

Mapping Document: GCE Design & Technology (Product Design)

Pearson Resistant Materials 9RM01 and Graphic Products 9GR01 (2008) to Pearson Product Design 9DT0 (2017)

The table below shows the existing Pearson content with the correlation to the new Pearson product design specification in the right-hand columns. The page numbers relate to each specification document.

In the interests of space, content that does not match the Pearson specification has not been reproduced.

Pearson content is shown in abridged form where useful.

9RM01 Resistant Materials (RMT) content	Page no.	9GR01 Graphic Products (GP) content	Page no.	Product Design 9DT0 (2017)	Page no.
Unit 2.3 Material and components (RMT)	36	2.3 Materials and components (GP)	94	Component 1: Principles of Design and Technology	8
The content for each discipline is listed separately.		The content for each discipline is listed separately.			
1 Materials		1 Materials		2.1 Materials: Performance characteristics of woods, metals, polymers, smart and modern materials, papers, boards, textiles and composites in order to discriminate between materials and select appropriately: a) conductivity b) strength c) elasticity d) plasticity	10

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				<ul style="list-style-type: none"> e) malleability f) ductility g) hardness h) toughness i) durability j) biodegradability. 	
<p>Metals: Aesthetic, functional and mechanical properties, application and advantages/disadvantages of:</p> <ul style="list-style-type: none"> • ferrous – mild steel, carbon steel and cast iron • non-ferrous – aluminium, copper and zinc • alloys – stainless steel, duralumin and brass. 	36	<p>Metals: Aesthetic, functional and mechanical properties, application and advantages/disadvantages of the following metals for graphic products and commercial packaging:</p> <ul style="list-style-type: none"> • ferrous – steel • non-ferrous – aluminium, tin • alloys – stainless steel, duralumin. 	95	<p>1.2 Metals:</p> <ul style="list-style-type: none"> a) ferrous metals – mild steel, carbon steels, cast iron b) non-ferrous metals – aluminium, copper, zinc, tin c) alloys (ferrous and non-ferrous) – stainless steel, duralumin, brass. 	9
<p>Polymers : Aesthetic, functional and mechanical properties, structural composition with reference to cross linking, application and advantages/disadvantages of:</p> <ul style="list-style-type: none"> • thermoplastics – acrylic, polyethylene, HDPE, LDPE, PET, PVC, PP, PS and ABS • thermosetting plastics – epoxy resins, urea formaldehyde and polyester resin. 	36, 37	<p>Polymers: Aesthetic, functional and mechanical properties, application and advantages/disadvantages of the following thermoplastics in the production of graphic products and commercial packaging:</p> <ul style="list-style-type: none"> • polythene, polyethylene: HDPE, LDPE, PP, PS, rigid (high-density polystyrene) and expanded • Styrofoam for block modelling • acrylic. 	96	<p>1.3 Polymers:</p> <ul style="list-style-type: none"> a) thermoplastics – acrylic, polyethylene, polyethylene terephthalate (PET), polyvinyl chloride (PVC), polypropylene (PP), acrylonitrile butadiene styrene (ABS) b) thermosetting plastics – epoxy resins (ER), urea formaldehyde (UF), polyester resin (PR) c) elastomers – rubber. 	9
<p>Woods: Aesthetic, functional and mechanical properties, application and</p>	37	<p>Woods: Aesthetic, functional and mechanical properties, application</p>	96	<p>1.1 Woods:</p> <ul style="list-style-type: none"> a) hardwoods – oak, mahogany, beech, 	9

