Design and Technology Curriculum Intent

Department Philosophy: Our delivery of Product Design, Textiles and Food is an inspiring, rigorous and practical group of curriculum subjects. It encourages students to learn to think and intervene creatively to solve problems both as individuals and as members of a team. It should always be an adventure where the ending is not necessarily what was intended from the start. We encourage students to use their creativity and imagination, to design and make products that solve real and relevant problems within a variety of contexts, considering their own and others' needs, wants and values. We want our students to become logical thinkers who are also analytical in their approach to any given problem. We aim to, wherever possible, link work to other disciplines such as mathematics, science, engineering, computer science and art. The students are also given opportunities to reflect upon and evaluate past and present DT and Food innovations, their uses and effectiveness. It is also our intent to teach students the principles of healthy eating and living and enjoy learning how to cook. We encourage them all to become innovators and risk-takers.

By the end of Key Stage 3 our students will know:	By the end of Key Stage 4 our students will know:	By the end of Key Stage 5 our students will know:
Design 1. *Use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups.* 2. *Generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional diagrams, prototypes, recipes, pattern pieces and CAD (Computer Aided Design)* ***Make*** 3. *Select from and use a wider range of tools, machines and equipment to perform practical tasks (for example, cutting, shaping, joining and finishing) accurately. This should also include C.A.M (Computer Aided Manufacture) where possible.* 4. *Select from and use a wider range of materials and components, including woods, metals, plastics, electronic components, textiles and ingredients, according to their functional properties and aesthetics or sensory qualities.* ***Evaluate*** 5. *Investigate and analyse a range of existing products.* 6. *Evaluate their ideas and products against their own design criteria and consider the views of others to improve their work.* 7. *Understand how key events and individuals in DT and food have helped shape the world and the environment.* ***Technical knowledge*** *Our students will be able to:* 8. *Distinguish between different materials and have a knowledge of their properties.* 9. *Understand the principles of levers, mechanical advantage and linkages.*	***Design*** 1. *Use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups. This will also involve user centred design research and an iterative approach to all design problems.* 2. *Generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional diagrams, prototypes, pattern pieces and CAD (Computer Aided Design)* ***Make*** 3. *Select from and use a wider range of tools, machines and equipment to perform practical tasks (for example, cutting, shaping, joining and finishing) accurately. This will also include C.A.M (Computer Aided Manufacture) with the laser cutter, vinyl cutter and 3D printer.* 4. *Select from and use a wider range of materials and components, including woods, metals, plastics, electronic components and textiles according to their functional properties and aesthetics or sensory qualities.* ***Evaluate*** 5. *Investigate and analyse a range of existing products.* 6. *Evaluate their ideas and products against their own design criteria and consider the views of others to improve their work.* 7. *Understand how key events and individuals in DT have helped shape the world and the environment. A list of designers and art movements is listed in the GCSE spec.* ***Technical knowledge*** *Our students will be able to:* *Under the heading of New and Emerging Technologies understand-*	***Design*** 1. *Use relevant research and develop design criteria in a detailed specification to inform the design of a product or an architectural model that is fit for purpose, aimed at particular individuals or groups. This will also involve user centred design research and an iterative approach to all design problems. Students will need to find a live client who will provide feedback for all their design developments.* 2. *Generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional diagrams, prototypes, orthographic projections, planometric drawing, isometric projections and CAD (Computer Aided Design)* ***Make*** 3. *Select from and use an even wider range of tools, machines and equipment to perform practical tasks (for example, cutting, shaping, joining, casting and finishing) accurately. This will also include C.A.M (Computer Aided Manufacture) with the laser cutter, vinyl cutter and 3D printer. Heavier machinery will also be used such as the lathe and milling machine.* 4. *Select from and use an even wider range of materials and components, including woods, metals, plastics, electronic components and textiles according to their functional properties and aesthetics or sensory qualities.* ***Evaluate*** 5. *Investigate thoroughly and analyse a range of existing products.* 6. *Evaluate their ideas and products against their own design criteria and specification. Consider and take action on the views of client feedback to improve their work.*

