A Level Product Design
Curriculum Intent 2023-2024

At Brine Leas, 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. We aim to, wherever possible, offer a breadth and depth of different disciplines and link with other subject areas such as Mathematics, Science, Engineering, Computing and Art which gives the learning purpose and relevance to the students. Our curriculum at Brine Leas strives to present a range of challenging opportunities for students to develop their creativity and imagination to design, to develop practical and technical skills as they design and make prototypes and products that solve real life design briefs, considering both their own and others' needs, wants and values. We deliver life skills through engineering skills, health and safety, teamwork, facilitated learning, confidence, workshop skills, Computer Aided Design and Computer Aided Manufacture, management skills and working independently. We have fantastic facilities with design and technology machinery that mirrors industry. We will encourage students to take risks in their design approaches and aim to develop resourceful, innovative and enterprising young learners who can go on to be the next generation of creative thinkers, designers and practitioners. This creative and thought-provoking qualification gives students the practical skills, theoretical knowledge and confidence to succeed in several careers and their future preparation. Especially those in the creative industries. They will investigate historical, social, cultural, environmental and economic influences on design and technology, whilst enjoying opportunities to put their learning in to practice by producing prototypes of their choice. Students will gain a real understanding of what it means to be a designer, alongside the knowledge and skills sought by higher education and employers.

Students will learn a range of life-long learning skills including to make decisions, consider sustainability and combine skills with understanding in order to design and make quality products, exploring ways in which aesthetics, technical, economic, environmental, economic, environmental, ethical and social dimensions interact to shape designing and making. Students will develop an understanding of why analysing existing products will help produce practical solutions to needs, wants and opportunities, recognising their impact on quality of life. By understanding the design process students can then design and make products which reflect and influence cultures and societies and that have an impact on lifestyle.

We also look at developing critical thinking and practical skills to resolve design situations. We take students through the process of the design & manufacture of products including model making skills, computer aided design and manufacture (CAD/CAM) which enables students to actively engage and take responsibility for their personal development in the process of design to develop as effective and independent learners.

Students will learn to make decisions, consider sustainability and combine skills with understanding in order to design and make quality products, exploring ways in which aesthetics, technical, economic, environmental, ethical and social dimensions interact to shape designing and making. Students will develop an understanding of why analysing existing products will help produce practical solutions to needs, wants and opportunities, recognising their impact on quality of life. By understanding the design process students can then design and make products which reflect and influence cultures and societies and that have an impact on lifestyle.

We are all in some small way creative, what this subject does is to foster and unleash that hidden talent by giving students the tools, skill and expertise to access it, and inspires and motivates them to do their best.

Community Involvement: Visiting speakers to discuss their business interest in Product Design, Photography and Graphics. Ex-students following either apprenticeships and/or university courses.

The A Level Product Design course places greater emphasis on understanding and applying iterative design processes. Students will use their creativity and imagination to design and make prototypes that solve real and relevant problem, consider their own and others' needs, wants and values.

The course is specification encourages students to be open to taking design risks, showing innovation and enterprise whilst considering their role as responsible designers and citizens. To develop intellectual curiosity about the design and manufacture of products and systems, and their impact on daily life and the wider world. To work collaboratively to develop and refine their ideas, responding to feedback from users, peers and expert practitioners. To gain an insight into the creative, engineering and/or manufacturing industries. To develop the capacity to think creatively, innovatively and critically through focused research and the exploration of design opportunities arising from the needs, wants and values of users and clients. To develop knowledge and experience of real world contexts for design and technological activity. To develop an in-depth knowledge and understanding of materials, components and processes associated with the creation of products that can be tested and evaluated in use. To be able to make informed design decisions through an in-depth understanding of the management and development of taking a design through to a prototype/product. To be able to create and analyse a design concept and use a range of skills and knowledge from other subject areas, including maths and science, to inform decisions in design and the application or development of technology. To be able to work safely and skilfully to produce high-quality prototypes/products. To have a critical understanding of the wider influences on design and technology, including cultural, economic, environmental, historical and social factors. To develop the ability to draw on and apply a range of skills and knowledge from other subject areas, including the use of maths and science for analysis and informing decisions in design.

This is a design based course. The course combines theoretical content with practical application. The use of mathematical skills is a key requirement, and is tested in the examination. An understanding of underlying scientific principles is expected. An iterative approach to designing is encouraged. Various design strategies can be used. The acquisition of practical skills is still expected.

Trips and visits

Trip to IKEA to link the lighting project to a real business and real clients.
Visiting a local design company, links with local companies and designers
Visit to University's (Liverpool St John Mores, Glyn Dwr University and Stafford University

Assessment

Please see website for internal assessment record.

This specification is designed to be taken over two years.
This is a linear qualification. In order to achieve the award, students must complete all assessments at the end of the course and in the same series.
A-level exams and certification for this specification are only available in May/June 2019 and then every May/June for the life of the specification.
All materials are available in English only.
Our A-level exams in Design and Technology: Product Design include questions that allow students to demonstrate their ability to:

- recall information

- draw together information from different areas of the specification
- apply their knowledge and understanding in practical and theoretical contexts.

Assessment criteria to include:
- Exploration
- Designing
- Development and CAD
- Making
- Analysis and evaluation.

The Non-exam assessment (NEA):
Students will develop intellectual curiosity about the design and manufacture of products. They will explore, design, create and evaluate innovative solutions in response to realistic design contexts. The NEA consists of a single design and make activity at A-level; students must identify and choose their own context making sure they have the opportunity to challenge themselves as a designer.

What's assessed:
Practical application of technical principles, designing and making principles.
How it's assessed:
- Substantial design and make project
- 100 marks
- 50% of A-level

Evidence:
Written or digital design portfolio and photographic evidence of final prototype.

The Exams:

Paper 1 What's assessed: Technical principles How it's assessed: • Written exam: 2 hours and 30 minutes • 120 marks • 30% of A-level Questions: Mixture of short answer and extended response.	**Paper 2** What's assessed: Designing and making principles How it's assessed: • Written exam: 1 hour and 30 minutes • 80 marks • 20% of A-level Questions: Mixture of short answer and extended response questions. ➢ Section A: • Product Analysis: 30 marks • Up to 6 short answer questions based on visual stimulus of product(s). ➢ Section B: • Commercial manufacture: 50 marks • Mixture of short and extended response questions

The exams and non-exam assessment will measure how students have achieved the following assessment objectives.

- AO1: Identify, investigate and outline design possibilities to address needs and wants.
- AO2: Design and make prototypes that are fit for purpose.
- AO3: Analyse and evaluate:
- design decisions and outcomes, including for prototypes made by themselves and others
- wider issues in design and technology.
- AO4: Demonstrate and apply knowledge and understanding of:
- Technical principles
- Designing and making principles.

