Key Stage 4
GCSE D&T

Resistant Materials
The Course

Scheme of Work

Resistant Materials
Contents

Key Elements of the Resistant Materials Course

The GCSE Resistant Materials course builds on the Key Stage 3 programme of study for Design and Technology. The course also allows for progression to post 16 courses such as: AS/2 level Product Design or related subjects such as GNVQ Advanced Manufacturing.
The 2 year course allows pupils to gain subject knowledge, design and making skills, and ICT, particularly CAD/CAM skills in Resistant Materials using a wide range of different materials and manufacturing techniques to produce several outcomes throughout the course culminating in the production of a final coursework project consisting of a 3-dimensional product/s and a concise design folder and / or the appropriate ICT evidence.

1. Coursework will consist of approximately 40 hours of work by each student producing approximately 20, A3 sheets of work.
2. Pupils will take a written paper at the end of the course (Full Course)

Coursework - 60% of total marks
Written Paper - 40% of total marks

Products should be designed to meet a commercial need. Most commercial products require some form of labeling, packaging or instructions and therefore an element of Graphic Design is likely for the product to be complete.

Most commercial products are constructed or assembled using a variety of materials. Single material products are acceptable outcomes for this course but it is likely that other materials will have been used to create manufacturing aids such as moulds, jigs, formers etc.

The notion of designing products that can be manufactured in quantity rather than a one-off product is an important aspect of the course.

A significant amount of time will be given to addressing general manufacturing issues, environmental and social issues as detailed in the course specification.

Summary of Subject Content (Taken from Specification)

The specified general designing and making skills required for this course and the knowledge and understanding candidates should acquire follow the four broad areas of study:

- Designing and Making Skills;
- Materials and Components;
- Design and Market Influences;
- Processes and Manufacture.

Designing and Making Skills

Design and Technology is a practical subject area which requires the application of knowledge and understanding when developing ideas, planning, producing products and evaluating them. The distinction between Designing and Making is a convenient one to make, but in practice the two often merge. For example, research can involve not only investigating printed matter and people's opinions, but also investigating e.g. proportions, adhesives, colour, structures, circuits and materials through practical work. The skills which follow underpin all learning and cover the programme of study for Key Stage 4 Design and Technology.

9.1 Designing Skills

Candidates should be taught:

- to understand the basic design principles of line, form and colour and their application in designing;
- to develop and use design briefs, detailed specifications and criteria in relation to product development;
- to consider the conflicting demands that moral, cultural, economic, environmental, historical and social issues can make in the planning and in the designing of products;
- to consider their own health and safety and that of makers, manufacturers, individual users and society at large;

- to consider an increasing range of users of products and different societies in relation to their differing needs and values;.
- to anticipate and design for product maintenance;
- to design for manufacturing in quantity;
- to plan for quality control and quality assurance when designing products and to be aware of the difference;
- to generate design proposals against stated design criteria, and to modify their proposals in the light of on-going analysis, evaluation and product development;
- to use graphic techniques and ICT, including CAD to generate, develop, model and communicate design proposals;
- to match materials and components with tools, equipment and processes, taking account of critical dimensions and tolerances when deciding how to manufacture the product;
- to produce and use detailed working schedules that will achieve the desired objectives in the time available, setting realistic deadlines for the various stages of manufacture, identifying critical points in the making process and providing alternatives to possible problems;
- to devise and apply test procedures to check the quality of their work at critical points during development, and to indicate ways of modifying and improving it when necessary;
- to be flexible and adaptable in their designing, in order to respond to problems, changing circumstances and new opportunities;
- to ensure that the quality of their design solution will be suitable for intended clients and consumers;
- to understand the difference between quality of design and quality of manufacture and use essential criteria to evaluate the quality of products they have made and products which have been made commercially;

9.2 Making Skills

Candidates should be taught:

- to match materials and components with tools, equipment and processes to produce quality products;
- to use tools and equipment safely, accurately and efficiently to achieve an appropriate fit, finish and reliable functioning in products that match their specifications;
- to use a range of industrial applications when working with familiar materials and processes;
- to manufacture products singly and in quantity, including the practical application of quality control and quality assurance techniques;
- to use computer-aided manufacture (CAM) in single item production and in batch or volume production;
- to simulate production and assembly lines including the use of ICT;
- to be adaptable in their working practices, in order to respond to changing circumstances and new opportunities;
- to ensure, through testing, modification and evaluation, that the quality of their products is suitable for intended users and devise modifications where necessary that would improve performance.

10

Materials and Components

Candidates should build upon the National Curriculum Key Stage 3 Programmes of Study to develop a working knowledge of a wide range of materials appropriate to modelling, prototyping and manufacturing.

10.1 Materials: Metal, Plastics, Wood

Properties, characteristics and combinations of metal, plastics and wood

Candidates should recognise the working characteristics of the common forms of metal; understand the differences between ferrous and non-ferrous metals and how they are used; know that the properties of metals can be changed by heat treatments; know that metals can be combined to form alloys; recognise the working characteristics of common forms of plastics; understand the difference between thermoplastics and thermosetting plastics and how this affects the way they are used; know that plastics can be combined with other materials to create extra strength and enhance appearance; recognise the working characteristics of the common forms of wood; know the difference between hardwoods and softwoods, and between natural wood and manufactured boards.

