

YEAR 10 Engineering Design

Autumn 1	Key knowledge/content to learn and retain	Essential skills to acquire (Subject and generic)	Link to other units / subjects	Why this task now	Anticipated misconceptions	Links to KS3	Links to KS5	Opportunity for stretch for high prior attainers	SMSC & British Values	Cultural Capital / Big Picture	Visit / talk opportunities	Career links	
R038 - Principles of Engineering Design	Ergonomic design Sustainable design Engineering drawing Topic Area 1 - 1.1 / 1.2 Topic area test so far.	3D sketching skills, (oblique, isometric, crating). Rendering, (thick and thin lines, tone, texture) Annotation. Dimensions and use of scale. 3rd Angle Orthographic Projection and drawing conventions.	Engineering Manufacture - Interpreting engineering drawings Maths - scale, dimensioning, recognising shapes R039/R040 Students will follow an iterative design process in both units	New school new expectations. Students arrive with varied prior learning experiences. Maths department look at measurements and units in Autumn 1. Simultaneous delivery of technical drawing for design and manufacture allows for more depth of knowledge. Vital to be able to interpret a technical drawing before NEA can start.	Ergonomics, anthropometrics	Use of 3D sketching by designers in response to a design brief. Use of engineering drawings to plan making.	Mechanical Design (unit 9) Computer Aided Design (Unit 10) A Level Product Design	Design briefs and specifications. Methods of research, (primary, secondary, product analysis-ACCESS FM, focus groups, anthropometric data).	Legislative - Technical drawing standards BS8888 User centered design, inclusive design and protected characteristics.	Understanding of universal systems for engineering drawings and how these can be shared and understood globally. BS8888	Ospray plastics - September	<a href="https://education.theiet.org/secondary/careers/engineering-careers-resources/">https://education.theiet.org/secondary/careers/engineering-careers-resources/</a>	Design Engineer Draftsperson Architect Graphic Designer
R039 - Communicating designs	3D sketching principles, (oblique, isometric, crating). Use of rendering. Annotation. Dimensions and use of scale. 3rd Angle Orthographic Projection and drawing conventions.			Scaling of drawings. Adding shadows to sketches.									
R040 - Design evaluation and modelling													
Practical	Principles/rules of drawing in Oblique, Isometric and 3rd Angle Orthographic Projection.	As R038 - sketching and drawing skills	R038 Topic Area 1.2.1 Design - Generation of design ideas by sketching and modelling	Engineering designers rely on sketching skills in order to communicate their ideas to others.	Importance of visually examining then plotting of construction lines, pencil pressure.	Design and Technology - design and make projects and shared technical knowledge	Mechanical Design (unit 9) Computer Aided Design (Unit 10) A Level Product Design	Use of drawing equipment to produce engineering drawings. (No reliance on grid underlays).	Legislation The rule of law - technical drawing standards BS888				
Independent Study	Use of relevant OCR Engineering Design Unit R107 and R038 materials. Useof Seneca or Kahoot for Principles of Engineering Design.												