Homework

Specific homework will be set on a lesson-by-lesson, week by week basis. As the course requires theoretical knowledge and understanding there will be opportunity to embed learning via homework tasks.
As the course moves onto the NEA stages (including the practice NEA's) there will be a requirement for students to complete tasks for this to make sure they are meeting the deadlines set by the course.

Clubs and/or intervention

Catch up sessions offered at lunchtime and after school. Engineering enhancement club on a Friday after school. CAD clinics are also offered both on the timetable and in extra-curricular sessions,

Intervention will take place if a student misses deadlines or is not engaging with the require effort or quality of work to satisfy their target grade. This will be tracked and communicated with parents/carers via Data Collection points, parent's evenings, phone call/email/letter correspondence.

Parental/Carer support

Parents are asked to support their child through this course, they should be encouraged to meet external deadlines and those set by the members of staff.

Helpful sources of information

Details of the course and support information, exemplar material and lesson content can be found on 'Teams'
Specification can be found on:
https://www.aqa.org.uk/subjects/design-and-technology/as-and-a-level/design-and-technology-product-design-7552

Websites:
http://www.technologystudent.com/
Seneca
https://www.youtube.com/?hl=en-GB&gl=GB

Textbooks/Revision Guides:
Hodder Education
My Revision Notes: AQA A Level Design and Technology: Product Design
ISBN: 9781510432291

Hodder Education
Essential Maths Skills for AS/A Level Design and Technology
ISBN: 9781510417069

Connections to future pathways

Careers: Designer, Manufacturing, Craft, Engineering, CAD technician, Clothing/ textile technologist, Colour technologist, Exhibition designer, Furniture designer, Interior and spatial designer, Product designer, Architect, Graphic Designer, Advertising, Brand Development, Web Designer, Games Designer, Pattern Designer, Exhibition designer, Furniture designer.

Year 12 Overview

Term	Knowledge	Assessment	Connections to learning

Autumn 1	**Big Idea: By studying design and technology, students will be able to build up their creativity, problem solving, planning, and evaluation skills. A-level Design and Technology: Product Design requires students to engage in both practical and theoretical study. This specification requires students to cover design and technology skills and knowledge through:** **• technical principles** **• designing and making principles.** **Students should develop their own personal style and approach to design by being able to apply a range of skills and knowledge from other subject areas to inform their decisions in design and the application or development of technology.** **Students are Introduced to the course. This is intended to build knowledge, skills and a more in-depth understanding of the course criteria as well preparing students for a further learning and/or the world of work. It will be the first time that students will follow the assessment criteria: Exploration, Designing, Making, Analysis and evaluation.** Rationale: A scaled project this will act as an introduction to the NEA that will embed the iterative design processes and allow students to become familiar with the BL6 facilities. The project allows students to develop their knowledge whilst enjoying the designing and making of a new product.

	Introduction to course criteria and the NEA ➢ Intro to H&S ➢ Research ➢ Designing for a need/target market Design methods and processes ➢ Design processes ➢ Iterative design process ➢ The use of a design processes ➢ Prototype development ➢ The iterative design process in industrial or commercial contexts ➢ Ergonomics/Anthropometrics ➢ Iterative Design Skills – including drawing and presentation in 2D & 3, Prototyping and model making ➢ Use of Machines/ Tools/ Equipment in the workshop ➢ How to use CAD Sketchup/Solidworks/2D Design/CAM equipment in the department: laser cutter, router and 3D printer. Investigating products to understand How, why and who using ACCESSFM/CAFEQUE What makes a good design? Designing for sustainability Understand how designers can support environmentally sustainable issues through choice of manufacture and materials used. ➢ Selecting appropriate tools, equipment and processes ➢ Materials and their applications ➢ Performance characteristics of materials ➢ Methods for investigating and testing materials ➢ Accuracy in design and manufacture ➢ Health and safety	Evidence in presentation and graphical improvement. **Investigation** ➢ Task analysis/Spider Diagram ➢ Mood board/existing product research ➢ Product ➢ Analysis/ disassembly ➢ User requirements/ questionnaire/ client research ➢ Material investigation/ material research- completed via internet research **Designing** ➢ Initial shapes sheet, looking at creativity ➢ Sketching, hand drawn design ideas **Development** ➢ Card templates- showing development and iterative design ➢ Modelling- showing development and iterative design ➢ CAD- giving different views of the product ➢ Sizes (working/ orthographic drawing) ➢ Exploded drawings ➢ The proficient use and application of CAD – 2D design, solid works/ Sketchup/2D Design ➢ Practical work – including modelling and the final product – use of H&S, the correct and relevant selection of processes, tools/machines and materials.	Prior learning in D&T (Y7-9) ➢ Templates and drawings to follow and create. ➢ Manufacture of a range of products ➢ Evaluation of outcomes. ➢ Mood boards ➢ Designing skills from KS3 projects ➢ Card modelling is done throughout KS3 in a variety of projects CAD is taught in all years at KS3 6R's Material properties, Sustainability Issues, Material enhancement (finishes) **PSHCE** Ethical, Moral, social issues 1.Personal development – building knowledge and understanding supported by a range of practical experiences to establish life skills. 2. Social development- the evolution of design and its effect on its users and the environment.

	➢ Design for manufacturing, maintenance, repair and disposal **Materials and their applications** Physical and mechanical properties (working characteristics) ➢ product function ➢ aesthetics ➢ cost ➢ manufacture and disposal. **Classification of materials** ➢ metals (ferrous, non-ferrous, alloys) ➢ woods (hardwoods, softwoods, manufactured boards) ➢ polymers (thermoplastics, thermoset polymers, elastomers) ➢ papers and boards ➢ composites ➢ smart materials ➢ modern materials. **Methods for investigating and testing material** ➢ tensile strength ➢ toughness ➢ hardness ➢ malleability ➢ corrosion ➢ conductivity. **Performance characteristics of materials** ➢ the ability to be scored ➢ cutting ➢ folding ➢ surface qualities for printing ➢ impact resistance ➢ recyclability and/or biodegradability. Students should be able to explain why different papers and boards are suitable for different applications, including:	➢ Apply where possible the theoretical knowledge in the pizza cutter project. Not all aspects will be relevant due to the individual approach of the outcome by students. ➢ Practical and theory tasks carried out –including modelling and the final product – use of H&S, the correct and relevant selection of processes, tools/machines and material classification and properties. ➢ Practical and theory tasks carried out – including modelling and the final product – use of H&S, the correct and relevant selection of processes, tools/machines and material classification and properties. ➢ Not all students will have reference to these in the design portfolios due to the individual nature of the final outcome but will have covered theoretical knowledge. ➢ Practical and theory tasks carried out – including modelling and the final product – use of H&S, the correct and relevant selection of processes, tools/machines and material classification and properties.	3.Moral development— understanding of other cultures to enable design to be inclusive 6. Cultural development – understanding how design has evolved through time and how this has impacted and directed the design which we see today, and the predictions made for future design. Prior learning in D&T related subjects as GCSE ➢ Creating a specification and manufacturing specification when responding to a design brief (Y11) ➢ Read and create a working drawing when responding to a design solution (Y11) Future learning ➢ Links to syllabus/ specification for exam/ revision ➢ Practice NEA will lead into the full NEA, which is 50% of the final grade.