Uses of resistant materials

Candidates should be aware of technological advances in resistant materials and their use in a wide range of industries.

10.2 Components and Adhesives

Selection of suitable components, premanufactured components and adhesives.

Candidates should know that many fixings are available to complete the functional aspects of a product, and use safely and effectively those which are appropriate; know about and use appropriate adhesives for a variety of materials and conditions.

Design and Market Influences

Candidates should be taught how to analyse products and processes. They should consider how design and technology affects the manufacturer, user and environment, and the importance of health and safety issues.

10.3 Product analysis

Analysis of designs and products

Candidates should use product analysis techniques to make critical judgements about the design and manufacture of resistant materials products; use design principles, taking into consideration form, function, shape, colour, materials, texture, component parts, decoration and aesthetic appeal to evaluate suitability for purpose; consider ergonomic and anthropometric data; use this information to review and modify own designs;

Image and lifestyle reflected in past and present resistant materials products

Candidates should analyse aesthetic and functional requirements in relation to modern life; assess and implement these factors when designing and producing products to achieve specific functions and effects;

Comparison of own designed product to alternative products on market

Candidates should compare own outcomes with other products on the market and analyse the differences;

10.4 Evaluation Techniques

Checking of design proposals against design criteria

Candidates should understand the design specification criteria that influence the design of commercial products.

Quality assurance of product(s), through testing and evaluation

Candidates should devise simple tests to check the effectiveness of designs and evaluate against the specification criteria; use ongoing evaluation to make judgements and suggest improvements during the design and manufacture of own products.
Evaluate the effectiveness of various manufacturing techniques.

Evaluation of own product

Candidates should consider other peoples' views (client, designer, manufacturer, user/consumer) when refining product designs; ensure that own product(s) are of suitable quality for intended users; test against original specification and against quality of similar commercial products;

10.5 Social, cultural, moral and environmental issues

Social and cultural influences on the consumer market

Candidates should recognise the effects of social and cultural influences on product design;
Consider the needs of students of different heights in a school workshop situation. Understand that differing circumstances can influence the requirements of designing for different users;
Collect relevant data on ergonomics and anthropometrics and use them as a resource;

Appreciate that sizes vary according to age, gender, culture and that products must suit the needs of the user(s).

Consumer choice

Identify the factors involved in consumer choice; carry out market research to establish consumer preferences of target group(s);
Ensure that own designs meet the requirements of the intended market;

Consumer rights legislation, product maintenance and codes of practice

Take legislation concerning consumer rights and safety codes of practice into account when designing own products; implement labelling of products in accordance with latest legislation and BSI;

Moral and environmental issues

Understand the moral and environmental issues associated with the production of artefacts, the harmful effects of industrial pollution and the crucial need to treat and dispose of waste materials correctly; be aware of the financial environmental and human costs involved in processing/making common materials and products; appreciate the importance of conservation and protection of natural resources and the need to recycle products when possible;

10.6 Health and Safety Issues

Identification and reduction of hazards or risks when designing and manufacturing products

Understand that safety for product maker and product user is essential; assess hazard and risk factors in product manufacturing and choice and use of materials, components, tools, equipment; work with these safely and effectively;

Safety in the working environment

Recognise that safety of the workforce is essential; take responsibility to ensure that hazards are minimised and the working environment is safe to use; observe health and safety regulations when working with materials and equipment;

Safety for the consumer

ensure that the end product is safe for the consumer in accordance with Health and Safety regulations;

Processes and Manufacture

Candidates should be aware of and use as appropriate, manufacturing processes and techniques including CAD and CAM. They should have an industrial and commercial awareness and know about the processes involved in manufacturing for batch and mass production.

10.7 Techniques and Processes

Selection and usage of appropriate tools and equipment, including CAD and CAM, for metal, plastics and wood

Use a range of hand-tools for marking out and making; match and use machinery and equipment appropriate to the material accurately and safely to produce quality products; prepare materials by using appropriate techniques; know how to cut, shape, join and form metal, plastics and wood appropriate to the properties and characteristics of each material; rearrange material by exploiting the material properties, i.e. casting, bending, forming, cutting, laminating; drilling, machining, and use of different fasteners and finishes;

Use of appropriate machine tools, techniques and processes

Use machine tools appropriate to the material and process to cut and remove waste safely; appreciate forming and reforming techniques for metal, plastics and wood, including laminating, casting, the use of a strip heater and the processes for vacuum forming; have knowledge of blow moulding, injection moulding and the use of CNC; know about and use appropriately machining processes including CNC where possible, for metals, plastics and wood, including drilling, boring, lathework, use of abrasive and cutting machines and hand power equipment;

Range of processes used for one-offs, batch and mass production

Understand how products are produced for various markets in society and the types of production systems used, including mass, batch, flow-line and one-off production;

Selection of appropriate process and techniques for own product

Select and use the most appropriate technique(s) and process(es) to make own product;

