Engineering and STEM Curriculum Overview Plan

Whole school curriculum intent Develop a broad and balanced curriculum that enables students to learn, recall and apply knowledge and skills across different contexts, supported by a robust and consistent approach to assessment. This will lead to successful and resilient lifelong learners who can cope in a range of changing contexts.
Key stage 3/4 subject curriculum intent Engineering: To equip students with the necessary engineering knowledge and confidence so that they can inform their career choices and compete globally with their peers. STEM: Develop an understanding of design, materials and an appreciation of the world around us so that they value resources and reduce waste. At TQEA we study STEM at KS3 which has Technology and Materials included in the curriculum. We aim to build the skills to support the GCSE Engineering course that we run and to give students a flavour of Engineering so that they can make an informed choice when taking their options in year 9 and applying for apprenticeships and college courses in year 11. All students can study STEM and Engineering and we adapt the curriculum to include all. Some examples are having ear plugs available, painting drill bits so that they are visible, left handed rulers, coloured paper to make HW or key information stand out as well as allowing students access to written work and finding ways for students to overcome their fear of machines. Some students who need an adapted curriculum will need support in practical lessons. As the world around us develops at a fast pace, it is important to keep up with technology such as CAD CAM and AI. We have 2 rooms; the STEM lab which includes a computer suite where we learn CAD, 3D printing and laser cutting and a workshop for learning more traditional engineering skills. Wider experiences include the enrichment activities which run at different times in the school year – these may include Sewing Bee, Coding and Wacky Races.

Specification for WJEC Engineering: Level 1/2 Vocational Award in Engineering (wjec.co.uk)

National Curriculum for Design Technology: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/239089/SECONDARY_national_curriculum_-_Design_and_technology.pdf

The topics outlined below may run at different times depending on the availability of resources and the weather.

Year Group		Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Year 7	**Topic**	**Data 1 - Rockets**	**Materials 1 (Polymers) – Keyring**	**CAD 1 – Fridge Magnet**	**Drawing 1 – Gift Boxes**	**Materials 2 – Dice Box Game**	**STEM Experiments 1 - Rollercoasters**
	Core knowledge from this topic	Students need to know the forces involved in launching rockets from Earth Students need to know the energy transfers in launching rockets Students need to know the design, make and evaluate process Students need to know how to change variables and collect data Students need to know how to use data to analyse performance Students need to know how to write a conclusion based on data and link to the scenario Students need to know how to draw accurately in 2D	Students need to know the meaning of specification Students need to know how to design a specification for target groups of people Students need to know how to design to specification Students need to know how to annotate designs and describe features Students need to know the safety precautions and routines when using equipment in the workshop Students need to know how to use acrylic cement safely under supervision	Students need to know the meaning of “CADCAM” Students need to know how to use TechSoftV3 to draw basic shapes Students need to know the different types of etching (scan and vector) Students need to know how to design a 2D item to cut – in one piece! Students need to know the different types of materials that can be laser cut and their limitations Students need to know the possibilities and limitations of laser cutting	Students need to know the difference between a rule and ruler Students need to know how to convert mm to cm and cm to mm Students need to know how to measure in cm and mm Students need to know how to draw accurately using a pencil and ruler Students need to know how to use a craft knife safely Students need to know what controls measures are	Students need to know how to use marking out tools to measure and draw accurately on materials Students need to know the hazards and control measures when using powered tools in the workshop Students need to know the hazards and control measures when using wood to make a project Students need to know how to plan the use of materials to avoid waste Students need to know that waste material is costly Students need to know that waste material can be used for	Students need to know how to plan and carry out a practical investigation in an engineering context 1 Carry out a process 2 Recording the process 3 Interpretation of data Students need to know how to analyse information in an engineering context and apply the conclusion to the brief

