OCR CAMBRIDGE NATIONALS / ENGINEERING: DESIGN / EXAM REVISION LIST

No	Topic	General Overview *You need to know the following:*	Revision guide pages	Revised? ✓ / X
Learning Outcome 1: Understand the design cycle and the relationship between design briefs and design specifications				
*	**The Design Cycle**			
1	**Identify Phase**	**The identify phase is the FIRST phase of the design cycle, during this phase, the following stages take place:** - exploring the requirements of the brief - research user and client needs - research product needs - process planning	**Section:** 1.1 **Pages:** 5-6	
2	**Design Phase**	**The design phase is the SECOND phase of the design cycle, during this phase, the following stages take place:** - development of a design specification - development of a range of design ideas - selection and justification of chosen designs - presentation of chosen designs - development of planning and engineering drawings - manufacturing plans	**Section:** 1.2 **Pages:** 7-11	
3	**Optimise Phase**	**The optimise phase is the THIRD phase of the design cycle, during this phase, the following stages take place:** - design testing, i.e. physical and virtual modelling and prototyping - error proofing - design optimisation, proposing how solution can be improved	**Section:** 1.3 **Pages:** 12-13	
4	**Validate Phase**	**The Validate phase is the FOURTH phase of the design cycle, during this phase, the following stages take place:** - justification of design decisions - market testing - product testing, i.e. virtual and physical processes - evaluation of success of solution against design brief and design specification - evaluating the impact of the design solution	**Section:** 1.4 **Pages:** 14-15	
*	**Identification of design needs**			
5	**Initial design brief from the client**	**Understanding:** - that the situation and context that has led to the brief - the needs of the client, i.e. corporate branding target audience - what is the actual purpose of the product? - what is the actual function(s) of the product?	**Section:** 1.1 **Pages:** 4-6	
6	**Information which may inform the design brief**	**The design brief may be affected by:** - market research, i.e. focus groups surveys needs of target market changing consumer trends - strengths and weaknesses of competitors' products - improvements in materials - new manufacturing processes - available budget, i.e. development budget and target cost of product	**Section:** 1.1 **Pages:** 4-6	
7	**The relationship between a design brief and a design specification**	**The following steps outline the process of getting the design brief to the specification stage:** - The client provides initial brief - There is discussion between client and designer (e.g. what is possible, what can be done within budget, essential and desirable aspects, timeframes) - If necessary, further research is carried out (if required) - Finally, the 'final' brief from which design specification will be developed	**Section:** 1.1 **Pages:** 4-6	

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Learning Outcome 2: Understand the requirements of design specifications for the development of a new product				
	Requirements of a design specification			
8	**User needs**	**User needs are what the user needs the product to do. Common needs include:** - aesthetics: how is the user would want the product to look - ergonomics: how would the user want the product to be comfortable to use - anthropometrics: what body sizes of the user are required to ensure the product is suitably designed - benefits and features: how will the product benefit the user and what will be its key features and USPs (Unique selling points) - product safety: what safety considerations must be addressed when designing this product for these users	**Section:** 3.1 **Pages:** 20	
9	**Product requirements**	**Product requirements are what a product has to meet/must do. Common requirements include:** - function: what a product's purpose/ job is - features: what makes a product unique and sellable - performance: how well it completes its function - target group/intended users: how it appeals to its customers - working environment: how it is suitable for where it will be used - limitations and constraints: size, weight, functional limitations - appearance: what it will look like - ergonomics: how it's comfortable and safe to use - lifecycle: what environmental impact it makes (and how that can be reduced) - product maintenance: how easily can it be taken apart - product safety: how has product and user safety been considered?	**Section:** 3.1 **Pages:** 20	
*	**Manufacturing considerations**			
10	**Material availability/ supply chain**	**When manufacturing a product it is integral to consider availability of material, this is because:** - material must be available to actually manufacture the product - the product will not be able to be manufactured - customers will be disappointed - the company will not be able to make profits	**Section:** 2.2 **Pages:** 15	
11	**Ease of manufacture**	**Consideration of how easy it is to manufacture a product, this includes:** - Standard components, have they been used as opposed to glue and adhesives? - Pre-manufactured components, have these been used to make manufacturing more streamlined? - Design for manufacturing assembly (DFMA), how easy it is to assemble the product, ensuring there are no obstructions, minimal amount of parts and components. - Design for disassembly, manufacturing processes, how easy it is to disassemble the product, have standard components been used to allow standard tools to take the product appart, does this allow for product maintenance or for the product to be recycled?	**Section:** 3.3-3.6 **Pages:** 22-23	
12	**Scale of production**	**Various scales of production include:** - Just-in-time, when products are made to order, with materials/ parts are ordered when needed. - One off, Specialised companies/items using specialist materials. Usually high quality items made by skilled workers. Generally expensive products. - Batch, Small quantities of products, Mix of workers and automatic machinery, "Stations" of workers, creating and assembling the products - Mass, Heavily automated with a large product output. Lots of Standardised/ identical products being made. - Continuous, Heavily automated with a large product output. Lots of Standardised/identical products being manufactured, "Never ending" production, 24/7.	**Section:** 3.7 **Pages:** 24-25	
13	**Durability and reliability**	**How Durable something is, is how long that product/material can last:** Products can be made more durable when they are maintained. This can be done by: - Repairing - Replacing parts (disassembly) - Not over-using a product/using it in correctly - Storing and caring for a product correctly	**Section:** 1.1 **Pages:** 4-6	
14	**Tolerances**	**Tolerances are the allowances for products/parts/materials to not meet their exact sizing:** - They exist because it is extremely difficult to get the exact measurement every time - Not allowing any variation can result in a high amount of waste.	**Section:** 3.8	