10.8 Systems and Control

Organisation of working environment
Plan an efficient and safe working environment;

Basic production systems
Identify common components used in structural and mechanical systems; use the following basic mechanisms: cams, levers, springs, gears, cranks and pulleys;

Design, use and connection of systems and sub-systems
Understand the critical stages that influence the development of a product; design and set up a system with sub-systems to make a product, ensuring efficient use of time and energy and cost effectiveness;

Quality assurance by incorporating critical checks, feedback and testing procedures
Understand and implement the concept of input-process-output and incorporate quality check feedback loops during the making of a product; apply appropriate checking procedures and tests to ensure quality control; reject faulty items;

10.9 Information and Communication Technology

Computer technology and communication techniques
Use ICT as appropriate to research, gather, sort and present relevant material for the planning of tasks and generation of solutions;

Usage of CAD for graphical techniques
Use relevant graphical techniques, including CAD, to generate, develop, modify, enhance, model and communicate design ideas and production plans which can be understood by others; use CAD to present accurate drawings with sizes, using 3D and 3rd angle orthographic projections and to consider alternative forms and colours when developing ideas;

Industrial usage of CAD and CAM

Recognise the economic importance and benefits of using CAD/CAM in the production of resistant materials products; have knowledge of CAM for single item, batch and mass production;

10.10 Industrial Practices

Industrial and market awareness
Investigate the world of design and manufacture and understand the key roles of client, designer, manufacturer and user in the development of products for industrial manufacture;

Planning for industrial production
Understand industrial production plans, including scheduling, job sequencing and processing, timescales and costs of production; efficient methods of batch and volume production;

Industrial systems for batch or volume production
Understand the commercial implications of manufacturing in quantity and the effects of introducing new technologies; understand that costs are related to physical, environmental and human resources (set-up time, money, labour, site, energy, overhead, etc.);

CAD/CAM in industry
Understand that repetition of quality can be assured if CAD/CAM equipment is used to aid making; understand the economic and aesthetic benefits of standardising components and materials; understand the application of CAM to single items and small batches; understand that identical parts, if made sequentially, minimise effort and assist accuracy;

Computer Integrated Manufacture (CIM)
Have a knowledge of Computer Integrated Manufacture (CIM);

Advertising and marketing
Understand the importance of advertising resistant materials products; be aware of different distribution / wholesale and retail methods, i.e. shops, supermarkets, mail order catalogues and the Internet;

Legislation, symbols and conventions
Understand the need for and use of appropriate legislation, symbols and conventions i.e. BSI, related to product safety, use and drawing conventions.

Resistant Materials
Year 10 Projects

During year 10, students will undertake a series of FPTs which can help them with elements of their main coursework assignments or be substituted if problems are encountered. Appropriate homework's have been set that will further build on student's experiences in class. Deadlines for FPTs and the main coursework project are to be set each term to reflect the school calendar of events. * Extension activity

Term	Project Outline & Learning Experiences	Sequence of Lessons	Resources	Homework
Year 10 **Term 1**	**Project 1 – Jewellery Box** **Design Brief:** Pupils need to store/keep their valuables – small objects such as rings and pendants. Using appropriate resources, they will produce a jewellery box with a lid and internal partitions..	Introduction to the first project - The Wooden Box. Maximum size. Material available 800 X 80 X 12 mm hardwood. Joints to be used - Corner halving. rebate, finger/comb joint. Explain the options for lids and fixings, colour schemes/ finishes. Overall quality expected. First practical session - marking out the timber and cutting square. Emphasise use of marking knife. gauge. try square. Face side and edge. Use of jigs to cut wood - mitre saw. Tenon saw-and bench hook. Wood issued and marking out started.	Chalkboard/Marker board. Examples of hardwoods. Softwoods, ferrous metals and non ferrous metals. Thermosetting and thermoplastics. Examples of joints [see display in entrance]. Sample of timber to be used. Example boxes. Marking out tools. Saws - tenon, dovetail,	Use text book to study for short test. Use text book to research joints and their applications. Produce initial ideas, and final idea for box, giving particular reference to size, hinges fastenings and colour scheme.

	Description: Students will manufacture a small box using hard wood. The corners will be marked out using correct tools to produce comb or finger joints. The inside will be partitioned and the whole box finished using acrylic paint/varnish **Appropriate research opportunities:** Research a range of commercial joints to see how they work, their uses and advantages.. **Multi Material opportunities:** Hardwoods and manufactured boards are used **Opportunities to manufacture in quantity:** The use of jigs and devices to enable batch production are considered **Industrial applications, systems and control:** Templates, CAD/CAM, and jigs considered. Industrial finishes are	Demonstration of how to use the rebate plane to produce rebates along the top and bottom of the timber length. Class continue to cut wood and use plane in turns. How to cut the joints (corner halving and comb joint) - demonstration. Class mark out and start to cut joints. Demonstration of the use of machines to cut joints i.e. link to industrial / commercial manufacturing processes. Jigs again: The router and table set up to cut rebates. The bandsaw to cut comb joints. Demonstration of the use of adhesives and clamping devices. Demonstration - Use of abrasives - going through the grades. A good finish. By this point (8 weeks) the class should have completed the assmbly of the basic box and be sanding down to final finish. Cutting the box to separate the lid and then attaching any fastenings. Demonstrate and teacher to execute using band saw. Tenon saw method also to be explained.	mitre. Timber lengths for the group. Research joints and their applications. Rebate planes. Joint examples and boxes in various stages of completion. Router set up for rebate cutting with dust extraction. Band saw. G-cramps. Solo clamps. quick action clamps, vices and sash cramps. PVA glue and box parts. Rubbing boards, glass paper. aluminium oxide paper, wet and dry paper.	Study relevant tools and processes Designs for final version of design to be refined. Read about mass production and the use of jigs and other devices used in the production of manufactured wooden items. Market research - survey on which finish is preferable. Present results/findings as a pie chart. Text book to study abrasives and what grades mean.

