KESTEVEN AND SLEAFORD HIGH SCHOOL

Year 9 Design & Technology RM Scheme of Learning

Topic: Resistant Materials

Year 1– Term 6 (2 Terms - On Rotation)

Intent – Rationale

Students should: demonstrate an good understanding of Health and Safety; confidently use the workshop equipment accurately and safely; analyse existing products to establish functional design criteria; writeba design brief prioritising functional criteria; Understand the possible conflict between funtional and aesthetic design criteria; produce 3D prototypes and be able to convert to 2D design; present details of prototype withannotation to hightlight the funtional design solutions; understand how to convert a 3D prototype to a CAD solution with use of CAD for fine design modifications: understand how to use CAD to add aesthitic features to a functional design solution; Uderstand how CAD/CAM can be utilised to make products; understand the properties of thermoforming polymers (Acrylic & HIPS); understand how acrylic can be thermoformed on the strip heater; understand the principle of electronic circuits (components and microchips); understand how to build electronic circuits; understand how to use soldering to connect electronic components onto a pcb; understand how to use thermonforming techniques to make containers (polystyrene/vacuum forming)

Sequencing – what prior learning does this topic build upon?	Sequencing – what subsequent learning does this topic feed into?
• The safe use of tools & equipment in the workshop • Yr7 Creating 3D products in Resistant Materials • Yr8 working with acrylic – clock project • Understanding Resistant Materials for constructing outcomes	• Y10 – Design and Technology GCSE – Making prototypes • Y11 – Design and Technology GCSE – Appropriate use of CAD/CAM
What are the links with other subjects in the curriculum?	**What are the links to SMSC, British Values and Careers?**
• Business Studies – Understanding how consumer demand shapes design • Art – Presentation techniques to show the development process • Science - Understanding the properties of materials and how they can be changed	• Problem solving; independence; resilience; encouraging creativity; communication skills; confidence; organisation (GB4)
What are the opportunities for developing literacy skills and developing learner confidence and enjoyment in reading?	**What are the opportunities for developing mathematical skills?**
• Subject specific terminology throughout • Descriptive writing • Writing a sequence of events FROM THE LIBRARY *300 Years of Industrial Design;* A Heath-*604* *Cad/Cam Constructions*; S. Aikin-620.00 *Electronic Constructions*; S. Aikin-621.38 *Mechanical Construction*; S. Aikin-621	• Measurements throughout prototypes and outcomes • Use of scale to develop refined outcomes • Understanding dimensions on CAD • Geometric understanding

KESTEVEN AND SLEAFORD HIGH SCHOOL

Year 9 Design & Technology RM Scheme of Learning

2 Terms - On Rotation

Intent – Concepts

What knowledge will students gain and what skills will they develop as a consequence of this topic?	
Know **Students will need to understand:-** How to use a wider range of workshop tools independently; The properties and uses of acrylic and HIPS (High Impact Polystyrene); how acrylic can be wasted, formed and joined to create products; how wood can be wasted, joined to make formers; the working properties of acrylic and be able to 'hand work' and thermoform acrylic.; how understanding and evaluating existing products can assist in the generation of functional design solutions; how to produce prototypes to develop detailed design ideas; how CAD/CAM can be used to create both functional aesthetic features; how functional criteria can be modelled using traditional modelling techniques; how CAD can be used to refine functional design criteria; how to use traditional modelling techniques to produce a prototype; how CAD/CAM can be used to produce 3D functional outcomes; how formers need to be designed and constructed for vacuum forming; how HIPS can be thermo formed using a vacuum forming machine; how microchips work in a circuit; how to recognise an electronic component; how components can be soldered into a circuit **Apply** Use a wide variety of power tools and hand tools in a safe and productive way. (Base material -Acrylic) (Wood for former construction) Use hand techniques to cut, shape, form and finish acrylic and wood Identify key functional design criteria and use prototypes to model possible solutions Use investigation of functional design solutions through the making of prototypes Record the progress of the designing by prototype Design and make an individual product using a range of plastic changing techniques including CAD/CAM and thermoforming techniques Learn through the designing and making process to adapt and modify an outcome using a combination of strategies. Power tools, Hand techniques & CAD/CAM Use CAD create and refine a 3D outcome Use CAD as a method of 2D and 3D presentation and using a combination of techniques to design a functional outcome Use CAD/CAM with a prototype to refine and produce a unique 3D outcome (CAD & Laser Cutter) Use CAD/CAM to apply additional aesthetic features to a functional design solution **Extend** Use CAD/CAM to produce design and make a supplementary item Produce CAD based designs which utilise extensive slot together technology	
What subject specific language will be used and developed in this topic?	**What opportunities are available for assessing the progress of students?**

KESTEVEN AND SLEAFORD HIGH SCHOOL

• Functional V's Aesthetic design criteria • Thermoforming – principles of polymer forming (Strip Heater/ Vacuum Former) • Acrylic and HIPS (Polystyrene Sheet) as thermoforming polymers • Prototypes – developing functional solutions through physical modelling/testing • The 'Iterative Design' process through testing and evaluating throughout development phase • CAD – Computer Aided Design; Understanding & effective use of CAD • CAM; Laser cutter - Understanding & effective use of the cutter to shape materials • CAD/CAM – Understanding the process of designing and manufacture with CAD/CAM • Automated Production -Understanding automated processes • Electronics – Microchips, Electronic components • Capacitors, Resistors – Units & values • Soldering electronic components – safe use of soldering irons • Formers for Thermoforming; appropriate design and construction	• Research; functional design criteria; techniques – use prototypes and effective use of the iterative design process; finished product; diary of make; evaluation. • **Mid Project Review** • **Tracking points.** • **Final Assessment of completed project.**

