

GCE Design and Technology: Product Design – Graphics with Materials Technology – Cross referencing

The textbook to refer to is: Graphics with Materials Technology, 2nd Edition – ISBN: 0435757687

Unit 2: Knowledge and Understanding of Product Design

2.1 Materials and components

Unit Content	Cross reference from new content to textbook – 2 nd edition
<p>Sources, classification, formation and structure of materials and components</p> <p>Paper, card and boards</p> <ul style="list-style-type: none"> • Sources, classification and structure of paper, card and boards <ul style="list-style-type: none"> – copier paper – card – corrugated board – common carton boards. 	<p>P17 – 18, 66 – 68</p>
<p>Woods</p> <ul style="list-style-type: none"> • Sources, classification and structure of woods <ul style="list-style-type: none"> – softwoods – hardwoods. • Cellular structure, fibres and grain direction. 	<p>P19 – 20, 68 – 72</p>
<p>Polymers</p> <ul style="list-style-type: none"> • Sources, classification, structure and manufacture of thermoplastics <ul style="list-style-type: none"> – acrylic – PET – HDPE – PVC – LDPE – PP – PS – thermosetting plastics <ul style="list-style-type: none"> – polyester resins. • Monomers, polymerisation and cross-linking. 	<p>P18 – 19, 72 – 74</p>

Unit Content	Cross reference from new content to textbook – 2 nd edition
<p>Metals and alloys</p> <ul style="list-style-type: none"> • Sources, classification, structure and production of ferrous metals <ul style="list-style-type: none"> – steel • Sources, classification, structure and production of non-ferrous metals <ul style="list-style-type: none"> – copper – aluminium – zinc – tin – brass • Specialist alloys for specific tasks <ul style="list-style-type: none"> – steel – aluminium alloys. 	<p>P20 – 21, 74 – 76</p>
<p>Composites and laminates</p> <ul style="list-style-type: none"> • Manufacture of composite materials <ul style="list-style-type: none"> – carbon fibre – glass reinforced plastics (GRP) – medium density fibreboard (MDF) – laminates – plywood. 	<p>P76 – 78</p>
<p>Components</p> <ul style="list-style-type: none"> • Pencils <ul style="list-style-type: none"> – graphite – coloured. • Pens and marker pens <ul style="list-style-type: none"> – water – spirit based. 	<p>P78 – 79</p>

2.2 Working properties of materials

Unit Content	Cross reference from new content to textbook – 2 nd edition
<p>Working properties of materials and components, relating to the composition and structure of materials</p> <ul style="list-style-type: none"> • Aesthetic properties, for example colour, style, texture. • Functional properties, for example strength, durability, flammability. • Mechanical properties, for example plasticity, ductility, hardness and malleability. 	<p>P80 – 81</p>

2.3 Hand and commercial processes

Unit Content	Cross reference from new content to textbook – 2 nd edition
<p>Hand and commercial methods of preparing, processing, manipulating and combining materials and components to enhance their properties including associated tools, machinery and equipment including CAD/CAM in relation to:</p>	
<ul style="list-style-type: none"> • drawing – pictorial, information and accurate working drawings 	P81 – 83
<ul style="list-style-type: none"> • computer graphics <ul style="list-style-type: none"> – desktop publishing (DTP) – 2-dimensional design to create and modify designs and layouts – 3-dimensional modelling for creating photo realistic images and ‘virtual’ products 	P84 – 85
<ul style="list-style-type: none"> • typography <ul style="list-style-type: none"> – theory and practice including typeface design and application 	P85 – 87
<ul style="list-style-type: none"> • 2D/3D modelling and prototyping <ul style="list-style-type: none"> – rapid prototyping using CAD/CAM – block modelling 	P87 – 88
<ul style="list-style-type: none"> • CNC machining <ul style="list-style-type: none"> – milling machine – lathe 	P163 – 166
<ul style="list-style-type: none"> • production of nets <ul style="list-style-type: none"> – constructing nets – structural packaging design – commercial production of packaging nets – cutting, wasting, abrading, shaping, bending, casting, moulding 	P30, 89 – 92
<ul style="list-style-type: none"> • thermoforming <ul style="list-style-type: none"> – blow moulding – injection moulding – vacuum forming 	P28 – 30, 92 – 93
<ul style="list-style-type: none"> • joining, preparation for finishing. 	P31, 93 – 95

