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Republic of Zambia
Ministry of Education

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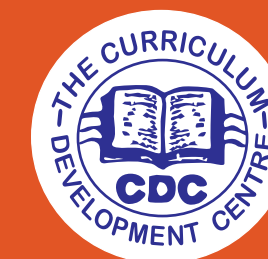
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DESIGN AND TECHNOLOGY SYLLABUS

SECONDARY EDUCATION ORDINARY LEVEL

FORM 1 - 4



DEVELOPED BY THE CURRICULUM DEVELOPMENT CENTRE
LUSAKA
2024



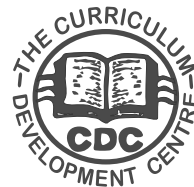
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VISION

Quality, life long education for all which is accessible, inclusive and relevant to individual, national and global needs and value systems

PREFACE

The **Design and Technology Syllabus** at Ordinary level of Education has been developed arising from the need to provide quality education that is aligned with the **Competence-Based Curriculum** and 21st Century Skills. This syllabus builds up from primary school syllabus and is designed to produce learners that are capable of applying problem solving skills, integrating theoretical knowledge and practical skills, employing critical thinking and analysis, as well as demonstrating innovativeness and creativity in solving real-world problems. The content in the syllabus will also enable learners to acquire knowledge in Design principles, Engineering and Technology in order to help them create innovative solutions. Therefore, the syllabus provides sufficient theoretical and practical content needed to impart knowledge, skills, values and positive attitudes that are aimed at enabling self-sustainability and attainment of national development. The Design and Technology syllabus comprises of four components namely; *Materials and Manufacturing, Graphic Communication, Systems Technology and Research and Entrepreneurship*. These areas are critical for product design and realisation in order to respond to societal problems. Cross cutting issues and themes such as; *Entrepreneurship, Climate Change and Financial Education* have been incorporated in the syllabus to ensure that learners cultivate a mind-set change, skills, values and positive attitudes not only for academic achievement but also for real life experiences.

Furthermore, the Design and Technology syllabus has been designed to promote and enhance the provision of Science, Technology, Engineering and Mathematics (STEM) Education in Zambian Schools at all levels in line with current global trends. This syllabus also applauds the importance of Computers in designing through Computer Aided Design (CAD) for quality works. The syllabus has a column where suggested activities are designed to offer learners hands-on experiences. The column is self-explanatory and has enough room for creative additions and amendments.



Joel Kamoko, (Mr.)
Permanent Secretary- Educational Services
MINISTRY OF EDUCATION

ACKNOWLEDGMENT

The development of the **Design and Technology Syllabus** was a collaborative effort involving several stakeholders within and outside the education system. Many thanks go to individuals, institutions and organisations that provided the technical and financial input to the successful development of this syllabus. These include; teachers, lecturers from colleges and public universities in Zambia, officers from the Examination Council of Zambia and the Directorates of Secondary Education and National Science Centre in the Ministry of Education.

Their valuable insights, expertise and feedback were instrumental in shaping the content, structure, and overall direction of this syllabus. We appreciate their dedication, time and effort in helping the Ministry of Education to design and develop a comprehensive and relevant Design and Technology syllabus. Last but not the least, I recognise the commitment and hard work of all staff at the Curriculum Development Centre in ensuring that this syllabus comes to fruition.



Charles Ndakala, (Dr.)
Director – Curriculum Development
MINISTRY OF EDUCATION

INTRODUCTION

Design and Technology is a multidisciplinary subject that calls on learners to become problem solvers and creative entrepreneurs through a design and making methodology and the application of relevant technology education. It provides a distinctive constructivist approach to learning which caters for a wide spectrum of learners' learning styles. By studying Design and Technology, learners shall develop a range of skills and knowledge that can be applied in various careers, from product design and engineering to architecture and innovation. By teaching Design and Technology, educators aim to nurture well-rounded individuals who are not only technically proficient but also creative, critical thinkers capable of contributing meaningfully to society. Furthermore, the study of Design and Technology endeavors to enable learners to:

- Take a safe and active role in designing and making projects that are linked to their own interest, families, the community and industrial practices
- Become responsible citizens with the qualities and skills necessary to live and serve happily and productively in their communities
- Apply what they are learning to life and work-related situations for the common good
- Develop a culture of enterprise and wealth creation for the benefit of themselves and their societies as a whole
- Adapt new technologies directly and appropriately to their environment and their own social and economic needs.

Components of Design and Technology

The Ordinary level Syllabus for **Design and Technology** will be developed in four components as outlined below.

Materials and Manufacturing	This component will help learners investigate various materials and properties to help them choose the right material for any project based on availability, cost and characteristics of each material
Graphic Communication	This component involves communication by drawings or symbols. It is meant to help learners develop ability to convey information about design problems, ideas and solutions graphically. This includes the ability to use a broad range of Communication Technologies.
Systems Technology	This component involves the study of how to design, build and operate systems. It will focus on developing skills in Structures, Mechanisms and Electronics. Learners will be helped to identify how these are interrelated and their role in designing and making control systems.
Research and entrepreneurship	This component aims at helping learners to come-up with solutions to real life problems as well as preparing learners for entrepreneurship.

Therefore, teachers should integrate content from each of the components of the syllabus for one particular Form level when preparing schemes of work in order to allow for holistic acquisition of competences.

STEM and Design and Technology

Design and Technology contributes greatly to Science, Technology, Engineering and Mathematics (STEM) Education in instilling key skills, knowledge and attitudes leading to STEM careers. In STEM, Design and Technology includes the following:

Science	Understanding materials, their properties, and how they can be used in design.
Technology	Using software, tools, and equipment to design, prototype, and manufacture products.
Engineering	Applying engineering principles to design and develop solutions
Mathematics	Using mathematical concepts such as geometry, measurement, and calculation to design and optimise solutions.

