

Ursuline College Curriculum Implementation: Engineering Design Y10



Curriculum Intent	<i>'I have come so that they may have life and have it to the full.'</i> John 10: Chapter 10. V 10 Inspired by the Gospel values of love, joy, and compassion, we nurture and develop the whole child so that each unique individual grows in confidence and has the knowledge and skills to enable them to achieve their true potential. Cambridge National in Engineering Design course will encourage students to: • understand and apply the fundamental principles and concepts of Engineering Design, including the design process, types of drawings, influences on design, and the use of Computer Aided Design (CAD) • develop learning and practical skills that can be applied to real-life contexts and work situations • think creatively, innovatively, analytically, logically and critically • develop independence and confidence in using skills that would be relevant to the engineering design and development sector and more widely • analyse problems in design terms through practical experience of solving such problems, including designing, and modelling designs to meet a design brief • understand the different stages of the iterative design process, recognising the cyclical nature of this approach • evaluate designs through product disassembly and the process of using product analysis Respecting each other, helping each other and bearing with each other: Getting better never stops.	
Year 10 Intent	Develop techniques in sketching and gain industrial skills in engineering drawing using standard conventions that include dimensioning, line types, abbreviations, and representation of mechanical features. Use computer aided design (CAD), 2D and 3D software, to produce accurate and detailed drawings and models that visually communicate designs.	
Exam Board & Specification	OCR Cambridge National Engineering Design J822	
	Cycle 1 Term 1 1.9.26 – 23.10.26 8 weeks 	Term 2 2.11.26 – 18.12.26 7 weeks
Focus & Skills (Inc paper/ unit focus)	Unit R039 Communicating Designs Task One: Manual production of freehand sketches	R039 Communicating Designs Task Two: Design Development
Links to CST	Peace and reconciliation – 24.25 focus	Peace and reconciliation – 24.25 focus

	Sketching is a method of communication that can be very effective and relevant to the design of symbols of peace	Developing a design requires the use of communication skills with a client. Pupils can use their communication skills in which will be useful in later life in a work environment to help spread peace or reconcile with others in love and harmony.
Explicit Skill Content	R039 • 2D/3D sketches • Thick/thin lines • Texture • Tone • Shading • Annotation and labelling techniques: ○ explain key features ○ functions ○ dimensions ○ materials	R039 • Produce an isometric sketch for a design proposal • 2D sketches of improved design • Extensive annotation of design • All skills from term one
Homework	One 45 minute piece every 2 lessons. Recall and comprehension activities based on disciplinary literacy for this term	One 45 minute piece every 2 lessons. Recall and comprehension activities based on disciplinary literacy for this term
Assessment	• R+R tests based on disciplinary literacy set for H/W • Ongoing AfL based on coursework • Coursework tracking spreadsheet shared with pupils	• R+R tests based on disciplinary literacy set for H/W • Ongoing AfL based on coursework • Coursework tracking spreadsheet shared with pupils
Disciplinary Literacy Vocab	• 2D • 3D • sketches • Thick/thin lines • Texture • Tone • Shading • Annotation • labelling techniques: ○ key features ○ functions ○ dimensions ○ materials	• 2D • 3D • sketches • Thick/thin lines • Texture • Tone • Shading • Annotation • labelling techniques: ○ key features ○ functions ○ dimensions ○ materials

Texts/ Resources	Engineering Design J822 textbook (Hodder) Engineering Design Revision Guide & Workbook (Cambridge Uni Press)	Engineering Design J822 textbook (Hodder) Engineering Design Revision Guide & Workbook (Cambridge Uni Press)
Revision Material Sources	Engineering Design Revision Notes (Hodder) Engineering Design Exam Practice Workbook (Hodder)	Engineering Design Revision Notes (Hodder) Engineering Design Exam Practice Workbook (Hodder)
	Cycle 2 Term 3 4.1.27 – 12.2.27 6 weeks Term 4 22.2.27 – 25.4.27 5 weeks	
Focus & Skills (Inc paper/ unit focus)	R039 Communicating Designs Task Four: Use of Computer Aided Design	R039 Communicating Designs Task Three: Production of Engineering Drawings
Links to CST	Peace and reconciliation – 24.25 focus Computer Aided Design can help us communicate more accurately in the design of products which could be used as symbols of peace and reconciliation. Designing accurately for computer aided manufacture can help produce useful products that help people come together in the pursuit of sustainability and peace.	Peace and reconciliation – 24.25 focus Engineering drawings have a key focus – to produce drawings that conform to standard conventions so that others can read and understand them universally. This focus on producing something that others can use and work from allows pupils to understand that most things we create are for use by others – our communications must be clear and precise to avoid misunderstandings and consider the end user.
Explicit Skill Content	R039 ☐ CAD sketch tool features: • lines • arcs • polygons • extrudes • revolves • sizing • dimensioning • shelling • holes ☐ CAD reference geometry: • work planes ☐ CAD rendering	R039 ☐ Produce a 3rd angle orthographic projection drawing of a design proposal using standard conventions ☐ Produce an assembly drawing for a design proposal. • Isometric projection • Centre line • Parts list to include up to 4 parts • Parts number referencing • Exploded view • Sectional view
Homework	One 45 minute piece every 2 lessons. Recall and comprehension activities based on disciplinary literacy for this term	One 45 minute piece every 2 lessons. Recall and comprehension activities based on disciplinary literacy for this term