	➢ layout paper: sketch pads ➢ cartridge paper: printing ➢ tracing paper: copying images ➢ bleed proof paper: marker rendering ➢ corrugated card: packaging ➢ bleached card: greeting cards and high quality packaging ➢ mount board: modelling ➢ duplex card: food packaging ➢ foil backed and laminated card: drinks packaging ➢ metal effect card: gift packaging ➢ moulded paper pulp: eco-friendly packaging. ➢ the ability to be scored ➢ cutting ➢ folding ➢ moulding ➢ transparency ➢ translucency ➢ flexibility ➢ recyclability and/or biodegradability. Students should be able to explain why different polymer based sheet and film are suitable for different applications, including: ➢ foam board: model making ➢ fluted polypropylene: signs and box construction ➢ translucent polypropylene sheets: packaging ➢ styrofoam: modelling and formers ➢ low density polyethylene sheet: wrapping, packaging and bags ➢ plastazote foam: protective packaging ➢ cellulose acetate: packaging ➢ polyactide sheet and film: biodegradable packaging. **Performance characteristics of woods** ➢ rough sawn ➢ planed square edge (PSE) ➢ planed all round (PAR)	➢ Not all students will have reference to these in the design portfolios due to the individual nature of the final outcome but will have covered theoretical knowledge	Future learning ➢ Links to syllabus/ specification for exam/ revision ➢ Practice NEA will lead into the full NEA which is 50% of the final grade.

	➢ natural timber ➢ manufactured boards ➢ mouldings Students should be able to describe the performance characteristics of woods, including: ➢ grain pattern ➢ grain direction ➢ surface defects ➢ warpage ➢ shrinkage ➢ splitting ➢ joining ➢ forming ➢ steam bending ➢ laminating ➢ machining qualities ➢ resistance to decay ➢ moisture resistance ➢ toxicity. Students should be familiar with the following woods and wood products: ➢ softwoods: • pine • spruce • Douglas fir • redwood • cedar • larch ➢ hardwoods: • oak • ash • mahogany • teak • birch • beech ➢ manufactured boards: • plywood • marine plywood • aeroply	➢ Practical and theory tasks carried out – including modelling and the final product – use of H&S, the correct and relevant selection of processes, tools/machines and material classification and properties. ➢ Not all students will have reference to these in the design portfolios due to the individual nature of the final outcome but will have covered theoretical knowledge. ➢ Many of the materials are not available in school therefore reference is made by imagery, material use, characteristics and properties ➢ Practical and theory tasks carried out – including modelling and the final product – use of H&S, the correct and relevant selection of processes,	Future learning ➢ Links to syllabus/ specification for exam/ revision ➢ Practice NEA will lead into the full NEA which is 50% of the final grade

	• flexible plywood • chipboard • medium density fibreboard (MDF) • veneers and melamine formaldehyde laminates. **Performance characteristics of metals** ➢ sheet ➢ plate ➢ bar: • flat • round • square • hexagonal ➢ tube: • round • square • rectangular • hexagonal ➢ structural: • H beam • I beam • tee • channel • angle. Students should be able to describe the performance characteristics of metals, including: ➢ hardness ➢ toughness ➢ malleability ➢ elasticity ➢ tensile strength ➢ density ➢ resistance to corrosion ➢ thermal conductivity ➢ electrical conductivity ➢ melting points ➢ ability to be alloyed	tools/machines and material classification and properties. ➢ Not all students will have reference to these in the design portfolios due to the individual nature of the final outcome but will have covered theoretical knowledge. ➢ Many of the materials are not available in school therefore reference is made by imagery, material use, characteristics and properties	Future learning ➢ Links to syllabus/ specification for exam/ revision ➢ Practice NEA will lead into the full NEA, which is 50% of the final grade.

	➢ ability to be joined with heat processes ➢ ability to take applied coatings and finishes. ➢ Ferrous: • low carbon steel • stainless steel • high speed steel (HSS) • medium carbon steel • cast iron ➢ Non-ferrous: • aluminium • copper • zinc • silver • gold • titanium • tin ➢ ferrous alloys: • stainless steel • die steel (tool steel) ➢ non-ferrous alloys: • bronze • brass • duralumin • pewter. Digital design and manufacture the advantages and disadvantages of using CAD compared to a manually generated alternative ➢ the use of CAD to develop and present ideas for products, including: • the use of 2D CAD for working drawings • the use of 3D CAD to produce presentation drawings. • how CAD is used Computer aided manufacture (CAM) ➢ laser cutting ➢ routing	➢ Practical and theory tasks carried out – including modelling and the final product – use of H&S, the correct and relevant selection of processes, tools/machines and material classification and properties. ➢ All students will have been shown the relevant software and CAM machinery. Final outcome will vary depending on the student's design. ➢ Calculating speeds and times for machining.	

	➢ milling ➢ turning ➢ plotter cutting.		