		Students need to know how to use a craft knife safely Students need to know what controls measures are	Students need to know how to use hand tools, powered fret saw and pedestal drill safely Students need to know how to evaluate the design against the specification and its use by target groups Students need to know 5S – industry standard for organisation and cleanliness			something else rather than being discarded	
	Links to the national curriculum	develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools analyse the work of past and present professionals and others to develop and broaden their understanding	develop specifications to inform the design of innovative, functional, appealing products that respond to needs in a variety of situations use research and exploration, such as the study of different cultures, to identify and understand user needs	develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools investigate new and emerging technologies understand and use the properties of materials and the performance of structural elements to achieve functioning solutions	develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling	select from and use specialist tools, techniques, processes, equipment and machinery precisely, including computer-aided manufacture select from and use a wider, more complex range of materials	understand and use the performance of structural elements to achieve functioning solutions
	Previous content that this topic builds upon	NA	What is a specification? Annotating designs Be able to evaluate designs and make improvements	What is a specification? Annotating designs Be able to evaluate designs and make improvements Justification of designs	Y7 – Rockets – Draw and measure accurately	Y7 – Materials 1 - Safely use hand tools and some powered tools in the workshop	Y7 Rockets - Analyse performance using data collection. Annotate and justify design improvements
	Key vocabulary	Streamlining Thrust Weight Gravity Mass Forces Air resistance Trajectory Variable Process Data Scenario Atmosphere Orbit	Specification Annotation Product Evaluation Polymer Pedestal Drill Fret Saw Hand Tools Target group Materials Adhesive	Plywood Material Laser Laser Cutting 2D CADCAM Etch Limitation Possibility Environment Vector	mm control measure risk hazard rule ruler craft knife safety rule score	Plywood Composite mm Rule PVA Abrasive sheet Permanent fastener 5S PPE Machine Guard	Scenario Observations Interval Range Pattern Even Scale Line of best Fit Anomaly Conclusion Evaluation
	Development of cultural capital	Understand the advances made in engineering and science because of space travel for example the development of memory foam for sleeping space has now become a common place material in Earth mattresses	Understand diversity and the need to understand target groups for design and production for example what different colours symbolise in different cultures and in the LBGT+ community.	Understand that automation can save time and money, but also that it has limitations for example the cost of research, set up and hardware or that a laser cutter can only cut 2D	Understand that using pre-cut edges and positioning designs on the edge of material saves cutting time and reduces waste	Understand that materials are selected for their properties and cost and that some times one has to be compromised	Understand that data can be represented visually to help support a point or argument and that it can be interpreted in different ways for example in the daily government briefings for COVID19.
	Development of reading	https://www.britannica.com/topic/Laika	https://www.weforum.org/agenda/2015/02/5-synthetic-materials-that-will-shape-the-future/	The Magic History Of Fridge Magnets - The Fact Site	https://kids.britannica.com/kids/article/paper/399561	About the Forest | National Forest	Grand National (roller coaster) - Wikipedia

Engineering and STEM Curriculum Overview Plan

		Read the source and summarise the behaviours that would be unacceptable nowadays.	Read the source from the World Economic forum and summarise how each of these new polymers can solve a problem	Draw a timeline of fridge magnet and complete the acrostic poem.	Read the article and answer the questions about the history of paper. Discuss the future of paper.	Before reading – what do you know about the National Forest? Complete the questions about the National Forest.	Before reading answer the question – what do you think this is like to ride? Read the source and answer the questions.
	Concepts –what will students be able to do at the end of the topic	Analyse performance using data collection. Annotate and justify design improvements	What is a specification? Annotating designs Justification of designs Safely use hand tools and some powered tools in the workshop	What is a specification? How to design to specification. Annotating designs Justification of designs Be able to evaluate designs and make improvements	Be able to measure, cut and fold card carefully and accurately Use craft knives and measure to within 5mm	Safely and confidently use hand tools and some powered tools in the workshop	Be able to carry out a practical procedure and record, collect and interpret data in an engineering context.
Year Group		**Autumn**		**Spring**		**Summer**	
Year 8 (1 lesson per fortnight)	**Topic**	**Engineering 1 - Race for the line**	**Drawing 2 – 3D greetings cards**	**CADCAM 2 – Secret Message Box**		**Data 2 – Race for the line competition**	**STEM Experiments 2 - Pendulums**
	Core knowledge from this topic	Students need to know how to develop design processes Students need to know how to draw 2D elevations and 3D isometric drawings Students need to know the build and testing procedures Students need to know safety and workshop routines when using equipment Students need to know how streamlining and weight affect speed of rocket cars Students need to know how to evaluate designs based on performance Students need to know 5S – industry standard for organisation and cleanliness	Students need to know the difference between a rule and ruler Students need to know how to convert mm to cm and cm to mm Students need to know how to measure in cm and mm Students need to know how to draw accurately using a pencil and ruler Students need to know how to use a craft knife safely Students need to know what controls measures are	Students need to know the meaning of “CADCAM” Students need to know how to use TechSoftV3 to draw basic shapes Students need to know the different types of etching (scan and vector) Students need to know how to design a 2D item to cut – in one piece! Students need to know how to evaluate the finished workpiece Students need to know the different types of materials that can be laser cut and their limitations Students need to know impact of laser cut materials on the environment Students need to know the possibilities and limitations of laser cutting		Students need to know the build and testing procedures Students need to know safety and workshop routines when using equipment Students need to know workshop safety and tidiness (5S – industry standards) Students need to know how streamlining and weight affect speed of rocket cars Students need to know how to evaluate designs based on performance Students need to know how to explain the safety of testing procedures	Students need to know how to plan and carry out a practical investigation in an engineering context 1 Carry out a process 2 Recording the process 3 Interpretation of data Students need to know how to analyse information in an engineering context and apply the conclusion to the brief Students need to know that testing procedures are not always reliable and they can be critically evaluated and improved
	Links to the national curriculum	develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools select from and use specialist tools, techniques, processes, equipment and machinery precisely, including computer-aided manufacture analyse the work of past and present professionals and others to develop and broaden their understanding understand developments in design and technology, its impact on individuals, society	develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling	develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools investigate new and emerging technologies understand and use the properties of materials and the performance of structural elements to achieve functioning solutions		analyse the work of past and present professionals and others to develop and broaden their understanding understand developments in design and technology, its impact on individuals, society and the environment, and the responsibilities of designers, engineers and technologists understand how more advanced mechanical systems used in their products enable changes in movement and force	understand and use the performance of structural elements to achieve functioning solutions