Assessment	• R+R tests based on disciplinary literacy set for H/W • Ongoing AfL based on coursework • Coursework tracking spreadsheet shared with pupils	• R+R tests based on disciplinary literacy set for H/W • Ongoing AfL based on coursework • Coursework tracking spreadsheet shared with pupils
Disciplinary Literacy Vocab	☐ CAD sketch tool features: • lines • arcs • polygons • extrudes • revolves • sizing • dimensioning • shelling • holes ☐ CAD reference geometry: • work planes ☐ CAD rendering	• 3rd angle orthographic projection • design proposal • standard conventions • assembly drawing • Isometric projection • Centre line • Parts list to include up to 4 parts • Parts number referencing • Exploded view • Sectional view
Texts/ Resources	Engineering Design J822 textbook (Hodder) Engineering Design Revision Guide & Workbook (Cambridge Uni Press)	Engineering Design J822 textbook (Hodder) Engineering Design Revision Guide & Workbook (Cambridge Uni Press)
Revision Material Sources	Engineering Design Revision Notes (Hodder) Engineering Design Exam Practice Workbook (Hodder)	Engineering Design Revision Notes (Hodder) Engineering Design Exam Practice Workbook (Hodder)
	Cycle 3	
	Term 5 12.4.27 – 28.5.27 7 weeks	Term 6 7.6.27 – 16.7.27 6 weeks
Focus & Skills (Inc paper/ unit focus)	R039 Communicating Designs Task Four: Use of Computer Aided Design R040 Focussed Practical Task (preparation for R040 unit)	R040 Design, Evaluation and Modelling Task One: Product Analysis R038 Principles of engineering design Topic Area 2: Design requirements • 2.1 Types of criteria included in an engineering design • 2.2 How manufacturing considerations affect design
Links to CST	Peace and reconciliation – 24.25 focus This aspect of CAD refers to the assembly of components in one drawing / product / machine. Sometimes these components are designed in different parts of the world initially and shared via the	Peace and reconciliation – 24.25 focus Analysing products and looking at design requirements means the pupils must consider the end user specifically. What if the user is excluded from using these products for some reason? Inclusive design and ergonomic

	internet. This is an example of people coming together and working in peace from other nations, designing with others in peace and harmony.	design focus on the need to consider inclusivity and comfort. Students must evaluate on behalf of others, considering others showing how people can come together in peace and unity to improve the lives of others.
Explicit Skill Content	R039 (related to completion of Task 4) ☐ Aspects of CAD assembly • multiple components • mate tools • mate constraint tools • animation R040 Use of manufacturers manuals or other published sources ☐ Use appropriate tools and instruments R040 ☐ Apply safe working procedures when making the prototype Working drawings ☐ 2D engineering drawings using third angle orthographic projection ☐ Standard conventions • title block • metric units of measurement • scale • tolerance ☐ Standard conventions for dimensions: • linear measurements • radius • diameter ☐ Meaning of line types: • hidden detail • centre line • dimension • leader line	R040 Product analysis using ACCESS FM. ☐ Aesthetics ☐ Cost ☐ Customer ☐ Environment ☐ Size ☐ Safety ☐ Function ☐ Materials and manufacturing Compare products using: ☐ Ranking matrices ☐ Quality Function Deployment (QFD) R038 2.1 Types of criteria included in an engineering design specification Types of criteria included in an engineering design specification: ☐ Needs and wants ☐ Quantitative and qualitative criteria ☐ Reasons for the product criteria included in the design specification (ACCESS FM): • Aesthetics • Cost • Customer • Environment • Size • Safety • Function • Material • Manufacturing R038 2.2 How manufacturing considerations affect design ☐ Scale of manufacture:

		• one-off • batch • mass ☐ Material availability and form ☐ Types of manufacturing processes: • wasting • shaping • forming • joining • finishing • assembly ☐ Production costs • labour • capital cost
Homework	One 45 minute piece every 2 lessons. Recall and comprehension activities based on disciplinary literacy for this term	One 45 minute piece every 2 lessons. Recall and comprehension activities based on disciplinary literacy for this term
Assessment	• R+R tests based on disciplinary literacy set for H/W • Ongoing AfL based on coursework • Coursework tracking spreadsheet shared with pupils	• R+R tests based on disciplinary literacy set for H/W • Ongoing AfL based on coursework • Coursework tracking spreadsheet shared with pupils • Y10 Mock Exam June
Disciplinary Literacy Vocab	• CAD assembly • multiple components • mate tools • mate constraint tools • animation	☐ Aesthetics ☐ Cost ☐ Customer ☐ Environment ☐ Size ☐ Safety ☐ Function ☐ Materials and manufacturing ☐ Ranking matrices ☐ Quality Function Deployment (QFD) ☐ Needs and wants ☐ Quantitative and qualitative criteria ☐ Scale of manufacture:

		• one-off • batch • mass ☐ Material availability and form ☐ Types of manufacturing processes: ○ wasting ○ shaping ○ forming ○ joining ○ finishing ○ assembly ☐ Production costs ○ labour ○ capital cost
Texts/ Resources	Engineering Design J822 textbook (Hodder) Engineering Design Revision Guide & Workbook (Cambridge Uni Press)	Engineering Design J822 textbook (Hodder) Engineering Design Revision Guide & Workbook (Cambridge Uni Press)
Revision Material Sources	Engineering Design Revision Notes (Hodder) Engineering Design Exam practice Workbook (Hodder)	Engineering Design Revision Notes (Hodder) Engineering Design Exam practice Workbook (Hodder)



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Year 11 Intent	R038 Study the different design strategies and where they are used, as well as the stages that are involved in iterative design. Learn about the type of information needed to develop a design brief and specification, and the manufacturing and other considerations that can influence a design. Develop knowledge of the types of drawing used in engineering to communicate designs, as well as the techniques used to evaluate design ideas and outcomes, including modelling methods. R040 Develop understanding of how products are manufactured to ensure that their ideas can be produced effectively. Analyse how products are made to help to inform designs, and disassemble existing products to discover how they function and how they were manufactured. Learn how designers can quickly create and test models to develop a prototype of a design. Develop virtual modelling skills using computer aided design (CAD) 3D software, to produce a high-quality model that will be able to simulate a design prototype. Develop your physical modelling skills using modelling materials or rapid prototyping processes to produce a physical prototype.				
Exam Board & Specification	OCR Cambridge National Engineering Design J822				
	<table> <tr> <th colspan="2">Cycle 1</th></tr> <tr> <td>Term 1 3.9.24 – 22.10.19 7 weeks</td><td>Term 2 4.11.24 – 20.12.24 7 weeks</td></tr> </table>	Cycle 1		Term 1 3.9.24 – 22.10.19 7 weeks	Term 2 4.11.24 – 20.12.24 7 weeks
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Term 1 3.9.24 – 22.10.19 7 weeks	Term 2 4.11.24 – 20.12.24 7 weeks				

Focus & Skills (Inc paper/ unit focus)	R040 Design, Evaluation and Modelling Task Two: Product Disassembly R038 Principles of engineering design Topic Area 2: Design requirements 2.3 Influences on engineering product design	R040 Design, Evaluation and Modelling Task Three: Virtual CAD 3D Task Four: Physical modelling – production planning R038 Principles of engineering design Topic Area 1: Designing processes
Links to CST	Peace and reconciliation – 24.25 focus Analysing products through disassembly and looking at design requirements means the pupils must consider the end user specifically. What if the user is excluded from using these products for some reason? Inclusive design and ergonomic design focus on the need to consider inclusivity and comfort. Students must evaluate on behalf of others, considering all users and showing how people can come together in peace and unity to improve the lives of others.	Peace and reconciliation – 24.25 focus Studying design processes allows pupils to understand that people work in many ways to achieve an outcome. This improves the empathy of pupils by allowing them to understand how other cultures / designers work in harmony to achieve the end goal – one system is not always best and anything that improves empathy can help with peace and reconciliation.
Explicit Skill Content	R040 Use of manufacturers manuals or other published sources ☐ Use appropriate tools and instruments ☐ Analyse the disassembled product • components and their functions • assembly methods • materials • production methods • maintenance consideration R038 2.3 Influences on engineering product design ☐ Market pull and technology push ☐ British and International Standards ☐ Legislation ☐ Planned obsolescence ☐ Sustainable design (6Rs) • Rethink • Reuse • Recycle • Repair • Reduce • Refuse	R040 Virtual CAD 3D ☐ Create a 3D model using CAD 3D software ☐ Simulate the operation of the product using CAD software ☐ Select an appropriate modelling method: • sheet • block • breadboarding • 3D printing ☐ Select and use appropriate materials, processes, tools and equipment to produce a prototype R038 1.1 The stages involved in design strategies ☐ Linear design ☐ Iterative design ☐ Inclusive design ☐ User-centred design ☐ Sustainable design ☐ Ergonomic design

	☐ Design for the circular economy	
Homework	One 45-60 minute piece every 2 lessons. Recall and comprehension activities based on disciplinary literacy for this term.	One 45-60 minute piece every 2 lessons. Recall and comprehension activities based on disciplinary literacy for this term.
Assessment	• R+R tests based on disciplinary literacy set for H/W • Ongoing AfL based on coursework • Coursework tracking spreadsheet shared with pupils	• R+R tests based on disciplinary literacy set for H/W • Ongoing AfL based on coursework • Coursework tracking spreadsheet shared with pupils • Y11 Mock Exam 1 November
Disciplinary Literacy Vocab	disassembled product • components • assembly methods • production methods • maintenance consideration R038 ☐ Market pull and technology push ☐ British and International Standards ☐ Legislation ☐ Planned obsolescence ☐ Sustainable design (6Rs) • Rethink • Reuse • Recycle • Repair • Reduce • Refuse ☐ circular economy	Virtual CAD 3D modelling method: • sheet • block • breadboarding • 3D printing prototype design strategies ☐ Linear design ☐ Iterative design ☐ Inclusive design ☐ User-centred design ☐ Sustainable design ☐ Ergonomic design
Texts/ Resources	Engineering Design J822 textbook (Hodder) Engineering Design Revision Guide & Workbook (Cambridge Uni Press)	Engineering Design J822 textbook (Hodder) Engineering Design Revision Guide & Workbook (Cambridge Uni Press)

Revision Material Sources	Engineering Design Revision Notes (Hodder) Engineering Design Exam practice Workbook (Hodder)	Engineering Design Revision Notes (Hodder) Engineering Design Exam practice Workbook (Hodder)
	Cycle 2	
	Term 3 6.1.25 – 14.2.25 6 weeks	Term 4 24.2.25 – 4.4.25 6 weeks
Focus & Skills (Inc paper/ unit focus)	R040 Design, Evaluation and Modelling Task Five: Physical modelling – prototype production Task Six: Physical modelling – evaluation of a prototype R038 Principles of engineering design Topic Area 1: Designing processes	R038 Principles of engineering design Topic Area 4: Evaluating design ideas Topic Area 3: Communicating design outcomes
Links to CST	Peace and reconciliation – 24.25 focus Safe working procedures are studied. These are important when considering the safety of others on the workplace. For example – if working practices in industry must consider the safety of others to promote peace and avoid the need for reconciliation.	Peace and reconciliation – 24.25 focus Evaluating products and looking at design requirements means the pupils must consider the end user specifically. What if the user is excluded from using these products for some reason? Inclusive design and ergonomic design focus on the need to consider inclusivity and comfort. Students must evaluate on behalf of others, considering all users and showing how people can come together in peace and unity to improve the lives of others.
Explicit Skill Content	R040 ☐ Apply safe working procedures when making the prototype ☐ Record the key stages of making the prototype ☐ Compare the prototype against the product design specification ☐ Identify potential improvements in the design R038 1.2.1 Design: ☐ Analysis of the design brief ☐ Methods of researching the product requirements • types of information obtained from primary research • types of information obtained from secondary research • market research to determine existing products • interviews with potential users and focus groups • use of tables of anthropometric data • analysis of existing products using:	R038 4.1 Methods of evaluating design ideas ☐ Production of models ☐ Qualitative comparison with the design brief and specification ☐ Ranking matrices ☐ Quality Function Deployment (QFD) 4.2 Modelling methods ☐ Virtual (3D CAD) ☐ Card ☐ Block ☐ Breadboarding ☐ 3D printing 4.3 Methods of evaluating a design outcome ☐ Methods of measuring the dimensions and functionality of the product ☐ Quantitative comparison with the design brief and specification