	Big Idea: By studying a second design activity in the style of the NEA, students will be able to build up their creativity, problem solving, planning, and evaluation skills and knowledge from the specification, which could not be covered in the first design task. **Students are Introduced to a more rigorous bespoke Low Energy Lighting. This is intended to build knowledge, skills and a more in-depth understanding of the course criteria as well enhancing the students personal development, preparing students for a further learning and/or the world of work. It will allow further knowledge and skills to be developed for the students actual NEA as well as knowledge which could be examined on either paper 1 or 2** Rationale: To prepare properly for the NEA, another practice NEA is essential. This will be used to assess the students against the specification criteria and to make sure that they are able to produce work to the required standard. It will inform teachers and help make decisions on UCAS predicted grades. Alongside the practise NEA there will be continued teaching of the Theoretical aspects of the specification		
Autumn 2 **&** **Spring 1**	➢ Design for manufacture and project management ➢ Enhancement of materials ➢ Design theory ➢ Technology and cultural changes ➢ Design processes ➢ Critical analysis and evaluation ➢ Accuracy in design and manufacture ➢ Responsible design ➢ Design for manufacture ➢ Enhancement of materials ➢ Forming, redistribution and addition processes ➢ The use of finishes ➢ Modern and industrial commercial practice ➢ Digital design and manufacture ➢ Product design and development ➢ Health and safety ➢ Design for manufacturing, maintenance, repair and disposal ➢ Enterprise and marketing in the development of products **Metal finishing** ➢ cellulose paint ➢ acrylic paint ➢ electro-plating ➢ dip coating	➢ Folders are checked and feedback given which matches against the breakdown of criteria sheet given to students. Individual targets given matched to whichever section students are working on. Work to be completed and assessed: ➢ Investigation into target market profiles and their needs and wants. ➢ How technology and cultural changes can impact on the work of Designers ➢ Produce a detailed and well-reasoned Specification and Design Brief ➢ Produce high quality initial ideas with clarity and communication ➢ Review and refine designs ➢ Use feedback throughout the whole process to inform decisions ➢ Apply with detail new (and prior) iterative design and development approaches – model making,	Prior learning in D&T (Y7-9) ➢ Templates and drawings to follow and create. ➢ Manufacture of a range of products ➢ Evaluation of outcomes. ➢ Mood boards ➢ Designing skills from KS3 projects ➢ Card modelling is done throughout KS3 in a variety of projects CAD is taught in all years at KS3 6R's Material properties, Sustainability

	➢ powder coating ➢ galvanising ➢ sealants ➢ preservatives ➢ anodising ➢ plating ➢ coating ➢ cathodic protection. **Wood finishing** ➢ Applied finishes: • polyurethane varnish • acrylic varnish • water based paints • stains • colour wash • wax finishes • danish oil • teak oil • pressure treating with chemical preservatives. **Modern industrial and commercial practice** ➢ one-off, bespoke ➢ batch production ➢ mass/line production ➢ unit production systems (UPS) ➢ quick response manufacturing (QRM) ➢ vertical in-house production.	sketching, exploded/ sectional drawings, CAD (2d design/ Sketchup/ Solidworks), ➢ Recording and application of the iterative design process from initial sketches through to modelling, feedback, CAD, rendering, working drawings, material and processes testing. ➢ Plan of manufacture ➢ Must apply the effective use of CAM at some point ➢ Record and evidence ALL practical work ➢ A high quality and innovative product ➢ Evaluation processes – with critical modifications and reflections. ➢ Series of practical tasks and demonstrations to cover the theory. All tasks and theory content will be revisited for examination.	Issues, Material enhancement (finishes) **PSHCE** Ethical, Moral, social issues 1.Personal development – building knowledge and understanding supported by a range of practical experiences to establish life skills. 2. Social development- the evolution of design and its effect on its users and the environment. 3.Moral development— understanding of the effect of finishes and production on users and the environment. 6. Cultural development – understanding how design has evolved through time and how this has impacted and directed the design which we see today, and the predictions made for future design. Prior learning in D&T related subjects as GCSE ➢ Creating a specification and manufacturing specification when responding to a design brief (Y11) ➢ Read and create a working drawing when responding to a design solution (Y11) Future learning ➢ Links to syllabus/ specification for exam/ revision

			➢ Prior knowledge and skills from the photo frame project (Practice NEA)
Spring 2	**Big Idea: Continue working on the a second design activity in the style of the NEA, students will be able to build up their creativity, problem solving, planning, and evaluation skills and knowledge from the specification which could not be covered in the first design task. These tasks will continue in the summer term as for some it will bridge the actual NEA. Students are Introduced to a more rigorous bespoke Low Energy Lighting This is intended to build knowledge, skills and a more in-depth understanding of the course criteria as well preparing students for a further learning and/or the world of work. It will allow further knowledge and skills to be developed for the students actual NEA as well as knowledge which could be examined on either paper 1 or 2.** Rationale: To prepare properly for the NEA, another practice NEA is essential. This will be used to assess the students against the specification criteria and to make sure that they are able to produce work to the required standard. It will inform teachers and help make decisions on UCAS predicted grades. Alongside the practise NEA there will be continued teaching of the Theoretical aspects of the specification		
	NEA- students will continue to work on the completion of the low energy lighting/blue speaker. Depending on student individual progress, students will need to begin looking at a final NEA project **Jigs and fixtures** They should be able to describe them and explain their suitability for accurate and repeated manufacture of products. **Smart materials** ➢ changes in temperature ➢ changes in light levels ➢ changes in pressure (force). Students should be familiar with the following smart materials: ➢ shape memory alloys (SMA), e.g. Nitinol ➢ thermochromatic pigment ➢ phosphorescent pigment ➢ photochromic pigment ➢ electroluminescent wire ➢ piezo electric material. **Modern materials**	➢ Practical and theory tasks carried out – including modelling and the final product – use of H&S, the correct and relevant selection of processes, tools/machines and material classification and properties. ➢ Not all students will have reference to these in the design portfolios due to the individual nature of the final outcome but will have covered theoretical knowledge. ➢ Many of the materials are not available in school therefore reference is made by imagery, material use, characteristics and properties	Future learning ➢ Links to syllabus/ specification for exam/ revision ➢ Prior knowledge and skills from the photo frame and lighting project (Practice NEA) 1.Personal development – building knowledge and understanding supported by a range of practical experiences to establish life skills. 2. Social development- the evolution of design and its effect on its users and the environment. . 3 Moral development— understanding of the effect of finishes and production on users and the environment. 6. Cultural development – understanding how design has evolved through time and how

	➢ Kevlar ➢ precious metal clay (PMC) ➢ high density modelling foam ➢ polymorph. **Metal processes** ➢ press forming ➢ spinning ➢ cupping ➢ deep drawing ➢ forging ➢ drop forging ➢ bending ➢ rolling ➢ casting: • sand casting • die casting • investment casting • low temperature casting (pewter). Students should be aware of the different permanent and temporary joining methods for metals. They should be able to explain the suitability of the different joining methods for a range of specific products and scales of production. Including addition/ fabrication processes: ➢ metal inert gas (MIG) welding ➢ tungsten inert gas (TIG) welding ➢ spot welding ➢ oxy-acetylene welding ➢ soldering (soft and hard) ➢ brazing ➢ riveting ➢ temporary joining methods and fasteners: ➢ self-tapping screws ➢ machine screws ➢ nuts and bolts.		this has impacted and directed the design which we see today, and the predictions made for future design.

