Year 12 Design and Technology Subject Plan

School: The Marlborough Science Academy. **Teacher:** Alan Dwane.

September – Autumn half-term (8 weeks approx.)

Topics: Introduction to Materials and their applications, Performance characteristics of materials, Enhancement of material, Communication of Design

Learning Outcomes:

- Discuss the importance of careful material selection in relation to product application.
- List and differentiate between the different physical and mechanical properties of materials
- Understand how additives are used to enhance the properties of materials and outline the benefits if these processes
- Identify and explain different workshop and industrial tests that are carried out on woods
- Describe how tests are set up and what is tested, measured, and compared
- Describe how material properties can be enhanced.
- Identify and effectively utilise a range of graphical communication techniques including freehand sketching, drawing and rendering to present ideas.

Key Learning

- List and define physical and mechanical properties terminology.
- Classification of materials such as; metals, woods, polymers, papers / boards, composites, smart materials and modern materials
- Methods for investigating and testing materials – Practical workshop tests and industrial tests.
- Paper and board types, emphasis on stock forms and types.
- Woods- classification of woods – test for toxicity of woods, differentiate between natural woods and manufactured.
- Metals – ferrous vs non-ferrous, alloys, stock forms.
- Polymers – polymer production, Thermoplastic vs thermoset, stick forms
- The methods in which materials such as wood, polymers and metals can be enhanced.
- Create a variety of design sheets that explore a range of design communication techniques.

Assessment: Class and home assignments/Verbal questioning (Bloom) and class test, peer, and group assessment.

Resources: Booklet, Laminated safety signs in the classroom, Powerpoint presentations etc., Tools and machines.

October – Christmas break (7 weeks approx.)

Topics: Full work through and implementation of the investigatory design process - Lighting project

Learning Outcomes & Key principles:

Technical Principles

Further looking at materials and properties (wood and plastic). Complexities of designing with wood and plastic. **(Alan)**

Wood – Properties of wood and production methods. Looking at basic joining techniques (dovetail, finger, dowel/biscuit, butt joints etc.) Importance of finishes and treatments. **(Alan)**

Plastic – Processing polymers – using heat to process and shape plastic both in job, batch and mass production. **(Alan)**

Paper and Boards – uses and process (die cutting bending and laser cutting) **(Alan)**

Modern and Industrial scales of Practise – Scales of Production (manufacturing techniques in industry) Efficient use of materials (material cost, manufacturing processes and scales of production, Design and economic use of materials, manufacturing to minimalize waste and increase accuracy, comparing bulk and one-off production.) The use of computer systems (computer systems for planning and control, computer systems for manufacturing and production, computer systems for production distribution and storage, standardised and bought in components. **(Alan)**

Design Principles

The Design Process, more detail – Investigation and analysis, importance of illustration, development of design specification, evaluating and testing. **(Paul)**

Technology and cultural changes – major developments in technology, new materials, new methods of manufacture, advancements in CAD/CAM, social moral and ethical issues product life cycle. **(Alan)**

Prototyping – Using papers and boards to create accurate prototypes of their product. **(Paul)**

Assessment: Class and home assignments/Verbal questioning (Bloom) and class test, peer, and group assessment.

Resources: Booklet, Laminated safety signs in the classroom, Powerpoint presentations etc., Tools and machines.

January – Spring Half-Term (7 weeks approx.)

Topics: Modern and Industrial Scales of Practice, Digital Design and manufacturing, Designing for manufacturing, maintenance, repair and disposal, Creative idea generation.

Learning Outcomes:

- List and differentiate between the 3 modern industrial scales of practise (Bespoke, batch, mass and continuous).
- Justify the importance of efficient use of materials: relationship between cost, form manufacturing process and scale of production.
- Outline the advancements in both computer aided design and manufacture addressing the advantages and disadvantages of these systems.
- Investigate virtual modelling/testing methods as well as using rapid prototyping to create a working phone case that each student can use. Includes a modification that solves an additional problem.
- Comprehend and discuss how the choice of materials affect the use, care and disposal of products and how this links to the 6 R's of sustainability.
- Justify the importance for effective product design that considers the manufacture, maintenance, repair and disposal of a product in the context of sustainable design.
- Outline how nature and biomimicry can be used to inspire designers when creating products.