10. *Understand and use electrical systems in their products.* 11. *Use tools and equipment competently and safely.* 12. *Communicate their ideas in a variety of technical techniques both traditional and using CAD.* 13. *Understand how gears work and their uses.* 14. *Join materials together using a variety of techniques or processes.* 15. *Have a good understanding of our impact on the environment and how we can limit our carbon footprint.* 16. *Understand how energy is created and how sustainable energy sources are being developed.* 17. *Understand how food nutrition relates to a healthy lifestyle.* 18. *Relate science to food and nutrition.* 19. *Know how to use ingredients in a hygienic and safe manner.* 20. *Understand how to make correct food choices and the provenance of what they are eating.*	8. Industry and Enterprise 9. Sustainability and the environment 10. People, culture and society 11. Production techniques and systems 12. Informing Design Decisions 13. *Under the heading of Energy, materials, systems and devices understand-* energy generation energy storage Modern Materials Smart Materials composite materials and technical textiles systems approach to designing electronic system processing mechanical devices 14. *Under the heading of materials and their working properties understand-* papers and boards natural and manufactured timbers metals and alloys polymers textiles 15. *Under the heading of timber based materials understand-* sources, origins and properties working with timber based materials commercial manufacturing, surface treatments and finishes 16. *Under the heading of designing and making principles understand-* investigation, primary and secondary data the work of others design strategies communication of design ideas and prototype development 17. *Under the heading of making principles understand-* selection of materials and components tolerances and allowances material management and marking out specialist tools, equipment, techniques and processes surface treatments and finishes	7. *Understand how key events and design movements have helped shape the world and the environment. A list of designers and art movements is listed in the A level spec.* ***Technical Knowledge*** ***Woods:*** *a) hardwoods - oak, mahogany, beech* *b) softwoods – pine* ***Metals:*** *a) ferrous metals – mild steel, carbon steels, cast iron b) non-ferrous metals – aluminium, copper, zinc* *c) alloys (ferrous and non-ferrous) – stainless steel, duralumin, brass.* ***Polymers:*** *a) thermoplastics – acrylic, polyethylene, polyethylene terephthalate (PET), polyvinyl chloride (PVC), polypropylene (PP), acrylonitrile butadiene styrene (ABS) b) thermosetting plastics – epoxy resins (ER), urea formaldehyde (UF), polyester resin (PR)* *Composites:* *a) composites – carbon fibre (CFRP), glass fibre (GRP), Medium Density Fibre Board (MDF), chipboard, plywood.* *Papers and boards:* *a) drawing papers – layout, tracing, copier, cartridge b) commercial printing papers – bond, coated* *c) boards – mounting board, recycled card, corrugated board, folding box board, foil-lined board.* ***Textiles:*** *a) natural fibres – cotton, linen, wool* *b) manmade fibres – nylon, polypropylene, polyester c) textile treatments – flame resistant, polytetrafluoroethylene (PTFE).* *Smart and modern materials:* *a) thermo-ceramics* *b) shape memory alloys (SMA)* *c) reactive glass* *d) liquid crystal displays (LCD)* *e) photo-chromic materials f) thermo-chromic materials* *g) quantum tunnelling composites.* ***Performance characteristics of woods, metals, polymers, smart and modern materials, papers, boards, textiles and composites in order to discriminate between materials and select appropriately:*** *d) plasticity* *e) malleability f) ductility* *g) hardness* *j) biodegradability* ***Processes, applications, characteristics, advantages and disadvantages of the following,*** *in order to discriminate between them and select appropriately including the selection of specific*

		and relevant tools to be used for domestic, commercial and industrial products and systems, and use safely when experimenting, improving and refining in order to realise a design: *a) heat treatments – hardening and tempering, case hardening, annealing, normalising (including use of specialist tools)* *b) alloying (basic)* *d) casting – sand, die* *e) machining – milling/routing, drilling, turning, (including use of specialist tools)* *f) moulding – blow moulding, injection moulding, vacuum forming, extrusion, rotational moulding (including use of specialist tools)* *g) lamination (including use of specialist tools)* *lamination (paper and board only)* *Application of specialist measuring tools and equipment to determine and apply the accuracy and precision required for products to perform as intended.* *g) jigs and fixtures* *Use of media to convey design decisions, to record to recognised standards, explain and communicate information and ideas using the following methods and techniques:* *a) pictorial drawing methods for representing 3D forms – isometric, 2-point perspective* *b) working drawings for communicating 2D technical information – 3rd angle orthographic projection,* *c) nets (developments) for communicating information about 3D forms in a 2D format* *d) translation between working drawings, pictorial drawings and nets (developments).* ***Uses, characteristics, advantages and disadvantages of the following permanent and semi-permanent joining techniques in order to discriminate between them, select appropriately and use safely:*** *a) adhesives – contact adhesive, acrylic (tensol) cement,epoxy resin, polyvinyl acetate (PVA), hot melt glue, polystyrene cement (including use of specialist tools)* *b) mechanical – screws, nuts, bolts, washers, rivets, (including use of specialist tools)* *c) heat – oxy-acetylene welding, MIG welding, brazing, hard soldering (including use of specialist tools)* *Application, advantages and disadvantages of the following finishing techniques and methods of preservation in order to discriminate between them and select appropriately for use, including for the prevention of degradation:* *a) finishes – galvanization* *b) paper and board finishing process – laminating, varnishing, hot foil blocking, embossing (including use of specialist tools).* *Set up, safe and accurate operation, advantages and*

