KS4 Curriculum Overview

Engineering

WJEC Level ½ Vocational Award

(Technical Award)

Curriculum Intent

Students choose this course in order to develop their knowledge, understanding and the practical application of skills in an engineering context, particularly from the manufacturing and planning perspectives. It provides learners with a broad introduction to the engineering sector and, as it is a vocational course, the types of further education, training and employment they may wish to engage in. Students will experience the engineering production and design process from start to finish and apply this to a range of contexts and engineering materials. This will develop their appreciation of engineering related industries in terms of their potential future opportunities, but more importantly, to understand, appreciate and respect the planning process involved in creating the complex world we live in. With this understanding students will be well equipped to think sensitively about the life cycle of products and production values, equipping them to be the new generation of ethical thinkers and consumers.

Unit 1 Manufacturing Engineering Products.
This unit introduces learners to interpreting different types of engineering information in order to plan how to manufacture 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 manufacturing 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.

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 manufactured during Unit 1 of the course. 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 manufactured for Unit 1.

Unit 3 Solving Engineering Problems.
This unit introduces learners to how engineering design is impacted by a range of external considerations such as the properties of materials, both traditional and smart developing materials, as well as methods of manufacturing in both the traditional and new and emerging technologies. The unit also gives the learner the opportunity to explore how engineering achievements have had an impact on modern day life at home, work and in society in general. Finally, the unit allows learners to develop understanding and skills to assist them in the solving of engineering problems.

How does the KS4 curriculum build on that from KS3?

At Downham Market Academy the subject of KS3 design technology is broken down into smaller rotations throughout the year, these include food, graphics, textiles, engineering and product design. By the end of KS3 all students should have had an opportunity to carry out a variety of projects using a range of disciplines and master some key skills from each of these areas allowing them to flourish and understand the world around them.

Students will learn to:

- Use creativity and imagination to design and make products that solve real and relevant problems including those encountered in their everyday lives.
- Build resilience and confidence to face challenges whilst raising their self-esteem and developing new personal interests.
- Be able to work within a range of contexts, considering their own and others' needs, wants and values.
- Acquire a broad range of subject knowledge whilst learning how to take risks and becoming a resourceful, innovative, enterprising and capable citizen in an increasingly technological world.

At KS4 students are offered the opportunity to specialise in courses related to hospitality and catering, engineering and product design. These courses build on the skills, knowledge and understanding gained in KS3 using the design, make, evaluate model into a more industry ready approach. For example, rather than just producing annotated sketches and design ideas at KS3, in KS4 students are expected to support these with accurate engineering drawings and prototypes that are commercially viable. Students at KS4 use a wider range of materials, techniques and processes and are expected to be mastering their own design style and approach, justifying their choices taking into account a deeper appreciation of the impact of their designs.

What do students *do* with this knowledge or these skills?

Students will identify the key features and functions required be analysing given design briefs, then use this information to develop a design specification. Following this, students will be expected to generate creative ideas based on successful engineered products. They should be able to review the suitability of their ideas and recommend the best option. Once this has been justified students will be required to create engineering drawings of the preferred solution using the accepted standards and drawing conventions.

Students will interpret different types of engineering information and drawings in order to plan how to make engineered products (identify materials and sequence activities.) Students will develop the skills needed to work safely with a range of engineering processes, equipment and tools. With these skills students will learn to apply a range of engineered processes to make products that are fit for purpose, finally evaluating the quality of these examples.

How does the KS4 curriculum align to the National Curriculum?

There is no specific KS4 Engineering curriculum, however there are numerous opportunities for the KS4 Engineering opportunities we offer to align with other subjects to provide a broad and balanced approach across the school. E.g.

- Investigating other cultures and designers.
- Teamwork, cooperation and participation. developing social skills, creativity, confidence and independence.
- Recycling, sustainability and ethics.
- Working mathematically - developing fluency, reasoning and solving problems. Number, algebra, ration, proportion, rates of change, geometry, measure, probability.
- English – spoken language, reading, writing, developing vocabulary.
- Science – working scientifically, biology, chemistry, physics.
- How technology can solve problems, new and emerging technologies.