In STEM, Design and Technology, involves:

- Designing and developing innovative products and solutions
- Analysing and evaluating the effectiveness of designs
- Optimising and improving existing designs
- Developing problem-solving skills and critical thinking

In this syllabus, examples of STEM aspects include:

- Computer Aided Design and 3-Dimensional printing
- Robotics
- Materials science and engineering principles
- Product design and realization

Suggested Methods for Teaching Design and Technology

The Competence Based Curriculum is learner-centred. Therefore, in order for learners to attain the needed competences, emphasis should be placed on what learners are expected to do rather than what they are expected to know. In this way, learners will acquire necessary skills that will enable them contribute to the attainment of national aspirations. In this regard, the starting point for teaching and learning is to recognise that learners come to school with a wealth of knowledge and experience gained from families, communities and interactions with the environment. Thus, learning in school must build on the learner's prior experience and this is best achieved when

learners are actively involved in the learning process through *hands-on activities*. However, each learner has individual needs, pace of learning, experiences in life and abilities. To accommodate this, the teacher must determine the needs of the learners and shape the learning experiences accordingly. Therefore, the teaching methods must be varied but flexible within well-structured sequences of lessons and should include among others:

- **Project-Based Learning:** Learners work on real-world projects, developing problem-solving skills and applying Design and Technology principles.
- **Hands-on Learning:** Learners engage in practical activities, experimenting with materials and technologies.
- **Inquiry-Based Learning:** Learners explore questions and problems through investigation and research.
- **Collaborative Learning:** Learners work in teams, developing communication, teamwork, and leadership skills.
- **Flipped Classroom:** Learners learn theory at home and work on practical activities in class.
- **Modeling and Simulation:** Learners to create and test designs.
- **Reverse Engineering:** Learners analyse and deconstruct existing products to understand Design and Technology principles.
- **Guest Lectures and Workshops:** Industry experts share real-world experiences and skills.

These methods can help learners develop the skills, knowledge and mindset needed for success in Design and Technology. The teacher should have reasons for choosing a particular teaching method and must employ strategies and techniques to make the lesson interesting. The syllabus outlines specific competences. Thus, the teacher must decide when it is best to let learners *research* or *explore* information for themselves; when they need *directed learning*; *reinforcement* or when the learners can be allowed to find their own way through a topic. In this way, competences shall be attained in a spiral manner considering that in any lesson, different competences can be covered through knowledge, skills and values. The objective is to ensure that learners are able to apply the knowledge gained in real life situations.

Time Allocation

The standard period allocation for Ordinary Level Design and Technology syllabus has been prescribed in the Zambia Education Curriculum Framework (ZECF) of 2023 as **12 periods** per week. The duration for a single period is **40 minutes** .

Assessment and Certification

Assessment is an integral part of the teaching and learning processes. It helps to determine whether learning has taken place and whether the desired competences have been attained. In this regard, assessment for learning is meant to help learners improve their performance. Thus, both Formative in form of School Based Assessment (SBA) and Summative Assessment shall be conducted. The Examinations Council of Zambia will provide guidelines in Assessments.

All Vocational Education Training (VET) will be assessed and certified by TEVETA. This means that schools shall receive Trade Test syllabuses from TEVETA. Schools taking Design and Technology will be required to choose vocational subjects from the following: Bricklaying and Masonry, Carpentry and Joinery, Electrical Engineering, Plumbing and Metal Fabrication and Welding.

FORM 1

KEY COMPETENCIES TO BE DEVELOPED IN DESIGN AND TECHNOLOGY

S/N	COMPETENCE	DESCRIPTORS
1	Analytical Thinking	<ul style="list-style-type: none"> • Disassemble products and machines • Draw exploded views of objects in pictorial • Divide a line into a given proportion • Analyse parts of a circle • Analyse a given theme • Identify a problem from a given situation
2	Collaboration	<ul style="list-style-type: none"> • Share dividends in a business venture • Work with others to accomplish tasks • Participate in carrying out group research • Cooperate with peers to develop solutions to challenging situations
3	Communication	<ul style="list-style-type: none"> • Share information using signs • Share possible solutions using sketches • Communicate ideas using symbols • Communicate information using models • Display information using appropriate signs • Relay information using drawings
4	Creativity and Innovation	<ul style="list-style-type: none"> • Generate new solutions to existing problems • Manipulate waste materials using processes that add value • Create new products and services to meet customer's needs • Design products innovatively • Modify existing products through processes that add value • Transform ideas into valuable, practical and viable solutions
5	Critical Thinking	<ul style="list-style-type: none"> • Analyse a given theme • Test products in order to assess their quality • Produce evaluation reports of project designs and products • Research and compile vital information to produce project reports/portfolios

S/N	COMPETENCE	DESCRIPTORS
		<ul style="list-style-type: none"> Analyse researched information in order to make meaningful decisions Assemble components and materials in order to come up with complex products
6	Digital	<ul style="list-style-type: none"> Use digital tools and technologies in the design process Generate drawings using Computer Aided Design (CAD) software Use computers, phones and tablets to research on given topics
7	Entrepreneurship	<ul style="list-style-type: none"> Identify business opportunities within the environment. Create a business plan Develop a business venture Create a marketing plan Create partnerships to share roles and responsibilities Manage finances Liquidate a business
8	Environmental Sustainability	<ul style="list-style-type: none"> Recognize individual roles in protecting the environment Participate in cleaning of the local environment Use natural resources sustainably Recycle waste materials Manage waste in a productive manner Use eco-friendly materials in product development
9	Financial Education	<ul style="list-style-type: none"> Demonstrate ethical ways of earning money Prepare a Budget for a business enterprise Prepare a savings plan Manage debt Explore low-risk investment options Utilise services provided by financial institutions
10	Problem Solving	<ul style="list-style-type: none"> Identify problems in a given situation Analyse identified problems to determine their potential consequences Analyse possible solutions to existing problems Apply the design process to solve problems Generate innovative solutions to challenging situations

I. MATERIALS AND MANUFACTURING

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
1.1 SAFETY	1.1.1 Personal Safety	1.1.1.1 Apply personal safety precautions in a workplace	<ul style="list-style-type: none"> • Discussing safety precautions to be applied in a work place (<i>wearing correct safety attire, eat in designated areas, operate machinery that you are familiar with, lift objects carefully, use proper equipment...</i>) • Researching on uses of various Personal Protective Equipment (PPEs) • Demonstrating safe ways of handling tools and equipment • Developing safety plans 	Personal safety precautions in a workplace applied correctly
	1.1.2 Workplace Safety	1.1.2.1 Apply workplace safety practices	<ul style="list-style-type: none"> • Exploring workplace safety practices (<i>storing tools and equipment in the right places, keeping gangways clear, cleaning of the benches and the floors...</i>) • Investigating methods of providing adequate lighting for a workstation • Discussing methods of providing adequate ventilation for a workstation • Creating safety protocols for workplaces 	Workplace safety practices applied accordingly