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R038 - Principles of Engineering Design	Sketching and drawing, CAD Topic Area 1.1 , 1.2, 3.1 Topic area test so far.	Modelling, freehand sketching, drawing types Block diagrams, flow charts, circuit diagrams and wiring diagrams	R038 Topic Area 1.1 and 1.2.1 Iterative design, Analysis of the design brief, methods of research, analysis of existing products. R039 Students will produce drawings of design ideas OCR CamNat Programmable systems	Spiralised curriculum - links to technical drawing understanding needed for R015 but now deeper understanding and how to draw.	Assembly drawings and exploded drawings. Wiring diagrams	R038 Topic Area 1.2.1 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	Unit 9 Mechanical Design, Unit 10 CAD Product Design	Students challenged to produce original, creative design solutions. Emphasis on quality and communication of ideas.	Legislative - Technical drawing standards BS8888. Inclusive design - understanding of the diverse needs of users across society.	Developed understanding for the need for a universal approach to designs and engineering drawings - globalisation.	IGUS - Polymers	<a href="https://education.theiet.org/secondary/careers/engineering-careers-resources/">https://education.theiet.org/secondary/careers/engineering-careers-resources/</a>	CAD Engineer CAM Engineer and operator Engineering product analyst Metallurgist
R039 - Communicating designs	Understand assessment criteria for Unit R039. Understand how design solutions are created to meet a specification. Know how primary and secondary research can be used to inform designing. Know the characteristics, properties of key materials.	Different methods of researching including analysing products using ACCESSFM. Using a specification to guide design thinking. Applying 2D and 3D sketching skills, 3rd Angle Orthographic Projection and drawing conventions learnt previously.	Engineering Manufacture - interpreting engineering drawings Science - Mechanical properties of materials	Students need to understand importance of meeting specification criteria when creating design solutions. Effective methods of research will support students in arriving at creative and successful design solutions.	Important lessons can be learnt from market research and poor examples of design. Good design involves an iterative process if a successful design solution is to be achieved.	Developing on knowledge of design briefs, specifications, user needs and methods of researching.	Materials Science (Unit 11) Mechanical Design (unit 9) A Level Product Design		Understanding that successful design relies on thorough research and a detailed iterative design process in order to arrive at viable solutions.				
R040 - Design evaluation and modelling													
Practical	Assessment requirements as OCR Engineering Design specification.	As R038 - applying sketching and drawing skills previously learnt.	R038 Topic Area 1.2.1 Design - Generation of design ideas by sketching and modelling	Engineering designers rely on research for inspiration, sketching skills in order to communicate their ideas and knowledge of material properties in order to make decisions on material choices.		Science - material properties Design and Technology - design and make projects and shared technical knowledge	Materials Science (Unit 11) Mechanical Design (unit 9) A Level Product Design	Quality of sketching and annotation. Originality of ideas.	Legislative - Technical drawing standards BS8888. Inclusive design - understanding of the diverse needs of users across society.	A range of creative design solutions sketched and annotated. Clear evidence that specification as been considered.			
Independent Study	Use of relevant OCR Engineering Design Unit R107 and R038 materials. Useof Seneca or Kahoot for Principles of Engineering Design.												

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R038 - Principles of Engineering Design	Sketching and drawing, CAD Topic area 3.2 Topic area test on topics covered so far	Third angle orthographic projection, drawing conventions, line types, practical drawing	R039 - Communicating designs, Manufacture - R015	Spiralised curriculum - links to technical drawing understanding needed for R015 but now deeper understanding and how to draw. Provides students in depth knowledge in order to undertake R039 technical drawings.	Developing designs and design fixation	Designing and drawing products and design ideas	Unit 9 Mechanical Design, Unit 10 CAD Product Design	Peer Development, using the spec to ensure compliance	Understanding of standards for drawings. Clear communication between different people and possibly different countries.	Required to be able to express designs	Schneider	<a href="https://education.theiet.org/secondary/careers/engineering-careers-resources/">https://education.theiet.org/secondary/careers/engineering-careers-resources/</a>	CAD Engineer Engineer and operator Engineering product analyst Metallurgist	CAM Engineer and operator Engineering product analyst Metallurgist
R039 - Communicating designs	Drawing, developing and annotating designs for coursework.	Design idea generation, development and evaluations. Engineering drawing skills, rendering, annotating and labelling.	R038 - Principles of Engineering Design, Manufacture R015											
R040 - Design evaluation and modelling														
Independent Study	Use of relevant OCR Engineering Design Unit R107 and R038 materials. Useof Seneca or Kahoot for Principles of Engineering Design.													

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R038 - Principles of Engineering Design	Sketching and drawing, CAD Topic area - 3.2, 3.3, 2.3. Topic area test on aspects covered.	Drawing abbreviations, mechanical features (on drawings) Market pull and technology push, legislation	R038 - Students will produce engineering drawings using CAD R040 - Students could identify legislation when carrying out a product evaluation	Spiralised curriculum - links to technical drawing understanding needed for R015 but now deeper understanding and how to draw. Provides students in depth knowledge in order to undertake R039 technical drawings.	CAD and familiarity with software	Design ideas and modelling/manufacture of ideas.	Unit 9 Mechanical Design, Unit 10 CAD Product Design	3D modelling in solidworks	The rule of law and legislation. How the use of CAD has had an impact on globalisation and technology within engineering. The impact this has then had on the workforce.		Unison	<a href="https://education.theiet.org/secondary/careers/engineering-careers-resources/">https://education.theiet.org/secondary/careers/engineering-careers-resources/</a>	CAD Engineer Engineer and operator	CAM Engineer and operator
R039 - Communicating designs	Producing and modelling of designs in CAD	Techsoft design, Solidworks												
R040 - Design evaluation and modelling														
Independent Study	Use of relevant OCR Engineering Design Unit R107 and R038 materials. Useof Seneca or Kahoot for Principles of Engineering Design.													