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<p>advantages/disadvantages of:</p> <ul style="list-style-type: none"> • hardwoods – oak, mahogany, beech • softwood – pine. 		<p>and advantages/disadvantages of the following woods for the creation of models and prototypes:</p> <ul style="list-style-type: none"> • hardwoods – jelutong, balsa • softwood – pine. 		<p>jelutong, balsa</p> <p>b) softwoods – pine, cedar, larch, redwood.</p>	
<p>Composites: Aesthetic, functional and mechanical properties, structural composition, application, manufacture and advantages/disadvantages of:</p> <ul style="list-style-type: none"> • carbon fibre, GRP, MDF and chipboard. 	37	<p>Composites: Aesthetic, functional and mechanical properties, structural composition, application and advantages/disadvantages of the following composite used by the graphics industry:</p> <ul style="list-style-type: none"> • carbon fibre, GRP, MDF. 	97	<p>1.4 Composites:</p> <p>a) composites – carbon fibre (CFRP), glass fibre (GRP), Medium Density Fibre Board (MDF), hardboard, chipboard, plywood.</p>	9
<p>Laminates: Aesthetic, functional and mechanical properties, structural composition, application, manufacture and advantages/disadvantages of:</p> <ul style="list-style-type: none"> • plywood and block-board. 	38			<p>Plywood listed under composites (1.4).</p>	9
<p>Modern materials and products: Application and advantages/disadvantages of:</p> <ul style="list-style-type: none"> • thermoceramics, tinted glass, solar panels, LCDs and EL lighting. 	38	<p>Modern materials and products: Structural composition, application and advantages/disadvantages of the following modern materials and products used by the graphics industry:</p> <ul style="list-style-type: none"> • LCDs, phosphorescent pigments, electroluminescent (EL) lighting. 	97		
<p>New and smart materials: Application and advantages/disadvantages of:</p> <ul style="list-style-type: none"> • SMA, reactive glass, photochromic paint and quantum tunnelling composites. 	38	<p>Smart materials: Structural composition, application and advantages/disadvantages of the following smart materials used by the graphics industry:</p> <ul style="list-style-type: none"> • thermochromic liquid 	97	<p>1.7 Smart and modern materials:</p> <p>a) thermo-ceramics</p> <p>b) shape memory alloys (SMA)</p> <p>c) reactive glass</p> <p>d) liquid crystal displays (LCD)</p>	10

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		crystals/film, piezoelectric crystals, smart ink and RFID.		e) photochromic materials f) thermochromic materials g) quantum tunnelling composites.	
		<p>Paper and board:</p> <p>(i) Processes and advantages/disadvantages of producing wood pulp by the following methods:</p> <ul style="list-style-type: none"> • mechanical, chemical and waste pulp. <p>(ii) The process of manufacturing paper and card using the Fourdrinier process.</p> <p>(iii) Aesthetic, functional and mechanical properties, application and advantages/disadvantages of the following common paper, card and board for commercial and everyday use:</p> <ul style="list-style-type: none"> • drawing papers, layout, tracing, copier and cartridge • commercial printing papers – bond and coated • commercial card and board – mounting board and recycled. <p>(iv) Aesthetic, functional and mechanical properties, structural composition, application and advantages/disadvantages of the following carton boards in the production of commercial packaging:</p>	94, 95	<p>1.5 Papers and boards:</p> <p>a) drawing papers – layout, tracing, copier, cartridge</p> <p>b) commercial printing papers – bond, coated</p> <p>c) boards – mounting board, corrugated board, foam board, folding box board, foil-lined board.</p>	9

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		<ul style="list-style-type: none"> folding boxboard, corrugated board, solid white board, and foil-lined board. 			
				<p>1.6 Textiles:</p> <p>a) natural fibres – cotton, linen, wool</p> <p>b) manmade fibres – nylon, polypropylene, polyester</p> <p>c) textile treatments – flame resistant, polytetrafluoroethylene (PTFE).</p>	9
2 Components		2 Components			
<p>Characteristics, application and advantages/disadvantages of the following components:</p> <ul style="list-style-type: none"> nuts, bolts, spacers and washers, screws, and pop and snap rivets gears – simple and compound gear trains, rack and pinion, worm and wheel, bevel and mitre gears, and spur gears bearings – plain bearings, journal bearings, ball bearings and bushes cams – pear shaped, circular or eccentric, heart shaped and snail followers – flat-foot, knife-edge and roller. 	39	<p>Processes, application and advantages/disadvantages of the following binding methods in relation to both paper and board:</p> <ul style="list-style-type: none"> saddle-wire stitching, side-wire stitching, perfect binding, hard-bound or case-bound, and spiral or comb binding. 	98		
Unit 2.4 Industrial and commercial practice (RMT)		Unit 2.4 Industrial and commercial practice (GP)			
The content for each discipline is listed separately.		The content for each discipline is listed separately.			