	○ ACCESS FM (Aesthetics, Cost, Customer, Environment, Size, Safety, Function, Materials and Manufacturing) ○ product disassembly ☐ Production of an engineering design specification ☐ Generation of design ideas by sketching and modelling	☐ User testing ☐ Reasons for identifying potential modifications and improvements to the design 3.1 Types of drawing used in engineering ☐ Freehand sketching ☐ Isometric ☐ Oblique ☐ Orthographic drawings ☐ Exploded views ☐ Assembly drawings ☐ Block diagrams ☐ Flowcharts ☐ Circuit diagrams ☐ Wiring diagrams 3.2 Working drawings ☐ 2D engineering drawings using third angle orthographic projection ☐ Standard conventions • title block • metric units of measurement • scale • tolerance ☐ Standard conventions for dimensions: • linear measurements • radius • diameter • surface finish ☐ Meaning of line types: • outlines • hidden detail • centre line • projection • dimension • leader line ☐ Abbreviations: across flats, centre line, diameter, drawing, material, square
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		☐ Representations of mechanical features: threads, holes, chamfers, countersinks, knurls 3.3 Using CAD drawing software ☐ Advantages and limitations of using CAD drawing software compared to manual drawing techniques
Homework	One 45-60 minute piece every 2 lessons. Recall and comprehension activities based on disciplinary literacy for this term.	One 45-60 minute piece every 2 lessons. Recall and comprehension activities based on disciplinary literacy for this term.
Assessment	• R+R tests based on disciplinary literacy set for H/W • Ongoing AfL based on coursework • Coursework tracking spreadsheet shared with pupils	• R+R tests based on disciplinary literacy set for H/W • Ongoing AfL based on coursework • Coursework tracking spreadsheet shared with pupils • Y11 Mock Exam 2
Disciplinary Literacy Vocab	prototype ☐ product design specification design brief product requirements • primary research • secondary research • market research • existing products • potential users • focus groups • anthropometric data ○ analysis ○ ACCESS FM (Aesthetics, Cost, Customer, Environment, Size, Safety, Function, Materials and Manufacturing) ○ product disassembly ☐ engineering design specification	Qualitative comparison design brief and specification ☐ Ranking matrices ☐ Quality Function Deployment (QFD) Modelling methods ☐ Virtual (3D CAD) ☐ Card ☐ Block ☐ Breadboarding ☐ 3D printing evaluating a design outcome dimensions functionality of the product Quantitative comparison brief and specification User testing modifications ☐ Freehand sketching ☐ Isometric ☐ Oblique

		☐ Orthographic drawings ☐ Exploded views ☐ Assembly drawings ☐ Block diagrams ☐ Flowcharts ☐ Circuit diagrams ☐ Wiring diagrams Working drawings ☐ 2D engineering drawings using third angle orthographic projection ☐ Standard conventions • title block • metric units of measurement • scale • tolerance ☐ Standard conventions for dimensions: • linear measurements • radius • diameter • surface finish ☐ Meaning of line types: • outlines • hidden detail • centre line • projection • dimension • leader line Abbreviations: across flats, centre line, diameter, drawing, material, square mechanical features: threads, holes, chamfers, countersinks, knurls CAD
Texts/ Resources	Engineering Design J822 textbook (Hodder) Engineering Design Revision Guide & Workbook (Cambridge Uni Press)	Engineering Design J822 textbook (Hodder) Engineering Design Revision Guide & Workbook (Cambridge Uni Press)
Revision Material Sources	Engineering Design Revision Notes (Hodder) Engineering Design Exam Practice Workbook (Hodder)	Engineering Design Revision Notes (Hodder) Engineering Design Exam Practice Workbook (Hodder)

	Cycle 3	
	Term 5 22.4.25 – 23.5.25 5 weeks	
Focus & Skills (Inc paper/ unit focus)	R038 Principles of engineering design REVISION	
Links to CST	Peace and reconciliation – 24.25 focus The overarching concept of engineering design is that we design with others in mind – we meet the needs of others who are part of the design and manufacturing process; we meet the needs of users; we design items to improve sustainability; we design for ergonomics and inclusivity. All of these can relate to peace and reconciliation by spreading peace through unity in the workplace, considering the needs of others and avoiding the need for reconciliation whilst improving our empathy should the need for reconciliation arise.	
Explicit Skill Content	Exam technique Revision technique	
Homework	One 45-60 minute piece every 2 lessons. Recall and comprehension activities based on disciplinary literacy for this term.	
Assessment	• R+R tests based on disciplinary literacy set for H/W • Terminal external exam (Unit R038)	
Disciplinary Literacy Vocab	All previous R038 vocab	
Texts/ Resources	Engineering Design J822 textbook (Hodder) Engineering Design Revision Guide & Workbook (Cambridge Uni Press)	
Revision Material Sources	Engineering Design Revision Notes (Hodder) Engineering Design Exam Practice Workbook (Hodder)	