		and the environment, and the responsibilities of designers, engineers and technologists understand how more advanced mechanical systems used in their products enable changes in movement and force					
	Previous content that this topic builds upon	What is a specification? Annotating designs Be able to evaluate designs and make improvements Justification of designs Use of laser cutting, 3D printing and hand tools 5S from workshop use in Y7 2D drawing in Y7	Y7 – Drawing 1 – Draw and measure accurately	What is a specification? Annotating designs Be able to evaluate designs and make improvements Justification of designs		Analyse performance of rockets using data collection. Annotating designs Justification of designs Be able to evaluate designs and make improvements	Y7 Rockets - Analyse performance using data collection. Annotate and justify design improvements Y8 RFTL - Analyse performance using data collection. Evaluate and improve designs
	Key vocabulary	Safety Workshop Hand tools Coping Saw Specification Justify Streamlining Weight Force Rocket Performance Testing	mm control measure risk hazard rule ruler craft knife safety rule score	Plywood Material Laser Laser Cutting 2D CADCAM Etch Limitation Possibility Environment Vector		Safety Workshop Hand tools Coping Saw Specification Justify Streamlining Weight Force Rocket Performance Testing	Scenario Observations Interval Range Pattern Even Scale Line of best Fit Anomaly Conclusion Evaluation
	Development of cultural capital	Understand how research and development can link to everyday advances in technology for example the wind tunnel modelling simulation that was developed for bloodhound will be used in industry to reduce prototype costs be testing computer models first.	Understand that using pre-cut edges and positioning designs on the edge of material saves cutting time and reduces waste	Understand that automation can save time and money, but also that it has limitations for example the cost of research, set up and hardware or that a laser cutter can only cut 2D		Understand that competition like land speed records and moon-shot can lead to innovation that benefits the human race.	Understand that data can be represented visually to help support a point or argument and that it can be interpreted in different ways for example in the daily government briefings for COVID19.
	Development of reading	https://www.guinnessworldrecords.com/records/hall-of-fame/andy-green-fastest-car-land-speed-record Andy Green was born in Atherstone in 1962. Read the source and answer the comprehension questions.	https://northerncards.com/blogs/nc/the-history-of-the-greeting-card Draw a timeline of greetings cards – to scale	What Is a Laser? | NASA Space Place – NASA Science for Kids Read the source and complete the questions embedded in text.		10 Reasons Why Space Exploration Matters to You | HowStuffWorks Pick your top three reasons and justify them.	https://www.britannica.com/topic/Big-Ben-clock-London Read the article and create a explanation sheet for children explaining how the clock keeps time.
	Concepts –what will students be able to do at the end of the topic	Analyse performance using data collection. Evaluate and improve designs Appreciate the value of materials Select and use a range of hand tools	Be able to measure, cut and fold card carefully and accurately Use craft knives and measure to within 2mm	What is a specification? How to design to specification. Annotating designs Justification of designs Be able to evaluate designs and make improvements Use a prototype		Be able to apply the theory of fair testing to ensure fair competition and relate this to the Guinness book of records and speed competitions	Be able to carry out a practical procedure and record, collect and interpret data in an engineering context.