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			<ul style="list-style-type: none"> • Conducting safety audits in a work station • Applying workplace safety practices 	
	1.1.3 First Aid	1.1.3.1 Apply first aid techniques in the workplace	<ul style="list-style-type: none"> • Identifying common accident scenarios (<i>suffocation, burns, cuts...</i>) • Role-playing the provision of first aid to injured persons • Demonstrating first aid to an injured person 	First aid techniques in the workplace applied correctly
	1.1.4 Fire Fighting	1.1.4.1 Demonstrate fire-fighting techniques	<ul style="list-style-type: none"> • Classifying fires • Utilising fire-fighting equipment (<i>fire extinguishers, sand, hose reels, hydrants, fire blanket...</i>) • Demonstrating ways of fighting fire • Practising methods of preventing fire 	Fire-fighting techniques demonstrated correctly
1.2 MATERIALS	1.2.1 Materials	1.2.1.1 Use timber in different situations	<ul style="list-style-type: none"> • Classifying types of wood (<i>softwood and hardwood</i>) • Analysing properties of wood (<i>physical and mechanical</i>) • Researching on timber production processes (<i>felling, conversion, seasoning</i>) • Identifying timber defects • Applying preservatives on timber (<i>brushing, dipping, spraying...</i>) 	Timber used in different situations accordingly

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			<ul style="list-style-type: none"> Using timber in product making, using appropriate tools and equipment for measuring, marking, cutting, testing and finishing Practising re-planting of trees 	
		1.2.1.2 Utilise manufactured boards in different situations	<ul style="list-style-type: none"> Identifying types of manufactured boards (<i>plywood, block board, fiberboard, chipboard, Medium Density Fibre (MDF)...</i>) Discussing uses of manufactured boards Utilising manufactured boards in product making, using appropriate tools and equipment for measuring, marking, cutting, testing and finishing. Applying edge treatment to manufactured boards (<i>lipping, veneering...</i>) 	Manufactured boards in different situations utilised appropriately
		1.2.1.3 Use metals in different situations	<ul style="list-style-type: none"> Discussing properties of metals Classifying types of metals (<i>ferrous, non-ferrous and alloys</i>) Exploring the production of ferrous metals (<i>Iron and steel</i>) and non-ferrous metals (<i>copper, aluminum, lead, zinc, tin...</i>) 	Metals in different situations used appropriately

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			<ul style="list-style-type: none"> Utilising metals (ferrous, non-ferrous and alloys) for making products, using appropriate tools and equipment for measuring, marking, cutting, testing and finishing Analysing effects of using metals on the environment (<i>lead poisoning, land degradation, water/air/land pollution...</i>) Recycling and re-using metals Applying safety when working with metals 	
		1.2.1.4 Use plastics in different situations	<ul style="list-style-type: none"> Exploring the structure and chemistry of plastics Identifying types of plastics Researching on properties of plastics (<i>physical and mechanical</i>) Classifying plastics (<i>thermal and thermosetting</i>) Exploring plastic forming processes Manipulating plastics using appropriate tools and equipment, for measuring, marking, cutting, testing and finishing Analysing the effects of plastics on the environment 	Plastics in different situations used accordingly

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			<ul style="list-style-type: none"> Using plastics in different situations Applying safety when working with plastic Conserving plastics (<i>reusing, recycling, reducing...</i>) 	
		1.2.1.5 Utilise other materials in different situations	<ul style="list-style-type: none"> Exploring other materials (<i>reeds, grass, leather, glass ceramic, canvas, rubber, fiberglass...</i>) Researching on properties of the other materials (<i>reeds, glass, grass, leather, clay, canvas, rubber, fiberglass...</i>) Analysing the effects of using other materials on the environment Utilising other materials in product development, using appropriate tools and equipment for measuring, marking, cutting, testing and finishing Applying safety when working with plastic Using other materials sustainably (<i>recycling and re-using</i>) 	Other materials utilised in different situations accordingly
	1.2.2 Manufacturing Processes	1.2.2.1 Join materials using different methods	<ul style="list-style-type: none"> Joining metal using temporary and permanent methods (<i>temporary: bolt and nut, screwing...; permanent: seaming,</i> 	Materials using different methods joined appropriately

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			<p><i>soldering, welding, riveting...</i>)</p> <ul style="list-style-type: none"> • Joining wood using temporary and permanent methods (<i>temporary: screwing, nailing...; permanent: mortise and tenon, housing, dovetail, halving, gluing, dowelling...</i>) • Joining plastics using temporary and permanent methods (<i>temporary: screwing, press fit, snap fit; permanent: gluing, plastic welding, riveting...</i>) 	
		1.2.2.2 Use holding tools in product making	<ul style="list-style-type: none"> • Identifying holding tools (<i>bench vice, hand vice, engineers vice, sash clamps, G-clamps, bench holdfast, quick release/instantaneous clamps...</i>) • Using holding tools to clamp work pieces • Caring and maintaining holding tools • Practising safety precautions when using holding tools 	Holding tools in product making used accordingly

II. GRAPHIC COMMUNICATION

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
1.3 GRAPHICS	1.3.1 Drafting Aids	1.3.1.1 Use drafting aids to create drawings	<ul style="list-style-type: none"> Using drafting aids (<i>pencils, drawing board, T-square, set squares, stencils, fillet, flex curves...</i>) to create drawings Applying varied effects to lettering work 	Drafting Aids to create drawings used correctly
	1.3.2 Plane Geometry	1.3.2.1 Construct lines from given data	<ul style="list-style-type: none"> Drawing boarder lines and title block Bisecting lines Dividing lines into equal parts Dividing lines into given ratios 	Lines from given data constructed correctly
		1.3.2.2 Construct angles from given data	<ul style="list-style-type: none"> Constructing angles from given data Incorporating angles in designs Applying angles in different situations 	Angles from given data constructed accurately
		1.3.2.3 Construct triangles from given data	<ul style="list-style-type: none"> Constructing triangles from given information (<i>sides, angles and ratio</i>) Inscribing and circumscribing triangles Incorporating triangles in designs Applying knowledge of triangles to solve problems 	Triangles from given data constructed correctly
		1.3.2.4 Construct quadrilaterals from given data	<ul style="list-style-type: none"> Exploring types of quadrilaterals 	Quadrilaterals from given data constructed correctly