Unit Content	Cross reference from new content to textbook – 2 nd edition
<p>Finishing processes</p> <p>Applied finishes to improve quality and provide enhanced aesthetic or functional properties:</p> <ul style="list-style-type: none"> • surface coating <ul style="list-style-type: none"> – anodising – painting – varnishing • self-finishing <ul style="list-style-type: none"> – plastics • surface decoration <ul style="list-style-type: none"> – CNC engraving – vinyl cutting. 	P95 – 97
<p>Printing processes</p> <p>Understanding how one-off/batch/high-volume (mass) product manufacture is achieved using printing processes:</p> <ul style="list-style-type: none"> • computer printers <ul style="list-style-type: none"> – ink jet – laser • black and white printing and full colour printing • computers in pre-press and quality control • offset lithography, screen-printing, letterpress • finishing and binding ready for distribution. 	P97 – 102

2.4 Product manufacture

Unit Content	Cross reference from new content to textbook – 2 nd edition
<p>Scale of production</p> <p>How and why products are manufactured using:</p> <ul style="list-style-type: none"> • one-off production • batch production, including short-term print runs • high volume (mass) production • continuous production. 	P23 – 24
<p>Systems and control</p> <ul style="list-style-type: none"> • Computer integrated manufacture (CIM) <ul style="list-style-type: none"> – information handling – stock control and just in time(JIT) – planning – quick response manufacturing – CAD/CAM. 	P24
<p>Quality control in production</p> <ul style="list-style-type: none"> • Using quality assurance (QA), quality control (QC) and total quality management (TQM) systems. • Quality control during final print run <ul style="list-style-type: none"> – colour density on colour bars – registration marks – crop marks – greyscale. • Meeting specifications and tolerances. 	P32 – 34, 104
<p>Quality standards</p> <ul style="list-style-type: none"> • Meeting aesthetic, performance and price requirements. • Testing against external quality standards such as British, European and international standards. • Standard performance tests <ul style="list-style-type: none"> – tensile strength – hardness – toughness and ductility workshop tests. 	P14 – 15, 34, 102 – 103, 105

Unit Content	Cross reference from new content to textbook – 2 nd edition
<p>Health and safety procedures in production</p> <ul style="list-style-type: none"> • Principles of health and safety legislation <ul style="list-style-type: none"> – The Health and Safety at Work Act (1974). • Principles of health and safety at work <ul style="list-style-type: none"> – Health and Safety Executive (HSE) risk assessments. 	<p>P15, 35 – 36</p>

2.5 Design in practice

Unit Content	Cross reference from new content to textbook – 2 nd edition
<p>The effects of design and technological changes on society</p> <ul style="list-style-type: none"> • Mass production and the consumer society. • The 'new' industrial age of high-technology production. • The global market place. • Issues related to local/global production. 	P108 – 112
<p>Influences on the development of products</p> <ul style="list-style-type: none"> • Aesthetics, balance, colour, decoration, design, form, function, line, scale, shape, styling, surface pattern, texture. • Design and culture, for example Arts and Crafts, Art Nouveau, Art Deco, Bauhaus, Memphis and modern design movements. • New materials, processes and technology <ul style="list-style-type: none"> – computers and design – eco-design – environmentally-friendly processes – miniaturisation – modern production techniques – 'smart' materials. 	P112 – 120
<p>The basic principles and application of anthropometrics and ergonomics</p> <ul style="list-style-type: none"> • Interacting with products, users, equipment and environments. • Applying anthropometric data. • Ergonomic considerations for designs and models <ul style="list-style-type: none"> – standard sizes and dimensions. 	P130 – 132

Unit 3: Further Study of Product Design

3.1 Modern technologies and materials

Unit Content	Cross reference from new content to textbook – 2 nd edition
<p>The creation and use by industry of modern and ‘smart’ materials</p> <ul style="list-style-type: none"> • LCD displays. • Smart and composite materials <ul style="list-style-type: none"> – carbon fibres – thermochromic liquid crystals – phosphorescent pigments – polymorph – Kevlar – piezo-electric actuators and transducers – electronic point of sale (EPOS) – radio frequency identification (RFID). • New materials as used in the computer and electronics industry. 	<p>P178 – 182</p>
<p>The impact of modern technology and biotechnology on the development of new materials and processes</p> <ul style="list-style-type: none"> • Genetic engineering in relation to woods, for example altering genes to provide quicker-growing trees, or to supply wood that resists wear, rot or infestation. • The use of micro-organisms to aid the disposal of environmentally friendly plastics. • Special effects in the cinema and on television. • Digital photography. • Internet website design. • The recycling of materials <ul style="list-style-type: none"> – producing materials that are totally recyclable. • Modification of properties of materials <ul style="list-style-type: none"> – paper and board used in laminates and construction – seasoning and lamination of woods – polymerisation of plastics – alloying of metals. 	<p>P182 – 192</p>

