

**Study Skills**  
**Course Milestones for Students**

**Course Title: Design & Manufacture**

**Level: National 5**

**Work to be covered/Topics/Activities/Assignments**

Month	Unit 1 Design		Unit 2 Materials & Manufacturing	
	Unit Assessment	Topics	Unit Assessment	Topics
June/July		<p><b>Design factors</b></p> <p><b>Function:</b> Primary and secondary functions, fitness for purpose.</p> <p><b>Performance:</b> Ease of maintenance, strength and durability, ease of use, material selection, construction, size.</p> <p><b>Market:</b> Consumer demands, social expectations, niche marketing, branding, introduction of new products, market segments, marketing mix, needs, wants, technology push, market pull.</p> <p><b>Aesthetics:</b> Shape, proportion, size, colour, contrast, harmony, texture, materials, fashion.</p> <p><b>Ergonomics:</b> Establishing critical sizes, basic understanding of how humans interact with products, anthropometrics.</p>	<p><b>Task 1 Frame:</b></p> <p><b>1. Plan the manufacture of a prototype by:</b></p> <p>1.1 Selecting and effectively justifying materials to suit manufacturing tasks</p> <p>1.2 Selecting suitable tools and equipment for manufacturing tasks</p> <p>1.3 Producing a detailed sequence of operations</p>	<p><b>Tools, Materials &amp; Processes</b></p> <p><b>Planning for manufacture:</b> Preparing materials, planning for practical tasks, assembly, selecting appropriate tooling and finishes, reading of working drawings and diagrams, including an appreciation of orthographic projection.</p> <p><b>Properties of Materials:</b> Softwoods, hardwoods, manufactured boards, ferrous and non-ferrous metals, thermoplastics and thermosetting plastics.</p> <p><b>K&amp;U of common tools and equipment:</b> A range of common and acceptable hand tools for: Measuring, marking, cutting, shaping and forming of materials A range of common and acceptable tools or equipment for: holding, clamping and restraining materials A range of common and acceptable machine tools for: Sanding, shaping, drilling or other similar activities</p>
August/ September			<p><b>Task 1 Frame:</b></p> <p><b>2. Manufacture and review a prototype by:</b></p> <p>2.1 Effectively preparing and marking materials for component parts</p> <p>2.2 Effectively cutting, shaping and finishing component parts</p> <p>2.3 Effectively assembling and joining component parts</p> <p>2.4 Adequately finishing assembled prototype.</p> <p>2.5 Effectively testing the prototype</p>	<p><b>Fixing and joining techniques:</b> range of standard and recognised jointing/joining techniques for woods, metals and plastics including thermal joining and adhesive bonding</p> <p><b>Metalworking and associated processes:</b> Cutting, shearing, notching, parallel and step turning, taper turning, drilling, knurling, annealing, hardening, tempering, filing, folding, bending, fitting and fixing, and in industry — casting, die-casting.</p> <p><b>Woodworking and associated processes:</b> Cutting, sizing, drilling, shaping, turning.</p> <p><b>Plastic work:</b> Cutting, drilling, filing, forming, bending and twisting, moulding and, in industry, vacuum forming, injection moulding, and rotational moulding.</p> <p><b>Surface finishing:</b> Sanding/abrading, polishing, varnishing, oiling, staining, waxing, painting/lacquering, dip coating.</p>