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			<ul style="list-style-type: none"> • Constructing quadrilaterals from given data (<i>sides, diagonals, angles and circles</i>) • Inscribing and circumscribing quadrilaterals • Applying quadrilaterals in product designs 	
	1.3.3 Symbols	1.3.3.1 Design symbols	<ul style="list-style-type: none"> • Identifying symbols (<i>used in building construction, welding, electrical, mechanical, pneumatics, hydraulics...</i>) • Designing symbols using appropriate tools and equipment (<i>color pens, pencils, computer software...</i>) • Applying symbols in product designs 	Symbols designed appropriately
	1.3.4 Introduction to Computer Aided Design (CAD)	1.3.4.1 Produce Computer Aided Drawings in 2-Dimesion	<ul style="list-style-type: none"> • Exploring CAD softwares (<i>AutoCAD, ArchiCAD, Revit, google Sketch up...</i>) • Interacting with the user interface • Operating command tools • Drawing lines, circles, arcs, shapes, • Performing auxiliary tasks using CAD software (<i>extending lines, trimming, erasing, scaling, offsetting, dimensioning...</i>) • Setting the size of a figure • Producing computer aided drawings 	Computer aided drawings in in 2-Dimension produced correctly

III. SYSTEMS TECHNOLOGY

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
1.4 ENERGY	1.4.1 Forms of Energy	1.4.1.1 Utilise forms of energy	<ul style="list-style-type: none"> • Researching forms of energy (<i>heat, light, sound, chemical, electrical, mechanical...</i>) • Discussing uses of different forms of energy • Utilising various forms of energy in real life situations 	Forms of energy utilised accordingly
	1.4.2 Sources of Energy	1.4.2.1 Utilise sources of energy	<ul style="list-style-type: none"> • Identifying sources of energy • Classifying sources of energy (<i>renewable and non-renewable</i>) • Discussing advantages and disadvantages of different sources of energy (<i>sun, water, wind, coal, uranium...</i>) • Harnessing sources of energy (<i>sun, water, wind...</i>) 	Sources of energy utilised accordingly
1.5 STRUCTURES	1.5.1 Structures	1.5.1.1 Apply knowledge on structures in different situations	<ul style="list-style-type: none"> • Identifying structures • Classifying structures • Researching on the properties of structures • Applying structures in product design • Applying knowledge of structures in different situations 	Knowledge on structures in different situations applied accordingly
1.6 MECHANISMS	1.6.1 Motions	1.6.1.1 Apply motions in various situations	<ul style="list-style-type: none"> • Identifying different types of motions • Analyzing types of motions 	Motions in various situations applied accordingly

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			<ul style="list-style-type: none"> • Sketching various types of motions • Applying types of motions in product design and development 	
	1.6.2 Levers	1.6.2.1 Apply levers in different situations	<ul style="list-style-type: none"> • Researching on levers • Classifying levers into first, second and third class (<i>screw driver, bottle opener, door handle, pair of snips, wheelbarrow...</i>) • Applying the principle of moments in designing and making levers • Applying levers in different situations 	Levers in different situations applied appropriately
	1.6.3 Linkages	1.6.3.1 Apply linkages in different situations	<ul style="list-style-type: none"> • Identifying different types of linkages • Analysing operations of various linkages • Designing linkages • Utilising linkages in different situations 	Linkages in different situations applied appropriately
1.7 ELECTRONICS	1.7.1 Electronic Components	1.7.1.1 Utilise electronic components	<ul style="list-style-type: none"> • Identifying electronic components (<i>switch, diode, capacitor, transistor, Integrated Circuit (IC), resistor...</i>) • Interpreting symbols of electronic components • Drawing conventional symbols of electronic components 	Electronic components utilised accordingly

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			<ul style="list-style-type: none"> Utilising electronic components (<i>diode, switch, resistor, transistor...</i>) in different situations 	

IV. RESEARCH AND ENTREPRENEURSHIP

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
1.8 DESIGNING	1.8.1 Design Process	1.8.1.1 Apply Design process stages in problem solving	<ul style="list-style-type: none"> Identifying the theme from societal needs Analysing the theme Describing the situation Identifying the problem Deriving a design brief Carrying out a research Formulating design specifications 	Design process stages in problem solving applied accordingly
1.9 ENTREPRENEURSHIP	1.9.1 The Entrepreneur	1.9.1.1 Identify entrepreneurial opportunities in Design and Technology	<ul style="list-style-type: none"> Discussing attributes of an entrepreneur Exploring ways of strengthening entrepreneurial abilities Identifying entrepreneurial opportunities in Design and Technology 	Entrepreneurial opportunities in Design and Technology identified accordingly
		1.9.1.2 Generate a Business Idea	<ul style="list-style-type: none"> Brainstorming on business ideas Assessing a business idea using the SWOT analysis and PMI methods Selecting a viable business opportunity 	Business idea generated successfully
	1.9.2 Business Plan	1.9.2.1 Develop a business plan	<ul style="list-style-type: none"> Discussing components of a business plan Formulating parts of a business plan: <ol style="list-style-type: none"> (i) Summary (ii) Business description (iii) Marketing plan (<i>product description, product costing and pricing, selecting a</i> 	Business plan developed accordingly

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			<p><i>target group, sales strategies (credit/cash), advertising strategies...)</i></p> <p>(iv) Organisation structure (v) Financial plan</p> <ul style="list-style-type: none"> • Compiling a business plan 	

FORM 2

I. MATERIALS AND MANUFACTURING

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
2.1 MATERIALS	2.1.1 Manufacturing Processes	2.1.1.1 Cut screw threads	<ul style="list-style-type: none"> Classifying types of screw threads (<i>internal and external</i>) Identifying thread cutting equipment Discussing thread cutting techniques Cutting threads on materials (<i>metal, wood, plastic...</i>) using correct equipment and techniques Applying safety precautions when cutting threads 	Screw threads cut correctly
		2.1.1.2 Apply heat treatment processes on metals	<ul style="list-style-type: none"> Discussing heat treatment processes (<i>hardening, tempering, case-hardening, annealing, normalizing...</i>) Applying heat treatment processes on metals Practising safety when heat treating metals 	Heat treatment processes on metals applied accordingly
	2.1.2 Environmental Management	2.1.2.1 Manage waste	<ul style="list-style-type: none"> Classifying waste Sorting waste Disposing waste in designated places Researching on effects of waste on the environment (<i>diseases, flooding, land/air/water pollution...</i>) 	Waste managed appropriately

