ENGINEERING

To support our Year 11 applicants in the transition from school to college, we have prepared a study handbook to make the transition from school to college a smooth and pleasant affair. This handbook will cover equipment needs and requirements for your study of Engineering, as well as educational material that will assist you in your studies.

Be Classroom Ready

Stationery List

- HB Pencil
- Ball point Pen
- Rubber
- Ruler
- A4 Ruled Pad
- Protractor
- Highlighter
- Sharpener
- Document Wallets (Plastic folders) for assignments
- A4 Folder (for study notes)
- 7 to 10-part dividers (to separate study notes)
- Casio Calculator - *fx* range
- USB memory stick

Required PPE

- Boiler suit type overalls (purchased during enrolment)
- Safety Glasses (purchased during enrolment)
- Safety boots with steel toe caps

Be Ready to Learn Policy

Lanyards	Wear your lanyard at all times
Phones	Mobile phones must not be used
Language	No swearing or inappropriate language
Food & Drink	No eating or drinking (water may be consumed in classrooms with tutor
Hats	No caps / hats / hoods to be worn
Coats/Bags	No coats to be worn and bags must be placed under your desk
Headphones	Headphones must not be worn
Respect	Respect everyone in the classroom
Contribute	Make positive contributions to lessons
Prepared	Come prepared for lessons

Glossary of Assessment Wording

You can categorically state that for any engineering programme of study you should be able to:

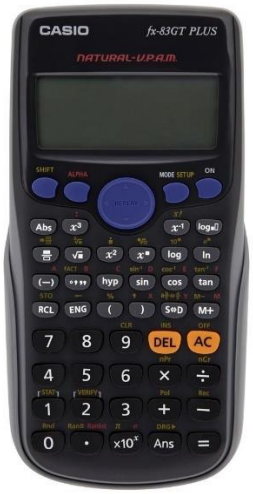
ACCOUNT FOR Requires more than a description. An explanation of the topic is needed, giving reasons why.
ANALYSE Break down a complex topic into simpler parts, exploring patterns and explaining significance.
ASSESS Examine the strengths and weaknesses or opposing viewpoints
COMPARE Identify and explain the similarities and differences.
CONTRAST Identify and explain the differences.
DEMONSTRATE Show awareness and understanding.
DESCRIBE Give a description of the major features.
DISCUSS Present and examine clearly the various views on a topic or issue.
EVALUATE Examine the strengths and weaknesses (just like Assess) and judge the merits of particular perspectives.
EXAMINE Lay out the essential elements of an issue and investigate in detail.
EXPLAIN Show clearly knowledge and understanding of a topic.
EXPLORE Examine or investigate a topic or issue, often in an imaginative way.
IDENTIFY Pick out and describe the main points.
ILLUSTRATE Give examples to clarify the argument or answer.
INTERPRET Clarify or explain the meaning.
INVESTIGATE A careful and systematic inquiry into a topic or issue.
JUSTIFY Provide reasons why something is valid.
OUTLINE Identify the main features.
RESEARCH Use a variety of sources to establish facts or collect information.
REVIEW Write a critical assessment.
SIGNIFY Consequence or importance.
SPECIFY Identify clearly and definitely.
STATE Provide information in a brief uncomplicated form.
SUMMARISE Give an account of the main points.

What Type of Subject Material Will You Study

Studying Engineering at Bury College will take you into many different Engineering specialisms such as, Engineering Maths, Mechanical Engineering & Electrical Engineering. You will also study some other related ancillary units such as Communications, Engineering Materials, Engineering Design and workshop units. This pack is broken down into 3 tasks. These tasks have been designed to give you an insight into the topics covered within your chosen field.

Using a Scientific calculator

It pays to become familiar with your calculator. The Casio FX range is the most popular calculator amongst students. They change from time to time with newer models, but the function of operation remains the same. Access the video link shown below. The contents will either refresh your memory or teach you how to use undiscovered functions.



Get to know your calculator - CASIO fx-83GT plus & similar

https://youtu.be/Bgv5ZIePPuM

Task 1 – Engineering Maths

Answer the following questions:

a) What does the representation of this number tell you? 0.7’

b) Enter this calculation on your calculator (¼) (½) and obtain the answer. Which button would convert the answer from a fraction to a decimal and vice versa

c) How would you set up your calculator to give trigonometric values in radians rather than in the defaulted degrees?

