Design & Technology Curriculum KS4 at Coombe Dean School

WESTCOUNTRY SCHOOLS TRUST

D&T intent	Our learners will develop the ability to solve problems creatively, using technological and design knowledge, underpinned by an understanding of the environmental impact of the made world.					
Core concepts	Creative problem solving	Design knowledge	Technical knowledge	Cultural and environmental awareness	Culinary knowledge	Nutrition and health

	Task	Core design/technical strand	Key knowledge: Conceptual	Key knowledge: Procedural	Wider knowledge	Key vocabulary	Assessment
Half term 1	Behaviour curriculum, workshop safety and PPE. Orthographic drawings will be provided to enable students to develop their ability to work independently and to solve problems. **Mainly Make task** **Wood and Plastic** Storage box and different wood joints (including plastic, vacuum forming after making a former) Students are to develop their knowledge of different materials and joining methods to manufacture a range of simple and complex components. These will be broken down to suit different briefs and scaffolded specifications. Success will be determined by the level of accuracy/tolerances achieved and the quality of each finished component. Key knowledge of material properties and specialist tools and equipment will also be developed. (Soft, hard, seasoning, kiln seasoning, manufactured timber, boards, props, flatpack)	Sources, origins and properties Environmental impact of materials Material selection The impact of forces and stresses Stock forms, types and sizes Scales of production Specialist tools and techniques Surface finishes and treatments Core knowledge:	What are the properties of pine compared with plywood? How does grain structure affect performance? What is the impact of deforestation and how can a designer minimise the ecological footprint of a product? What are the aesthetic and functional differences between pine and plywood? Laminating of plywood and advantages of joining methods Sections and sheet material – natural vs manmade One off and jigs Lamination, jigs, formers, veneers, adhesives, temporary fixings Varnish Materials ability to withstand forces and stresses	Understand how to measure, mark and cut the following joints: • Mortise and tenon • Dowel • Lap • Finger • half lap with hand router • line bent acrylic • screwed temporary • Tensol cemented joint Understand how to interpret an orthographic drawing Understand how to produce accurate components within a given tolerance Ikea assembly task/demonstration???	The SIX R's of sustainability. Rethink, Reuse, Recycle, Repair, Reduce and Refuse.	Mortice Tenon Rebate Accuracy Tolerance Jig Laminating Adhesive Deforestation Ecological Aesthetic **Use of Frayer models to deliver complex vocabulary below:** Accuracy Tolerance Jig	Microsoft Forms quiz – questions at the end of the SOW. Exam questions to prepare students for Summer 2024 Homework: See independent learning section at the end of SOW – Mental health chair design task
Half term 2	Design and make task **What a mess!** With the population increasing, homes are becoming smaller, however, our consumption of products is increasing. Where do we keep them all??? Design and make a prototype for something that can store, organise, hold something used daily. Research and decide potential problems and develop a 'client'. Student to complete a task analysis to determine what will be stored and where. Student to find out key data, including critical measurements to inform designing and modelling. Write a design brief and specification Create 2 separate design ideas and model using card. One per lesson. Design and model a card prototype gadget tidy/controller stand/jewellery stand etc. Use 2D design software to create laser files for card modelling Assemble card models and refine design files to be produced from 3mm acrylic.	Context, research, design brief and specification. Generating and developing design ideas Manufacturing prototypes (modelling) Analysing and evaluating design decisions	Understand and apply the design process Research example products and analyse them to determine function, materials etc Use isometric style to present design ideas and annotate them against specification Model idea using card and evaluate. Photograph models and sketch over the top of photos (take opacity down to 50%) Refine idea and produce 2D design files before laser cutting. Bend any parts using line bender and glue using tensol cement.	Understand and apply the design process Show an understanding of user needs and how they inform design thinking Demonstrate how to write a specification in response to a design brief Understand the design process and how good ideas are born out of context, identifying a problem, user needs/wants. Follow the iterative design process to create ideas that meet the needs of the user. Follow the isometric drawing principles to present design ideas to a high visual standard. Use annotation to explain features of the designs and how they meet the needs of the user	Market pull – responding to demands from the market. Technology push – development in materials and components, manufacturing methods. Advantages and disadvantages of the use of computer aided manufacture (cam). How cam equipment can be used in a variety of applications: cnc embroidery, vinyl cutting, cnc routing, laser cutting and 3d printing.	Iterative Specification Annotation Isometric Prototype CAD CAM **Use of Frayer models to deliver complex vocabulary below** Annotation Specification Prototype	Microsoft Forms quiz – questions at the end of the SOW. Presentation of work and student led evaluation. Homework: See independent learning section at the end of SOW – Mental Health chair design task