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		- A product/part must still function within tolerance. - If a product's diameter is 5mm, the tolerance might be 4.9mm – 5.1mm	**Pages:** 26	
15	**Consideration of production costs**	**The complete costs considered when manufacturing a product. They include:** - Direct costs to manufacture the particular item (such as materials and labour) - Indirect costs (such as research and design time, electricity and rent). If a company has more budget for a product, they can invest in better materials, components and manufacturing methods.	**Section:** 3.2 **Pages:** 21	
16	**Regulations and safeguards**	**Legislation, safety and regulations considered to safeguard both products and users. The following safeguard products, which include:** - copyright, Legal right which protects work from unauthorised duplication - patents, stops others from making, using or selling an invention. - registered designs, shows the registration of a trade mark. - trademarks, protects a brand definition such as logos, slogans, etc. **The following safeguard users, which include:** - British Standards, shows that a product has consistently met the requirements of the British Standards Institute. These regulations are of a higher standard than European ones. - European Conformity (CE), shows that a product has consistently met the **minimum** requirements of the EU.	**Section:** 6.0 **Pages:** 35-36	
Learning Outcome 3: Know about the wider influences on the design of new products				
*	**Wider influences on new products**			
17	**Market forces**	**There are a variety of different forces which can influence a productions introduction to the market, they include:** - Market Pull, refers to the need/requirement for a new product or a solution to a problem, which comes from the marketplace. The need is identified by potential customers or market research. - Technology Push, is when research and development in new technology, drives the development of new products. It tends to start with a company developing an innovative technology and applying it to a product. - Fashion trends, influenced by changing technology. Wearable items embrace new technology, such as high-tech watches or the desire to have the latest smartphone. - Cultural trends, many countries now have a diverse range of **cultures**, so it has become important for **designers** to consider a range of cultural beliefs when designing for the **mass market**.	**Section:** 7.1 8.1 **Pages:** 37 & 39	
18	**Legislative design requirements**	**Consumer protection laws are what rights a consumer has to be protected against defective products. All companies must abide by these laws. They include:** - Sales and Supply of Goods Act 1994 - Trade Descriptions Act - Consumer Protection Act 1987 - Fire Safety Regulation **Safety to safeguard a user is also integral, this can be done by the following:** - evidence of product safety though: Consistently passed testing and standards (British and European), Non-toxic finishes and materials, Suitable for the market (age appropriate, etc), Error Proofing, Suitable warnings and instructions. - Signs and symbols for materials products and safety issues, potentially including: Age restricted logos, The Lion Mark or Flammable.	**Section:** 6.0 **Pages:** 35-36	
19	**Inspirational / iconic products**	**An iconic design is usually a design that is 'ground breaking' and one that sets new standards in its field, they:** - are iconic products being looked at for inspiration - include: Dyson; Mini Cooper; Sony Walkman; iPhone(s),;LEGO	**Section:** 7.0 **Pages:** 38	
20	**Life Cycle Analysis (LCA)**	**Product Lifecycle is what environmental impact a product makes over its lifetime. Including:** - lifecycle of a complete product - lifecycle of specific materials used in a product - lifecycle of components used in a product - impact of materials and processes when manufacturing - Product Miles (how far a product has to travel to get from factory to consumer) - impact while in use and when being disposed of	**Section:** 9.3 **Pages:** 41	

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*	**Sustainable design**			
21	**Renewable versus non-renewable material and energy sources**	**Greater consideration is now given to ensuring that the materials and energy we use are sustainable. Finite resources are non-renewable and will eventually run out.** - Metals, plastics and fossil fuels (coal, natural gas and oil) are all examples of finite resources. **Non-finite resources are found naturally and can be replaced.** - Examples include wood, cotton and renewable energy sources such as solar and wind. **A Designer must consider the following when designing products:** - impacts of extracting non-renewable resources, i.e. resource depletion transportation from source - waste from conversion to usable form - types of renewable resources, i.e. energy sourcing - eco-materials - recycled materials energy efficiency	**Section:** 9.0 **Pages:** 40-42	
22	**Consideration of 6R's**	**The 6 Rs are an important checklist. They are used by designers to reduce the environmental impact of products. They are:** - ecycle, reuse, repair, refuse, reduce, rethink	**Section:** 9.2 **Pages:** 40	
24	**Environmental pressures**	**Making a product uses resources, such as raw materials and energy. This has an impact on the environment. There are a number of things that a designer might think about to reduce environmental impact:** - Designers could use less material in the product. - Really consider what is needed or whether it could be made smaller, tinner, lighter, use less components and still do the same job. - Could an alternative material with better properties, so that not as much of the material is required. - At the end of the product's life, is there the opportunity for recycling, reusing, upcycling? - How has disposal of non-recyclable materials been addressed? - Having an awareness of ethical and socially responsible design.	**Section:** 9.0 **Pages:** 40-42	
*	**New Materials & Technologies**			
25	**New and emerging materials**	**New/ modern: These are materials that have been recently developed. They include:** - Titanium, Kevlar, Carbon Fibre **Smart Materials: These are materials that change in reaction to the environment. They may react to moisture, heat and UV rays, for example. They Include:** - Polymorph, Thermochromic Pigments, Photochromic Pigments, Shape Memory Alloys	**Section:** 2.6 **Pages:** 19	