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<p>Scale of production: Characteristics, application and advantages/disadvantages of the following scales of production:</p> <ul style="list-style-type: none"> one-off, batch, mass and continuous. 	40	As RMT	98	<p>8.1 Characteristics and stages of the following methods of production when applied to products and materials:</p> <ul style="list-style-type: none"> a) one-off production b) batch production c) high-volume production. 	15
<p>Material processing and forming techniques: Characteristics, preparation, processes, application and advantages/disadvantages of the following methods when manipulating materials and components:</p> <ul style="list-style-type: none"> casting – sand and die milling/routing, drilling, turning, blow moulding, injection moulding, vacuum forming, extrusion and rotational moulding. 	40	<p>Forming techniques: Characteristics, preparation, processes, application and advantages/disadvantages of the following methods for the batch and mass production of graphic products and components:</p> <ul style="list-style-type: none"> blow moulding, injection moulding and vacuum forming. 	100	<p>Processes, techniques and specialist tools</p> <p>3.1 Processes, applications, characteristics, advantages and disadvantages of the following, in order to discriminate between them and select appropriately, including the selection of specific and relevant tools to be used for domestic, commercial and industrial products and systems, and safe use when experimenting, improving and refining in order to realise a design:</p> <ul style="list-style-type: none"> d) casting – sand (to include investment), die, resin, plaster of Paris (including use of specialist tools) e) machining – milling/routing, drilling, turning, stamping, pressing (including use of specialist tools) f) moulding – blow moulding, injection moulding, vacuum forming, extrusion, rotational moulding (including use of specialist tools) g) lamination (including use of specialist tools) h) marking out techniques – woods, metals, polymers, paper and boards 	11

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				(including use of specialist tools).	
		<p>Graphical communication: Application, demonstration and advantages/disadvantages of the following graphical-drawing techniques:</p> <ul style="list-style-type: none"> • pictorial drawing methods for representing 3D forms • isometric, 2-point perspective and planometric (axonometric). <p>Working drawings for communicating 2D technical information:</p> <ul style="list-style-type: none"> • 3rd angle orthographic projection to BSI standards and nets (developments) • translation from working drawings to pictorial drawings and vice versa • translation from pictorial drawings to nets (developments) and vice versa. 	98	<p>3.3 Use of media to convey design decisions, to record to recognised standards, and to explain and communicate information and ideas using the following methods and techniques:</p> <p>a) pictorial drawing methods for representing 3D forms – isometric, 2-point perspective</p> <p>b) working drawings for communicating 2D technical information – 3rd angle orthographic projection, triangulation</p> <p>c) nets (developments) for communicating information about 3D forms in a 2D format</p> <p>d) translation between working drawings, pictorial drawings and nets (developments)</p> <p>e) report writing.</p>	12
<p>Manufacturing techniques for mass production: Preparation, application and advantages/disadvantages of the following when manufacturing products and components:</p> <ul style="list-style-type: none"> • jigs, patterns, formers and moulds. 	40	<p>Computer-generated graphics: The application and advantages/disadvantages of computer-generated graphics in the design and production of graphic products:</p> <ul style="list-style-type: none"> • use of DTP to create and modify designs and layouts for printed materials • process of 2D image creation and manipulation. 	99		

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<p>Joining techniques: Characteristics, preparation, processes, application and advantages/disadvantages of using the following permanent and semi-permanent methods when joining materials and components:</p> <ul style="list-style-type: none"> • mechanical – nuts, bolts and washers, and rivets • heat – oxy-acetylene welding, MIG welding, brazing and hard soldering • chemical – Tensol cement and polystyrene cement • adhesives – PVA, epoxy resin, contact adhesive and hot melt glue. 	41	<p>Joining techniques: Preparation, application and advantages/disadvantages of using the following adhesives for joining like and unlike materials:</p> <ul style="list-style-type: none"> • contact adhesive, acrylic cement, polystyrene cement, epoxy resin and PVA. 	99	<p>3.4 Uses, characteristics, advantages and disadvantages of the following permanent and semi-permanent joining techniques in order to discriminate between them, select appropriately and use safely:</p> <p>a) adhesives – contact adhesive, acrylic cement, epoxy resin, polyvinyl acetate (PVA), hot melt glue, cyanoacrylate (superglue), polystyrene cement (including use of specialist tools)</p> <p>b) mechanical – screws, nuts, bolts, washers, rivets, press (including use of specialist tools)</p> <p>c) heat – oxy-acetylene welding, MIG welding, brazing, hard soldering, soft soldering (including use of specialist tools)</p> <p>d) jointing – traditional wood joints, knock-down fittings (including use of specialist tools).</p>	12
<p>Material removal: Characteristics, preparation, processes, application and advantages/disadvantages of the following methods when manipulating materials:</p> <ul style="list-style-type: none"> • cutting and abrading. 	41				
		<p>Modelling and prototyping: Processes, application and advantages/disadvantages of the following 2D/3D models and prototypes to aid the development of graphic products:</p>	99		