	also discussed.	Finishing - demonstrate all the finishes available. Danish oil. Teak oil. Acrylic varnish, Wax. Liming. Acrylic paint effects. Final display of boxes and assessment. (Total time 10 weeks)	Finishing materials, brushes. cloth. Wire wool.	Prepare a plan of production. Finalise the design in light of final demonstrations - fitting out the box. Finalise designs using market research etc. to decide on final finish. Study for end of project test.

Term	Project Outline & Learning Experiences	Sequence of Lessons	Resources	Homework
Year 10 **Term 2**	**Project 2 – The Clock Project** **OBJECTIVE:** To introduce the pupils to design and problem solving in detail and a range of graphics techniques. The pupils will learn a variety of practical skills, suitable	**Stage One. Study existing clocks** 1. Produce a *rich picture* with the theme existing clocks at its centre. 2. Discuss the needs of the client and present these on either the rich picture or in a separate *analysis* **N**. Lay out of presentation sheet discussed (border and guideline measurements explained). **L.** Example client requirements read and	Internet Access Drawing/writing equipment	Complete graphical presentation of rich picture.

	for the solution of design problems. Students will produce a limited design folder but will go through the entire design process. **Design Brief** To design a clock suitable for a young person. Using appropriate resources they will design and make a clock. **Description** Students will manufacture a free standing or wall mounted clock. The main material will be Acrylic sheet. The acrylic will be shaped using a coping saw and a range of files. The line bender (strip heater may be used . The overall finish must be as close to professional as possible. The laser cutter may be used. **Appropriate research opportunities** Research a range of	discussed. **C**. Views of other should always be discussed, in this case the client. **Extension work** **ICT**. Research into a range of clocks using the internet. **Stage Two.** **Investigation and disassembly** 1. Pupils shown an existing clock and mechanism and shown how it is assembled / disassembled. Methods of fixing the mechanism to a simple clock face explained. **N**.Dimensions of clock mechanism explained. **L**. Instruction diagrams regarding assembly of clock mechanism discussed. **Characteristics of plastics FPT** 1. Range of plastics explored. 2. Costs of a variety of plastics discussed. 3. Working characteristics / properties investigated and demonstrated where appropriate, FPT. Strength, toughness, hardness, density, stiffness, thermal conductivity, environmental resistance. **ICT**. Website reference and Focus on Plastics CDRom for plastics properties and working of plastics	Focus on plastics CD-ROM Internet Access to department website. Drawing/writing equipment	Pupils to present a materials properties table, drawn by hand or through the use of ICT.

	existing clocks. **Multi Materials opportunities** Acrylic sheet is used for the main parts but other materials could be used for particular effects. Card is used for modelling **Opportunities to manufacture in quantity** The card model will be used a s a template to aid in the marking out of the acrylic sheet. This method could be used for batch production. **Industrial applications, systems and control** The use of computer controlled machinery such as the laser cutter demonstrates the possibility of producing a series of identical products. The clock mechanism itself is a mass-produced product.	4. Pupils should consider the range of effects achieved through the combination of different materials and how these could be joined. **Forming Methods** 1. Vacuum forming demonstrated although this may not be a technique used by the pupils at this stage. Emphasis placed on how this technique could be used for mass production. 2. Blow moulding discussed – website and CDRom 3.Injection moulding – demonstrated **Extension work** Pupils to collect some additional information regarding the properties or /and working methods of plastics. **Stage Three. Specification** 1. Pupils produce a detailed specification including statements about the following: Where will the clock be situated? What size will it be? How will it mark the hours? How will it be powered? What will it be made from? Which colours and textures will be used? L. Example specifications given to pupils and	Drawing equipment.	Completion of specification