Engineering and STEM Curriculum Overview Plan

				Appreciate the value of materials and impact on the environment			
Year Group		**Autumn Term 1**	**Autumn Term 2**	**Spring Term 1**	**Spring Term 2**	**Summer Term 1**	**Summer Term 2**
Year 9	**Topic**	**Circuits 3 – Steady Hand Game or Quiz Game**	**Engineering 3 - Drawing**	**Materials 3 (Metals) – Dog Tags**	**CADCAM 3 – Jitterbug**	**CADCAM 4 – 3D Printing**	**STEM Experiments 3 - Stadiums**
	Core knowledge from this topic	Students need to know how to build and draw complete circuits Students need to know how to explain circuits in terms of insulators and conductors Students need to know how to choose suitable conductors and insulators for designs Students need to know the circuit symbols for a cell, wire, resistor and buzzer Students need to know how to calculate resistance in order to protect components Students need to know how to design circuits and housings to fulfil a design brief Students need to know how use a soldering iron safely Students need to know why we no longer use lead solder and the disadvantages of lead-free solder	Students need to know how to read 2D elevations and 3D isometric drawings Students need to be able to draw 2D orthographic elevations of simple components Students need to know how to read basic information from a drawing such as dimensions, hole sizes and radii. Students need to be able to read the dimensions off a drawing and then use them to make a component and inspect a component Students need to be able to use specialist drawing tools to draw accurately to scale using engineering conventions	Students need to know how to draw 2D elevations and 3D isometric drawings Students need to know how to compare properties of materials Students need to know the names and uses of hand tools (tin snips, scribe, rule, centre punch, metal files, deburring tool, ball pein hammer) Students need to know how to use hand tools safely, how to store them and why they are counted before and after use Marking out workpieces Students need to know how to work to engineering drawings Students need to know what tolerances on a drawing mean Students need to know how to carry out the following using hand tools: Cutting, sawing, filing, deburring, drilling, stamping, polishing Students need to know 5S – industry standard for organisation and cleanliness Students need to know how to compare the properties of the materials they have used	Students need to know how to use prototypes to design 3D animals to be cut in 2D and assembled Students need to know how to make slots correct width to assemble project Students need to know how to safely soften acrylic to bend it Students need to know the different types of materials that can be laser cut and their limitations Students need to know the impact of materials on the environment Students need to know how to draw a basic 2D design on TechsoftV3 Students need to know the possibilities and limitations of 3D printing and laser cutting	Students need to know how to draw 2D elevations and 3D isometric drawings Students need to know how to use prototypes to design a 2D and then 3D maze with tracks and walls Students need to know how to use 3D CAD modelling software to draw out their maze design Students need to know how 3D printers work Students need to know the possibilities and limitations of 3D printing and laser cutting	Students need to know how to plan and carry out a practical investigation in an engineering context 1 Carry out a process 2 Recording the process 3 Interpretation of data Students need to know how to analyse information in an engineering context and apply the conclusion to the brief Students need to know that testing procedures should be rigorous and data should be critically evaluated
	Links to the national curriculum	develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools select from and use specialist tools, techniques, processes, equipment and machinery precisely, including computer-aided manufacture		select from and use specialist tools, techniques, processes, equipment and machinery precisely, including computer-aided manufacture select from and use a wider, more complex range of materials, components and ingredients, taking into account their properties understand and use the properties of materials and the performance of structural elements to achieve functioning solutions	develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools investigate new and emerging technologies understand and use the properties of materials and the performance of structural elements to achieve functioning solutions	develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools investigate new and emerging technologies understand and use the properties of materials and the performance of structural elements to achieve functioning solutions	understand and use the performance of structural elements to achieve functioning solutions
	Previous content that this topic builds upon	Be able to design circuits including the use of resistors to protect components	2D drawing in Y7 and an introduction to 2D elevation drawing in Y8	Appreciate the value of polymers (Y7) and wood, fabric	What is a specification? How to design to specification. Annotating designs	What is a specification? How to design to specification. Annotating designs	Y7 Rockets - Analyse performance using data collection.