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		<ul style="list-style-type: none"> block modelling, rapid prototyping using CAD/CAM, computer modelling for creating photo realistic images and 'virtual' products using wire frame, surface modelling and solid modelling. 			
<p>Heat treatment: Characteristics, preparation, processes, application and advantages/disadvantages of the following heat treatment methods when altering the appropriate material and component as stated in 2.3 to enhance their properties:</p> <ul style="list-style-type: none"> annealing, hardening and tempering, normalising, and work hardening. 	42	<p>Industrial and commercial processes: Production and advantages/disadvantages of the following processes for creating structural packaging nets for containing, protecting, dispensing and advertising products:</p> <ul style="list-style-type: none"> designing and creating nets using hand-drawn and CAD methods, commercial automated production of packaging nets using die cutting, folding, scoring and spot gluing. 	99	<p>Processes, techniques and specialist tools</p> <p>3.1 Processes, applications, characteristics, advantages and disadvantages of the following:</p> <p>a) heat treatments – hardening and tempering, case hardening, annealing, normalising (including use of specialist tools).</p>	11
<p>Conversion and seasoning: Preparation, processes and advantages/disadvantages of the following conversion and seasoning methods:</p> <ul style="list-style-type: none"> conversion – through and through (slab) sawn, quarter sawn seasoning – natural and kiln-drying. 	42				
<p>Faults in woods: Characteristics of the following faults in woods and why such faults occur:</p>	42	<p>Finishing processes: Processes, application and advantages/disadvantages of</p>	100	<p>3.5 Application, advantages and disadvantages of the following finishing techniques and methods of</p>	12

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<ul style="list-style-type: none"> cupping, twisting, splitting and knots. 		<p>applying the following finishes to improve the performance, quality and provide enhanced aesthetic and/or functional properties:</p> <ul style="list-style-type: none"> enhancing the format of paper and board, laminating, encapsulation, varnishing, hot foil blocking and embossing surface decoration for signage using CAD/CAM, production of lettering and decals using laser cutting and engraving, and vinyl cutting. 		<p>preservation in order to discriminate between them and select appropriately for use, including for the prevention of degradation:</p> <p>a) finishes – paints, varnishes, sealants, preservatives, anodising, electro-plating, powder coating, oil coating, galvanisation, cathodic protection (including use of specialist tools)</p> <p>b) paper and board finishing process – laminating, varnishing, hot foil blocking, embossing (including use of specialist tools).</p>	
<p>Computer-aided design (CAD): Processes, application and advantages/disadvantages of the following CAD systems when designing products:</p> <ul style="list-style-type: none"> 2D design to create and modify designs 3D modelling for creating 'virtual' products. 	42	<p>Printing processes: Processes, application and advantages/disadvantages of the following commercial printing methods to create graphic products:</p> <ul style="list-style-type: none"> offset lithography, flexography, screen-printing and gravure. 	100	<p>Processes, techniques and specialist tools</p> <p>3.1 Processes, applications, characteristics, advantages and disadvantages of the following:</p> <p>c) printing – offset lithology, flexography, screen-printing, gravure (including use of specialist tools).</p>	11
<p>Modelling and prototyping: Processes, application and advantages/disadvantages of the following 3D modelling and prototyping techniques to aid the development of manufacturing products:</p> <ul style="list-style-type: none"> block modelling and rapid prototyping using CAD/CAM. 	42				

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<p>Computer-aided manufacture: Processes, application, production and advantages/disadvantages of the following CNC systems when manufacturing products:</p> <ul style="list-style-type: none"> lathes, routers, milling machines and laser cutters. 	43			<p>4.1 Set up, safe and accurate operation, and advantages and disadvantages of the following digital technologies:</p> <p>a) computer-aided design (CAD) – 2D and 3D design to create and modify designs and create simulations, 3D modelling for creating 'virtual' products</p> <p>b) computer-aided manufacture (CAM) and rapid prototyping – CNC lathes, CNC routers, CNC milling machine, CNC laser, CNC vinyl cutters, rapid prototyping.</p>	13
<p>Unit 2.5 Quality (RMT)</p>	43	<p>Unit 2.5 Quality (GP)</p>	101		
		<p>Unit 2.5 – differences are highlighted.</p>			
<p>Quality assurance systems and quality control in production: Concept, characteristics, application and advantages of the following when designing and manufacturing commercial products:</p> <ul style="list-style-type: none"> QA systems, QC, TQM (ISO 9000 series). 	43	<p>Quality assurance systems and quality control in production (in addition to RMT content):</p> <ul style="list-style-type: none"> QC during a final print run using printer's marks colour bars for colour consistency/density registration marks for aligning printing plates crop marks for cutting/trimming guides greyscale for monochrome consistency. 	101	<p>8.2 Characteristics, application, advantages and disadvantages of the following types of quality monitoring systems:</p> <p>a) quality control – the monitoring and achieving of high standards and degree of tolerance by inspection and testing, computer-aided testing</p> <p>b) quality assurance – monitoring the quality of a product from its design and development stage, through its manufacture, to its end-use performance and degree of customer satisfaction</p> <p>c) Total Quality Management (TQM) – when applied to quality assurance</p>	15