	A professional finish is discussed and demonstrated especially when polishing the edges of the acrylic but also the need for care and accurate working at every stage. Plastic forming methods demonstrated.	discussed. **ICT**. Website reference discussed. **N**. Layout/measurements discussed. The pupils will watch a video which shows how a company interacts with its client, in particular in working towards a specification **Extension Work** Pupils to write an alternative specification. Continue research on existing designs through use of internet, catalogues etc…. **Stage Four. Initial ideas and modelling** 1. Pupils will produce a number of designs using suitable drawing / colouring techniques. Detail notes to accompany each idea reflecting the specification. 2. Each pupil will select his/her best idea and make a model from a material such as card. 3. A working drawing and parts list will be produced. 4. A plan for manufacture (flow chart or time chart) listing materials, processes and making stages - to be presented. **ICT**. One design presented through use of graphics software. **N**. Application of flowcharts discussed. Use in programming and other areas discussed. **Extension work** One or more ideas to be completed using graphics software. **Stage Five. Construction**	Scissors and card. Modelling knives. Pritt stick. Acrylic 150 x150 in a range of colours. Off cuts of acrylic and other materials as required Line bending machine. Tensol cement. Coping saws, files.	Four ideas, well presented with notes. Basic sequence drawing following each stage of manufacture.

		1. Appropriate construction techniques demonstrated by teacher and utilised by pupils. 2. Health and Safety emphasised at all times. **L**. Pupils to follow safety instructions and notices **N**. Pupils shown how to use appropriate equipment for accurate measuring **C**. Pupils shown importance in working together in the workplace. Sharing equipment etc **Quality of finish** Care to be taken over :- Joining materials. Removing excess or waste materials. Smoothing rough edges. Applying protective and special finishes **Stage Six. Testing and Evaluation** Pupils test clocks against specification and write evaluation. Example evaluations discussed with pupils. Survey carried out in an attempt to find the most popular clock. **L**. Read through example specifications. Pupils read their specifications to rest of the class. **C**. Importance of carrying out a survey to find out public opinions/needs. **N**. Layout of survey, examples shown to class. Findings presented as graphs. **ICT**. Spreadsheet software used to produce	Wet and dry paper in a range of grades. Metal polish and cloths. 8mm Drill bit Spanners to fit nuts on clock mechanisms. AA batteries. Clock mechanisms Spreadsheet software.(Excel)	Complete survey at home and produce a pie chart or bar chart using Excel.

		graphs. **Extension Work** Write an evaluation of another pupils work or a manufactured clock		

Term	Project Outline & Learning Experiences	Sequence of Lessons	Resources	Homework
Year 10 **Term2**	**Project 3 – Jewellery (Pewter Casting)** **Design Brief:** Body adornment is a part of the culture of most people in the world. Using simple resources pupils will design and make a pendant or broach from pewter. **Description:**	**Stage One. Study existing jewellery** 1. Produce a *rich picture* with the theme jewellery and styles at its centre. 2. Discuss the needs of the client and add these to the rich picture - why do people wear jewellery, who wears it, types of jewellery etc, **N**. Lay out of presentation sheet discussed – use of design frames. **L.** Client requirements discussed. **C**. Link to the wider issue of body adornment - its place in world cultures. **Extension work** **ICT**. Research into design themes and body	A display board with stages of the project mounted up like a story-board. Tools – blowtorch, machine vise and quick action clamps, coping saw, files and rasps, ladle for pouring the molten pewter, drill bits, pillar drill, scroll saw. Materials – 40 x 40 MDF 3mm squares, a range	Using design frames –

	Students will manufacture a piece of jewellery by simple casting. The mould will be made from 3mm MDF. In addition a small acrylic shape will be embedded in the casting.. The jewellery will be finished by fettling and the going through the grades to achieve a polished finish. **Appropriate research opportunities** Research a range of existing jewellery. Research a range of classic design themes such as Art Nouveau and Art Deco. **Multi Material Opportunities.** The mould or pattern is made from MDF the inserts are acrylic and the metal used is a low melting point alloy called pewter (Lead	adornment using the internet. **Stage 2. Initial ideas and modelling** 1. Pupils will produce a number of designs using suitable drawing / colouring techniques. Detail notes to accompany each idea reflecting the general specification. 2. Each pupil will select his/her best idea and draw in detail. 3. A plan for manufacture (flow chart or time chart) listing materials, processes and making stages - to be presented. **ICT**. One design presented through use of	of 3mm acrylic shapes cut on the laser cutter, pewter pieces, double sided tape. Finishing materials – files, wet and dry paper 300, 800, 1200, metal polish and rag. Internet Access to department website. Drawing/writing equipment	Look at a range of existing jewellery and design themes such as Art Nouveau and Art Deco. Produce some research sheets displaying the information. Produce an ideas sheet for their own designs where the outside shape and the insert are allowed to vary.

	free version). **Opportunities to manufacture in quantity** The method being used can easily be used for batch production as the pattern is re-usable (with slight scorching) and a batch of ten or so is quite possible with this system as long as the shapes are kept simple. Mass production would require a die casting approach.	graphics software. **N**. Application of flowcharts discussed. Use in programming and other areas discussed. **Extension work** One or more ideas to be completed using graphics software. Ideas for laser cut version drawn using a vector based program – XaraX or 2D – Design. **Stage Three Construction** 1. Appropriate construction techniques demonstrated by teacher and utilised by pupils. Full use to be made of process display board 2. Health and Safety emphasised at all times. Especially with hot metal **L**. Pupils to follow safety instructions , process board and safety notices. **N**. Pupils shown how to use appropriate equipment for accurate measuring **C**. Pupils shown importance of working together in the workplace. Sharing equipment and most importantly co-operating to work safely using the blow torch and pouring the molten pewter into the mould. **Quality of finish**		Produce a final idea for their own design perhaps as a result of market research – a survey or interview to help them finalise their design. Produce a simple planning sheet to show the stages of preparing the mould through casting and finishing.

