Intent, sequencing, and narrative thread

Department: Technology and Art: **Engineering**

<table>
<tr><td colspan="3">What is the intent statement for you subject? What does the discipline offer young people? What is the subject's purpose? This should be a short, snappy statement.</td></tr>
<tr><td></td><td colspan="2">Technology prepares students for the modern word by focusing on innovating solutions to a problem.
Students will be empowered to work with a wide range of materials, ingredients, modern technology and components in order for them to design and manufacture creative solutions to a wide range of problems and scenarios. These skills form a foundation of knowledge for their specialist Engineering pathway.
In Key Stage 4 and 5 students will focus on obtaining the knowledge and skills required for an Engineering career</td></tr>
<tr><td colspan="3">What are the core aims of the curriculum? What key knowledge do you want students to have at the end of their learning journey?</td></tr>
<tr><td rowspan="3">Year 7</td><td colspan="2">Core Aims:
Understand safe working practices within the Technology environment using substances, materials, food, tools and equipment.
Developing an understanding for healthy choices in nutrition.
Introducing basic electronic principles and key component function.
Develop presentation, drawing and communication skills through sketching, using drawing equipment and computer aided design.
Introducing an understanding of mechanical systems through linkages and cams.
Introducing practical skills in wood working using hand tools and machinery.
Introducing food hygiene and basic food handling skills.
Working with care and precision to accurately cut, measure and weigh materials</td></tr>
<tr><td>Key knowledge:</td><td>Key skills:</td></tr>
<tr><td>Nutrients:
Food Safety
Eat well guide.
3D sketching skills – isometric, oblique and 2-point perspective drawing.
Health and safety
Mechanisms- linkages, Cams.
Tool names and functions.
Understanding the purpose of a specification</td><td>Knife skills.
Weighing, cutting, marking measuring accurately – use of templates.
Heat control in food – use of hob, oven and grill.
Soldering.
Computer Aided Drawing
3D drawing.
Cutting, smoothing and drilling wood.</td></tr>
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<table>
<tr><td rowspan="3">Year 8</td><td colspan="2">Core aims:</td></tr>
<tr><td colspan="2">

Developing an understanding of material properties in wood, metal and plastic through modelling and experimenting.
Introducing programmable electronics.
Developing communication skills through 3D drawing and computer aided design.
Sustainability, environmental impact, life cycle of plastic and metal.
Sustainable energy.
Sustainability in Food- Food Miles, seasonality.
Develop nutritional knowledge by understanding special dietary needs.
Increase time management skills by creating more complex dishes.
Working as a team

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<tr><td>Key knowledge:</td><td>Key skills:</td></tr>
<tr><td>

Sustainable energy and finite resources – advantages and disadvantages.
Life cycle of plastics and aluminium- effect on the environment.
Developing an understanding of the properties of Thermoplastics and alloys.
Developing evaluative skills to make considered choices.
Understanding the effect of friction- use of bearings and pulleys.
Using electrical generator.
Designing for function
Developing their own technical specifications to meet the needs of a user.
Dietary needs, Seasonality and food miles.

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Cutting screw threads.
Forming: -Heat forming thermoplastics and bending alloys.
CAD using Autodesk Fusion.
Programming using the BBC Micro bit
Communication skills- working as a team; development of drawing skills; 3D modelling ideas;
Dough, batter and cake making consistency;
Kneading, proving and shaping.
Planning and time management.
Developing practical cooking skills.

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<tr><td rowspan="3">Year 9</td><td colspan="2">Core aims:</td></tr>
<tr><td colspan="2">

Develop practical skills to create complex dishes.
To understand and apply time plans to meet a brief and specification.
To be able to use wood working tools with care and accuracy: - measuring tools, templates.
Developing an understanding of material properties in timber, ferrous and non-ferrous materials.
Further develop CAD drawing skills to create 3D and 2D images which can be manufactured through laser cutting.
Develop an understanding of wood finishes.
Sustainability in Timber- FSC.
Scales of Production.
Metal processes- Heat Treatment, wasting using the lathe,
Creating a thread through tapping a hole.