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				procedures and its impact on employees at every stage of the production process (ISO 9000).	
<p>Quality standards: Process of testing products, components and materials against external quality standards set by the following organisations:</p> <ul style="list-style-type: none"> • British (BSI and relevant kitemarks) • European (CEN and CE) • International (ISO). 	43	As RMT	101	<p>11.4 Implication to designers, manufacturers and consumers of the following standards when developing designs and manufacturing products:</p> <p>a) British Standards (BSI and kite mark)</p> <p>b) European (CEN and CE)</p> <p>c) International Standards (ISO).</p>	18
2.6 Health and safety	44		102	10 Current legislation	17
<p>Health and Safety at Work Act (1974): The principles and application of the Health and Safety at Work Act (1974).</p> <p>Procedures to safeguard the risk of injury to people: PPE, signage and warning symbols.</p> <p>Carrying out risk assessments in accordance with the HSE:</p> <ul style="list-style-type: none"> • identify potential hazards • identify people at risk • evaluate the risks • decide upon control measures • record assessment. <p>COSHH regulations: Risk assessment to control the storage and use of solvent-based substances containing VOCs.</p>	44	AS RMT	102	<p>10.2 The principles and applications of health and safety laws and regulations and their impact on the designing and making process, including the consequences of non-adherence:</p> <p>a) health and safety regulation – the Health and Safety Executive (HSE) and an awareness of relevant regulations to manufacturing industries</p> <p>b) Health and Safety at Work etc. Act (1974) – the procedures to safeguard the risk of injury to people: personal protective equipment (PPE), signage, warning symbols</p> <p>c) Control of Substances Hazardous to Health (COSHH) regulations – the storage and use of solvent-based substances containing volatile organic compounds (VOCs).</p> <p>7 Safe working practices, potential</p>	17 & 14

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				<p>hazards and risk assessment</p> <p>7.1 Adopting safe working practices, recognise and react to potential hazards:</p> <p>a) understanding safe working practices for yourself and others when designing and making, including when selecting and safely using machinery, equipment and tools in order to ensure safe working environments</p> <p>b) understanding the need for risk assessments – identification of potential hazards, identification of people at risk, evaluation of risks, implement control measures, recording and storing of risk assessment documentation.</p>	
Unit 3 Designing for the future (RMT)	45	Unit 3 Designing for the future (GP)	103	8 Features of manufacturing industries	15
<p>Information and communication technology (ICT): Characteristics, processes, application, advantages/disadvantages of ICT in the development, manufacture and sales of products in the global marketplace:</p> <ul style="list-style-type: none"> • electronic communications – email, EDI, ISDN and broadband, LAN, global networks (internet) and video conferencing • electronic information handling – market analysis and specification development 	46	<p>Information and communication technology (ICT): Characteristics, processes, application, and advantages/disadvantages of ICT in the design, development, marketing and sales of graphic products in the global marketplace:</p> <ul style="list-style-type: none"> • electronic communications between designers, manufacturers, retailers and consumers using email, EDI, ISDN and broadband video conferencing • computer-aided design 	104	<p>8.3 Characteristics, processes, application, advantages and disadvantages, and the importance of considering accuracy of production and efficiency of modern manufacturing methods and systems when designing for manufacture for small-, medium- and large-scale production:</p> <p>a) production scheduling and production logistics</p> <p>b) robotics in production – robots on fully-automated production and assembly lines/cells</p> <p>c) materials handling systems –</p>	15

