P16

POST 16 SUBJECT OVERVIEW

Name of Subject - A Level Design and Technology (Product Design)

Which Examination Specification is Studied for this Course?
Edexcel Pearsons, Qualification Number: 603/0697/X

Why should I study this course? -

An A Level in Design and Technology enables students to participate successfully and with confidence in an increasingly technological world. They will learn from the wider influences on the subject including historical, social, cultural, environmental and economic factors. This course provides an exciting opportunity to gain the skills and qualifications required for a career in design.

Students will develop a knowledge and understanding of a wide range of materials and processes used in the field of design and technology. They will foster a greater understanding of how products can be designed and manufactured. Students will also learn about industrial and commercial practices, and the importance of health and safety issues alongside appreciating the responsibilities that design technologists have in protecting our planet for the future.

The course is thought-provoking and stimulating, whilst being fast-moving, packed full of opportunities for students to apply their knowledge and creativity.

Who is suitable to study this course?
Design and Technology is a multidisciplinary subject that ties many other areas of learning together, in particular STEAM subjects (Science, Technology, Engineering, Art and Maths) Students who typically study an A Level in D&T will have good mathematical skills and have the confidence to innovate and produce creative design solutions as they develop their own design brief with a client/end user. A lot of our students will go on to study a form of Design and Technology at University such as Architecture, Product Design, Industrial Design or enter a higher apprenticeship. Students thinking of taking A Level in D&T should show an aptitude for problem solving and functionality of products as well as an appreciation for the role that aesthetics can play in developing a successful product.

What GCSE Qualifications Support the Study of this Course?
A GCSE in Design and Technology would be beneficial but not essential if you are a hardworking and motivated student. GCSE in Mathematics. GCSE Art and Design. Any practical vocational qualifications such as Engineering. GCSE in Physics.

What are the Qualification Requirements for this Course?
At least a level 5 Mathematics, English and Science is essential with a level 5 or higher in GCSE Design and Technology or equivalent is desirable.

How is the Course Delivered? - *A Level Design and Technology is typically taught by two teachers so students gain the shared experience of both members of staff. Students will receive four hours of contact time each week with staff that will be broken into theory and practical based lessons. The course works on a blended model of teaching with the students receiving additional support to enrich their learning through Google Classroom.*

Year 12 is an exciting year where students can experiment and develop their own understanding of the subject through interesting design briefs. The course is designed so the theory element is supported by practical lessons based around live briefs around the local York area. Over the period of Year 12, students will be taught different techniques to communicate their ideas, create design iterations and learn how to develop successful solutions to design problems.

Year 13 will be a chance for students to bring all of their skills, talents and knowledge together by completing their NEA (Non Examined Assessment) worth 50% of their final A Level qualification. The NEA is a portfolio of work based around a design problem chosen by the student working closely with a real client. Students will work with the user to understand and research the design challenge and then design, develop and manufacture a solution to meet the needs of the user. In addition to this, students will sit a formal examination at the end of Year 13 to test their understanding of the subject.

In grid below outline what units / content is taught when across the two year course

Subject Overview		
Half Term	**Year 12**	**Year 13**
Autumn	**INTRODUCTION / INCLUSIVE DESIGN (P1)** **CONTAINER PROJECT (P2)** Introduction into the specification of the course, dates and expectations. First project is teaching students to put the primary user first by designing a toothbrush for users with specific needs. **Content / Theory:**	**NEA– PART 1 (33 MARKS)** **INVESTIGATING THE PROBLEM / SPECIFICATION** Students will have successfully identified a problem taken from a real Primary User. They will have undergone the process of researching the needs of the user and the problem by using Primary and Secondary research. Students will then start to make key