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R038 - Principles of Engineering Design	Influences on engineering product design. Topic area 2.3, 1.2.2 Topic test on aspects covered	British and international standards, planned obsolescence, 6 R's of sustainability	R040 - Students could identify planned obsolescence features when carrying out a product evaluation. Students could identify sustainable design features when carrying out a product evaluation	Preparation for R040 next term		Sustainability	Product Design Unit 22 Environmental Engineering		Environmental impact	Sustainability							
R039 - Communicating designs	R039 project write up and improvement activities											Use of unit recording sheet to obtain mark band three scores	NA	NA	Not applicable this term due to coursework deadlines	<a href="https://education.theiet.org/secondary/careers/engineering-careers-resources/">https://education.theiet.org/secondary/careers/engineering-careers-resources/</a>	Design Engineer Environmental and sustainability engineer
R040 - Design evaluation and modelling																	
Independent Study	Use of relevant OCR Engineering Design Unit R107 and R038 materials. Useof Seneca or Kahoot for Principles of Engineering Design.																

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R038 - Principles of Engineering Design	Make, model and evaluate; virtual and physical prototypes. Topic area 1.2.2, 4.2. Topic test on aspects covered so far	Investigate, use and evaluate modelling materials and prototyping methods.	Students will produce a virtual and physical prototype in R040 Students will select materials and methods for making a physical prototype			Making and modelling of products, knowledge of electrical components and 3D printing	Unit 6 Circuit Simulation and Manufacture. Unit 17 Computer Aided Manufacture. Product Design		Legislative - Use of specified materials in useage.	Importance of planning tasks prior to manufacture.			
R039 - Communicating designs											University of Hull - Maker Space	<a href="https://education.theiet.org/secondary/careers/engineering-careers-resources/">https://education.theiet.org/secondary/careers/engineering-careers-resources/</a>	
R040 - Design evaluation and modelling	Product analysis and disassembly activity - practice task for R040 Coursework Launch	ACCESS FM for analysis and evaluation. Primary and secondary research. Product disassembly	R038 / R039 - Students will be able to use ACCESS FM when labelling and annotating	June 1st - Launch date for new brief for R040	Evaluation, function, quality function deployment	Product analysis	A level product design		Using Access FM to analyse and communicate analysis with others. Giving constructive feedback on the work of others.				
Independent Study	Use of relevant OCR Engineering Design Unit R107 and R038 materials. Useof Seneca or Kahoot for Principles of Engineering Design.												

YEAR 11												
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R038 - Principles of Engineering Design	Design requirements; user needs, manufacturing considerations, and influences on engineering product design Topic area 2.1, 2.2. Topic test on aspects covered so far.	Difference between needs and wants, ACCESS FM for analysis	Students have used primary and secondary research, ACCESS FM and disassembly to evaluate a product in R040 - spirals curriculum - recap and embed	Students will develop knowledge from using ACCESS FM to analyse existing products in Unit R040	What it is to analyse	Existing product analysis	Product Design - research into existing products	Look in more detail at materials and manufacturing methods	Rule of law - regulations and compliance.	Design influences and movements	BDC Machinery	<a href="https://education.theiet.org/secondary/careers/engineering-careers-resources/">https://education.theiet.org/secondary/careers/engineering-careers-resources/</a>	
R039 - Communicating designs													
R040 - Design evaluation and modelling	Product analysis and disassembly activity	ACCESS FM for analysis and evaluation. Primary and secondary research. Product disassembly	R038 / R039 - Students will be able to use ACCESS FM when labelling and annotating	Retrieval of ACCESS FM and products purchased for new brief from OCR	Evaluation, function, qualify function deployment	Existing product analysis	A level product design	Look in more detail at materials and manufacturing methods	Rule of law - regulations and compliance.	Design influences and movements			
Independent Study	Use of relevant OCR Engineering Design Unit R107 and R038 materials. Useof Seneca or Kahoot for Principles of Engineering Design.												