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			<ul style="list-style-type: none">• Managing waste (<i>recycling, re-using and reducing...</i>)	

II. GRAPHIC COMMUNICATION

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
2.2 GRAPHICS	2.2.1 Form	2.2.1.1 Apply form in drawings	<ul style="list-style-type: none"> • Drawing shapes • Interpreting form in drawings • Applying form in drawings (<i>rendering, adding depth to shapes...</i>) 	Form in drawings applied correctly
	2.2.2 Plane Geometry	2.2.2.1 Construct circles from given data	<ul style="list-style-type: none"> • Classifying circles (<i>eccentric and concentric</i>) • Constructing circles from given data • Drawing circles in contact (<i>external and internal</i>) • Using circles in profile design • Applying circles to solve real-world problems 	Circles from given data constructed accordingly
		2.2.2.2 Construct tangents and arcs from given data	<ul style="list-style-type: none"> • Constructing common tangents to satisfy given data (<i>external and internal</i>) • Constructing a tangent from a circle to a point • Constructing tangential arcs to satisfy given data • Applying tangents and arcs to real life situations 	Tangents and arcs from given data constructed accordingly
		2.2.2.3 Construct polygons from given data	<ul style="list-style-type: none"> • Constructing polygons • Applying polygons in profile design (<i>signs, logos, symbols...</i>) 	Polygons from given data constructed accordingly

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
		2.2.2.4 Transform plane figures to address given situations	<ul style="list-style-type: none"> Producing figures of equal area (<i>triangles, quadrilaterals, regular and irregular polygons</i>) Interpreting linear and area ratios Reducing and enlarging plane figures using linear and area ratios 	Plane figures to address given situations transformed correctly
	2.2.3 Solid Geometry	2.2.3.1 Produce pictorial drawings	<ul style="list-style-type: none"> Drawing free hand sketches in isometric projection Drawing freehand sketches in Oblique projection Producing pictorial drawings using geometrical instruments (<i>cubes, rectangular and stepped blocks ...</i>) 	Pictorial drawings produced correctly
	2.2.4 Surface Development	2.2.4.1 Produce surface development of solids	<ul style="list-style-type: none"> Drawing surface developments of prisms and cylinders Applying surface development in product making (<i>chicken feeders, dustpans, packages...</i>) Calculating surface area of a developed solid 	Surface development of solids produced correctly
	2.2.5 Orthographic Projection	2.2.5.1 Convert pictorial views to orthographic drawings	<ul style="list-style-type: none"> Preparing the layout for the elevations (<i>spacing of elevations</i>) Converting pictorial drawings to orthographic 	Pictorial views to orthographic drawings converted accordingly

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			projection using 1st/3rd Angle Projection <ul style="list-style-type: none"> • Showing the cutting plane, section subtitle, symbol of projection and scale • Dimensioning of elevations 	

III. SYSTEMS TECHNOLOGY

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
2.3 ENERGY	2.3.1 Electricity	2.3.1.1 Construct electrical Circuits	<ul style="list-style-type: none"> • Researching on electrical components (<i>Bulb, circuit board, circuit breakers, cells, resistor, switch, wire...</i>) • Interpreting electrical symbols • Designing domestic electrical circuits (<i>ring and radial</i>) • Constructing domestic electrical circuits • Applying safety precautions when constructing electrical circuits • Researching on charge, voltage, electromotive force (<i>e.m.f</i>), current, resistance, power and energy • Installing electrical components using appropriate tools, equipment and materials • Calculating electrical quantities • Measuring electrical quantities using appropriate equipment 	Electrical circuits constructed correctly

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
	2.3.2 Energy Transformation	2.3.2.1 Transform energy from one form to another	<ul style="list-style-type: none"> • Researching on the concept of energy conversion and efficiency • Discussing ways of converting energy from one form to another • Developing a system that transforms energy from one form to another • Determining the efficiency of the energy transforming systems 	Energy transformed from one form to another accordingly
2.4 STRUCTURES	2.4.1 Structural Forces	2.4.1.1 Analyse the effects of forces on structures	<ul style="list-style-type: none"> • Identifying types of forces • Classifying forces in structures (<i>static and dynamic</i>) • Analysing structural forces (<i>Tension, shear, compression, bending, torsion...</i>) • Demonstrating effects of forces on structures • Analysing the effects of forces on structures 	Effects of forces on structures analysed accordingly
2.5 MECHANISMS	2.5.1 Pulleys and Belts	2.5.1.1 Apply pulleys and belts in problem solving	<ul style="list-style-type: none"> • Identifying types of pulleys and belts (<i>flat, grooved...</i>) • Designing pulleys • Making pulleys from appropriate material (<i>plastic, metal...</i>) • Applying pulleys and belts in problem solving • Maintaining pulleys and belts 	Pulleys and belts in problem solving applied appropriately

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
	2.5.2 Chains and Sprockets	2.5.2.1 Apply chains and sprockets in problem solving	<ul style="list-style-type: none"> • Exploring chains and sprocket operations • Analysing advantages and disadvantages of using chains and sprocket • Applying chains and sprockets in real life situations • Maintaining chains and sprockets 	Chains and sprockets in problem solving utilised correctly
	2.5.3 Cranks	2.5.3.1 Apply cranks in solving problems	<ul style="list-style-type: none"> • Identifying uses of cranks in everyday life • Making designs of cranks using suitable material • Producing cranks from suitable material • Utilising cranks in problem solving • Maintaining cranks 	Cranks in solving problems applied appropriately
2.6 ELECTRONICS	2.6.1 Electronic Circuits	2.6.1.1 Develop Electronic Circuits	<ul style="list-style-type: none"> • Researching on electronic components (<i>Circuit boards, diodes, thermistors, resistors capacitors, transistors, Integrated Circuits (IC)...</i>) • Determining resistance in an electronic circuit (<i>using colour codes, ohm's law...</i>) • Designing electronic circuits • Drawing electronic circuits • Developing electronic circuits • Applying safety precautions 	Electronic circuits developed correctly