	Students should be able to explain the suitability of the different wasting processes for a range of specific components and products. Specific processes to include: ➢ milling ➢ turning ➢ flame cutting ➢ plasma cutting ➢ laser cutting ➢ punching/stamping. **Wood processes** They should be able to explain the suitability of the different joining methods for a range of specific products and scales of production. Including: ➢ addition/fabrication processes ➢ traditional wood jointing: • dovetail joint • comb joint • housing joint • half-lap joint • dowel joint • mortise and tenon ➢ Component jointing: • knock down (KD) fittings • wood screws • nuts and bolts • coach bolts. • Laminating • steam bending ➢ Machine processes: • turning between centre • use of the chuck and faceplate • milling • routering **The use of adhesives and fixings** ➢ PVA ➢ Contact adhesives		

	➢ UV hardening adhesive ➢ Solvent cements such as Tensol or acrylic cement ➢ Epoxy resin		
Summer 1	**Big Idea: This is the exciting part! The formulation of a design task which will take the remainder of the course to complete. Applying the skills and knowledge previously gained as well as developing a new skill set and preparation for examinations, apprenticeship or university application. This design task follows the same format as the previous two design activities. Students are encouraged to set themselves a challenging and rigorous bespoke project. The student should become the master in the area they have chosen. It will allow further in depth knowledge and skills to be developed which could be examined on either paper 1 or 2.** Rationale: The NEA is compulsory element of the course which is worth 50% of the final grade. The work produced will be assessed against the specification criteria. It will inform teachers and help make decisions on UCAS predicted grades. Alongside the practise NEA there will be continued teaching of the Theoretical aspects of the specification		
	NEA **The use of finishes** ➢ laminating ➢ embossing ➢ debossing ➢ varnishing, UV varnishing and spot ➢ varnishing ➢ foil blocking. ➢ screen printing ➢ flexographic and offset lithographic printing ➢ digital printing. **Polymer finishing** ➢ acrylic spray paints ➢ thermoplastic elastomer. ➢ gel coats when laminating GRP ➢ smart pigments such as thermochromic or ➢ phosphorescent. **Efficient use of materials**	Students must produce a final prototype based on the design brief that they have developed. Students should produce a concise folder. It is recommended that this folder should not exceed 45 pages. Students who do not follow these guidelines will penalise themselves by not meeting the expectations of the assessment appropriately. Students that exceed the recommended length will self-penalise by not being appropriately focused on the demands of the task.	Future learning ➢ Links to syllabus/ specification for exam/ revision ➢ Prior knowledge and skills from the photo frame and lighting project (Practice NEA) 1.Personal development – building knowledge and understanding supported by a range of practical experiences to establish life skills. 2. Social development- the evolution of design and its effect on its users and the environment. The understanding of the 6R's and the importance of sustainability .

	The development of designs which use materials economically and with regard to their characteristics. ➢ The use of manufacturing processes which increase accuracy and reduce waste. ➢ The savings to be gained when comparing bulk production with one-off production. ➢ The advantages of Just In Time (JIT) manufacture. **The use of computer systems** ➢ modular/cell production ➢ just in time (JIT) ➢ quick response manufacturing (QRM) ➢ flexible manufacturing systems.	Students that produce work that is shorter than the recommended page count will self-penalise by not allowing appropriate coverage of the assessment objectives.	3 Moral development—understanding of the effect of finishes and production on users and the environment. 6. Cultural development – understanding how design has evolved through time and how this has impacted and directed the design which we see today, and the predictions made for future design.Understaning how different religions have different beliefs which must be considered in designing and development.
Summer 2	**Big Idea: Continuation: Big Idea: This is the exciting part! The formulation of a design task which will take the remainder of the course to complete. Applying the skills and knowledge previously gained as well as developing a new skill set and preparation for examinations, apprenticeship or university application. This design task follows the same format as the previous two design activities.** **Students are encouraged to set themselves a challenging and rigorous bespoke project. The student should become the master in the area they have chosen. It will allow further in depth knowledge and skills to be developed which could be examined on either paper 1 or 2.** Rationale: The NEA is compulsory element of the course which is worth 50% of the final grade. The work produced will be assessed against the specification criteria. It will inform teachers and help make decisions on UCAS predicted grades. Alongside the practise NEA there will be continued teaching of the Theoretical aspects of the specification		
	NEA-students will need time to investigate a number of different design strategies. Various design problems will need to be considered either from a range of areas or a single point. **Theory will be covered to allow knowledge of the subject to continue as selecting the correct project is key to the success of achieving a good grade.** **The requirements for product design and development**	Students must produce a final prototype based on the design brief that they have developed. Students should produce a concise folder. It is recommended that this folder should not exceed 45 pages. Students who do not follow these guidelines will penalise themselves by not meeting the expectations of the assessment appropriately.	Future learning ➢ Links to syllabus/ specification for exam/revision ➢ Prior knowledge and skills from the photo frame and lighting project (Practice NEA) 1.Personal development – building knowledge and understanding supported by a range of practical experiences to establish life skills.

	The design, development and manufacture of products to meet specification criteria ➢ fitness for purpose accuracy of production ➢ how the critical assessment of products can lead to the development of new designs. Students should develop the skills to critically assess products and develop new design proposals. Students should develop their ability to work with a variety of materials, including two and three-dimensional forms, to produce creative and original products which satisfy the demands of the target market and consider accurate and efficient manufacture. When designing products Students should consider aesthetics, ergonomics and anthropometrics. **Inclusive design** Students should be aware of, and be able to explain, the development of products that are inclusive in their design so that they can be used by a wide range of users including the disabled, children and the elderly.	Students that exceed the recommended length will self-penalise by not being appropriately focused on the demands of the task. Students that produce work that is shorter than the recommended page count will self-penalise by not allowing appropriate coverage of the assessment objectives.	2. Social development- the evolution of design and its effect on its users and the environment. . 3 Moral development—understanding of the effect of finishes and production on users and the environment. 6. Cultural development – understanding how design has evolved through time and how this has impacted and directed the design which we see today, and the predictions made for future design.