	Industrial applications, systems and control. The laser cutter allows students to produce a delicate and intricate shape in the acrylic insert. The use of lasers to produce high quality detailed work is becoming more common in the manufacture of jewellery. This project is a simple introduction to casting – an important industrial process and gives the opportunity to consider sand casting, investment or lost wax casting as well as die casting and even injection moulding of plastics.	Care to be taken over :- Joining materials. Double sided tape to temporarily hold insert in place. Removing excess or waste materials. Smoothing rough edges. Going through the grades and final polishing to achieve a highly polished finish. **Stage Four Testing and Evaluation** Pupils to complete a simple evaluation by survey or interview. Write up evaluation using design frame. Example evaluations discussed with pupils evaluating against general specification. Production methods discussed. **L**. Read through example specifications. **C**. Importance of carrying out a survey to find out public opinions/needs. **N**. Layout of survey, examples shown to class. Findings presented as a piechart. **ICT**. Spreadsheet software used to produce graphs. **Extension Work** Write an evaluation of another pupils work or a manufactured piece of jewellery		Evaluate the final product, consider how it could be batch produced and mass produced perhaps by die-casting or stamping.

Term	**Project Outline & Learning Experiences**	**Sequence of Lessons**	**Resources**	**Homework**
Year 10	**Project 4 – CD**	Introduction to project on CD rack. Size 280 x 160 x 18 mm. Material to be used 18mm MDF.	Vacuum forming machine	

Term2	**rack** **Design Brief** Keeping CDs in a sensible order is always a problem. If they are stacked they fall over. A CD rack is needed which keeps the CDs securely so that they can be easily found. **Description** Students will produce a box module from 18mm MDF. The unit will be constructed using the biscuit cutter to produce a reinforced butt joint. The CDs will be supported in vacuum formed inserts which are to be held in place with double sided adhesive tape. The decoration and finish are decided by the students. **Appropriate research opportunities:** Research a range of commercial joints to see how they work, their	Explanation to class on production process's to include, single, mass, and batch production. CAD/CAM introduced as a method of production. Explanation to the class of the need for a batch production for this project which will need to assure quality of build. To include finish, build quality and the need for an identical product each time. To include some element of CAD/CAM. First practical lesson – collecting timber (timber to be cut to correct lengths, alternatively students to cut to length from one piece), Explain through manufactured boards why we use MDF,re-emphasis the alternatives such as hardwood, softwood and plastic. Emphasising the use of jigs to help cut to correct length, explaining through marking out tools, such as try square. Class should mark out and cut to length all their timber. Demonstration on the use of jigs explaining the advantages and the way they work using a variety of different jigs to help demonstrate. Recap on types of joints and there uses. Introduction to the Biscuit joint, it uses and why we use it.	CD rack mould. Black recycled HIPSsheet. 18mm MDF sections pre-cut to make standard box module. Biscuit cutter and biscuit inserts. Full range of woodworking tools. Laser cutter. Roland Camm Vinyl cutting MachineCX24. Double sided tape. Acrylic paint and rollers and brushes. Belt sander. Scrap materials for extra features. Coloured self adhesive vinyl. Sheet acrylic to be used on the laser cutter.	Design a poster to be used in school to demonstrate the process's of single, batch. And mass production Produce initial ideas, and final idea for CD rack,. Use text book to research joints and their applications.

	uses and advantages.. **Multi Material opportunities:** Manufactured boards are used. Thermosetting and thermoplastic, such as styrene. **Opportunities to manufacture in quantity:** The use of jigs and devices to enable batch production **Industrial applications, systems and control:**	Demonstration of the use of power tools, introduction to the biscuit cutter and how it works, to include safety instructions. Show example of the biscuit cutter cutting the joints using the jig. Reinforcement of advantages of jigs. Explain through batch production again, with reference to the demonstration. link to industrial / commercial manufacturing processes Students to use the biscuit cutter and jig to cut all joints on CD rack. Demonstration of the use of adhesives and clamping devices. Demonstration - Use of abrasives - going through the grades. A good finish. Demonstrations of attaching backboard of CD rack using panel pins and adhesive. Recapping on safety and use of tools By this point the class should have completed the assembly of the basic CD rack and be sanding down to final finish. Demonstration of vacuum forming inserts of CD rack, going over plastics and their properties, as well as jigs and industrial practises.		Read about mass production and the use of jigs and other devices used in the production of manufactured wooden items Market research - survey on which finish is preferable. Present results/findings as a pie chart. Text book to study abrasives and what grades mean. Complete a plan of make.

