Scarborough Sixth Form College

Engineering Transition Pack

About the course

The engineering course at S6F is available in two sizes: an Extended Certificate that uses up one of your three course choices; and a Diploma that uses up two of your course choices.

Both sizes contain a mixture of mechanical and electrical engineering and design work. Both courses are assessed through a mixture of exams and assignment work.

This document contains some activities you can do to help prepare yourself for studying engineering.

Local Engineering Companies

It will help in your assignments if you know about the local engineering workplace. Try to find out about some local engineering companies. Make some notes on:

- What do they do? Are they a manufacturer? Do they provide a service?
- Where are they located? Are they only local or do they have other sites in the UK or abroad?
- How many people do they employ? What sorts of jobs do they have?
- Who are their customers?

If you are struggling to think of local engineering companies here are some ideas, but try to come up with your own as well:

- Rosti
- Ellis Patents
- GCHQ
- McCains
- Deep Sea Electronics
- Sirius Minerals

Maths for Engineering

One of the first topics you will study is maths as it is an important skill throughout all aspects of engineering. At the end of this section are some questions to try on the most important parts of GCSE maths. If you need to revise any of the topics then one of the best places in Khan Academy.

Try looking here: https://www.khanacademy.org/math/algebra-home

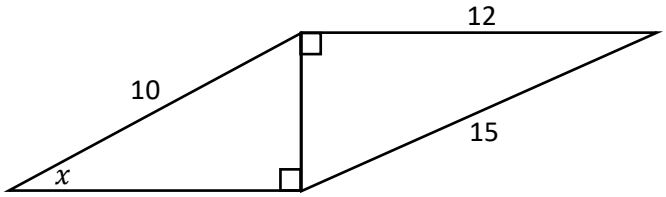
You will need a calculator from the very start of the course. Any scientific calculator will do but the one we recommend is the Casio FX-991ex. We sell these in college once you start.

The most important topics are:

- Algebra:
    - Working with algebraic expressions: simplifying; expanding; factorising
    - Surds and Indices: simplifying powers; working with square and cube roots
    - Solving equations: linear and quadratic equations
    - Simultaneous equations
- Statistics
    - Charts and graphs: bar charts; pie charts; histograms
    - Scatter graphs: plotting graphs and drawing lines of best fit
    - Averages; mean, mode, median and range
- Geometry
    - Pythagoras' Theorem
    - Trigonometry: finding lengths and angles; using the sine and cosine rule

Maths Practice Questions

Question	Marks
Simplify $x + x + x$	1
Simplify $3k^5 \times 2k^4$	2
Simplify $2x + 5y - 4x + 2y$	2
Factorise $12x^4y^2 - 6xy^3$	2
Expand and simplify $(x + 3)(x - 4)$	2
Factorise $m^2 + 5m + 4$	3
Factorise $p^2 - 36$	3
Solve $7x + 3 = 66$	2
Solve $5q + 3 = 8q - 7$	3
Solve $\frac{2x + 4}{x - 1} = 7$	3
Solve $x^2 - 7x + 12 = 0$	3
Solve $3x^2 - 14x - 5 = 0$	3

Solve these equations simultaneously $5x + 4y = 13$ $3x - 5y = 30$	4
In the diagram find the size of the angle marked x:  	5
Total	38

Engineering Materials

As engineers the correct selection of a material when designing a new product is of high importance.

When building bridges, we used to use wood, in plentiful supply, but susceptible to environmental conditions giving rise to rot. While preservatives like oil were applied the lifespan on the bridge was limited.

We then built bridges of iron, again these needed to be highly maintained to stop corrosion.

The Humber Bridge is a world wide iconic structure, once the longest single span suspension bridge in the world. The Humber Bridge is made of concrete, reinforced concrete. If you look closely at the bridge you can see how it was built (in its day it was revolutionary). You can see how the concrete was slip formed from the lines on the towers.

You can watch the full story and build, here:
https://www.youtube.com/watch?v=l4rPHbokQ-E

We take everyday objects for granted sometimes. As engineers we should have the interest to ask the questions like:

- Why does it do that?
- What is it made of?
- Where did it come from?

When considering what to make a new product out of we need to think about some basic material properties such as:
Stiffness; hardness; ductility; toughness; fatigue resistance; wear properties etc

For each of the items below, describe

a) the purpose of the product (what does it do?)
b) what material(s) could it be made from
c) what properties does your selected material have that makes it a good material for that product.

1. Plastic bottle
2. Pressure vessels
3. Internal combustion engine piston
4. Storage tanks
5. Turbine blade for a jet engine
6. Bicycle/Motor bicycle frame

Electrical Engineering

Electrical systems and electronic devices are present in almost every aspect of modern life – and it is electrical and electronic engineers who design, test and produce these systems and devices.

Watch the following video which gives a brief introduction to electricity.

https://youtu.be/mc979OhitAg

One of the aspects discussed is the difference between AC (Alternating Current) and DC (Direct Current).

Tasks

1. Investigate this aspect further by researching how electricity is generated by power stations and transmitted to consumers.

- Try and identify all the steps that need to happen to get the electricity from the power station to the charging circuit of your mobile phone.
- Include a diagram explaining the process in pictures.
- Make sure you include the following:
    - At what points in the process is the electricity converted from AC to DC or vice versa.
    - At what points is the voltage 'stepped up' or 'stepped down'?
    - The general principles of how an AC generator works.
    - The general principles of how a transformer works.
    - The difference between how electricity is delivered to domestic and industrial consumers.

2. Apart from your phone, many other devices in your home run off electricity. How many can you identify and, for each one, state whether it runs off DC or AC power.

Sources which may be helpful:

https://youtu.be/Ylgb8FFMgd4

https://youtu.be/A4E35Akk7kM

https://www.electronics-tutorials.ws/transformer/transformer-basics.html