		disadvantages of the following digital technologies: *a) computer-aided design – 2D and 3D design to create and modify designs and create simulations, 3D modelling for creating 'virtual' products.* *b) computer-aided manufacture and rapid prototyping – CNC lathes, CNC routers, CNC milling machine, CNC laser, rapid prototyping.* ***Principles, applications and the influence on design of anthropometrics and ergonomics:*** *a) sources and applications of anthropometric data* *b) ergonomic factors for a designer to consider when developing products and environments with which humans react.* *The influence of aesthetics, ergonomics and anthropometrics on the design, development and manufacture of products:* *a) form over function* *b) form follows function.* *Design theory through the influences and methods of the following key historical movements and figures:* *a) Arts and Crafts – William Morris* *b) Art Nouveau – Charles Rennie Mackintosh c) Bauhaus Modernist – Marcel Breuer* *d) Art Deco – Eileen Gray* *e) Post Modernism – Philippe Starck f) Streamlining – Raymond Loewy* *g) Memphis – Ettore Sottsass.* ***Current and historical technological developments that have had an effect on the work of designers and technologists and their social, moral and ethical impacts:*** *a) mass production – the consumer society, built-in obsolescence, the effect mass production has on employment* *b) the 'new' industrial age of high-technology production – computers and the development and manufacture of products, miniaturisation of products and components, the use of smart materials, products from innovative applications* *c) the global marketplace – multinational companies in developed and developing countries, manufacturing 'offshore' in developing countries and local and global production.* ***Adopting safe working practices, recognise and react to potential hazards:*** *a) understanding safe working practices for yourself and others when designing and making, including when selecting and safely using machinery, equipment and tools in order to ensure safe working environments* *b) understanding the need for risk assessments – identification of potential hazards, identification of people at risk, evaluation of risks, implement control measures, recording*

		and storing of risk assessment documentation. *Characteristics and stages of the following methods of production when applied to products and materials:* *a) one-off production b) batch production* *c) high-volume production.* ***Characteristics, application, advantages and disadvantages of the following types of quality monitoring systems:*** *a) quality control – the monitoring and achieving of high standards and degree of tolerance by inspection and testing, computer-aided testing* *b) quality assurance – monitoring the quality of a product from its design and development stage, through its manufacture, to its end-use performance and degree of customer satisfaction* *c) Total Quality Management (TQM) – when applied to quality assurance procedures and its impact on employees at every stage of the production process, ISO 9000.* ***Characteristics, processes, application, advantages and disadvantages and the importance of considering accuracy of production and efficiency of modern manufacturing methods and systems when designing for manufacture for small, medium and large scale production:*** *a) production scheduling and production logistics* *b) robotics in production – robots on fully-automated production and assembly lines/cells* *c) materials handling systems – automated storage and retrieval systems (ASRS), automatic guided vehicles (AGVs)* *d) flexible manufacturing systems (FMS), modular/cell production systems* *e) lean manufacturing using just-in-time (JIT) systems g) quick response manufacturing (QRM)* *h) data integration – product data management (PDM), enterprise resource planning (ERP) systems i) concurrent manufacturing.* ***Characteristics, application, advantages and disadvantages of 'cleaner' design and technology – a product's life cycle in relation to the following sustainable development issues:*** *a) material selection – source, quantity, quality, range, recyclability, biodegradability* *b) manufacture – minimising energy use, simplification of processes, achieving optimum use of materials and components, giving consideration to material form, cost and scale of production* *c) distribution – efficient use of packaging, reduction of transport, alternatives to fossil fuels* *d) use – repair versus replacement, energy efficiency, efficiency ratings* *e) repair and maintenance – standardisation, modular*

		construction, bought in parts *f) end of life – design for disassembly, recovered material collection, sorting and re-processing methods, energy recovery, environmental implications of disposal to landfill.* *The wider issues of using cleaner technologies:* *b) sustainability – designing without jeopardising the potential for people in the future to meet their needs.* *From the consumer's point of view the implications of consumer rights legislation to consumers and manufacturers:* *a) Consumer Rights Act (2015)* *b) Sale of Goods Act (1979).* ***The principles and applications of health and safety laws and regulations and their impact on the designing and making process, including the consequences of non-adherence:*** *a) health and safety regulation – the Health and Safety Executive and an awareness of relevant regulations to manufacturing industries* *b) Health and Safety at Work etc Act (1974) – the procedures to safeguard the risk of injury to people: personal protective equipment (PPE), signage, warning symbols* *c) Control of Substances Hazardous to Health (COSHH) regulations – the storage and use of solvent-based substances containing volatile organic compounds (VOCs).* *Collection, collation and analysis of information and the use of this to make informed decisions:* *a) marketing – marketing analysis* *Modelling the costing of projects to achieve an optimum outcome:* *b) planning for production – allocation of: - employees* *- materials* *- scale of production* *c) selection of appropriate tools, machines and manufacturing processes.* ***The importance, implications and ways of protecting the intellectual property rights of designers, inventors and companies:*** *a) patents b) copyrights c) design rights d) trademarks.* ***Implication to designers, manufacturers and consumers of the following standards when developing designs and manufacturing products:*** *a) British Standards (BSI and kite mark)* *b) European (CEN and CE)* *c) International Standards (ISO)*