	U2.1 Performance Characteristics. Looking at how materials perform in different ways to meet a given need. **U1.7 Smart Materials.** Application of smart materials. Used in their toothbrush project to reinforce learning. (KS3 and KS4) **U5.2 Anthropometrics and Ergonomics.** Linked to how designers use data and user feedback to develop designs. Linked to the toothbrush project. (KS3 and KS4) **U3.3a Pictorial Drawings.** How 3D drawings such 1PP, 2PP, 3PP, Isometric, Plano metric and Oblique are used to communicate effectively. (KS3 and KS4) **U3.3b Working Drawings.** How formal drawings like Orthographic, exploded, cross sectional drawings are created and used effectively to communicate. (KS4)	decisions in the form of a design specification which will be the basis for their design ideas (PART B). **Content / Theory:** **U12.1a - Strategies, techniques and approaches** to explore, create and evaluate design ideas: a) user-centred design: **(KS4)** · framework process · problem solving · user needs, wants and values · Limitations of end user consideration. **U12.1b & c – Strategies, techniques and approaches** b) circular economy – biologically-based systems and an understanding of how waste and pollution can be eliminated c) Systems thinking – the influence of systems on commercial activity to enable all elements of a manufacturing enterprise to work together. **U6.1a - 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. **(KS4)** **U6.1b - Current and historical technological developments** 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. **(KS4)**
Autumn 2	**CONTAINER PROJECT(P2) / INDUSTRIAL LIGHTING (P3)** Project 2 is a live brief based around Spark in York. A local connection that asks students to investigate start-up businesses and how design of the buildings can help them to keep overheads down and attract customers. Project 2 is allowing students to experiment with materials they wouldn't normally use in product design such as concrete by designing an LED light. **Content / Theory:** **U1.5 Papers and Board.** Students understand the different uses of papers, cards and boards and how this can be used to model their architectural building. (KS4) **U3.1c Printing.** Different printing techniques explored from low volume to industrial printing. (KS4) **U3.5b Paper and Board finish.** Different finishes taught looking at commercial and small scale methods that could be used on their architectural project. (KS4) **U1.4 Composites.** Using mixed materials to help gain better material characteristics. (KS4) **U1.2 Metals.** Origins, characteristics, properties and categories of metals. (KS4)	**NEA PART 2** **DESIGNING A PROTOTYPE (46 MARKS)** Part 2 of the NEA is about producing a range of design proposals that are realistic and workable and meet the needs of the design problem and user. The student should use different methods of communicating and different design strategies to come up with possible ideas. Interaction with Primary users is imperative to ensure the ideas are not fixated. **Content / Theory:** **U6.1c – Effect of technology -** the global marketplace – multinational companies in developed and developing countries, manufacturing 'offshore' in developing countries and local and global production. **U8.1 Production Volumes –** 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. **(KS4)** **U8.2 Quality assurance and control -** 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

	U3.1b Alloying. The mixing of different metals to create a new material with specific properties. (KS4)	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. **(KS4)** **U8.3 Features of Manufacturing Industry -** 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 f) standardised parts, bought-in components g) quick response manufacturing (QRM) h) data integration – product data management (PDM), enterprise resource planning (ERP) systems i) concurrent manufacturing.
Spring 1	**INDUSTRIAL LIGHTING (P3) / IDENTITY PROJECT (P4)** Project 3 spans two half terms and will allow students to focus on experimenting with a range of materials and techniques to understand what is possible. Project 4 is a graphics based project looking at corporate Identity. Students will be using paper, card and board to design and manufacture their own perfume packaging for a Primary User.	**NEA PART 2** **DEVELOPMENT OF DESIGN PROPOSAL & FINAL DESIGN (46 MARKS)& PART 3 MAKING PROTOTYPE** The second part of the NEA is demonstrating an iterative approach to designing development. This will be influenced by a number of factors such as knowledge materials, the user's needs/wants. 2D and 3D techniques should be used to evaluate the success of the idea and small incremental steps should be evidenced throughout. This

	Content / Theory: **U3.1a Heat Treatment.** 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)** **U3.1d Casting.** sand (to include investment), die, resin, plaster of Paris (including use of specialist tools) **U3.4c User Centred design.** heat – oxy-acetylene welding, MIG welding, brazing, hard soldering, soft soldering (including use of specialist tools) **(KS4)** **U5.1 User Centred design.** The importance and influence of user centred design in ensuring products are fit-for-purpose and meet the criteria of specifications when designing, making and evaluating in relation to: a) user needs, wants and values b) purpose c) functionality d) innovation e) authenticity. **U5.2 Form follows Function.** 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. **(KS4)**	will culminate in a final proposal and comparison against the specification. **Content / Theory:** **U7.1 Hazards and risk assessment –** 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. **U10.1 Current legislation -** 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). **U10.2 Health and safety laws -** 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). **U11.a Making –** Collection, collation and analysis of information and the use of this to make informed decisions: a) marketing –