**Work to be covered/Topics/Activities/Assignments**

Month	Unit 1 Design		Unit 2 Materials & Manufacturing	
	Unit Assessment	Topics	Unit Assessment	Topics
October	<p><b>Task 2 Clock:</b></p> <p><b>1. Analyse a design brief and produce a detailed specification by:</b></p> <p>1.1 Effectively researching design factors using a range of techniques</p> <p>1.2 Effectively incorporating research findings into a detailed specification</p>	<p><b>Members of a design team:</b> Designers, market researchers, accountants, engineers, manufacturers, marketing teams, ergonomists, consumers, retailers, economists.</p> <p><b>Design process</b></p> <p><b>Identification of a problem:</b> Situation analysis, need and wants, product evaluation.</p> <p><b>Brief:</b> Statement of problem, target market, design brief analysis.</p> <p><b>Research:</b> Such as use of search engines, measuring and recording, asking questions, surveys, using data.</p> <p><b>Specification:</b> Generation of a specification.</p> <p><b>Idea generation:</b> Morphological analysis, thought showers, technology transfer, analogy, and lateral thinking. Application of idea generation techniques. Mood and lifestyle boards.</p> <p><b>Development and refinement of ideas:</b> Synthesis of ideas. Justification and recording of decisions taken. Presentation techniques. Modelling techniques.</p> <p><b>Evaluation:</b> Surveys, user trials, comparisons with specifications and standards, the concept of function and fitness for purpose.</p>		<p><b>Manufacturing in industry:</b> Computer-aided manufacture- benefits: (unit cost for mass production, quality assurance, globalisation, clean manufacturing); drawbacks: (breakdown, set up cost), awareness of rapid prototyping technology. Identification of common industrial processes, standard components.</p>
November/ December	<p><b>Task 2 Clock:</b></p> <p><b>2. Explore and refine ideas to produce a design proposal by:</b></p> <p>2.1 Effective application of knowledge of design factors</p> <p>2.2 Effective application evaluation and justification of design decisions.</p> <p>2.3 Effective application of idea generation techniques</p> <p>2.4 Effective application of 2D &amp; 3D graphic techniques</p> <p>2.5 Effective application of modelling techniques</p>	<p><b>Communication techniques and modelling</b></p> <p><b>Graphic techniques:</b> Working drawings, annotated sketches and drawings, perspective sketches, illustration and presentation techniques, scale and proportion, simple orthographic drawings.</p> <p><b>Range of modelling techniques and materials:</b> The role of simple modelling as it supports designing — scale models, mock-ups, fully crafted prototypes, computer generated models. Use of appropriate modelling materials such as paper, card, corrugated card, MDF, wire, pipe cleaners, foam, clay, modelling compound, balsa wood, expanded foam, sheet plastic, construction kits, smart materials.</p>	<p><b>Task 2 Clock:</b></p> <p><b>3. Explain the key aspects of commercial manufacture by:</b></p> <p>3.1 Identifying and justifying suitable materials for commercial manufacture</p> <p>3.2 Identifying and justifying suitable processes for commercial manufacture</p> <p>3.3 Identifying ways in which design and manufacturing technologies impact on the environment and society</p>	<p><b>The impact of manufacturing technologies and activities on the world of work and society:</b> Reduction in workforce, skilled workforce, cost of equipment, impact on environment (energy and pollution) and the measures that can be taken to support sustainability.</p>

February	Prelim Exam					
January/ February	Component 1 ASSIGNMENT	Skills	Activity	Marks	Marks allocated for	
<p><b>Course Assignment TASK (60% of overall grade)</b></p> <p>For applying design skills and knowledge and understanding, 90 marks will be available.</p> <p><b>Design Skills (45 marks):</b></p> <ul style="list-style-type: none"> <li>• generation of ideas</li> <li>• development of ideas</li> <li>• applying communication techniques</li> <li>• evaluation of proposal</li> </ul> <p><b>Deadline Friday 24 February 2016</b></p>	<p><b>Course Assignment TASK (60% of overall grade)</b></p> <p>For applying design skills and knowledge and understanding, 90 marks will be available.</p> <p><b>Design Skills (45 marks):</b></p> <ul style="list-style-type: none"> <li>• generation of ideas</li> <li>• development of ideas</li> <li>• applying communication techniques</li> <li>• evaluation of proposal</li> </ul> <p><b>Deadline Friday 24 February 2016</b></p>	Generation of ideas	Producing a range of alternative ideas	3	<ul style="list-style-type: none"> <li>• The range of ideas is very good with many exhibiting clear differences</li> </ul>	
			Producing creative ideas	6	<ul style="list-style-type: none"> <li>• Ideas are generated and are very creative</li> </ul>	
			Adding useful information	3	<ul style="list-style-type: none"> <li>• Ideas have detailed annotations which add clarity</li> </ul>	
			Development of ideas	Exploring and refining of ideas towards a design proposal	6	<ul style="list-style-type: none"> <li>• Ideas being developed show thorough exploration and refined towards a design proposal</li> </ul>
				Applying knowledge and understanding of materials and manufacturing	6	<ul style="list-style-type: none"> <li>• There is effective application of knowledge and understanding of materials and manufacturing to inform next steps</li> </ul>
				Applying knowledge and understanding of design issues	3	<ul style="list-style-type: none"> <li>• There is effective application of knowledge and understanding of design issues to inform next steps</li> </ul>
				Reviewing and justifying decisions	3	<ul style="list-style-type: none"> <li>• There is clear review and justification of decisions</li> </ul>
			Applying communication techniques	Communicating effectively, with clarity, and giving reasons for decisions	9	<ul style="list-style-type: none"> <li>• There is effective use of graphics and/or modelling to communicate the proposal and its development</li> <li>• The use of graphics and/or modelling communicates appropriate detail about the proposal and its development</li> </ul>
			Evaluation of proposal	Evaluating the design proposal against the specification using appropriate techniques	6	<ul style="list-style-type: none"> <li>• There is clear and valid evaluation of the design proposal.</li> <li>• There is clear reference to the specification</li> </ul>
		March/ April	<p><b>Practical Skills (45 marks):</b></p> <ul style="list-style-type: none"> <li>• measuring and marking out</li> <li>• using hand and machine tools</li> <li>• assembly of components</li> <li>• finishing</li> </ul> <p><b>Deadline Friday 31 March 2016</b></p>	Measuring and marking out	Measuring and marking out	9
Using hand and machine tools	Using hand and machine tools			18	<ul style="list-style-type: none"> <li>• A high level of skill is demonstrated in cutting,</li> <li>• A high level of skill is demonstrated in the removal of material</li> <li>• Strong evidence of accurate work</li> <li>• A high level of skill is demonstrated in forming materials.</li> </ul>	
Assembly of components	Preparing for assembly and assembling the prototype			9	<ul style="list-style-type: none"> <li>• Resources are prepared and used with minimal guidance.</li> <li>• Strong evidence of accurate and sound assembly.</li> </ul>	
Finishing	Preparing surfaces, applying techniques and final finishing			9	<ul style="list-style-type: none"> <li>• There is strong evidence of appropriate surface preparation (removal of all marking, cutting, shaping and forming marks and glues)</li> <li>• There is a higher level of skill demonstrated in application techniques (processes used are appropriate to the material and applied with care and skill)</li> <li>• There is a high level of skill demonstrated in final finishing ( no runs or accumulations, even layers of finish, even lustres or glosses, no bristles, few and shallow brush marks)</li> </ul>	
	<b>Total</b>			<b>/90</b>		