IV. RESEARCH AND ENTREPRENEURSHIP

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
2.7 DESIGNING	2.7.1 Design Process	2.7.1.1 Apply the design process stages to problem solving	<ul style="list-style-type: none"> • Producing sketches of design solutions • Generating possible solutions while applying creativity and innovation • Developing a chosen idea • Producing a working drawing • Producing a presentation drawing • Preparing a cutting list • Preparing a materials list • Outlining the production plan 	Design process stages in problem solving applied accordingly
	2.7.2 Product Realisation	2.7.2.1 Apply design process skills to make products	<ul style="list-style-type: none"> • Selecting materials • Using various skills to make a product • Finishing the product • Testing the product • Evaluating the product • Compiling the report/portfolio 	Design process skills to make products applied accordingly
2.8 ENTREPRENEURSHIP	2.8.1 Financial Planning	2.8.1.1 Make a Financial plan	<ul style="list-style-type: none"> • Brainstorming the importance of financial planning • Setting up financial goals • Managing finances (<i>cash flow, reducing expenses, achieving sales target, banking ...</i>) • Preparing a Financial Plan 	Financial plan made accordingly

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
		2.8.1.2 Prepare a budget for a business	<ul style="list-style-type: none"> • Researching on components of a budget for a business (<i>income and expenditure</i>) • Preparing a budget 	A budget for a business prepared successfully
		2.8.1.3 Organise start-up capital	<ul style="list-style-type: none"> • Discussing sources of start-up capital (<i>loan, savings, leasing an asset...</i>) • Organising start-up capital 	Start-up capital organised successfully
2.9 BUSINESS FINANCIAL RECORDS	2.9.1 Record Keeping	2.9.1.1 Manage business records	<ul style="list-style-type: none"> • Identifying business documents (<i>quotations, receipts, invoices...</i>) • Preparing records of business activities (<i>purchases, sales, records of creditors and debtors...</i>) • Calculating profit or loss of a business (<i>Profit = Selling Price - Cost Price</i>) 	Business records managed accordingly

FORM 3

I. MATERIALS AND MANUFACTURING

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
3.1 HARDWARE	3.1.1 Fastening/ Fixing	3.1.4.1 Join materials using fasteners	<ul style="list-style-type: none"> Identifying various types of fasteners Exploring the uses of various fasteners Preparing materials before fastening (<i>Boring clearance and pilot holes...</i>) Joining using fasteners (<i>nails, screws, rivets, Bolts and nuts, studs...</i>) Applying safety precautions when using fasteners 	Materials using fasteners joined appropriately
	3.1.2 Fittings	3.1.2.1 Mount fittings	<ul style="list-style-type: none"> Identifying types of fittings (<i>Hinges, mortise locks, Catches, latches, handles...</i>) Exploring the uses of various fittings Preparing materials before fitting (<i>planing, drilling...</i>) Mounting fittings 	Fittings mounted correctly
3.2 MANUFACTURING	3.2.1 Casting	3.2.1.1 Produce components by casting	<ul style="list-style-type: none"> Researching on casting Identifying casting tools and equipment Designing a pattern for casting Making a pattern for casting Preparing materials for casting (<i>sand, pattern, mould, material to be cast...</i>) 	Components by casting produced correctly

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			<ul style="list-style-type: none"> • Casting using appropriate techniques and tools • Applying safety precautions during casting 	
	3.2.2 Forging	3.2.2.1 Make products using forging techniques	<ul style="list-style-type: none"> • Researching on forging techniques (<i>swaging, fullering, drawing down, bending, upsetting, twisting, flaring...</i>) • Identifying tools and equipment used in forge work • Making products using forging techniques (<i>swaging, fullering, drawing down, bending, upsetting, twisting, flaring...</i>) • Practising safety precautions during forging 	Products using forging techniques made correctly
	3.2.3 Sheet Material	3.2.3.1 Make products using sheet materials	<ul style="list-style-type: none"> • Identifying types of sheet materials (<i>sheet metal, plastic sheet, glass sheet...</i>) • Identifying tools and equipment for making products from sheet materials (<i>snips, guillotine, glass cutter, marker...</i>) • Joining sheet materials (<i>metal, glass, plastic, wood...</i>) • Making products from sheet materials using appropriate tools and equipment • Practising safety when handling sheet materials (<i>wearing gloves, avoiding scratching the surface...</i>) 	Products using sheet materials made accordingly

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
		3.2.3.2 Make products using beaten metalwork processes	<ul style="list-style-type: none"> • Researching on beaten metalwork processes (<i>bossing mallet, sandbag, planishing hammer, tinman's anvil, stakes...</i>) • Identifying tools and equipment used in beaten metalwork • Preparing materials to undergo beaten metalwork processes • Making products using appropriate beaten metalwork techniques • Practising safety when carrying out beaten metalwork processes 	Products using beaten metalwork processes made accordingly
	3.2.4 Lathe Work	3.2.4.1 Turn materials on the lathe	<ul style="list-style-type: none"> • Researching on lathe operations (<i>turning between centres, face plate turning, knurling, drilling, boring...</i>) • Identifying lathe turning tools • Operating lathe machines (<i>setting the speed, changing direction of rotation...</i>) • Turning materials on the lathe (<i>wood, metal, plastic...</i>) • Caring and maintaining lathe tools and machines • Applying safety precautions when using the lathe machine 	Materials on the lathe turned correctly

II. GRAPHIC COMMUNICATION

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
3.3 GRAPHICS	3.3.1 Logos	3.3.1.1 Produce logos	<ul style="list-style-type: none"> Analysing characteristics of logos Exploring stages in logo production Designing logos Producing logos using appropriate tools and equipment (<i>crafting knife, safety rule, compass cutter, cutting mat, paper guillotine, scissors...</i>) 	Logos produced accordingly
	3.3.2 Models	3.3.2.1 Produce models	<ul style="list-style-type: none"> Researching on the functions of models Exploring tools and materials used in model making Designing the model Producing models using appropriate tools and equipment (<i>crafting knife, safety rule, compass cutter, cutting mat, paper guillotine, scissors...</i>) 	Models produced appropriately
	3.3.3 Computer Aided Designs (CAD)	3.3.3.1 Produce Computer Aided Designs in 3-Dimension	<ul style="list-style-type: none"> Performing auxiliary tasks using CAD software (<i>extending lines, trimming, erasing, scaling, offsetting, dimensioning...</i>) Setting the size of a figure 	Computer Aided Designs in 3-Dimension produced appropriately