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<ul style="list-style-type: none"> • automated stock control – JIT • production scheduling and production logistics • flexible manufacturing systems (FMS) – quick-response manufacturing (QRM) • production control • marketing, distribution and retailing of products using EPOS and internet marketing. 		<p>(CAD) in the development of products involving creative and technical design, virtual modelling and testing, and rapid prototyping (RPT)</p> <ul style="list-style-type: none"> • marketing, distribution and retailing of products using EPOS, internet marketing and sales. 		<p>automated storage and retrieval systems (ASRS), automatic guided vehicles (AGVs)</p> <p>d) flexible manufacturing systems (FMS), modular/cell production systems</p> <p>e) lean manufacturing using just-in-time (JIT) systems</p> <p>f) standardised parts, bought-in components</p> <p>g) quick-response manufacturing (QRM)</p> <p>h) data integration – product data management (PDM), enterprise resource planning (ERP) systems</p> <p>i) concurrent manufacturing.</p>	
<p>Biotechnology:</p> <p>a) Characteristics, advantages/disadvantages and the impact on the environment of the following genetic engineering techniques when manufacturing products:</p> <ul style="list-style-type: none"> • altering genes in woods to provide quicker-growing trees, or to supply wood that resists wear, rot or infestation • use of micro-organisms to aid the disposal of environmentally-friendly plastics producing materials that are totally recyclable. <p>b) The sources, manufacture, application and</p>	<p align="center">47</p>	<p>Biotechnology: Characteristics advantages/disadvantages and the impact on the environment of the following genetic engineering techniques when manufacturing paper and board:</p> <ul style="list-style-type: none"> • altering genes in woods to provide quicker-growing trees, or to supply wood that resists wear, rot or infestation • reduction of lignin to reduce environmental impact of the paper industry <p>The sources, manufacture, application and advantages/disadvantages of the following biodegradable polymer: Biopol®.</p>	<p align="center">105</p>		

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<p>advantages/disadvantages of the following biodegradable polymer: Biopol®.</p> <p>c) Characteristics, application and advantages/disadvantages of adding the following additives to polymers:</p> <ul style="list-style-type: none"> • plasticisers, fillers, fibres, stabilisers and foamants. <p>d) Characteristics, application and advantages/disadvantages of modifying woods: lamination.</p>				
		<p>Digital special effects: Process and application of the following digital special effects used in film-making:</p> <ul style="list-style-type: none"> • blue/green screen and CGI. 	104	
3.4 Systems and control	48	3.4 Systems and control	106	
<p>Manufacturing systems: Characteristics, processes, application and advantages/disadvantages of advanced manufacturing technology (AMT) which enable quick-response manufacturing (QRM), including:</p> <ul style="list-style-type: none"> • concurrent manufacturing and flexible manufacturing systems (FMS). 	48	As RMT	106	
<p>Computer-integrated manufacture (CIM): Characteristics, processes, application, advantages/disadvantages and its impact on employment of CIM systems to integrate the processing of production and business information</p>	48	As RMT	106	

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<p>with manufacturing operations, including:</p> <ul style="list-style-type: none"> • data integration involving product data management (PDM) and enterprise resource planning (ERP) systems • lean manufacturing using JIT systems • CAM, involving CNC equipment and computer-aided quality (CAQ) in flexible manufacturing cells • materials handling systems including automated storage and retrieval systems (ASRS) and automatic guided vehicles (AGVs). 					
<p>Robotics and artificial intelligence (AI): Application, advantages/disadvantages and its impact on employment of complex automated systems, including:</p> <ul style="list-style-type: none"> • robots on fully automated production and assembly lines/cells • development of artificial intelligence (AI) for industrial applications. 	48	As RMT	106		
<p>Flow charts: Flow charts to represent open and closed loop systems for QC of production processes.</p>	48	As RMT	106		

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Unit 3 Designing for the future (RMT)	49	Unit 3 Designing for the future (GP)	107		
3.5 Design in context	49	3.5 Design in context	107	6 Effects of technological developments	14
<p>The effects of technological changes on society: The impact and advantages/disadvantages of the following technological changes on society in relation to product manufacture:</p> <ul style="list-style-type: none"> • mass production – consumer society including built-in obsolescence and employment • the 'new' industrial age of high-technology production – computers in the development and manufacture of products, miniaturisation of products and components, and the use of smart materials and products for innovative applications • the global marketplace – multinational companies in developed countries manufacturing 'offshore' in developing countries, and local and global production. 	49	As RMT	107	<p>6.1 Current and historical technological developments that have had an effect on the work of designers and technologists and their social, moral and ethical impacts:</p> <p>a) mass production – the consumer society, built-in obsolescence, the effect mass production has on employment</p> <p>b) the 'new' industrial age of high-technology production – computers and the development and manufacture of products, miniaturisation of products and components, the use of smart materials, products from innovative applications</p> <p>c) the global marketplace – multinational companies in developed and developing countries, manufacturing 'offshore' in developing countries, and local and global production.</p>	14
<p>2 Influences of design history on the development of products: Characteristics in terms of design styles, philosophy and influences on design culture of the following</p>	49	As RMT	107	<p>5.4 Design theory through the influences and methods of the following key historical movements and figures:</p> <p>a) Arts and Crafts – William Morris</p> <p>b) Art Nouveau – Charles Rennie</p>	13