	Templates, CAD/CAM, and jigs considered. Industrial finishes are also discussed. The use of laser cutting and Vinyl cutting machines.	Students should now have constructed CD rack complete with CD storage inserts. Demonstration on the use of CAD/CAM for engraving. Demo on the laser Cutter. Demonstration on the use of vinyl cutter to produce stencilling for decoration of CD rack.. Finishing - demonstrate all the finishes available. Danish oil. Teak oil. Acrylic varnish, Wax. Liming. Acrylic paint effects Final display of CD racks and assessment.		Evaluation to be done on final product Study for end of term test.

Homework

Homework will be set regularly in line with current school policies for the first three terms of the two year course. (Year 10).
E – Learning - The website gives students the opportunity to complete extension work, to extend their studies by working through the quizzes as well as using web pages and links to other sites to inform their work. The project guides and design frames provide a clear framework in which the students can work through the design process and document their progress.

Homework will include work in the following areas.

Year 10

Term 1	Term 2	Term 3
1. Simple Product Analysis. 2. Research into woodworking joints. 3. Mass production 4. Batch production and the use of jigs and templates. 5. Tools and processes. 6. Market research – the production of surveys/questionnaires. Barcharts/piecharts 7. Research using website/books into finishing methods 8. Producing process charts – flowcharts of production. 9. Graphic techniques to present work effectively. 10. Annotation of ideas and developments.	1. Research for projects using different techniques. Including the internet, market research, LRC, asking questions. 2. Prodesktop practice - CAD/CAM 3. Completion of design frames :- Evaluations, Rich Pictures, Final Ideas, Annotated Designs, Planning Sheets. 4. Homework will also be used for revision and preparation for end of year examinations using exemplar exam questions focused on relevant areas of study. The website has a key part to play here.	1. Brainstorm exercise for main project.. 2. Preliminary research for main project 3. Researching existing products for main project 4. Then working through the early stages of the design process using design frames to complete work to generate fist designs.

Year 11

Term 3	Term 3	Term 3
1. Individual needs for student's coursework.	1. Individual needs for student's coursework	1. Homework will focus on end of year examinations using exemplar exam questions focused on relevant areas of study

Coursework Monitoring and Feedback

- During the 2 year course, feedback will be continuous and cumulative. Students will be issued with a sheets/booklet that will be used to record progress throughout the course for each project and main coursework project. (APPENDIX)
- Common deadlines will be set for each piece of coursework for the entire course.
- Letters will be sent home at the start of the first and second year notifying parents of deadlines. (APPENDIX)
- Positive letters of commendation will also be sent home as appropriate. (APPENDIX)

Coursework Assessment

Because of the nature of design and technology work, students work will be marked in a flexible, integrated and holistic way.

Work will be informally assessed during project work with feedback given to the student and formally when estimating the candidates overall final grade.

Candidate's work shall be measured against exemplar material which illustrates standards with criteria for grades (A*-G)

Grade Descriptions

The following grade descriptors indicate the level of attainment characteristic of the given grade at GCSE. They give a general indication of the required learning outcomes at each specific grade. The descriptors should be interpreted in relation to the content outlined in the specification; they are not designed to define that content. The grade awarded will depend in practice upon the extent to which the candidate has met the assessment objectives overall. Shortcomings in some aspects of the examination may be balanced by better performances in others.

Grade F

- When designing and making products, and acquiring and applying knowledge, skills and understanding, candidates draw on and use various sources of information.
- They clarify their ideas through discussion, drawing and modelling; use their understanding of the characteristics of familiar products when developing and communicating their own ideas and work from their own plans, modifying them where appropriate.
- Candidates work with a range of tools, materials, equipment, components and processes with some precision; check their work as it develops and modify their approach in the light of progress; test and evaluate their products, showing that they understand the situations in which their designs will have to function and are aware of resources as a constraint and evaluate their use of basic information sources.

Grade C

- When designing and making products, and acquiring and applying knowledge, skills and understanding, candidates use a wide range of appropriate sources of information and strategies to develop ideas, responding to information they have identified.
- They investigate form, function and production processes and communicate ideas, using appropriate media.
- Candidates recognise the needs of users and develop realistic designs.
- They produce plans that make use of time and resources to carry out the main stages of making products.
- They work with a range of tools, materials, equipment, components and processes, taking account of their characteristics, and organise their work so that they can carry out processes accurately and consistently, and use tools, equipment, materials and components with precision.

- Candidates adapt their methods of manufacture to changing circumstances, providing a sound explanation for any change from the initial specification.
- They select appropriate techniques to test and evaluate how their products would perform when used and modify their products in the light of ongoing evaluation to improve their performance.
- They evaluate their use of information sources.

Grade A

- When designing and making products, and acquiring and applying knowledge, skills and understanding, candidates seek out and use information to help their detailed design thinking, and recognise the needs of a variety of client groups.
- They are discriminating in their selection and use of information sources to support their work and they use a wide range of strategies to develop appropriate ideas, responding to information they have identified.
- Candidates investigate form, function and production processes and communicate ideas using a variety of appropriate media.
- They recognise the different needs of a range of users when developing fully realistic designs. When planning, they make sound decisions on materials and techniques based on their understanding of the physical properties and working characteristics of materials.
- They work from formal plans that make the best use of time and resources; work with a range of tools, equipment, materials and components to a high degree of precision and make products that are reliable and robust and that fully meet the quality requirements given in the design proposal.
- Candidates identify conflicting demands on their design, explain how their ideas address these demands and use this analysis to produce proposals. They identify a broad range of criteria for evaluating and testing their products, clearly relating their findings to the purpose for which the products were designed and the appropriate use of resources, and fully evaluate their use of information sources.