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<tr><td>Key knowledge:</td><td>Key skills:</td></tr>
<tr><td>

Food Safety: - Apply it to making plans.
Food quality, temperature control; Contingency plans for change and adaptation.
Softwoods, Hardwood, manufactured boards – properties and sustainability-FSC
Wood finishes.
Processes: - lathe, heat treatment, metal properties.
Scales of manufacture.
Specifications- How to write accurately and create a brief.
Marking out and measuring accurately

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Using chisels safely and accurately.
Developing CAD skills in 2D design and Auto Desk.
Understanding how to use the lathe correctly to parallel turn, knurl, taper turn, facing and drilling.
Heat treatment- hardening and tempering.
Casting using moulds.
Cutting a screw thread with a die.
Spot welding.
Quality testing- seasoning and using temperature probes.
Quality control checking.
Independence when looking at contingencies.

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Year 10

Core aims:

In Year 10 students will complete a 12-hour practical workshop-based exam from January to March. They will independently read a set of engineering drawings and then manufacture a single product in the workshops with a high degree of independence and tolerance. Students will produce their own risk assessment and production plan.

- Developing practical skills using metal sheet, bar, rod and sections to ensure that students use the specialist range of tools, equipment and machinery.
- Ensuring students can produce and interpret engineering drawings.
- Development of theory knowledge through practice exam questions.
- Developing numeracy through calculations to assess dimensions: Pythagoras, Trigonometry, scaling, ratios
- Understanding and producing risk assessment documentation.
- Understand and apply the fundamental principles and concepts of Engineering Manufacture, including manufacturing processes, engineering materials, manufacturing requirements and developments in engineering manufacture
- 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, manufacturing, process and control sector and more widely
- Determine the sequence of operations required, recognising hazards and risks so that control measures can be implemented for safe working

Key knowledge:	**Key skills:**
• Marking out correctly: Understanding what equipment to use to mark out accurately: Callipers, engineers blue, scribes, engineers square; • Using data tables. • Cutting speeds of different metals. • Metal properties. Ferrous/ Non ferrous • Joining and fixing methods- Temporary, permanent and mechanical. • Scales of Manufacture: one off, batch, mass: Lean Manufacturing – 7 categories of waste • Advantages and limitations of jigs, fixtures, templates, moulds. Go no go gauges. • Levels of automation: Manual control, CAM processes, robotic control – fully automated. • Quality Control and Assurance systems – Impact.	• *Operating and setting up lathe, milling machine and pillar drills. Using gauges, stop settings and changing tools.* • *Using CAD software: 2D design and fusion design and drawing to communicate ideas and produce BS standard drawings.* • *Working safely in the workshops. Understanding and implementing control measures.* • *Marking out accurately.* • *Manufacturing to tolerance and quality standards.* • *Cutting outer and inner threads.* • *Heat treating workpieces in order to change their properties.* • *Sawing, shearing bending and filing sheet metal*

<table>
<tr><td rowspan="3">Year 11</td><td colspan="2">Core aims:</td></tr>
<tr><td colspan="2">In Year 11, students will complete a 12-hour workshop-based exam where they will manufacture a batch of products using CAD and CNC equipment. Students will plan to manufacture the product safely and independently.
Students will be ready to sit a knowledge-based exam.

• Interpret engineering drawings to facilitate manufacture, using a range of tools and equipment, including Computer Numerical Control (CNC) machines.
• Plan manufacturing production through practical experience of manufacturing in quantity.
• Independently set up CNC machinery understand datums, offsets and changing of tools.
• Understand how to simulate their CAD drawings and problem solve to achieve a batch of quality products.
• Knowledge organisers and practice papers used to prepare for exam.</td></tr>
<tr><td>Key knowledge:

• Additive printing.
• Understanding shaping processes: sand and die casting. Injection moulding; powder metallurgy; additive printing.
• Mechanical properties of materials: definition of properties
• Polymers: Thermoplastic and Thermosetting. – Types and properties
• Smart Materials: SMA, Thermochromic ink, photochromic ink, QTC: - properties, typical forms, common applications
• Composite materials: CRP, GRP: forms, properties and applications
• Engineering ceramics: Silicon carbide, tungsten carbide, silicate glass.
• Globalisation: ISO, employment opportunities. Social, ethical, economic and environmental considerations.</td><td>Key skills:

• Time Management skills: organise their time effectively.
• Setting up and operating CNC equipment: Lathes, milling machines, laser cutters, 3D printers. Datum points, use of coordinates, tool offsets, tool change over, exporting and importing information
• CAD drawing and simulating for production. 2D and 3D
• Applying Health and safety control measures;
• Working with quality systems to ensure products are right first time.
• Production planning and sequencing of operations.
• Exam skills development through practice papers and effective revision.
• Use of manufacturers manuals, charts, to find pertinent information for manufacture.</td></tr>
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<tr><td rowspan="3">Year 12</td><td colspan="2">Core aims:</td></tr>
<tr><td colspan="2">Preparation for Unit 3 ‘8’ hour May exam in Year 12: Engineering Product Design and Manufacture.
Preparation for Maths and Scientific Principles: January Year 13 exam
Understanding the Triggers and engineering challenges that lead to changes in design.
Designing out safety risks.
Material properties and manufacturing processes: How they impact on design for an Engineered product.
Developing technical specifications.
Sketching and technical drawing skills to develop designing and communication.
Exam techniques; practice questions and coaching.
Development of Mathematical and scientific problem solving;
Develop and apply the principles of Newton, Young, Faraday and Ohm
Electrical and electronic problem solving using static and direct current, DC networks, magnetism and single-phase alternating current.</td></tr>
<tr><td>Key knowledge:
Design triggers- Market, demand, innovation, market research, sustainability, designing out risk.
Design Challenges: reduction of energy, size, mass: power systems, energy recovery, sustainability, life cycle analysis.
Equipment and systems constraints and opportunities: Interfaces- hydraulic, mechanical, electronic, software advantages and disadvantages
Product Design Specifications.
Materials properties: Mechanical, physical, thermal, electrical and magnetic
Behaviour of advanced materials
Surface treatments and coatings.
Design for a customer; Ergonomics, carbon footprints; life cycle, commercial protection.
Regulations: Codes of practice, Health and safety.
Market, Performance, manufacturing analysis.
Algebraic and trigonometric mathematical methods.
Static Engineering systems.
Dynamic Engineering systems</td><td>Key skills:
Communication skills in designing: 3D sketching, working drawing, sectional drawing and exploded views.
Data analysis: Graphs and justifications.
Analytical skills to evaluate their designs and improve them through annotated justified iterations.
Applying the correct formulas and arranging formulas to solve problems
Developing examination skills; Use exam questions to quantify knowledge and show learning
Application of mathematical theory to a practical situation: - modelling electronics..</td></tr>
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Year 13	**Core aims:** *Prepare students for their January Year 13 exam in Mathematic and Scientific Principles.* • Working as a team: • Using engineering tools and machinery safely using control measures. • Planning for production and using quality systems. • Interpreting engineering drawings and working to tolerance. • Developing CAD skills using Auto CAD and Autodesk Fusion to produce drawings to industry standard. • Using electronic programs to produce a schematic drawing.	
	Key knowledge:	**Key skills:**
	• Thermodynamic systems: • Hydrostatic systems: - pressure and thrust; Archimedes principles, flow through changes in diameter. • Understanding magnetism- Electromagnetic induction. • Single phase alternating current: Mapping how phases can be combined to increase power or voltage. • Developing an understanding for revision through practice and assessment: • Working to British standards in the creation of third angle orthographic drawing and components. • Developing a working knowledge and understanding for using CAD based commands in Autodesk Fusion, AutoCAD and circuit diagram programs.	• Applying the correct formulas and arranging formulas to solve mathematical problems. • Developing examination skills; Use exam questions to quantify knowledge and show learning • Application of mathematical theory to a practical situation: - modelling electronics. • Working in a group to support each other. • Project managing a team. • Manufacturing an engineered product to tolerance. • Reading and interpreting engineering drawings. • Developing an understanding for Auto CAD to draw an engineered product to standard using layers. • Developing an understanding of Autodesk Fusion 3D CAD to create: a sheet material product, a fabricated product and an assembled product from 10 components. • Understanding how to render in tone and texture, produce assembly views, exploded drawings, 3D drawing and orthographic drawings that meet British Standards and the specification