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			<ul style="list-style-type: none"> Producing Computer Aided Designs 	
	3.3.4 Plane Geometry	3.3.4.1 Construct special curves	<ul style="list-style-type: none"> Exploring types of special curves (<i>ellipse, parabola, and hyperbola, cycloid, involute archmedian spiral and single start helices</i>) Constructing special curves Applying special curves in designing profiles 	Special curves constructed correctly
		3.3.4.2 Plot the locus of a point on link mechanisms	<ul style="list-style-type: none"> Exploring everyday applications of link mechanisms (<i>power saw, shaping machine, sewing machine, potter's wheel, conrod on crankshaft...</i>) Analysing movements of link mechanisms (<i>oscillations, linear...</i>) Plotting a locus of a point on link mechanisms (<i>at least two links</i>) Applying link mechanisms in product development 	Locus of a point on Link mechanisms plotted correctly
	3.3.5 Solid Geometry	3.3.5.1 Produce pictorial drawings incorporating circles and arcs	<ul style="list-style-type: none"> Producing drawings in isometric, incorporating circles and arcs. Converting orthographic views into isometric view incorporating circles and arcs 	Pictorial drawings incorporating circles and arcs produced correctly
		3.3.5.2 Draw exploded views	<ul style="list-style-type: none"> Drawing exploded views of objects in pictorial (<i>isometric and oblique projection</i>) 	Exploded views drawn correctly

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			<ul style="list-style-type: none"> Evaluating the importance of exploded views Applying exploded views in real life situations Dimensioning exploded views 	
	3.3.6 Surface Development	3.3.6.1 Draw surface developments of solids	<ul style="list-style-type: none"> Drawing surface developments of pyramids and cones Making templates of developed cones and pyramids (<i>template lofting</i>) 	Surface developments of solids drawn correctly
	3.3.7 Orthographic Projection	3.3.7.1 Produce Assembly drawings	<ul style="list-style-type: none"> Exploring applications of engineering fasteners (<i>bolts, nut washers, pins, keys, studs, locknuts, handles...</i>) Constructing a bolt and nut Sketching graphical representation of materials (<i>wood, metal, glass, plastic, concrete...</i>) Producing assembly drawings from exploded pictorial views (<i>isometric and oblique</i>) Producing assembly drawings in orthographic projection (<i>with at least 5 components</i>) Producing well-spaced sectional elevations of assembled components in orthographic Preparing a part list Dimensioning the elevations 	Assembly drawings produced correctly

III. SYSTEMS TECHNOLOGY

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
3.4 ENERGY	3.4.1 Conservation of Energy	3.4.1.1 Apply ways of conserving energy	<ul style="list-style-type: none"> • Discussing the importance of conserving energy • Exploring ways of conserving energy (<i>using energy saving bulbs, switching off lights when not in use, using low energy consuming devices...</i>) • Applying ways of conserving energy 	Ways of conserving energy applied accordingly
	3.4.2 Cells and Batteries	3.4.2.1 Utilise cells and batteries in problem solving	<ul style="list-style-type: none"> • Exploring characteristics of primary and secondary cells • Making simple cells • Applying cells and batteries in problem solving • Maintaining cells and Batteries • Practising safety precautions when using batteries • Disposing battery waste 	Cells and batteries in problem solving utilised accordingly
3.5 STRUCTURES	3.5.1 Construction of Structures	3.5.1.1 Construct Structures	<ul style="list-style-type: none"> • Researching on structures • Exploring structural failure • Strengthening structures • Stabilising structures (<i>triangulation, gussets...</i>) • Exploring structural sections of various materials (<i>U-channel, I-beam, H-beam, T-beam...</i>) 	Structures constructed accordingly

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			<ul style="list-style-type: none"> Constructing structures using appropriate materials 	
3.6 MECHANISMS	3.6.1 Gears	3.6.1.1 Apply Gears in problem solving	<ul style="list-style-type: none"> Identifying types of gears Classifying gears Calculating the gear ratio Analysing mechanical advantages and disadvantages of gear systems Applying gears in problem solving Maintaining gears. 	Gears in problem solving applied appropriately
	3.6.2 Cams and Followers	3.6.2.1 Apply Cams and Followers in problem solving	<ul style="list-style-type: none"> Identifying characteristics of cam and followers Analysing operations of cams and followers Designing various shapes of cams and followers Applying Cams and Followers in problem solving Maintaining cams and followers 	Cams and Followers in problem solving applied accordingly
3.7 ELECTRONIC S	3.7.1 Electronic Devices	3.7.1.1 Repair Electronic Devices	<ul style="list-style-type: none"> Identifying tools and equipment used for repairing electronic devices Analysing circuit and system operations of electronic devices (<i>phone, radio, decoder, computer...</i>) Trouble shooting faults in electronic devices Repairing simple faults in electronic devices (<i>radio,</i> 	Electronic devices repaired successfully

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			<i>television, microwave, phone, computer...</i>) <ul style="list-style-type: none"> • Maintaining electronic devices • Managing electronic waste 	

IV. RESEARCH AND ENTREPRENEURSHIP

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
3.8 ENTREPRENEURSHIP	3.8.1 Winding-up a Business	3.8.1.1 Winding-up a business venture	<ul style="list-style-type: none"> • Exploring methods of winding up a business (<i>formal methods: bankruptcy, voluntary liquidation; informal methods: asset sale, going-out-of-business sale, mergers and acquisition...</i>) • Outlining the steps of liquidating a business • Winding up a business enterprise (<i>dissolution... dissolving assets, determining debts, paying claiming parties, ceasing and deregistration...</i>) 	A business enterprise liquidated successfully