		marketing analysis, research techniques, raw data/analysed data to enable enterprise to be encouraged **U11.1b & c Innovation management -** b) innovation management – cooperation between management, designers and production engineers, the encouragement of creativity c) the use of feasibility studies on the practicability of proposed solutions
Spring 2	**IDENTITY PROJECT (P5) AND TOKYO OLYMPIC DESIGN (P6)** Project 5 is a continuation of the perfume and packaging project that allows students to work with. Project 6 is aimed at understanding cultural diversity and asking students to consider designing a product to fit into a different landscape or environment. Students will be looking at designing a product to fit into the Tokyo Olympics and be suitable for user from different backgrounds, religions and beliefs. **Content / Theory:** **U5.4 Design Movements.** 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 – Marianne Brandt d) Art Deco – Eileen Gray e) Post Modernism – Philippe Starck f) Streamlining – Raymond Lowey g) Memphis – Ettore Sottsass. **U1.1 Timbers.** Woods: a) hardwoods – oak, mahogany, beech, jelutong, balsa b) softwoods – pine, cedar, larch, redwood. **(KS4)**	**NEA PART 3 MAKING A PROTOTYPE (30 MARKS) & EVALUATING PROTOTYPE (12 MARKS)** Part 3 of the NEA will see students producing a high-quality prototype that is appropriate to an advanced level of demand, meeting the requirements of the design specification. Students will be able to select and evidence technical skill in application of material, range of tools, techniques, fixtures, components and finishes used in the manufacture of the final prototype. **Content / Theory:** **U12.2 Modelling Outcomes -** Applications, characteristics, advantages and disadvantages of the following project management strategies: a) critical path analysis – the handling of complex and time sensitive operations b) scrum – how flexible, holistic product development is achieved c) Six Sigma – the improvement of output quality of a process by identifying and removing the causes of defects and setting value targets of: o reduce process cycle time o reduce pollution o reduce costs o increase customer satisfaction o increase profits. **U11.3 International property rights -** The importance, implications and ways of protecting the intellectual property rights

	U3.1e machining. Milling/routing, drilling, turning, stamping, pressing (including use of specialist tools) **(KS4)** **U3.1g lamination**. (including use of specialist tools) **U3.4g Jointing.** Traditional wood joints, knock-down fittings (including use of specialist tools). **(KS4)**	of designers, inventors and companies: a) patents b) copyrights c) design rights d) trademarks. **U11.4 Standards -** 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). **(KS4)**
Summer 1	**DESIGN MOVEMENT CUTLERY(P7)** This final project before their NEA allows students to design cutlery around a given design movement / designer. Students will need to study two designers in depth understanding the economic and political landscape around them at the time that designs were created. **Content / Theory:** **U3.4A Adhesives**– contact adhesive, acrylic cement, epoxy resin, polyvinyl acetate (PVA), hot melt glue, cyanoacrylate (superglue), polystyrene cement (including use of specialist tools) **(KS4)** **U3.5A Material Finishes. P**aints, varnishes, sealants, preservatives, anodising, electro-plating, powder coating, oil coating, galvanisation, cathodic protection (including use of specialist tools) **U1.6 Textiles.** a) natural fibres – cotton, linen, wool b) manmade fibres – nylon, polypropylene, polyester c) textile treatments – flame resistant, polytetrafluoroethylene (PTFE). **(KS4)**	**NEA PART 4 (15 MARKS) TESTING AND EVALUATING** Students will be using this term to take their work to their Primary User and carry out a thorough test. Students will be testing for functionality, aesthetics and how well it has met the needs of the user. A thorough plan of exam preparation will also take place ensuring that all theory has been addressed and exam technique honed. **Content / Theory:** **Exam Recap – Timbers and properties** **Exam Recap – Polymers and properties** **Exam Recap – Metals and properties** **Exam Recap – Papers and Boards** **Exam Recap – Composites and smart materials / processes.**

Summer 2	**NEA INTRODUCTION –** **PART 1 (33 MARKS) INVESTIGATING THE PROBLEM** Just before half term students will be introduced to their NEA and given the tasks of looking at some possible design problems they could choose. Students will set about investigating a problem and solving it like a commercial designer would. A Primary User will be used throughout the project and Part A of the NEA will be investigating their needs and how these can be addressed. **Content / Theory:** **U1.3 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). c) elastomers – rubber. **U3.1 Moulding -** moulding – blow moulding, injection moulding, vacuum forming, extrusion, rotational moulding (including use of specialist tools) **U9.1 Cleaner Design Part 1 -** 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.	