Assessment Units

The Scheme of Assessment comprises two components.
All questions are compulsory.
Questions will test the application of knowledge and understanding of materials, components, processes, techniques, technologies and the evaluation of commercial practices and products.
Questions will largely address general aspects of product design which cross all material area, although some questions will allow subject specific knowledge to be shown.

The coursework project will be internally assessed and externally moderated.
The project should address all three assessment objectives in an integrated way.
Candidates are required to submit a 3-dimensional product or outcome and a concise design folder and/or the appropriate ICT evidence.
Candidates have the freedom in product design to use the type and variety of materials necessary to satisfy their design brief.
Throughout the project candidates should address the industrial and commercial practices, and the moral, social, cultural and environmental issues, arising from their work.

Weighting of Assessment Objectives

The approximate relationship between the relative percentage weighting of the Assessment Objectives (AOs) and the overall Scheme of Assessment is shown in the following table:

Assessment Objectives	Component Weightings (%)		Overall Weighting of AOs (%)
	Coursework	Written Paper	
1 Materials and Components	10	10	20
2 Designing and Making	40	20	60
3 Evaluation and Social Issues	10	10	20
Overall Weighting of Units (%)	**60**	**40**	**100**

Moderation / Standardisation Main Coursework Project Work

Students work will initially be internally moderated by teachers delivering the course thus enabling teachers to achieve a common agreement about standards. To facilitate this, a minimum sample (where possible) of one of each of the following pieces of students work should be used for standardising grades; 'A', 'C', 'D' and 'F'. Teachers from other D&T subject focus areas will be invited to standardize a sample of work. Once a standard has been agreed, teachers will continue to mark the cohort of work.

Examining body moderation of the coursework is by inspection of a sample of candidates' work. This will initially involve design folders for the sample being sent by post from the centre to the moderator appointed by the examination board.

Preparing Coursework Portfolios for Assessment

The following checklist should be used before work is finally assessed and moderated before the set deadline has expired:

Ensure that:

- candidate's work should has a front cover with their name, candidate number, the name of the project, the name of the school and the school center number.
- each portfolio has a contents sheet.
- each page is individually numbered to correlate with the contents sheet.
- references and bibliography is included listing all sources of information.
- the students has met all of the assessment criteria.
- the work is in the correct order.

Some work carried out will not result in hard evidence, for example, visits to industry or business and phone calls to companies or watching a video. It is helpful to have at least a record of all activities undertaken by a student by including a log sheet in the portfolio to complement the reference section.

Key Skills

Opportunities to develop and generate evidence of achievement in all six of the key skills will be offered during the Product Design course:

Communication
Application of Number
Information Technology
Working with Others
Improving Own Learning Performance
Problem Solving

Examples of the application of Key Skills in Design and Technology will be displayed appropriately 'Signposting' opportunities.

Course Resources

Resources for the course consists of a range of text books, handouts with information and/or tasks, references to internet sites etc.

Title	Publisher	ISBN
Nuffield Design and Technology – Product Design	Longman	0582 23469 7
Design & Make It Product Design for Key Stage	Nelson Thornes	0 7487 4429 0
Design & Make It Graphic Products	Nelson Thornes	0 7487 2474 5
Design Topics Series:		
Product Design	Oxford	0 19 832784 6
Product Modelling	Oxford	0 19 832784 6
Design in Society	Oxford	0 19 832761 7
Human Factors	Oxford	0 19 832783 8

Project 'Programmes of Study' are mapped out using an 'EXCEL' spreadsheet which should be readily available in the D&T department and updated accordingly.

Project Assessment – 1

Name:

PROJECT - Storage Solutions

Your work has been marked against GCSE grade descriptors as if it was your major project. The grades indicated are for the descriptions shown in this pack and on the notice boards in the department. Check your grade against the chart.

Designing										Making					
Grade										**Grade**					
G	1	2	3	4	5	6	7	8		**G**	1	2	3	4	
F	1	2	3	4	5	6	7	8		**F**	1	2	3	4	
E	1	2	3	4	5	6	7	8	9	**E**	1	2	3	4	5
D	1	2	3	4	5	6	7	8	9	**D**	1	2	3	4	5
C	1	2	3	4	5	6	7	8	9	**C**	1	2	3	4	5
B	1	2	3	4	5	6	7	8	9	**B**	1	2	3	4	5
A	1	2	3	4	5	6	7	8	9	**A**	1	2	3	4	5

Final Designing Grade	**A**	**B**	**C**	**D**	**E**	**F**	**G**

Final Making Grade	**A**	**B**	**C**	**D**	**E**	**F**	**G**

Comments:

Targets for next project: