

# BTEC Level 3 National Diploma in Engineering



## Introduction

Thank you for choosing to study Engineering. Engineering covers a broad variety of roles and it involves the application of scientific principles and practical knowledge to transform ideas and materials into products and systems safely and support them during their lifetime. This qualification has a focus on a broad range of engineering specialist areas including electrical and electronic, mechanical, and others for example manufacturing.

Throughout this course you will study mandatory units including the following topics:

- Engineering principles and mathematics
- Health and safety, teamwork and interpreting and creating computer-aided engineering drawings
- Design and manufacture of products

You will also study a mix of electrical/electronic, mechanical, and other engineering specialist areas. They could include electronic devices and circuits, electronic measurement and testing of circuits, behaviour of metallic materials, maintenance of mechanical systems, programmable logic controllers, secondary machining processes. The content of this qualification has been developed in consultation with employers and professional bodies to ensure relevance to current industry practice in engineering occupational disciplines.

How this work links to Year 12

For each of the units that you will study in Year 12 you have been given short task to complete that will prepare you for the start of the course.

## Tasks

### Unit 1. Engineering Principles

Unit 1 is an externally assessed unit which is assessed by an exam at the end of Year 13. As engineers we deal with a lot of maths. For this course you do not have to be a whizz with numbers just not scared of them. You need to be confident at handling numbers and make them do what you want. If you are really good at maths, great, but if you're not, all it will mean is that you will need to spend longer on this unit and put more effort into it.

**Your task** - Using the link below:

<https://www.mathsisfun.com/algebra/exponent-laws.html>

Go down to the brownish table called the 'laws of exponents' (you can look at the part that is titled 'laws explained' as well).

You need to learn and understand the first 3 laws (down to  $x^{-1} = 1/x$ ).

- Read the subject

- Make notes on the subject (only move to the next part once you have understood what it means)
- Condense your notes into some revision materials (flash cards, graphic organiser etc.)

### Unit 3 – Engineering Product Design and Manufacture

Unit 3 is assessed by an exam. In the exam you are given a design problem where you must improve a product. You then need to show your improvements through a series of drawings and evaluate how effective the improvements are.

**Your task** - Pick an everyday object and think of one or two improvements that you could make to it. Then draw the improved product in 3d - isometric drawing is best for this. Then draw in it 2d (3<sup>rd</sup> Angle Orthographic Projection) showing the side view, end view and plan (bird's eye) view. Finally, if you can add notes to explain the improvements and explain how they improve the product.

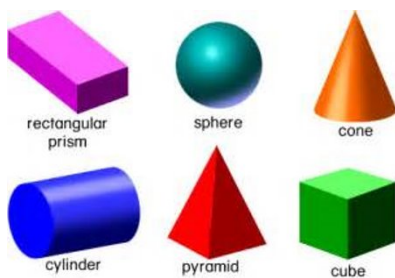
### Unit 10. Computer Aided Design in Engineering

This is an internally assessed unit where you will use CAD software to produce 2D and 3D drawings. You will acquire the skills to produce models of products, editing and modifying these. You will output a portfolio of drawings, for example orthogonal, 3D shaded or solid model, and detail view drawings, to an international standard.

**Your task** – Download the free educational versions of **Autodesk Inventor**.

<https://www.autodesk.com/education/free-software/inventor-professional>

Using Inventor draw the following shapes, you will need to watch YouTube tutorials or follow the tutorials within the programme to help you. By producing these drawings, you will be familiarising yourself with various commands such as extrude, revolve, and loft. If you cannot download the software try drawing these shapes in google SketchUp.



### Unit 22. Electronic Printed Circuit Board Design and Manufacture

Electronic products are everywhere, from toasters to computer tablets, and at the heart of these devices are ever more complex electronic circuits. To make these products function as intended (reliably and safely), the circuits need to be connected effectively; and this is the job of a PCB.

#### **In this unit you will**

- understand and explore the industrial processes involved in designing and manufacturing sustainable PCBs
- gain an understanding of the different types of PCBs
- experiment with software tools to design and simulate the PCB
- manufacture a PCB
- reflect on the skills and understanding you have acquired

#### **Your task**

Types of PCB and their technology

- through hole (THC),
- surface mount (SMT),
- mixed-technology boards,
- single and multiple layer/sided boards,
- Rigid
- flexible
- chip-on-board (COB).

<https://www.twistedtraces.com/blog/learn-about-different-types-of-pcbs-and-their-advantages>

<https://www.theengineeringprojects.com/2018/03/different-types-of-pcb-printed-circuit-board.html>

[https://en.wikipedia.org/wiki/Chip\\_on\\_board](https://en.wikipedia.org/wiki/Chip_on_board)

[https://en.wikipedia.org/wiki/Chip\\_on\\_board](https://en.wikipedia.org/wiki/Chip_on_board)

[https://en.wikipedia.org/wiki/Through-hole\\_technology](https://en.wikipedia.org/wiki/Through-hole_technology)

Using the links provided above, research the PCB types and technologies above. To do this you need to look at the websites, and any others you may find, and cut and paste anything to do with the topic. Put the information onto a word document. It is important that you include the website address with the information.

Once you have collected the information you need to present it as a report.

It is difficult to do this, but it is a skill you will need to learn.

A technique for do this is to create some questions to answer.

### Example

I have asked you to research 'rigid PCBs' so you might form the questions

- What is a rigid PCB?
- What are they used for?
- Why are they used?

### The report success criteria:

- explains all the information required
- has some images
- The images have titles and link to the text
- Is easy to read and to follow
- Has your name on it
- Has an introduction and a conclusion
- Has a bibliography

## Unit 26. Mechanical Behaviour of Non-Metallic Materials

Unit 26 is assessed by three assignments over the academic year. It looks at the different categories of material in 3 areas, Ceramics, Polymers and Composites (there are 2 groups in each). We will also go into detail exploring the different characteristics and properties of these materials and how they can fail in service due to poor design.

**Your task** – I would like you to research the 6 engineered products listed below, two from each of the 3 named categories above. You need to find out the group name of each product, what specific material it is made from and its working characteristics/properties that make it suitable for the job that it does during its

everyday usage. Pictures are essential and it would be excellent if you were able to find out the materials atomic structure.

1 Motor car headlight (acrylic)

2 Carbon fibre racing bicycle

3 Concrete paving slab

4 Nylon washing line

5 Clay plant pot

6 Wine glass

### **Unit 44. Fabrication Manufacturing Processes**

Unit 44 is assessed by three assignments over the academic year. It primarily concentrates on using the machines and tools in the workshop to manufacture two products, one of which is made to within certain tolerances, all whilst abiding by the health & safety regulations set out by industrial standards.

**Your task** – Using machines and tools in a workshop requires knowledge and experience of all the different processes. You must also keep yourself, and others around you, protected from any possible hazards and risks. There are 5 main stages in producing a risk assessment (RA) to minimise any potential harm or dangers. Think of a metal project that you did in DT over the past few years. It could be the Gonk or Scroll project. Research the 5 main stages of creating a RA and explain how the product you have chosen can be made safe/reduce any risks as far as is possible using the headings. Describe each stage in detail against the different machines and processes you have used on the product manufacture.

#### **Appendix – Useful sources of information**

<https://tomorrowsengineers.org.uk/students/what-is-engineering>

<https://www.thisisengineering.org.uk/>

[www.technologystudent.com](http://www.technologystudent.com)

<http://www.engineering.com/>

<http://www.howstuffworks.com/>

<http://www.discoverengineering.org/>

<http://www.engineergirl.org/>

<https://www.mathsisfun.com/algebra/exponent-laws.html>

#### **How it links to the Specification:**

Unit 1. Engineering Principles

Unit 3. Engineering Product Design and Manufacture

Unit 10. Computer Aided Design in Engineering

Unit 22. Electronic Printed Circuit Board Design and Manufacture

Unit 26. Mechanical Behaviour of Non-Metallic Materials

Unit 44. Fabrication Manufacturing Processes

**Exam board:** Pearson/edexcel



#### **For more information see:**

- o Mrs Cottle [s.cottle@academy.org.uk](mailto:s.cottle@academy.org.uk)
- o Mr Carr [a.carr@academy.org.uk](mailto:a.carr@academy.org.uk)
- o Mr Mogie [d.mogie@academy.org.uk](mailto:d.mogie@academy.org.uk)
- o Mr Badger [a.badger@academy.org.uk](mailto:a.badger@academy.org.uk)

#### **Deadline:**

Friday 11 September 2020