May

### Component 2 QUESTION PAPER (40% of overall grade, 60 marks, 1 hour 30 minute duration)

The purpose of the question paper is to assess the learner's ability to retain and integrate knowledge and understanding from across the Course. This question paper will give learners an opportunity to demonstrate the following skills, knowledge and understanding:

- Knowledge and understanding of how products are influenced by materials and processes
- Knowledge and understanding of the use of tools
- Knowledge of how products are influenced by design factors

The question paper will have 60 marks out of a total of 150 marks. This is 40% of the overall marks for the Course assessment. The paper will broadly examine the following categories of design and manufacturing learning:

- Design processes
- Design factors
- Communicating and modelling
- Planning for manufacture
- Tools, materials and processes
- Manufacturing in industry
- The impact of design and manufacturing technologies on society and the environment and the world of work
- The properties of common materials

The question paper will have two Sections.

**Section 1** will represent approximately 40% of the total marks for the question paper. It will consist of a single question, based on a product, and will require extended and reasoned responses. The question will follow a similar format each year and will test the learner's knowledge and understanding of core areas from across the Course. The question will also require the learner to integrate this knowledge.

This question will focus on the manufacturing issues associated with a product, namely materials, tools and processes. It will not assess commercial aspects of manufacturing.

**Section 2** will represent approximately 60% of the total marks for the question paper. It will consist of four or five questions. The responses will require integration of knowledge and understanding from across the Course. Questions will be based on products which are illustrated or products with which the learners are familiar. It will give learners an opportunity to demonstrate knowledge and understanding specified in the table provided in 'Further mandatory information on Course coverage' at the end of this *Course Assessment Specification*.

Within the question paper, a proportion of marks will be available for more challenging questions where learners may be expected to provide a more detailed response, an explanation, justification, or to respond to more challenging concepts.

Resource Type	Resources	Topic/Activity/Assignment
BOOKS	<p>Leckie and Leckie National 4/5 Design and Manufacture Course Notes</p> <p>Various design and materials books available to borrow from the department.</p> <p>Highland Council Theory Notes.</p>	<p>Whole course Theory.</p> <p>Has been uploaded to Show My Homework in 4 parts; Design Theory, Materials and Manufacturing Theory, Homework Questions and Exam Style Questions. Pupils to download at home for use throughout the year.</p>
DVD	<p>'The Genius of Design' series. Available to borrow from the department.</p>	
DIGITAL RESOURCES	<p>Show My Homework/Shared Docs</p>	<p>Various notes for all areas of the course. Industrial Process Sheets with YouTube links to videos of processes. National 5 Design and Manufacture Past Papers and Specimen Questions, Intermediate 2 Product Design Past Papers, Credit Standard Grade Craft and Design Past Papers. Course Unit Support Notes. Course Assessment Specifications. Unit Assignment Tasks. List of helpful websites.</p>