	Design and make task Once final design has been decided, start to develop CAD files that can be laser cut or CNC'd. Test using 3mm cardboard and refine until correct. Use iterative design process to check final design meets user needs and specification Continue with manufacture if prototype. Students taught to independently use laser cutter with support from teacher/technician Evaluate the final prototype against the design idea and original specification.	Context, research, design brief and specification. Generating and developing design ideas Manufacturing prototypes (modelling) Analysing and evaluating design decisions Sources, origins and properties Environmental impact of materials Material selection The impact of forces and stresses Stock forms, types and sizes Scales of production Specialist tools and techniques Surface finishes and treatments	Understand and apply the design process Research example products and analyse them to determine function, materials etc Use isometric style to present design ideas and annotate them against specification Model idea using card and evaluate. Photograph models and sketch over the top of photos (take opacity down to 50%) Refine idea and produce 2D design files before laser cutting. Bend any parts using line bender and glue using tensol cement.	Demonstrate iterative design process through modelling of ideas using card Demonstrate correct and independent use of laser cutter Demonstrate correct use of tools and equipment to make and assemble prototype	The importance of sustainability issues and environmental issues when designing and making. Social, cultural, economic and environmental responsibilities in designing and making products.	Iterative Specification Annotation Isometric Prototype CAD CAM **Use of Frayer models to deliver complex vocabulary below**	Microsoft Forms quiz – questions at the end of the SOW. Presentation of work and student led evaluation. Homework: See independent learning section at the end of SOW – Mental Health chair design task
Christmas Holidays							

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	Task	**Core design/technical strand**	**Key knowledge – Conceptual**	**Key knowledge – Procedural**	**Wider knowledge**	**Key vocabulary**	**Assessment**
Half term 3	**Mainly make task** **Metal** Students are to develop their knowledge and understanding of a variety of metal-based manufacturing processes. Pewter casting and metal drilling, filing and bending. They will be provided with orthographic drawings and will be required to interpret them and demonstrate the ability to work accurately and to a given tolerance. Students will be expected to work independently from Teacher demonstrations. **Develop metal make task with T Ward. Pewter casting? (Coat hook/medal?)** **DATA Resource? Charles Rennie Mackintosh.** https://www.designtechnology.org.uk/shop-products/hot-stuff-pewter-casting-key-resources/	Sources, origins and properties Environmental impact of materials Material selection The impact of forces and stresses Stock forms, types and sizes Scales of production Specialist tools and techniques Surface finishes and treatments	Know the primary sources of materials and how they are used to produce metals and alloys Be able to recognise and characterise different types of ferrous and non-ferrous metals Understand how the physical and working properties of Aluminium and steel affect their performance Understand, in detail, the process of sand casting. Understand, in detail, the process of brazing Understand, in detail, the process of metal bending and riveting Understand, in detail, the process of milling	Recall and apply the steps to set up and pack a sand-casting mould Recall and apply correct steps and terminology to successfully and safely braze two steel parts together. Recall and apply steps to measure, mark, cut, drill, bend and rivet 2 pieces of aluminium. Recall and apply the steps required to safely mill the surface of an aluminium block and also mill a slot.	Issues surrounding the use of fossil fuels: coal, oil and gas. The advantages and disadvantages of renewable energy sources	Ferrous Non- ferrous Alloy Capillary action Casting Fettling **Use of Frayer models to deliver complex vocabulary below** Ferrous Casting	Microsoft Forms quiz – questions at the end of the SOW. Exam questions to prepare students for Summer 2024 Homework: Researching and Designing the pewter casting outcome

