selecting or rejecting an idea. The evaluation section will consist of short notes which express general comments on test results, peer and personal opinion. Whenever possible and depending on ability levels, students will be encouraged to propose possible improvements or modifications.