Engineering and STEM Curriculum Overview Plan

		Be able to design a product to meet a specification and target audience Be able to evaluate a product, carry out a peer review and make suggestions for improvement		(Y8) and their impact on the environment Select and use a range of hand tools (RTTL rocket cars) 5S from workshop use in Y7 2D drawing in Y7 and 2D elevations and isometric drawing in Y8	Justification of designs Be able to evaluate designs and make improvements Use a prototype Appreciate the value of materials and impact on the environment	Justification of designs Be able to evaluate designs and make improvements Use a prototype Appreciate the value of materials and impact on the environment	Annotate and justify design improvements Y8 RFTL - Analyse performance using data collection. Evaluate and improve designs Y9 Wind Turbines/Dog Tags - Analyse and present production data Y9 Dog Tags - Understand the impact and cost of out of tolerance work in terms of time, energy, materials and money.
	Key vocabulary	Circuit Cell Battery Buzzer Resistance Ohms Insulator Conductor Component Soldering Iron Lead-free Solder	Elevation Scale drawing Plan Tolerance Isometric 2 dimensional 3 dimensional NTS Annotation Dimensions Extension lines	Properties Aluminium Brass Copper Malleability Hardness Lustre Engineer's blue Scribe Rule Centre punch Tin snips Bastard file Medium file Smooth file Hacksaw Deburring tool Burr Chamfer Drill bit Ball pein hammer Tolerance	Polymer Acrylic Wood Material Thermosetting Thermoforming Composite Laser Laser Cutting 2D 3D CADCAM Etch Limitation Possibility Environment Vector Coordinates	Polymer PLA Material Thermosetting Thermoforming 2D 3D CADCAM Limitation Possibility Environment Vector 3D printing Coordinates	Scenario Observations Interval Range Pattern Even Scale Line of best Fit Anomaly Conclusion Evaluation
	Development of cultural capital	Understand the need for resistance in a circuit as excess current can damage components Understand the need for surge protection when using delicate electronics and computers	Ability to read plans and assembly drawings for future life when building flat pack items or reading plans of places.	Increase the confidence to use hand tools to do simple tasks which may help students later in life for example drills or hand tools when completing DIY tasks in the home or garden.	Understand that automation can save time and money, but also that it has limitations and an impact on the work force and society for example people are employed as robot programmers and maintenance, but a lot of unskilled jobs are no longer available.	Understand that automation can save time and money and produce more possibilities – the jobs that some students will be doing don't exist yet	Understand that data can be represented visually to help support a point or argument and that it can be interpreted in different ways for example in the daily government briefings for COVID19.
	Development of reading	http://www.thepeoplehistory.com/kidselectronic.html Read the source and then use it to create a time line of electronic toys.	Leonardo da Vinci | Biography, Art, Paintings, Mona Lisa, Drawings, Inventions, Achievements, & Facts | Britannica Read about LDV's engineering drawings and annotate.	History of military dog tags (riflemantours.co.uk)	https://www.weforum.org/agenda/2020/05/robots-workers-industries-employment Read the source and describe the patterns in employment described in the source (scaffolded questions). Explain why this happened.	https://www.theguardian.com/science/2023/apr/12/nasa-texas-humans-prepare-mars Read the source and describe the use of 3D printing on Mars. Suggest other uses of 3D printing.	Inside Wimbledon's Centre Court: 100 years at the great colosseum of tennis (telegraph.co.uk) Summarise the developments of centre court over the last 100 years.
	Concepts –what will students be able to do at the end of the topic	Be able to design and build simple circuits Be able to calculate the resistance needed in a circuit	Be able to plan to make an engineering component Read a drawing and follow it Mark out a work piece	Be able to plan to make an engineering component Read a drawing and follow it Mark out a work piece	What is a specification? How to design to specification. Annotating designs Justification of designs	Do able to create a digital 3D model that fits the criteria set To understand the range of new technologies that are available.	Be able to carry out a practical procedure and record, collect and interpret data in an engineering context.