Half term 3 and 4?	Design and make task **Electronics, Health and Safety** **Glow** – students to develop the LED light made in KS3 using the iterative proess. Students to develop knowledge of designing and generating CNC files using 2D design software Basic circuit knowledge re taught from KS3. Safe and correct use of soldering irons. Teacher to ensure correct H&S protocols are taught along with hazards. Soldering irons are 400 o C + and solder is 180 0 C +. Burns should be held under cold running water for 10 minutes. Please see risk assessment Mortice and tenon joint using CNC – comparison to wood skills stick where the same joint was made by hand	Context, research, design brief and specification. Generating and developing design ideas Manufacturing prototypes (modelling) Analysing and evaluating design decisions Sources, origins and properties Environmental impact of materials Material selection The impact of forces and stresses Stock forms, types and sizes Scales of production Specialist tools and techniques Surface finishes and treatments	CAD and CAM - CNC - 2D design Advantages and disadvantages of CNC Commercial manufacture Basic circuits – LED, switch, resistor, circuit symbols, circuit diagram Soldering safety – Soldering irons reach temps of almost 400 degrees Solder has a melting point of about 180 degrees. Solder and manufacture letter light using copper tape. Conductivity of metals Physical and working properties of plywood, to include toughness, strength, hardness and grain structure Aesthetic properties of manufactured boards – MDF vs chipboard vs plywood vs melamine One off prototype vs batch production Jigs and CAM CAD and CAM to support repeatability Jointing – mortise and tenon and tensol cement Laser cutting	Follow teacher instruction to design the 'letter' element of the light Follow same procedure to produce a base. Generate files to enable design to be CNC'd out of plywood. Student to demonstrate the ability to use the offset tool in 2D design and to save the file and email it to Technician/Teacher. Use equipment correctly and safely to solder component parts of circuit. Demonstrate fault finding techniques to ensure LED lights up		CAD CAM CNC Soldering Circuit Diagram **Use of Frayer models to deliver complex vocabulary below** Circuit Diagram	Microsoft Forms quiz – questions at the end of the SOW. Exam questions to prepare students for Summer 2024 Homework: Research lights made from recycled materials
Feb Half term							

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	Task	**Core design/technical strand**	**Key knowledge**		**Wider knowledge**	**Key vocabulary**	**Assessment**
			Conceptual	**Procedural**			
Half term 4 week 1	Final soldering of components and assembly of parts		Soldering H&S Evaluate, using informed judgements, prototypes to determine	Use soldering equipment safely and correctly to finish soldering circuit parts and ensure a working prototype is produced.			Microsoft Forms quiz – questions at the end of the SOW. Exam questions to prepare students for Summer 2024
Half term 4 from week 2	Design and make (model) task **MINI NEA** **The great outdoors** Produce a design brief and specification for the design and model of a piece of outdoor furniture. Teach surface treatments and finishes.	Context, research, design brief and specification. Generating and developing design ideas Manufacturing prototypes (modelling) Analysing and evaluating design decisions	Outdoor furniture - Follow a design brief to design and model a piece of outdoor furniture. Students to research existing products and analyse them. Students to produce a basic specification to evaluate their final ideas against. Students to hand sketch 3-4 different design ideas using the iterative design process and specification. Students to produce basic fusion 360 models and a render.	Students to demonstrate understanding of creating a design brief and specification. Students to follow the iterative design process to design and develop a series of ideas for their outdoor furniture Students to use card to create basic models of their design ideas Teacher to photograph models so that students can iteratively improve design ideas.	The SIX R's of sustainability; rethink, reuse, recycle, repair, reduce and refuse. Life Cycle Analysis to determine the environmental impact of a product.	Design brief Specification Iterative design Prototype Annotation CAD CAM Scale	Microsoft Forms quiz – questions at the end of the SOW. Exam questions to prepare students for Summer 2024 Homework: Research recycled outdoor furniture

			Students to use basic tools and equipment and common materials to produce a scaled prototype of their design ideas. Students to evaluate final model against their original specifications.	Prototype final scale models of final design idea Evaluate final model and design against original design brief and specification Use peers to support evaluation of final prototype.	Technology push – development in materials and components, manufacturing methods. Brothers make video about plastic extrusion to manufacture benches	**Use of Frayer models to deliver complex vocabulary below** Scale Prototype	
Easter Holidays							

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Half term 5	**Mainly make task** Use orthographic drawings provided to manufacture the marquetry/laminated/joint box. Students to develop their understanding of interpreting orthographic drawings and working accurately, within set tolerances provided by the drawings. Use of hand tools and equipment will need to be readdressed to ensure students can identify and use them correctly. DRR TO PROVIDE BEFOREHAND	Sources, origins and properties Environmental impact of materials Material selection The impact of forces and stresses Stock forms, types and sizes Scales of production Specialist tools and techniques Surface finishes and treatments	What is a former/jig and how can they be used to created curved forms using flexi ply. Working properties of flexi ply with focus on grain structure Importance of glue and setting up the former and layers to maximise final output. Using a hand router (link to wood joint skills stick) to create the lap joints	Use jig to form laminated corner of box using 2 layers of flexi ply Demonstrate an understanding of grain structure and how it impacts manufacture. Use of PVA glue to laminate flexi ply. Demonstrate safe use of hand router to create lap joint for corner of box.	The functions of mechanical devices, to produce different sorts of movement, changing the magnitude and direction of forces. To include: • Pulley systems • Gear systems • Levers and linkages • Cams	Properties Toughness Hardness Laminating Marquetry Accuracy Tolerance Orthographic Dimension Manufacture Adhesive Abrasive Grain structure Aesthetics	Microsoft Forms quiz – questions at the end of the SOW. Exam questions to prepare students for Summer 2024 Homework:
			The advantages of using lap joints over finger joints Safe use of the hand router Softwoods compared to manufactured boards	Be able to articulate the difference between finger and lap joints. Be able to articulate the difference between pine and plywood			
			Measuring, marking and cutting a finger joint Correct selection of tools Working accurately to set tolerance	Demonstrate accurate measuring and marking out and the ability to interpret an orthographic drawing. Work as close to a given tolerance as possible.			
			Using a jig to create a dowel joint Accurate marking and cutting of parts	Articulate what a jog is and how they aid manufacture. Use a dowel jig to create another joint for the box.		**Use of Frayer models to deliver complex vocabulary below**	
			Marquetry and use of laser cutter CAD/CAM to support complex manufacture. Focus on grain structure and aesthetics of marquetry Use of vac bag to support gluing process	Understand the properties of hardwood compared to softwood. Demonstrate independent use of veneers to create a marquetry pattern on the lid of the box.		Tolerance Toughness Abrasive	

			Manufactured boards and their advantages – plywood for base of lid and hardboard for base of box				
			Final assembly and finish of box. Discuss different finishes and the appropriateness for various materials and products	Continue to work independently to complete and assemble the parts of the box and apply a finish.			
May Half term							

Half term 6	NEA introduction and preliminary exploration around contexts released by exam board eduqas Part of WJEC	Context, research, design brief and specification. Generating and developing design ideas Manufacturing prototypes (modelling) Analysing and evaluating design decisions Sources, origins and properties Environmental impact of materials Material selection The impact of forces and stresses Stock forms, types and sizes Scales of production Specialist tools and techniques Surface finishes and treatments	Introduce NEA contexts for initial task analysis and mind mapping.			**Use of Frayer models to deliver complex vocabulary below**	
			Research into contexts and potential NEA direction				
			Exploratory design ideas relating to research to date				
			Enrichment week				

Design & Technology Curriculum KS4 at Coombe Dean School year 11

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	Task	**Core design/technical strand**	**Key knowledge**		**Wider knowledge**	**Key vocabulary**	**Assessment**
			Conceptual	**Procedural**			
	Identifying and investigating design possibilities.	Context, research, design brief and specification. Generating and developing design ideas Manufacturing prototypes (modelling)	Identify looking at areas and opportunities in which designs can take place. Investigate pursuing ideas and gathering information relating to a context	Research the contexts Research the need Develop a task analysis Identify a client Investigate the work of relevant professionals		Research Investigate Explore Analyse	

		Analysing and evaluating design decisions Sources, origins and properties Environmental impact of materials Material selection The impact of forces and stresses Stock forms, types and sizes Scales of production Specialist tools and techniques Surface finishes and treatments	Identify and investigate are interdependent - the processes work together and take place in no particular order	Undertake a product analysis(s) of similar / parallel product(s) Investigate materials and methods Research relevant product constraints / sizes / locations		Constrain	
	Developing a design brief and specification.		To understand the purpose of a brief and how it frames a project To understand the purpose of and develop a specification in order to lead designing	Outline to produce a design brief and specification to inform AO2		Communicate Develop Isometric Exploded views CAD Modelling Orthographic	
	Generating and developing design ideas.		To develop and communicate ideas effectively. Quick generation of ideas Idea development Presentation techniques Use of isometric Exploded views / call outs Modelling techniques CAD Generation of a detailed design Orthographic projection Cutting list Manufacturing instructions	Design the generation and development of ideas that can be presented to a third party, and can be evaluated and tested (however, the actual analysis and evaluation forms part of AO3)			
	Manufacturing a prototype.		Product development At this point, all projects are different and use a range of materials and processes which is relevant to particular designs	Prototype an appropriate working solution to a need or want that is sufficiently developed to be tested and evaluated (for example, full sized products, scaled working models or functioning systems). Fit for purpose (prototype) in addition to being a working solution, addressing the needs/wants of the intended user.		Manufacture. Specific equipment tools and equipment Development Manufacture Prototype Manufacture	
Easter Holidays							

Independent Learning

Half term 1 and 2	**Mainly design task** Students are to follow the design process from research, design brief, specification and producing design ideas to design a chair to support the improvement of mental health.	Context, research, design brief and specification. Generating and developing design ideas Analysing and evaluating design decisions	How contexts inform outcomes Identify needs and wants of users Explore and investigate existing products Write specifications derived from needs etc Iterative design process, annotation Develop/refine and modify ideas based upon own opinion/decisions of others Isometric/orthographic Evaluate, using informed judgements, prototypes	Understand the design process and how good ideas are born out of context, identifying a problem, user needs/wants. Follow the iterative design process to create ideas that meet the needs of the user. Follow the isometric drawing principles to present design ideas to a high visual standard.	Research into existing products of Phillipe Starck Example chairs to use for analysis – physical and or pics (DRR to provide Eames chair).	Iterative Specification Annotation Isometric Orthographic Prototype Ergonomics Anthropometrics	MCQ's Presentation of work and student led evaluation.
	The iterative design process will be taught and explored to enable students to compare their design ideas against their initial design brief and specification. Design ideas will be presented in isometric format with clear annotation related to materials, manufacturing processes and details about how the design meets the spec. Card models of ideas and evaluated against specification. Iterative design process followed to improve ideas.					**Use of Frayer models to deliver complex vocabulary below:**	Homework:

	Design ideas will be presented in isometric format with clear annotation related to materials, manufacturing processes and details about how the design meets the spec. Final evaluation (peer supported) of final design against spec.			Use annotation to explain features of the designs and how they meet the needs of the user		Ergonomics Anthropometrics Iterative	

Homework questions to be set in line with the KO to support independent learning and subject knowledge.

Outline the properties of ferrous metals giving examples of different types	Can you outline the environmental impact of using aluminium in common products like: bicycles, foil wrapping and laptops.
Cog wheels are sometimes made from nylon a. Name two properties that make it suitable for this product	Explain what CAM is
Explain the disadvantages of using CAM in design	How could ICT be used to gather information from possible clients and how would this benefit the design process?
What can be used to improve the appearance and durability of manufactured boards?	Explain the advantages of using softwood in construction
Explain why photochromic glass might be used in a pair of glasses	Can you justify using Quantum Tunnelling Composite in a robotic hand
Explain how plywood is manufactured. Use sketches to help explain	Identify some advantages and disadvantages in the use of manufactured boards instead of real wood
Can you identify some wood joints? Sketch two examples	Explain the one advantage and one disadvantage of using smart glass on a modern home
Can you explain why a card restaurant menu would be laminated?	Can you explain two advantages of using carton boards for retail packaging?
In terms of sustainability discuss the use of unprotected steel to produce a bike frame	Why does a surface finish need to be applied to mild steel?
State three types of CNC Machine and state what you might use them to manufacture	Designers can make use of Computer Aided Design (CAD) software to produce virtual models of their designs. Explain the advantages and disadvantages of using CAD for virtual modelling instead of traditional modelling techniques
In terms of sustainability discuss the use of plastic for a milk bottle.	In terms of sustainability can you compare the use of stainless steel and biodegradable polymers as a material for the following common household product: Cutlery (knives and forks?)
A popular fast food chain has decided to use foil lined board for the packaging of their latest burger. Can you give reasons in relation to the foil lined boards working properties (flexibility, weight, surface finish and absorbency) why they selected this material?	Explain two advantages of using manufactured boards
Explain how a 3D Printer is effective in the development of a rapid prototype design	Discuss how the use of Computer Aided Design (CAD) has helped graphic designers. Give examples to support your answer
Give one common use of brass and explain why it is a suitable material for this use	Explain the process for galvanising a metal