FORM 4

I. MATERIALS AND MANUFACTURING

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
4.1 ADHESIVES	4.1.1 Adhesives	4.1.1.1 Apply adhesives in product making	<ul style="list-style-type: none"> • Researching on characteristics and uses of adhesives (<i>epoxy resins, contact adhesive, PVA, Tensol cement, synthetic, casein adhesives...</i>) • Preparing surfaces of materials in readiness for applying adhesives (<i>filing, cleaning, drying...</i>) • Applying adhesives using correct tools and equipment (<i>brushes, glue gun...</i>) • Storing adhesives correctly • Applying safety precautions when using adhesives 	Adhesives in product making applied correctly
4.2 FINISHES AND FINISHING	4.2.1 Finishes	4.2.1.1 Apply Finishes to products	<ul style="list-style-type: none"> • Discussing types of finishes (<i>varnish, stains, oxides, wax, paint, bluing, galvanizing, oiling, tempering, lacquer, glazing, plastic coating, dyes...</i>) • Preparing surfaces of materials in readiness for finishing (<i>using; glass paper, wet and dry, steel wool, paper, sanding sealant and a primer...</i>) • Applying finishing processes to products using appropriate tools and equipment (<i>spraying, dipping, brushing, pouring...</i>) • Practising safety precautions when applying finishes to products 	Finishes to products applied accordingly

II. GRAPHIC COMMUNICATION

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
4.3 GRAPHICS	4.3.1 Computer Aided Designs in 3D	4.3.1.1 Produce Computer Aided Designs in 3D	<ul style="list-style-type: none"> Utilising command tools (<i>drawing tools</i>) Drawing lines, circles, arcs, shapes and extruding Setting sizes of drawings Creating drawings in 3D using graphic software (<i>AutoCAD, ArchiCAD, Revit, Solidworks, Sketchup...</i>) 	Computer Aided Designs in 3D produced correctly
	4.3.2 Pictographs	4.3.2.1 Produce pictographs	<ul style="list-style-type: none"> Researching on pictographs Outlining stages of creating pictographs: <ol style="list-style-type: none"> Defining the pictograph's purpose Collecting and organising data Selecting symbols Determining the scale of the pictograph Designing the pictograph using graphic design tools such as spreadsheet, graphic design software or online pictograph maker Creating labels and titles Creating pictographs Utilising pictographs in real life 	Pictographs produced correctly
	4.3.3 Solid Geometry	4.3.3.1 Draw surface development of truncated solids	<ul style="list-style-type: none"> Drawing surface development of truncated solids (<i>prisms, cylinders, pyramids and cones</i>) 	Surface development of truncated objects drawn correctly

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			<ul style="list-style-type: none"> • Determining the True shape of the <i>developed surface</i> • Apply surface development of truncated objects in product development 	
		4.3.3.2 Draw a True shape of a cut surface	<ul style="list-style-type: none"> • Drawing elevations of truncated solids (<i>prisms, cylinders, pyramids and cones</i>) orthographic • Drawing the true shape of a cut surface • Applying true shape of cut surface in problem solving 	True shape of a cut surface drawn correctly
	4.3.4 Intersection of Objects	4.3.4.1 Draw intersection lines between geometrical objects	<ul style="list-style-type: none"> • Drawing views of intersecting objects: centred and off-centered (<i>cylinders and prisms</i>) • Applying knowledge of intersecting objects in product making 	Intersection lines between geometrical objects drawn correctly
	4.3.5 Projection	4.3.5.1 Draw building plans	<ul style="list-style-type: none"> • Interpreting abbreviations and building symbols of fittings and materials (<i>electric symbols, walls, windows, doors, toilet pans, bath tabs, electric symbols...</i>) • Drawing building plans using geometrical instruments • Drawing building plans using graphic software (<i>AutoCAD, ArchiCAD...</i>) 	Building plans drawn accordingly

III. SYSTEMS TECHNOLOGY

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
4.4 ENERGY	4.4.1 Energy Systems	4.4.1.1 Develop energy generating systems	<ul style="list-style-type: none"> • Researching on systems for generating renewable energy (<i>solar, hydro, wind, geothermal, biomass...</i>) • Designing a system for generating renewable energy • Developing a system for generating energy • Evaluating the efficiency of a system for generating energy 	Energy generating systems developed appropriately
4.5 STRUCTURES	4.5.1 Systems and Controls	4.5.1.1 Apply Systems and Controls in product development	<ul style="list-style-type: none"> • Exploring systems and controls (<i>perforator, stapler, lock, ladder, elevator, escalator...</i>) • Designing systems and controls • Applying systems and controls in product making 	Systems and Controls in product development applied appropriately
4.6 MECHANISMS	4.6.1 Pneumatics	4.6.1.1 Develop Pneumatic Systems	<ul style="list-style-type: none"> • Exploring operation principles of pneumatic systems • Analysing the advantages and disadvantages of pneumatic systems • Exploring components for pneumatic circuits (<i>reservoir, pump, valves, actuators, prime movers...</i>) • Drawing pneumatic circuits using appropriate symbols 	Pneumatic systems developed accordingly

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			<ul style="list-style-type: none"> • Designing Pneumatic Systems for products (<i>using block diagrams and symbols</i>) • Applying pneumatic systems in making products • Practising safety when working with pneumatic systems 	
	4.6.2 Hydraulics	4.6.2.1 Develop Hydraulic Systems	<ul style="list-style-type: none"> • Exploring operation principles of hydraulic systems • Analysing the advantages and disadvantages of Hydraulic systems • Discussing components for hydraulic circuits (<i>reservoir, pump, valves, actuators, prime movers...</i>) • Drawing hydraulic circuits using appropriate symbols • Designing hydraulic systems for products (<i>using block diagrams and symbols</i>) • Applying hydraulic systems in products • Practising safety when working with hydraulic systems 	Hydraulic systems developed accordingly
4.7 ELECTRONICS	4.7.1 Logic Control	4.7.1.1 Make Logic control Systems	<ul style="list-style-type: none"> • Exploring logic control systems • Applying logic systems in product development 	Logic control systems made successfully

TOPIC	SUB-TOPIC	SPECIFIC COMPETENCES	LEARNING ACTIVITIES	EXPECTED STANDARD
			<ul style="list-style-type: none"> • Integrating control systems in product development (<i>mechanical, electrical, computer, networking ...</i>) • Researching on operation principles of robotic systems (<i>industrial, service, autonomous, humanoid, collaborative ...</i>) • Designing logic controls for robotic operations • Making robots (<i>transport, health, agriculture, manufacturing...</i>) 	

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