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<p>designers and design movements:</p> <ul style="list-style-type: none"> • William Morris and the Arts and Crafts movement • Charles Rennie Mackintosh and the Art Nouveau movement • Marcel Breuer and the Bauhaus • Eileen Gray and the Art Deco movement • Raymond Loewy and streamlining • Philippe Starck and the New Design style. 				<p>Mackintosh</p> <p>c) Bauhaus Modernist – Marianne Brandt</p> <p>d) Art Deco – Eileen Gray</p> <p>e) Post Modernism – Philippe Starck</p> <p>f) Streamlining – Raymond Lowey</p> <p>g) Memphis – Ettore Sottsass.</p>	
<p>3 Form and function: The debate regarding 'form versus function' including the following two opposing views when designing products:</p> <ul style="list-style-type: none"> • form follows function (functionality as prime driver) • form over function (aesthetics as prime driver). 	49	As RMT	107	<p>5.3 The influence of aesthetics, ergonomics and anthropometrics on the design, development and manufacture of products:</p> <p>a) form over function</p> <p>b) form follows function.</p>	13
<p>4 Anthropometrics and ergonomics: The principles and application of anthropometrics data and ergonomics:</p> <ul style="list-style-type: none"> • key ergonomic factors for a designer to consider when developing products, equipment and environments with human interaction • sources and applications of anthropometric data. 	50	As RMT	108	<p>5.2 Principles, applications and the influence on design of anthropometrics and ergonomics:</p> <p>a) sources and applications of anthropometric data</p> <p>b) ergonomic factors for a designer to consider when developing products and environments with which humans react.</p>	13
<p>3.6 Sustainability</p>	50		108	<p>9 Designing for maintenance and</p>	16

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				the cleaner environment	
<p>Life-cycle assessment (LCA): Application of LCA to assess the impact of a product:</p> <ul style="list-style-type: none"> • environmental inputs/outputs of raw materials, energy resources and emissions • economic inputs/outputs of products, components or energy that are outputs from other processes. 	50	As RMT	109	See 9.1	16
<p>Cleaner design and technology: Application of 'cleaner' design and technology throughout each of the stages of a product's life-cycle in relation to the following sustainable development issues:</p> <ul style="list-style-type: none"> • design – for reducing environmental impact and for recycling • raw materials – reduction or recyclable, reduce environmental impact • manufacture – minimising waste and energy use, simplifying processes and efficient use of natural resources • distribution – reduce or lighten packaging, reduce mileage of transportation to the customer and alternatives to fossil fuels • use – repair versus replacement. 	51	As RMT	109	<p>9.1 Characteristics, application, advantages and disadvantages of 'cleaner' design and technology – a product's life-cycle in relation to the following sustainable development issues:</p> <p>a) material selection – source, quantity, quality, range, recyclability, biodegradability</p> <p>b) manufacture – minimising energy use, simplification of processes, achieving optimum use of materials and components, giving consideration to material form, cost and scale of production</p> <p>c) distribution – efficient use of packaging, reduction of transport, alternatives to fossil fuels</p> <p>d) use – repair versus replacement, energy efficiency, efficiency ratings</p> <p>e) repair and maintenance – standardisation, modular construction,</p>	16

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				bought-in parts f) end of life – design for disassembly, recovered material collection, sorting and re-processing methods, energy recovery, environmental implications of disposal to landfill.	
Minimising waste production: The principles and application of minimising waste production throughout the product life-cycle using the following 'four R's' – reduce, reuse, recover, recycle.	51	As RMT	109	See 9.1	16
Renewable and non-renewable sources of energy: Characteristics, comparisons, applications and advantages/disadvantages of using the following renewable and non-renewable sources of energy: <ul style="list-style-type: none">• wind, water, solar, biomass and biofuels, nuclear and fossil fuels.	52	As RMT	110	See 9.1	16
Responsibilities of developed countries: The responsibilities of 'developed' countries in relation to social, economic and environmental issues for global sustainable development. Impact of industrialisation on global warming and climate change: <ul style="list-style-type: none">• United Nations Framework Convention on Climate Change (UNFCCC)• Kyoto Protocol	52	As RMT	110	9.2 The wider issues of using cleaner technologies: a) cost implications to the consumer and manufacturer b) sustainability – designing without jeopardising the potential for people in the future to meet their needs.	16