Engineering and STEM Curriculum Overview Plan

		Be able to build a housing around a circuit so that it can perform its function	Use a range of hand tools Maintain the workshop in a clean and tidy manner Inspect a workpiece Use inspection tools	Use a range of hand tools Maintain the workshop in a clean and tidy manner Inspect a workpiece Use inspection tools	Be able to evaluate designs and make improvements Use a prototype Understand the possibilities and limitations of 3D printing and laser cutting Appreciate the value of materials and impact on the environment		
Year Group		**Autumn Term 1**	**Autumn Term 2**	**Spring Term 1**	**Spring Term 2**	**Summer Term 1**	**Summer Term 2**
Year 10	**Topic**	Bench Skills and Using Engineering Drawings	Engineering Materials and Forming Processes	Machining and Engineering Processes – Milling	Machining and Engineering Processes – Turning	Planning Manufacture	Design Project and Testing Materials
	Core knowledge from this topic	Learners should be able to understand engineering drawings Learners should be able to demonstrate safe working practice with a range of engineering tools Learners should be able to follow appropriate Health and Safety procedures when working in engineering workshops Learners should be able to produce engineering drawings, using traditional instruments or CAD based software Learners should understand processes, including relevant tools and equipment	Learners should be able to identify which materials are suitable Learners should know and understand which engineering processes and tools are appropriate for different materials Learners should know and understand materials and their properties, and when they should be used for a specific purpose Learners should know and understand the physical properties of materials	Learners should be able to understand engineering drawings Learners should be able to produce engineering drawings, using traditional instruments or CAD based software Learners should also be aware that tools (tooling) can include specific parts associated with items of equipment in an engineering workshop Learners should be able to demonstrate safe working practice with a range of engineering equipment e.g. centre lathe, milling machine, pillar drill	Learners should be able to present their plan of processes, sequencing, equipment, and tool/machine requirements in planning documentation Learners should be able to follow appropriate Health and Safety procedures when working in engineering workshops Learners should also be aware of Health and Safety, risk assessments and safe working practices during the use of engineering equipment Learners should know and understand how to work safely when working in an engineering environment such as a school/college workshop	Learners should be able to identify parts and/or components that will enable them to plan a final product Learners should be able to identify which materials are suitable Learners should be able to sequence production stages appropriately Learners should be aware of the need for contingency planning to allow for unforeseen situations Learners should be able to apply a range of key engineering processes used in engineering Learners should be able to evaluate their own practices and processes during the planning and production of engineering products or parts of engineering products Learners should be able to produce an engineering specification using mathematical techniques for solving applied engineering problems Learners should understand how engineering processes can be used Learners should know and understand and be able to use calculations and mathematical techniques that are required to solve engineering problems	Learners should be aware that design solutions must meet a range of specific criteria, including any limitations set by the brief Learners should be able to communicate design ideas in a suitable media appropriate to the information being presented Learners should be able to apply methods of testing to justify material selections that are fit for purpose and meet the design specification. Learners should be able to suggest and justify appropriate methods for producing the component parts of their engineering outcome Learners should know and understand how destructive testing (DT) and non-destructive testing (NDT) is undertaken to determine physical properties of engineering materials
	Links to the national curriculum (if applicable)	1.1 Understanding engineering drawings 1.2 Planning operations 1.3 Using engineering tools and equipment	1.3 Using engineering tools and equipment 1.4 Implementing engineering processes 3.2 Understanding properties of engineering materials	1.3 Using engineering tools and equipment 1.4 Implementing engineering processes	1.2 Planning operations 1.3 Using engineering tools and equipment 1.4 Implementing engineering processes	1.1 Understanding engineering drawings 1.2 Planning operations 1.3 Using engineering tools and equipment	2.1 Understanding function and meeting requirements 2.2 Proposing design solutions 2.3 Communicating an engineered design solution