3.2 Product manufacture

Unit Content	Cross reference from new content to textbook – 2 nd edition
<p>Uses of ICT in the manufacture of products</p> <p>The impact and advantages/disadvantages of ICT within the total manufacturing process:</p> <ul style="list-style-type: none"> • electronic communications <ul style="list-style-type: none"> – email – Electronic Data Interchange (EDI) – Integrated Services Data Network (ISDN) – Local Area Networks (LAN) – global networks (internet) – video conferencing – new communications technology • electronic information handling <ul style="list-style-type: none"> – market analysis – specification development • automated stock control <ul style="list-style-type: none"> – ‘just in time’ • production scheduling and production logistics • flexible manufacturing systems <ul style="list-style-type: none"> – quick response manufacturing (QRM) • production control, for example monitoring quality using lasers and coordinate measurement machines (CMMs) • product marketing, distribution and retailing <ul style="list-style-type: none"> – electronic point of sale (EPOS) – internet marketing. 	<p>P231 – 232, 254 – 265</p>

Unit Content	Cross reference from new content to textbook – 2 nd edition
<p>Systems and control</p> <p>Computer-Aided Design, Manufacture and Testing (CADMAT), Computer-Integrated Manufacture (CIM), Flexible Manufacturing Systems (FMS) and their wider application in industry:</p> <ul style="list-style-type: none"> • creative and technical design • modelling and testing <ul style="list-style-type: none"> – CAD – rapid prototyping (RPT) – virtual reality modelling • production planning • control of equipment, processes, quality and safety • control of complex manufacturing processes • integrated and concurrent manufacturing. 	<p>P230 – 242</p>
<p>The use of block flow diagrams and flow process diagrams for representing simple and complex production systems including open/closed loop control, feedback and degrees of freedom.</p> <p>The advantages and disadvantages of automation and its impact on employment, both local and global.</p> <p>Complex automated systems using artificial intelligence (AI) and new technology.</p>	<p>P248 – 254</p>

3.3 Design in practice

Unit Content	Cross reference from new content to textbook – 2 nd edition
<p>Values issues</p> <p>The impact of values issues on product design, development and manufacture:</p> <ul style="list-style-type: none"> • Life Cycle Assessment (LCA). <p>Responsibilities of 'developed' countries in relation to production and the environment:</p> <ul style="list-style-type: none"> • global sustainable development. 	P192 – 197
<p>Environmental implications of the industrial age:</p> <ul style="list-style-type: none"> • the use of non-renewable raw materials and fossil fuels during the manufacturing process • renewable sources of energy, energy conservation and the use of efficient manufacturing processes • new technology and environmentally-friendly manufacturing processes • importance of using sustainable technology • minimising waste production. 	P218 – 226
<p>Economics of production</p> <p>Economic factors in the production of one-off, batch, high-volume (mass) and continuous manufactured products, relating to, for example:</p> <ul style="list-style-type: none"> • sources, availability and costs of materials • advantages of economies of scale of production • the relationship between design, planning and production costs • the material and manufacturing potential for a given design solution. 	P200 – 206

Unit Content	Cross reference from new content to textbook – 2 nd edition
<p>Advertising and marketing</p> <p>The role of the media, including film, television, radio, video, newspapers and magazines, the internet, in marketing products.</p>	P212
<p>The basic principles of marketing and associated concepts such as brand loyalty, competitive edge, consumer demand, lifestyle marketing, market pull, market share, price range, product proliferation, promotional gifts, target market groups.</p>	P216 – 218
<p>Organisations that provide guidance, discrimination and approval:</p> <ul style="list-style-type: none"> • British Standards Institute (BSI) • Advertising Standards Authority (ASA) • consumer magazines/TV programmes. 	P206 – 208
<p>Relevant legislation on the rights of the consumer when purchasing goods:</p> <ul style="list-style-type: none"> • statutory rights. 	P209 – 211