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<ul style="list-style-type: none"> reduction of an individual's 'carbon footprint' by reducing carbon dioxide emissions and carbon offsetting non-fossil fuel obligation (NFFO) in the UK. <p>Timber production and sustainable forest management.</p>					
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The following content is new and does not match the 9RM01 or 9GR01 specification content; **refer to the editable schemes of work.**

Product Design 9DT0 (2017)		Product Design 9DT0 (2017)		Product Design 9DT0 (2017)	
3 Processes, techniques and specialist tools		5 Factors influencing the development of products		10 Current legislation	
<p>3.2 Application of specialist measuring tools and equipment to determine and apply the accuracy and precision required for products to perform as intended:</p> <ul style="list-style-type: none"> a) marking, cutting and mortise gauges b) odd leg, internal and external callipers c) squares (set, try, engineers and mitre) d) micrometer and vernier callipers e) densitometer f) dividers g) jigs and fixtures h) go and no-go gauges. 	11	<p>5.1 The importance and influence of user-centred design in ensuring products are fit-for-purpose and meet the criteria of specifications when designing, making and evaluating in relation to:</p> <ul style="list-style-type: none"> a) user needs, wants and values b) purpose c) functionality d) innovation e) authenticity. 	13	<p>10.1 From the consumer's point of view, the implications of consumer rights legislation to consumers and manufacturers:</p> <ul style="list-style-type: none"> a) Consumer Rights Act (2015) b) Sale of Goods Act (1979). 	17

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<p>11 Information handling, modelling and forward planning</p>					
<p>11.1 Collection, collation and analysis of information and the use of this to make informed decisions:</p> <p>a) marketing – marketing analysis, research techniques, raw data/analysed data to enable enterprise to be encouraged</p> <p>b) innovation management – cooperation between management, designers and production engineers, the encouragement of creativity</p> <p>c) the use of feasibility studies on the practicability of proposed solutions.</p>	18	<p>11.2 Modelling the costing of projects to achieve an optimum outcome:</p> <p>a) budgets – undertake financial forecasts</p> <p>b) planning for production – allocation of employees, materials, scale of production</p> <p>c) selection of appropriate tools, machines and manufacturing processes.</p>	18	<p>11.3 The importance, implications and ways of protecting the intellectual property rights of designers, inventors and companies:</p> <p>a) patents</p> <p>b) copyrights</p> <p>c) design rights</p> <p>d) trademarks.</p>	18
<p>12 Further processes and techniques</p>					
<p>12.1 Strategies, techniques and approaches to explore, create and evaluate design ideas:</p> <p>a) user-centred design – framework process, problem solving, user needs, wants and values, limitations of end user consideration</p> <p>b) circular economy – biologically-based systems and an understanding of how waste and pollution can be eliminated</p> <p>c) systems thinking – the influence of systems on commercial activity to enable all elements of a manufacturing enterprise to work</p>	19	<p>12.2 Applications, characteristics, advantages and disadvantages of the following project management strategies:</p> <p>a) critical path analysis – the handling of complex and time sensitive operations</p> <p>b) scrum – how flexible, holistic product development is achieved</p> <p>c) Six Sigma – the improvement of output quality of a process by identifying and removing the causes of defects and setting value targets of:</p> <ul style="list-style-type: none"> • reduce process cycle time 	19	<p>12.3 The cost, sales, profit and market implications to the designer and manufacturer of the stages of a product’s life-cycle:</p> <ul style="list-style-type: none"> • Introduction Stage • Growth Stage • Maturity Stage • Decline Stage 	19

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together.		<ul style="list-style-type: none"> • reduce pollution • reduce costs • increase customer satisfaction • increase profits. 			
Product Design 9DT0 (2017)					
Component 2: Independent Design and Make Project					
<p>Overview</p> <p>There are no limits to project selection beyond the time and resources available and the appropriateness of selection in matching individual students' potential.</p> <p>Students are expected to follow an iterative design process.</p> <p>In order to reach high attainment levels, students must adopt a commercial design approach to their work, reflecting how a professional designer might deal with a design problem and its resolution.</p> <p>Design and development are now separate assessment areas. Planning is no longer assessed as a discrete component.</p> <p>Mathematical and scientific principles are an important part of designing and developing products, and students will be expected to be able to apply these principles when considering their designs and the</p>	21				

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designs of others. Please see the specification Appendix 1: Mathematical skills requirement and Appendix 3: Science knowledge and skills requirement.					
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