Year 13 Overview

Term	Knowledge	Assessment	Connections to learning
Autumn 1	**Big Idea: Continuation: Big Idea: This is the exciting part! The formulation of a design task, which will take the remainder of the course to complete. Applying the skills and knowledge previously gained as well as developing a new skill set and preparation for examinations, apprenticeship or university application. This design task follows the same format as the previous two design activities.** **Students are encouraged to set themselves a challenging and rigorous bespoke project. The student should become the master in the area they have chosen. It will allow further in depth knowledge and skills to be developed which could be examined on either paper 1 or 2.** Rationale: The NEA is compulsory element of the course which is worth 50% of the final grade. The work produced will be assessed against the specification criteria. It will inform teachers and help make decisions on UCAS predicted grades. Alongside the practise NEA there will be continued teaching of the Theoretical aspects of the specification		
	NEA Virtual modelling simulation ➢ computational fluid dynamics (CFD) as used for testing aerodynamics and wind resistance, and flow of liquids within/around products ➢ finite element analysis (FEA) as used in component stress analysis.	Students must produce a final prototype based on the design brief that they have developed. Students should produce a concise folder. It is	Future learning ➢ Links to syllabus/ specification for exam/ revision ➢ Prior knowledge and skills from the photo frame and lighting project (Practice NEA)

	Rapid prototyping processes Students should be aware of, and be able to describe, rapid prototyping processes, including 3D printing. Students should understand, and be able to explain, the benefits to designers and manufacturers. **Electronic data interchange** the use of electronic point of sales (EPOS) for marketing purposes and the collection of market research data, including: ➢ the maintenance of stock levels ➢ the capture of customer data e.g. contact details. **Production, planning and control (PPC) networking** ➢ availability of materials ➢ scheduling of machines and people coordinating suppliers and customers. **Ease of manufacture** ribs and webbing to reduce material thicknesses ➢ snap fittings to remove the need for fixings/ adhesives ➢ internal moulded screw posts for use with self-tapping screws ➢ use of pre made components ➢ use of standardised patterns and sizes ➢ addition of texture in moulding to reduce number of manufacturing processes ➢ self-finishing. **Disassembly** Students should be aware of, and able to explain, how a product can be designed and manufactured with disassembly in mind, including integral fixings and active disassembly using smart materials such as SMA and biodegradable parts.	recommended that this folder should not exceed 45 pages. Students who do not follow these guidelines will penalise themselves by not meeting the expectations of the assessment appropriately. Students that exceed the recommended length will self-penalise by not being appropriately focused on the demands of the task. Students that produce work that is shorter than the recommended page count will self-penalise by not allowing appropriate coverage of the assessment objectives.	1.Personal development – building knowledge and understanding supported by a range of practical experiences to establish life skills. 2. Social development- the evolution of design and its effect on its users and the environment. 3 Moral development—understanding of the effect of manufacturing processes and production on both users and the environment. 6. Cultural development – understanding how manufacturing has evolved through time and how this has impacted and directed the design and manufacturing processes which we see today, and the predictions made for future design.

Autumn 2	**Big Idea: Continuation: Big Idea: This is the exciting part! The formulation of a design task, which will take the remainder of the course to complete. Applying the skills and knowledge previously gained as well as developing a new skill set and preparation for examinations, apprenticeship or university application. This design task follows the same format as the previous two design activities.** **Students are encouraged to set themselves a challenging and rigorous bespoke project. The student should become the master in the area they have chosen. It will allow further in depth knowledge and skills to be developed which could be examined on either paper 1 or 2.** Rationale: The NEA is compulsory element of the course, which is worth 50% of the final grade. The work produced will be assessed against the specification criteria. It will inform teachers and help make decisions on UCAS predicted grades. Alongside the practise NEA there will be continued teaching of the Theoretical aspects of the specification		
	NEA **Performance characteristics of polymers** ➢ sheet ➢ film ➢ granules ➢ rod and other extruded forms ➢ foam ➢ powder. ➢ toughness ➢ elasticity ➢ insulation (thermal and electrical) ➢ UV resistance ➢ ability to be moulded ➢ resistance to chemicals and liquids ➢ melting points ➢ suitability for food packaging applications ➢ biodegradability ➢ recyclability ➢ ability to be combined with other polymers and/or additives. Students should be familiar with the following polymers: ➢ thermoplastic: ➢ low density polyethylene (LDPE) ➢ high density polyethylene (HDPE) ➢ polypropylene (PP) ➢ high impact polystyrene (HIPS)	Students must produce a final prototype based on the design brief that they have developed. Students should produce a concise folder. It is recommended that this folder should not exceed 45 pages. Students who do not follow these guidelines will penalise themselves by not meeting the expectations of the assessment appropriately. Students that exceed the recommended length will self-penalise by not being appropriately focused on the demands of the task.	Future learning ➢ Links to syllabus/ specification for exam/ revision ➢ Prior knowledge and skills from the photo frame and lighting project (Practice NEA) 1.Personal development – building knowledge and understanding supported by a range of practical experiences to establish life skills. 2. Social development- the evolution of design and its effect on its users and the environment. Linking to environmental and sustainability particularly wih plastic and the future of materail development 3 Moral development—understanding of the effect of manufacturing processes and production on both users and the environment. 6. Cultural development – understanding how manufacturing has evolved through time and how this has impacted and directed the design and manufacturing processes which we see today, and the predictions made for future design.

	➢ acrylonitrile butadiene styrene (ABS) ➢ polymethylmethacrylate (PMMA) ➢ nylon ➢ rigid and flexible polyvinyl chloride (PVC) ➢ Polyethylene terephthalate (PET) ➢ thermosets, with specific reference to their properties ➢ urea formaldehyde (UF) ➢ melamine formaldehyde (MF) ➢ polyester resin ➢ epoxy resin. **Elastomers** ➢ Ability to be stretched and then return to original shape • texture • self-finishing • non-toxic. Students should understand how elastomers are used to enhance products, for example in producing grips for improved ergonomics. Be familiar with the following elastomers • natural rubber • polybutadiene • neoprene • silicone • Thermoplastic Elastomer (TPE). **Biodegradable polymers** ➢ Ability to be moulded into 3D products or film ➢ Ability to degrade with the action of UV rays (sunlight), water or enzymes present in soil. Students should understand how biodegradable polymers degrade. Corn starch polymers; • potatopak • biopol (bio-batch additive) • polyactide (PLA)	Students that produce work that is shorter than the recommended page count will self-penalise by not allowing appropriate coverage of the assessment objectives.	