KESTEVEN AND SLEAFORD HIGH SCHOOL

Intent – Concepts

Lesson title	Learning challenge	Higher level challenge	Suggested activities and resources
Functional v's Aesthetic design	Students will learn the difference between functional and aesthetic design considerations	Understanding some of the technical issues which arise out of the conflict of Function/Aesthetic appeal	Introduce the concept of Functional design V's Aesthetic design using familiar examples of everyday products.
Functional design criteria: Familiar Products	Students will learn to use their understanding of functional and aesthetic design by evaluating familiar household products	Understanding how market pull, fashion and trends can affect the conflict between functional/aesthetic design	Students to research familiar products to highlight/distinguish between functional and aesthetic
Project Brief Outline of project	Students will learn about the scope of the set project and how to ensure a unique outcome is designed	Several unique design features and use of high level CAD skills for incorporation of aesthetic features	Explain the project highlighting the priority to be given to functional design solutions
Review of 'Existing Products' to establish criteria	Students will learn how to seek design criteria from critical analysis of existing products	Use of other self-sourced existing products to broaden the understanding of functional design problems	Review of existing products to formulate functional design criteria
Individual criteria prioritisation & design brief	Students learn how to use the information gained from critical analysis to formulate key functional design criteria for their prototype	Detailed consideration of the key functional criteria giving a variety of solutions	Individual specific design criteria
Understanding rules of modelling/prototypes	Students will learn how to make 3D prototypes to meet their specific functional requirements	Extensive modelling with use of other materials eg plasticine, foam board etc	Introduction to modelling and use of prototypes. Demonstrate safe use of craft knifes for card models
Making prototypes	Students learn through experimentation how to build models/prototypes	Range of prototypes used to solve the different problems identified	Students reminded how to develop prototypes aimed at their priority criteria
Testing prototypes	Students learn how to use devices to test the function of their prototypes against the established criteria		Students reminded of how to use the iterative design process to develop solutions to their stated design criteria
Refining prototypes – Recording the progress	Students will learn how to use the iterative design process to evaluate and refine their prototypes recording the evidence of the changes		Using examples students taught how to evaluate, develop and refine their prototype model
Reminder of 2D CAD techniques & CAD/CAM uses	Students will learn how to use CAD to draw 2D versions of their models/prototypes	Investigate and use a wider range of CAD functions using the 'help' section	Students reminded of the CAD software and how it can be used for 2D design work
Using CAD to develop solutions from prototypes	Students will learn how to accurately convert a model in to a CAD design using a variety of techniques	Develop complex solutions meeting both functional and aesthetic design criteria Seek 3rd party input and use it to develop complex solutions	Students shown how to convert a 3D prototype to 2D CAD design. How to refine design solutions using CAD
Refining and testing using CAD	Students will learn to use CAD based outcomes for final testing prior to laser cutting		Students taught how to convert 2D CAD designs in to 3D models for final testing/checking
Introduction to thermoforming – strip heater	Students will learn how to safely use the strip heater for line bending. Use of scrap material to refine line bending skills		Students shown how to use the strip heater. Teacher demonstration. Students to use scrap acrylic prior to forming their outcome
Making the outcome	Students will learn how to use their strip heater skills to convert their 2D laser cut outcomes in to finished 3D outcomes	Making a complex outcome	Students using strip heater for thermoforming acrylic
Making the outcome	Students will learn how to use their strip heater skills to convert their 2D laser cut outcomes in to finished 3D outcomes		Students using strip heater for thermoforming acrylic

KESTEVEN AND SLEAFORD HIGH SCHOOL

Testing the outcome against the functional criteria	Students will learn how to use their unique design criteria to objectively evaluate their outcome		Students encouraged to use their priority design criteria to evaluate their outcome.
Introducing Electronics & Soldering	Students will learn the basics of electronic circuits to include microchips and components. Students will learn how to safely use soldering equipment	Investigate commercial production of micro chips Show an understanding of how miniaturisation enabled modern electronics	Teacher explanation of the principles of circuits, microchips and electronic components. Resistors & Capacitors. Teacher demonstration of safe use of soldering iron for soldering components onto a PCB
Assembling making the circuit	Students will learn how to identify and locate electronic parts on a PCB.		Students shown how to place parts on to a PCB. Reading resistor values, understanding polarity of capacitors
Thermoforming HIPS & making a former	Students will learn how resistant materials can be used to make a former. Students will learn the rules for former design. Students will learn how the vacuum forming machine forms HIPS		Through use of example models students are shown how to construct a former for vacuum forming. Draft angles and surface finishing.
Make/adapt a former	Students will learn the skills necessary for shaping and finishing a former in wood		Students shown how to make/adaft formers
Make a container	Students will learn how to use their former to produce a vacuum formed container		Students shown how the vacuum forming machine works. Teacher demonstration using existing formers
Record manufacturing methods	Students will learn how to produce an accurate account of their design/development and production of their outcome. Product Analysis; Unique prioritized design criteria, Model/prototype development (annotated photo's) ; CAD development; Methods & Electronics		Students reminded of the need to record all methods. Prototype making; photo's & annotation
			Use of the strip heater – line bending, Use of CAD – 'Screen Grabs' & annotation. Resistor Values table p81, Soldering techniques & equipment p83. Vacuum Forming diagrams & annotation.