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R038 - Principles of Engineering Design	Evaluating design ideas and outcomes Topic area 4.1, 4.3. Topic test on aspects covered so far	Use of matrices to rank data. Quality function deployment. Measuring dimensions. Comparison to specification.	Students will make a prototype and compare with supplied design/ brief specification in R040. Maths qualitative and quantitative data.	The following series of lessons complement product research activities that students will undertake in Unit R040.	Evaluation depth	Evaluation of manufactured products	Unit 17 CAM - evaluation, Unit 13 Mechanical Operations evaluation of manufactured components.	Using data to help analyse	Rule of law - regulations and compliance.	Evaluations lead to improvements on future work	McCain	<a href="https://education.theiet.org/secondary/careers/engineering-careers-resources/">https://education.theiet.org/secondary/careers/engineering-careers-resources/</a>	
R039 - Communicating designs													
R040 - Design evaluation and modelling	Virtual CAD and physical modelling	Generate a CAD drawing suitable for manufacturing, plan of manufacture. Tech soft design and Solidworks. Breadboarding	Students will make a prototype and compare with supplied design/ brief specification in R040. Maths qualitative and quantitative data. R015 - Manufacture plans of manufacture done in detail in Y10 so will have deep knowledge already.	CAD functions. Finite element analysis, Computational fluid dynamics and animations	Use of CAD and manufacture of artefacts	A level product design, Unit 10 CAD Unit 17 CAM	CFD and FEA analysis of their model	Rule of law - regulations and compliance.	Developing and transposing design from drawing to CAD				
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R038 - Principles of Engineering Design	Design considerations; user needs and manufacturing requirements Topic area 4.3, 2.2. Topic test on aspects covered so far	User testing, reasons for design modifications, and improvements from evaluations. Wasting processes	Students will compare a prototype against a specification, identify potential improvements, analyse production methods, and assembly methods in R040. Students undertake wasting processes in Manufacture.	The following series of lessons complement product research activities that students will undertake in Unit R040.	design fixation	Designing products for users need - user centred design	Product Design. Unit 13 Mechanical operations. Unit 17 CAM	User centred design	Rule of law - regulations and compliance. Designing for those with different needs - user centred design		Nissan Sunderland	<a href="https://education.theiet.org/secondary/careers/engineering-careers-resources/">https://education.theiet.org/secondary/careers/engineering-careers-resources/</a>	
R039 - Communicating designs													
R040 - Design evaluation and modelling	Virtual CAD and physical modelling	Generate a CAD drawing suitable for manufacturing, plan of manufacture. Tech soft design and Solidworks. Breadboarding	Students will make a prototype and compare with supplied design/ brief specification in R040. Maths qualitative and quantitative data. R015 - Manufacture plans of manufacture done in detail in Y10 so will have deep knowledge already.	CAD functions. Finite element analysis, Computational fluid dynamics and animations	Use of CAD and manufacture of artefacts	A level product design, Unit 10 CAD Unit 17 CAM	CFD and FEA analysis of their model	Culture and social - sharing ideas - protection of designs,					
Independent Study	Use of relevant OCR Engineering Design Unit R107 and R038 materials. Useof Seneca or Kahoot for Principles of Engineering Design.												

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R038 - Principles of Engineering Design	Design considerations; user needs and manufacturing requirements Topic area 2.2. Revision of all R038	Finishing methods, production costs, capital equipment	Students will analyse a disassembled product – assembly methods	Follows on from wasting processes - surface finishes.	How complex products would be made.	NA	Unit 13 Mechanical Operations		Rule of law - regulations and safe use of materials	How and why products are made from what they are. How these are made around the world - globalisation.	Not applicable due to coursework and exam deadlines	<a href="https://education.theiet.org/secondary/careers/engineering-careers-resources/">https://education.theiet.org/secondary/careers/engineering-careers-resources/</a>	
R039 - Communicating designs													
R040 - Design evaluation and modelling	Physical modelling	Physical modelling of R040 design brief, conducting risk assessments and collecting and providing evidence of manufacture.	R038 - students require understanding of the design cycle, specifically evaluating	Physical modelling can only take place after design - technical drawings developed and applied from Y10 and through CAD design generation and modelling		Manufacture of artefacts	A level product design	Produce a standard operating procedure for key tools/processes	The rule of law - Health and Safety at work	Understanding the importance of safety, shared work spaces and tool maintenance			
Independent Study	Use of relevant OCR Engineering Design Unit R107 and R038 materials. Useof Seneca or Kahoot for Principles of Engineering Design.												

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R038 - Principles of Engineering Design	Examination revision		R0389, R040, Engineering Manufacture	Exam in summer 2		NA		Development of flash cards and revision aids		NA	Not applicable due to coursework and exam deadlines	<a href="https://education.theiet.org/secondary/careers/engineering-careers-resources/">https://education.theiet.org/secondary/careers/engineering-careers-resources/</a>	
R039 - Communicating designs													
R040 - Design evaluation and modelling	Coursework improvement and completion												

Independent Study	Use of relevant OCR Engineering Design Unit R107 and R038 materials. Use of Seneca or Kahoot for Principles of Engineering Design.											
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Qualification submission												<a href="https://education.theiet.org/secondary/careers/engineering-careers-resources/">https://education.theiet.org/secondary/careers/engineering-careers-resources/</a>