	• polyhdroxyalkanoate (PHA) • water soluble: lactide, glycolide (Lactel and ecofilm). **Composites** ➢ Ability to be moulded into a variety of 3D forms ➢ Enhancement of physical and/or mechanical properties ➢ ease of manufacture for some uses against traditional materials ➢ improved product performance. Students should be familiar with the following composites: ➢ carbon fibre reinforced plastic (CFRP) ➢ glass reinforced plastic (GRP) ➢ tungsten carbide ➢ aluminium composite board ➢ concrete, including reinforced concrete ➢ fibre cement ➢ engineered wood, e.g. glulam (glued laminated timber).		
Spring 1	**Big Idea: Continuation: Big Idea: This is the exciting part! The formulation of a design task, which will take the remainder of the course to complete. Applying the skills and knowledge previously gained as well as developing a new skill set and preparation for examinations, apprenticeship or university application. This design task follows the same format as the previous two design activities.** **Students are encouraged to set themselves a challenging and rigorous bespoke project. The student should become the master in the area they have chosen. It will allow further in depth knowledge and skills to be developed which could be examined on either paper 1 or 2.** Rationale: The NEA is compulsory element of the course, which is worth 50% of the final grade. The work produced will be assessed against the specification criteria. It will inform teachers and help make decisions on UCAS predicted grades. Alongside the practise NEA there will be continued teaching of the Theoretical aspects of the specification.		
	NEA Health and safety ➢ Knowledge of the Health and Safety at Work Act 1974), and how it influences the safe manufacture of products ➢ Control of Substances Hazardous to Health (COSHH) and safety precautions that should be taken with relevant materials	Students must produce a final prototype based on the design brief that they have developed. Students should produce a concise folder. It is recommended that this	Future learning ➢ Links to syllabus/ specification for exam/ revision ➢ Prior knowledge and skills from the photo frame and lighting project (Practice NEA) 1.Personal development – building knowledge and understanding supported by

	➢ Safe working practices and identifying potential hazards for the school or college workshop and industrial contexts ➢ Safety precautions that should be taken with specific manufacturing processes ➢ The concept of risk assessment and its application to given manufacturing processes. **Safety in products and services to the customer** ➢ Legislation used to protect consumers and its impact on product design, e.g. Consumer Rights Act (2015), Sales of Goods Act (1979) ➢ the British Standards Institute (BSI), and how specific products might be tested to meet safety standards ➢ measures to ensure the safety of toys, e.g. Lion Mark ➢ advice to consumers: • manufacturer's instructions • safety warnings • aftercare advice. **Enhancement of materials** ➢ UV stabilisers to prolong the life of polymers ➢ bio-batch materials to encourage biodegradability. **Wood enhancement** Enhancing timber products with preservatives, finishes and coatings. **Metal enhancement** ➢ case hardening ➢ hardening and tempering. **Forming, redistribution and addition processes** ➢ Paper and board forming processes • die cutting • laser cutting • creasing	folder should not exceed 45 pages. Students who do not follow these guidelines will penalise themselves by not meeting the expectations of the assessment appropriately. Students that exceed the recommended length will self-penalise by not being appropriately focused on the demands of the task. Students that produce work that is shorter than the recommended page count will self-penalise by not allowing appropriate coverage of the assessment objectives.	a range of practical experiences to establish life skills. Particularly focussing on health and safety 2. Social development- the evolution of design and its effect on its users and the importance of health and safety in the workplace 3 Moral development—understanding of the effect of manufacturing processes and production on both users and the workplace when focussing on health and safety 6. Cultural development – understanding how manufacturing has evolved through time and how this has impacted and directed the design and manufacturing processes which we see today, and the predictions made for future design.

	• bending. **Polymer processes** ➢ vacuum forming ➢ thermoforming ➢ calendaring ➢ line bending ➢ laminating (layup) ➢ injection moulding ➢ blow moulding ➢ rotational moulding ➢ extrusion ➢ compression moulding.		
Spring 2	**Big Idea: Completion: Big Idea: This is the exciting part! The formulation of a design task which will take the remainder of the course to complete. Applying the skills and knowledge previously gained as well as developing a new skill set and preparation for examinations, apprenticeship or university application. This design task follows the same format as the previous two design activities.** **Students are encouraged to set themselves a challenging and rigorous bespoke project. The student should become the master in the area they have chosen. It will allow further in depth knowledge and skills to be developed which could be examined on either paper 1 or 2.** Rationale: The NEA is compulsory element of the course which is worth 50% of the final grade. The work produced will be assessed against the specification criteria. It will inform teachers and help make decisions on UCAS predicted grades. Alongside the practise NEA there will be continued teaching of the Theoretical aspects of the specification		
	NEA- students to continue on both the design folder and practical outcome. **Theory in preparation for the examinations** ➢ Protecting designs and intellectual property copyright and design rights • patents • registered designs • trademarks • logos. **Design for manufacturing, maintenance, repair and disposal** ➢ Reducing the number of manufacturing processes ➢ How the choice of materials affects the use, care and disposal of products	Students must produce a final prototype based on the design brief that they have developed. Students should produce a concise folder. It is recommended that this folder should not exceed 45 pages. Students who do not follow these guidelines will penalise themselves by not meeting the	Future learning ➢ Links to syllabus/ specification for exam/ revision ➢ Prior knowledge and skills from the photo frame and lighting project (Practice NEA) and final NEA ➢ Give specific examples from them to remember. 1.Personal development – building knowledge and understanding supported by a range of practical experiences to establish life skills.

	➢ labelling of materials to aid separation for recycling ➢ Making products easy to disassemble or separate ➢ Application of the six R's of sustainability: reduce the quantity of materials, of toxic materials, of damaging materials and associated energy use ➢ reuse components and parts ➢ rethink by using eco-friendly alternative materials ➢ recycle materials and/or components into new products • maintenance: • temporary and integral fixings • use of standardised parts allowing for service and repair/ replacement of parts ➢ ability to upgrade with software downloads. **Feasibility studies** Students should be aware of, and able to explain, the use of feasibility studies to assess the practicality for production of proposed designs, including the testing of prototypes with potential consumers. **Enterprise and marketing in the development of products** ➢ customer identification • labelling • packaging • corporate identification • concept of global marketing: • the promotion and advertisement of products including the use of new technologies, e.g. social media, viral marketing • product costing and profit • awareness of the role of entrepreneurs. Students should be aware of, and able to explain, the collaborative working of designers in the development of new and innovative products, including virtual and face-to-face collaborative working systems.	expectations of the assessment appropriately. Students that exceed the recommended length will self-penalise by not being appropriately focused on the demands of the task. Students that produce work that is shorter than the recommended page count will self-penalise by not allowing appropriate coverage of the assessment objectives.	2. Social development- the evolution of design and its effect on its users and the environment. Linking to environmental and sustainability particularly future of material development 3 Moral development—understanding of the effect of manufacturing processes and production on both users and the environment. Looking at end of life 6R's 6. Cultural development – understanding how manufacturing has evolved through time and how this has impacted and directed the design and manufacturing processes which we see today, and the predictions made for future design.