Key Learning

- Understand the following key terms unit production systems, vertical in-house production, modular/cell production, flexible manufacturing systems.
- Conduct a case study on the manufacturing of a product of students' choice and create a learning organiser.
- Use of CAD and CAM software in particular use of rapid prototyping methods.
- Create a hand drawn design sheet examining the disassembly of an existing product and ease of reassembly.
- Create a design sheet of a product of students choice that takes clear inspiration from biomimicry.

Assessment: Class and home assignments/Verbal questioning (Bloom) and class test, peer, and group assessment.

Resources: Booklet, Laminated safety signs in the classroom, Powerpoint presentations etc., Tools and machines.

February – End of Spring Term (6 weeks approx.)

Topics: Technological changes, Feasibility studies, Modern, Smart and composite materials, Creating design prototypes, Requirements for product design and development, Design Processes. Creation of a prototype suit of advanced armour.

Learning Outcomes:

- Outline impact of microelectronics on designing and manufacturing processes and how this has led to the advancement in new materials.
- List examples of and differentiate between Modern, smart, and composite materials, and their impact on modern industry.
- Justify the importance of testing the feasibility of designs through conducting tests, creating prototypes development of inclusive products, etc.
- Recognise the variety of design processes used by designers at both bespoke and mass production scales.
- Correctly use a wide range of tools and material to create a prototype of a modern armour set that solves a specific problem decided by the class.

Key Learning

- Explain what is meant by smart, modern and composite materials.
- Reflect on the significance of transistors in modern design and describe the importance they played in the form and function of modern products.
- Develop ability to work with a variety of modelling techniques to create a realistic prototype of an armour set.
- Work as a group to create a realistic and coherent design for the armour set.

Assessment: Class and home assignments/Verbal questioning (Bloom) and class test, peer, and group assessment.

Resources: Booklet, Laminated safety signs in the classroom, Powerpoint presentations etc., Tools and machines.

April – Summer Half-Term (7 weeks approx.)

Topics: Protecting designs and intellectual property, Enterprise and marketing in development of products, Accuracy in design and manufacture, Design for manufacture and project management.

Learning Outcomes:

- List and differentiate ways in which companies protect designs and intellectual properties.
- Outline what is meant by intellectual properties.
- Outline the importance of marketing and branding
- Identify the ways in which products are advertised and promoted, including the use of new technologies.
- Calculate product costing and profit.
- Identify the role of entrepreneurs, marketing and collaborative working with designer in the development of new innovative products.
- Comprehend how to use a range of measuring and marking out of equipment while justifying the importance of accuracy in manufacturing.
- Outline how testing can eliminate errors.
- Recognise the value of using manufacturing aids to ensure consistency of accuracy and the reduction of human error.
- Outline what is meant by quality control and justify its importance.

Key Learning

- Planning for accuracy and efficiency
- Using measuring and marking equipment.
- Using CAD to improve accuracy.
- Understand and explain each of the following terms: customer identification, corporate identity, packaging design, labelling, global marketing, advertising and promotion.
- Understand and explain each of the following terms: Copyright and design rights, patents, registered designs, trademarks and logos, open design.

Assessment: Class and home assignments/Verbal questioning (Bloom) and class test, peer, and group assessment.

Resources: Booklet, Laminated safety signs in the classroom, Powerpoint presentations etc., Tools and machines.

July – Summer End Term (6 weeks approx.)

Topics: NEA idea generation.

Learning Outcomes:

- Reflect on problems that effect the world on a global and local level and recognise the importance of designing to solve a problem.
- Effectively engage in communication with the wider populous and individual clients to understand and meaningfully apply problem solving skills that aid a client on a specific level.
- Analyse and discuss existing products and how they can be used to influence your design.
- Show in depth understanding and ability to adapt the work of influential designers and movements.

Key Learning

- Creating design problems based on real world, impactful problems.
- Conduct primary investigations, such as client interviews, surveys, site visits, product disassembly's, material experimentation etc.
- Conduct secondary research investigating the specific problem outlined, studies, blogs, deep dives etc.
- Create a design brief and specification on how you plan on solving the outlined problem.
- Using sketching and prototyping ideate some initial ideas that can be presented to a clieny.

Assessment: Class and home assignments/Verbal questioning (Bloom) and class test, peer, and group assessment.

Resources: Booklet, Laminated safety signs in the classroom, Powerpoint presentations etc., Tools and machines.