What new knowledge or skills are students taught?		
Term	**Year 10**	**Year 11**
Autumn	1.1.1 Interpreting engineering drawings 3.4.2 Understanding and producing engineering drawings Interpreting engineering information 1.2.1 Identifying materials 3.2.1 Understanding materials, their properties, and their selection for specific purposes 3.2.2 Describe properties required of materials for engineering products 3.2.3 Explaining how materials are tested for properties 1.2.2 Equipment selection 1.2.3 Tool selection 1.4.2 Work with a range of materials 1.4.3 Evaluate the quality of engineered products 3.3.3 Safe working practices These topic areas from the curriculum broadly fall in to understanding and creating orthographic and isometric drawings (manual and CAD), selecting and using tools and equipment, understanding materials and material properties and finally, safe working practices. These are taught through skills development exercises and the production of an acrylic prototype. E.g. ice scraper/ drill gauge.	Continuation of Unit 1 NEA with a target completion date no later than Xmas. 1.1.3 Presenting engineering information 1.2.5 Contingency planning 1.3.1 Using engineering tools 1.3.2 Using engineering equipment 1.4.1 Apply a range of engineering processes 1.4.2 Work with a range of materials 1.4.3 Evaluate the quality of engineered products 3.3.3 Safe working practices
Spring	1.2.2 Equipment selection 1.2.3 Tool selection 1.2.4 Planning and sequencing 3.3.1 Describing engineering processes 3.3.2 Describing applications of engineering processes 1.3.1 Using engineering tools 1.3.2 Using engineering equipment 1.4.1 Apply a range of engineering processes 1.4.2 Work with a range of materials 3.3.3 Safe working practices	2.1.1. Primary features of the given engineered product 2.1.2 Identifying features of other engineered products 2.1.3 Function of the proposed solution 2.2.1 Generating a range of engineering solutions 2.2.2 Developing ideas through to a conclusion 2.2.3 Communicating design ideas 2.3.1 Producing a manufacturing specification 2.3.2 Drawing an engineering design solution that adheres to recognised standards

	These topic areas from the curriculum broadly fall in to students improving their understanding and skills in using a wide range of engineering equipment. These are taught through practical exercises with students manufacturing a mixed media prototype e.g. pen stand/ photo frame.	2.4.1 Using mathematical techniques for solving applied engineering problems 2.4.2 Justifying suitable materials for use in the final engineered solution 2.4.3 Justifying suitable processes for manufacturing the final engineered solution The above all form part of NEA2 which requires students to design an improvement to the product made for NEA 1. 24 guided learning hours are required, so timing for this is quiet tight and it is better to start at the end of the Winter term if NEA1 can be completed in good time.
Summer	1.1.3 Presenting engineering information 1.2.4 Planning and sequencing 1.2.5 Contingency planning 1.3.1 Using engineering tools 1.3.2 Using engineering equipment 1.4.1 Apply a range of engineering processes 1.4.2 Work with a range of materials 1.4.3 Evaluate the quality of engineered products 3.3.3 Safe working practices In the first half term, these skills are taught through a practical unit making a metal based prototype e.g. miniature tool box with an aluminium handle. HALF TERM ONWARDS: NEA work for Unit 1: Manufacturing Engineering Products	3.1.1 Describing engineering development 3.1.2 Explaining the effects of engineering achievements 3.1.3 Explaining how environmental issues affect engineering applications 3.4.1 Using mathematical techniques for solving engineering problems
Rationale for this sequencing	NEA Work for unit 1 is released by WJEC on June 1st in Year 10. Although an earlier entry is available, students would not be successful as they need time to build skills through the autumn and spring terms relating to understanding materials, material properties, interpreting orthographic drawings and developing competency in the selection and safe use of tools and equipment.	NEA Work for Unit 2 cannot be completed until after the NEA work for Unit 1 is complete as it requires students to redesign one element of the engineered product that they have made. Theory in the summer term is specific for the exam and is best covered at the end of the course as students need to have developed their understanding of other elements of the engineering course in order to understand these topics in the depth required.

Additional support at home	
Additional reading for enjoyment, enhancement and extension	• The Language of Things. Deyan Sudjic. • Stuff Matters. Mark Miodownik. • Why Shrink Wrap A Cucumber? Stephen Aldridge • No More Plastic. Martin Dorey. • Process: 50 designs from concept to manufacture. Jennifer Hudson. • Design for the 21st Century – Charlotte Fiell.
Online resources to practice, consolidate and revise	• Print The Legend – Netflix. • Abstract: The Art of Design – Netflix. • Design Matters – Debbie Millman podcast. • Technologystudent.com • WJEC knowledge organisers.
Workbooks & revision guides to practice, consolidate and revise	• Pre-order WJEC course student guide. Please ensure you order the revised 'Technical' edition for the new course Sept 2023.

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