	U9.1 Cleaner Design Part 2 - 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. **U9.2 Wider Issues -** The wider issues of using cleaner technologies: a) cost implications to the consumer and manufacturer b) sustainability – designing without jeopardising the potential for people in the future to meet their needs. **3.3c Nets -** nets (developments) for communicating information about 3D forms in a 2D format. **3.3d & 3.3e Translations and Reports -** d) translation between working drawings, pictorial drawings and nets (developments) e) report writing.	

How is the Course Assessed?

The Pearson Edexcel Level 3 Advanced GCE in Design and Technology (Product Design) consists of one externally-examined paper and one non-examined assessment component. Students must complete all assessments in May/June in any single year.

Component 1: Principles of Design and Technology (Paper code: 9DT0/01)*
Written examination: 2 hours 30 minutes. 50% of the qualification. 120 marks

Content overview
Topic 1: Materials
Topic 2: Performance characteristics of materials

Topic 3: Processes and techniques
Topic 4: Digital technologies
Topic 5: Factors influencing the development of products
Topic 6: Effects of technological developments
Topic 7: Potential hazards and risk assessment
Topic 8: Features of manufacturing industries
Topic 9: Designing for maintenance and the cleaner environment
Topic 10: Current legislation
Topic 11: Information handling, Modelling and forward planning
Topic 12: Further processes and techniques.

Assessment overview
The paper includes calculations, short-open and open-response questions, as well as extended-writing questions focused on:

- *analysis and evaluation of design decisions and outcomes, against a technical principle, for prototypes made by others*
- *analysis and evaluation of wider issues in design technology, including social, moral, ethical and environmental impacts.*

Component 2: Independent Design and Make Project (Paper code: 9DT0/02)
Non-examined assessment. 50% of the qualification. 120 marks.

Content overview
● *Students individually and/or in consultation with a client/end user identify a problem and design context.*
● *Students will develop a range of potential solutions which include the use of computer aided design and evidence of modelling.*
● *Students will be expected to make decisions about the designing and development of the prototype in conjunction with the opinions of the client/end user.*
● *Students will realise one potential solution through practical making activities with evidence of project management and plan for production.*
● *Students will incorporate issues related to sustainability and the impact their prototype may have on the environment.*
● *Students are expected to analyse and evaluate design decisions and outcomes for prototypes/products made by themselves and others.*
● *Students are expected to analyse and evaluate of wider issues in design technology, including social, moral, ethical and environmental impacts.*

Assessment overview

- *The investigation report is internally assessed and externally moderated.*
- *Students will produce a substantial design, make and evaluate project which consists of a portfolio and a prototype*
- *The portfolio will contain approximately 40 sides of A3 paper (or electronic equivalent)*

There are four parts to the assessment:

o ***Part 1: Identifying and outlining possibilities for design***
Identification and investigation of a design possibility, investigation of client/end user needs, wants and values, research and production of a specification.
o ***Part 2: Designing a prototype****.*
Design ideas, development of design idea, final design solution, review of development and final design and communication of design ideas.
o ***Part 3: Making a final prototype.***
Design, manufacture and realisation of a final prototype, including tools and equipment and quality and accuracy.
o ***Part 4: Evaluating own design and prototype****.*
Testing and evaluation.

What is our Recommended Subject Reading list to Support your Study?

A Level – Product Choice/Material Choice/Design Process			
The Measure of Man and Woman: Human Factors in Design	Alvin R. Tilley	John Wiley & Sons; Revised Edition edition (13 Feb 2002)	ISBN: 0471099554

Invention by Design – How Engineers get from Thought to Thing	Henry Petroski	Harvard University Press, 1998	ISBN 0674463684
Small Things Considered: Why there is No Perfect Design	Henry Petroski	Random House, 2004	ISBN 1400032938
Product Design (Portfolio)	Paul Rodgers	Laurence King (1 Aug 2011)	1856697517
Material Innovation: Product Design	Andrew H. Dent	Thames and Hudson Ltd (12 May 2014)	0500291292
Process: 50 Product Designs from Concept to Manufacture	Jennifer Hudson	Laurence King; 2 edition (25 April 2011)	1856697258