	Design communication report writing • the use of graphs • tables and charts • 2D/3D sketching • the use of mixed media and rendering to enhance drawings dimensioning and details for manufacture.		
Summer 1	**Big Idea: The 'big push'-focus is on reviewing subject knowledge in preparation for the examinations. Topic areas will have been covered and many students will have included many elements within their design portfolios.**		
	NEA- students to be preparing to submit both design folder and practical outcome. **Theory in preparation for the examinations** **Iterative design process** ➢ Designing to meet needs, wants or values ➢ Investigations to inform the use of primary and secondary data: • market research • interviews • human factors • focus groups • product analysis and evaluation • the use of anthropometric data and percentiles • the use of ergonomic data • the development of a design proposal • the planning and manufacture of a prototype solution • the evaluation of a prototype solution to inform further development. Students should be aware of, and able to discuss, how key historical design styles, design movements and influential designers	Many of the topics have already been covered but this opportunity to reinforce understanding and students to be fully prepared,	Future learning ➢ Links to syllabus/ specification for exam/ revision ➢ Prior knowledge and skills from the photo frame and lighting project (Practice NEA) ➢ Give specific examples from them to remember and apply in a range of situations. 1.Personal development – building knowledge and understanding supported by a range of practical experiences to establish life skills. Design styles and making students aware of the changes over time which have informed the changes in how design and manufacture have been shaped 2. Social development- the evolution of design and its effect on its users and the changes each design movement has brought about. 3 Moral development—understanding of the effect of different design movements and how the changes have evolved within different cultures. Looking at moral

	that have helped to shape product design and manufacture. **Design styles and movements** ➢ Arts and craft movement ➢ Art Deco ➢ Modernism, e.g. Bauhaus ➢ Post modernism, e.g. Memphis. **Designers and their work** ➢ Phillipe Starck ➢ James Dyson ➢ Margaret Calvert ➢ Dieter Rams ➢ Charles and Ray Eames ➢ Marianne Brandt. **Socio economic influences** ➢ Post WW1: the Bauhaus and development of furniture for mass production ➢ WW2: rationing, the development of 'utility' products ➢ Contemporary times: fashion and demand for mass produced furniture ➢ Decorative design. **Major developments in technology** Micro electronics • new materials • new methods of manufacture • advancements in CAD/CAM. **Social, moral and ethical issues** ➢ Products are made using sustainable materials and ethical production methods ➢ The development of products that are: • culturally acceptable • not offensive to people of different race, gender or religious belief • the development of products that are inclusive • the design and manufacture of products that could assist with social problems e.g.poverty, health and wellbeing, migration and housing		influences and how they have influenced both design and manufacture 6. Cultural development – understanding how different cultures have different beliefs and how these design eras have been influenced by different cultual beliefs

	• the impact of Fairtrade on design and consumer demand • designing products **Product life cycle** Design introduction, evolution, growth, maturity, decline and replacement. Students should be familiar with examples of how designers refine and re-develop products in the lifecycle of specific products. **The use of a design process** Those used in the NEA • investigations and analysis • use of inspiration materials, e.g. mood boards • ideas generation • illustration • development of a design specification • modelling • planning • evaluating and testing. **Prototype development** Students should be aware of, and able to discuss and demonstrate, the development of a prototype from design proposals. This knowledge should influence the development of design ideas for the NEA so that students may make high quality products that meet the needs of identified users. **The iterative design process in industrial or commercial contexts** Students should be aware of, and able to discuss, how different design methodologies are used by designers in the corporate world when designing products including collaborative working and the cyclic nature of commercial design and manufacture. **Critical analysis and evaluation** Students should be aware of, and able to discuss, their own and commercial products leading to possible improvements/ modifications of the original idea.		

	Testing and evaluating products in commercial products Students should be aware of, and able to discuss, how products are required to undergo rigorous testing, and the testing methods used, before they become commercially available for sale. **Use of third party feedback in the testing and evaluation process** Students should be aware of, and able to discuss, how the use of feedback and testing informs the evaluation process, including: • informing future modification and development • the importance of ensuring the views of other interested parties in order to have objective and unbiased feedback. **Selecting appropriate tools, equipment and processes** the importance of using the correct tools and equipment for specific tasks • the importance of ensuring their own safety and that of others when in a workshop situation • how designs are developed from a single prototype into mass produced products • the effect on the manufacturing process that is brought about by the need for batch and mass manufacture • how to select the most appropriate manufacturing process to be able to realise there, or others', design proposals • the importance of health and safety in a commercial setting including workforce training and national safety standards. **Accuracy in design and manufacture** Students should be aware of, and able to discuss and demonstrate, the importance of accuracy in manufacturing, whatever the scale of production, including: • how testing can eliminate errors		

	• the value in the use of measuring aids, e.g. templates, jigs and fixtures in ensuring consistency of accuracy and the reduction of possible human error. **Responsible design** **Environmental issues** Students should be aware of, and able to discuss, the importance environmental issues in design and manufacture, including: • the responsibilities of designers and manufacturers in ensuring products are made from sustainable materials and components • the environmental impact of packaging of products, e.g. the use of excessive packaging and plastics. **Conservation of energy and resources** Students should be aware of, and able to discuss, the concept of a circular economy, including: • how products are designed to conserve energy, materials and components • the design of products for minimum impact on the environment including raw material extraction, consumption, ease of repair, maintenance and end of life • sustainable manufacturing including the use of alternative energy and methods to minimise waste • the impact of waste, surplus and by products created in the process of manufacture including reuse of material off-cuts, chemicals, heat and water • cost implications of dealing with waste • the impact of global manufacturing on product miles. **Planning for accuracy and efficiency** Students should be aware of, and able to discuss and demonstrate, the importance of		

	planning for accuracy when making prototypes and making recommendations for small, medium and large scale production. **Quality assurance** Students should be aware of, and able to discuss and demonstrate, the procedures and policies put in place to reduce waste and ensure manufactured products are produced accurately and within acceptable tolerances, including quality assurance systems including Total Quality Management (TQM), scrum, Six Sigma and their applications to specific industrial examples including critical path analysis. **Quality control** Students should be aware of, and able to discuss and demonstrate, quality control, including: • the monitoring, checking and testing of materials, components, equipment and products throughout production to ensure they conform to acceptable tolerances • specific quality control methods including the use of 'go-no go' gauges, laser or probe scanning and measuring • use of digital measuring devices such as vernier callipers and micrometers • non-destructive testing such as x-rays and ultrasound. **National and international standards in product design** ➢ British Standards Institute (BSI) ➢ International Organisation for ➢ Standardisation (ISO) ➢ Restriction of Hazardous Substances ➢ (ROHS) directive ➢ battery directive ➢ polymer codes for identification and recycling ➢ packaging directives ➢ WEEE directives ➢ energy ratings of products ➢ eco-labelling: ➢ the Mobius Loop		

	➢ the European Eco-label ➢ NAPM recycled mark ➢ the EC energy label ➢ the Energy Efficient label and logo ➢ Forest Stewardship Council (FSC) ➢ EPA energy star.		