Engineering and STEM Curriculum Overview Plan

		3.3 Understanding methods of preparation, forming, joining and finishing of engineering materials			3.3 Understanding methods of preparation, forming, joining and finishing of engineering materials	1.4 Implementing engineering processes	2.4 Solving applied engineering problems 3.4 Solving engineering problems
	Previous content that this topic builds upon	Y9 Materials 3 – Metal Dog Tags Y9 Engineering 3 - Drawing	Y7 Materials 1 – Polymers Y9 CADCAM 3 – Jitterbug Y9 Materials 3 – Metal Dog Tags	Y9 CADCAM 3 – Jitterbug	Y9 – Circuits 3 – Electronic Quiz Game	Y8 Engineering 1 - Race for the line Y9 CADCAM 3 – Jitterbug Y10 - Bench Skills and Using Engineering Drawings Y10 - Engineering Materials and Forming Processes Y10 - Machining and Engineering Processes	Data 3 – Wind Turbines STEM Experiments – Y7, 8, 9 Y10 - Bench Skills and Using Engineering Drawings Y10 - Engineering Materials and Forming Processes Y10 - Machining and Engineering Processes
	Key vocabulary	Tolerances Files Marking out Scriber Engineer's square Finishing Vernier callipers Risk Hazard Control Measures Risk Assessment CAD Orthographic projection Third angle projection Prototype Specification Criteria	Ferrous Metal Non-ferrous metal Thermoforming polymer Thermosetting polymer Line bender Vacuum Forming Injection moulding tensile strength compressive strength hardness toughness malleability ductility conductivity corrosive resistance environmental degradation elasticity	Milling machine Facing Slot Jig Taps Internal thread Tolerance 3D modelling CAD Isometric Set square Chamfer Gauge	Dies External Thread Solder Flux Ohm's law Resistance Current Potential Difference Multi-meter Lathe Tool post Facing Knurling Chamfer Parting Tail stock Revolving Centre	Contingency Process Time scale Risk Assessment Risk Hazard Control Measures Specification Assembly Component	Criteria Specification Limitation Destructive Testing Non-destructive testing tensile strength compressive strength hardness toughness malleability ductility conductivity corrosive resistance environmental degradation elasticity Engineering Brief
	Development of cultural capital	Understand how to follow drawings and plans to make components and assemblies, not just in the workshop but also following instructions and plans that come with household products.	Understand the different polymers available and their properties and the importance of selecting appropriate materials for example an item that may become hot needs to be made from thermosetting polymer and not thermoforming.	Understand the limitations and advantages of using CADCAM – although it can save time and money and be repeatable, ultimately machines only do what we tell them.	Understand that machine time is valuable and that is why many companies run shift patterns to maximise their investment in plant, leading to the need for flexible working, flexible childcare and support networks.	Understand that there are many different designs for products and they don't all suit each person or situation. For example if you buy household appliances they are different standards, specifications and costs.	Understand that manufacturing companies use data to sell their products for example car companies provide data for urban driving or 56mph which cannot be achieved in normal conditions because they are done under test conditions with no impediments.
	Development of reading	A Tool Odyssey: History of Tools from Prehistory to The Present | Ronix Mag (ronixtools.com) History of tools – summarise the main groups of tools.	Forces and materials in rollercoasters article and questions.	NASA backs designs for 3D-printed homes on Mars | CNN Answer the questions on the reading sheet.	Precious metals in mobile phones article and questions.	Who designed Titanic? — Ultimate Titanic Read the source and answer the questions including write a specification for the ship based on the article.	It Took James Dyson 15 Years to Make a Bagless Vacuum | Inc.com Read the source and annotate the diagram of the engineering design process with James Dyson's process from the article.
	Concepts –what will students be able to do at the end of the topic	Be able to read an orthographic drawing and make a simple component. Be able to draw a simple component in 3rd angle projection.	Be able to identify ferrous/non-ferrous metals and thermoforming/thermosetting polymers. Be able to suggest materials and processes to used based on their properties.	Be able to use the milling machine. Be able to use taps to make an internal thread. Be able to draw a simple component as an isometric component.	Be able to carry out various processes on the lathe. Be able to use dies to make an external thread. Be able to build simple circuits including soldering.	Be able to plan the manufacture of an assembly made up of different components. Be able to calculate the costings and volume of components.	Be able to test the properties of materials. Be able to design a product to specification.

Engineering and STEM Curriculum Overview Plan

		Be able to carry out bench fitting skills.		Be able to model a simple component in 3D CAD.	Be able to write a production plan.		
Year Group							
Year 11	**Topic**	Unit 1 – Manufacturing Engineering Products	Unit 3 – Solving Engineering Problems	Unit 2 – Designing Engineering Products	Unit 3 – Solving Engineering Problems		
	Core knowledge from this topic	Controlled assessment – Unit 1 - Manufacturing Engineering Products: This unit introduces learners to interpreting different types of engineering information in order to plan how to produce engineered products. Learners will develop the skills needed to work safely with a range of engineering processes, equipment and tools. With these skills, learners will acquire knowledge of a range of engineered processes that are fit for purpose for producing an end product. Finally, learners will learn how to test the final product against the information given in the technical information to ensure that they have met the given standards of the assigned brief.	Learners should know and understand how engineering developments have an impact on the design of products and structures Learners should know and understand how the manufacture and use of engineered products have an environmental impact Learners should know and understand how the development of engineering products are impacted by changes in materials and technologies	Controlled assessment – Unit 2 - Designing Engineering Products This unit allows learners to experience and gain understanding of how an engineered product is adapted and improved over time. The unit is linked to the engineering product produced in Unit 1 of the qualification. It will require the learner to work to a given brief to adapt an existing component, element or part of the engineering outcome that they produced for Unit 1.	Learners should know and understand how engineering developments have an impact on the design of products and structures Learners should know and understand how the manufacture and use of engineered products have an environmental impact Learners should know and understand how the development of engineering products are impacted by changes in materials and technologies		
	Links to the national curriculum (if applicable)	1.1 Understanding engineering drawings 1.2 Planning operations 1.3 Using engineering tools and equipment 1.4 Implementing engineering processes	3.1 Understanding the effects of engineering achievements 3.2 Understanding properties of engineering materials 3.3 Understanding methods of preparation, forming, joining and finishing of engineering materials 3.4 Solving engineering problems	2.1 Understanding function and meeting requirements 2.2 Proposing design solutions 2.3 Communicating an engineered design solution 2.4 Solving applied engineering problems	3.1 Understanding the effects of engineering achievements 3.2 Understanding properties of engineering materials 3.3 Understanding methods of preparation, forming, joining and finishing of engineering materials 3.4 Solving engineering problems		
	Previous content that this topic builds upon	Year 10 skills: Bench Skills and Using Engineering Drawings Engineering Materials and Forming Processes Machining and Engineering Processes – Milling and Turning Planning Manufacture	Data 3 – Wind Turbines Year 10 skills: Bench Skills and Using Engineering Drawings Engineering Materials and Forming Processes Machining and Engineering Processes – Milling and Turning	Year 10 skills: Using Engineering Drawings Engineering Materials and Forming Processes Design Project and Testing Materials	Data 3 – Wind Turbines Year 10 skills: Bench Skills and Using Engineering Drawings Engineering Materials and Forming Processes Machining and Engineering Processes – Milling and Turning		
	Key vocabulary	Engineering Drawing Planning Processes Tolerances Materials Equipment	Developments Achievements Environmental Issues Structural Design Mechanical Design Electrical Design	Scenario Feautures	Developments Achievements Environmental Issues Structural Design Mechanical Design Electrical Design		

		Sequencing Contingency Health and Safety Risk Assessment Quality Control Success Criteria Inspection	Smart Technologies Sustainability		Smart Technologies Sustainability		
	Development of cultural capital	Understand that production of items needs to be planned so that resources are not tied up in stock. This is called JIT – just in time and is used by large manufacturers for Toyota – who call it the TPS (Toyota Production System).	Understand that products that are sold in the UK must perform as they are advertised under the sale of good act. For example, when buying goods from abroad that are imported.	Understand the benefits of simple designs that are easier and cheaper to produce and maintain.	Understand that products can be fixed and do not need to be thrown away. Refer to the "right to repair" law which should extend the life by of products by up to 10 years.		
	Development of reading	Ferrous and non-ferrous metals article and questions.	The First Car Race on the Moon Will Take Place in 2021 (robbreport.com) Read the article and write a specification for the car.	Meet the inspiring woman who cycled around the world in 125 days - Lonely Planet Read the source and answer the comprehension questions.	Can the national grid cope with EV's? - Evolution Solutions Read the source and answer the comprehension questions.		
	Concepts –what will students be able to do at the end of the topic	Be able to read an orthographic drawing and make a simple component. Be able to carry out bench fitting skills. Be able to identify ferrous/non-ferrous metals and thermoforming/thermosetting polymers. Be able to suggest materials and processes to used based on their properties. Be able to use taps to make an internal thread. Be able to carry out various processes on the lathe. Be able to use dies to make an external thread. Be able to write a production plan. Be able to plan the manufacture of an assembly made up of different components. Be able to calculate the costings and volume of components.	Be able to draw a simple component in 3rd angle projection. Be able to identify ferrous/non-ferrous metals and thermoforming/thermosetting polymers. Be able to suggest materials and processes to used based on their properties. Be able to calculate the costings and volume of components. Be able to test the properties of materials. Be able to evaluate the environmental impact of engineering products.	Be able to draw a simple component in 3rd angle projection. Be able to draw a simple component as an isometric component. Be able to model a simple component in 3D CAD. Be able to design a product to specification.	Be able to draw a simple component in 3rd angle projection. Be able to identify ferrous/non-ferrous metals and thermoforming/thermosetting polymers. Be able to suggest materials and processes to used based on their properties. Be able to calculate the costings and volume of components. Be able to test the properties of materials. Be able to evaluate the environmental impact of engineering products.		