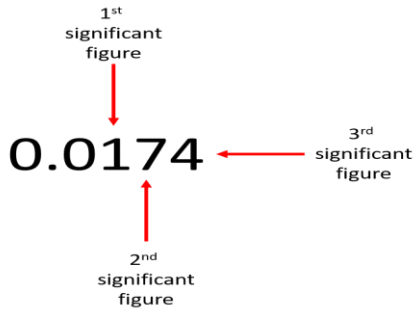
d) Name five adjustment operations that the SHIFT +MODE button, allows you to do on your calculator.

e) Use your calculator to calculate the following. Give your answers in standard form.

(3.45 x 10-5 + 9.5 x 10-6) ÷ 0.0024 =

2.31 x 105 x 3.98 x 10-3 + 0.0013 =

Significant Figures



When you round to one SF you must only have one number in your answer. For example, 2.367 would become 2. This is because the first digit after the decimal point, which is 3, is below 5 so, we round down. For example, 2.500 would become 3. This is because the first digit after the decimal point is dead on 5, so we round up.

When you round to two SF you must look at the second digit after the decimal point. For example, 3.67 would become 3.7. This is because the second digit after the decimal point is greater than 5, so we round up.

Have a go at rounding these numbers to 1 significant figure

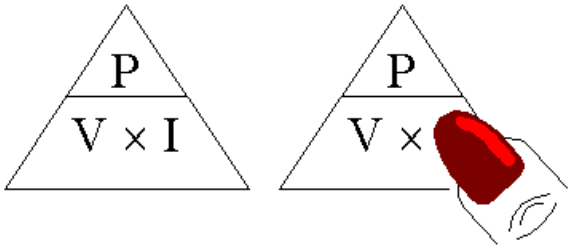
1) 1.754 =
2) 7.236 =
3) 946.2 =
4) 0.0758 =
5) 0.1076 =
6) 39560 =
7) 0.9999 =

Have a go at rounding these numbers to 2 significant figures

1) 1.754 =
2) 7.236 =
3) 946.2 =
4) 0.0758 =
5) 0.1076 =
6) 39560 =
7) 0.9999 =

Re-arranging equations

Below is a three subject power equation triangle. It is put in triangle form to allow it to be transposed easier (i.e. make another letter the subject of the formula). P = V x I in a linear sense. You can see that covering up “I” allows you to see that I = P/V. Covering up “V” allows you to see that V = P/I.



To re-arrange a formula means to transpose it, but you do not upset the formula in a mathematical sense. Tips to remember when transposing are:

- Dividing a numerator by the same value cancels out the subject
- Subtracting a negative subject from the same type positive subject cancels out the subject

Have a go at re-arranging these equations

1. V=IR R = I =

2. V = P/I P = I =

3. V = W/Q Q = W =

4. P= I^2 R R= I =

5. R = R1 + R2 + R3 R1 = R2 =

6. ε = V + Ir so V = I = r =

Mechanical Engineering

Mechanical Engineering is vast and very wide. From a scientific level, it covers Statics, Dynamics, Fluids and Gases. On a manufacturing level, Mechanical engineering can involve, Health and Safety, Fabrication & Sheet Metal work, Manual and Automated mechanical parts manufacturing, Welding and Structural Design to name just a few areas.

Task 2 - Health and Safety

Health and Safety is taken very seriously across the industry. Everybody has to wear Personal Protective Equipment (P.P.E).

Using research methods, can you name the items of PPE from the images below? What are they used for when working within Engineering?

	PPE Item: Why is it used in Engineering?
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Many Health & Safety Legislation and Regulation is abbreviated in to Acronyms (an abbreviation formed from the initial letters of other words and pronounced as a word).

Below is a table with a number of the acronyms used. Research what the acronym stands for and put it in the table. Include in the table the year of first issue, and a brief (2 sentence) description of Legislation or Regulation.

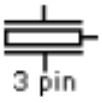
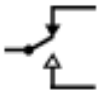
Acronym	Full title	Year of issue	Description
HASAWA			
COSHH			
DSEAR			
RIDDOR			
COMAH			
LOLER			
PUWER			

Electrical Engineering

Electrical Engineering is vast and very wide. From a use and applications level, it covers: General Electronics, HV & Power, PLC's, Digital and Analogue. From the different areas mentioned above that comes under the electrical remit, you can see that Mathematical skills will be useful in all the above disciplines mentioned. It should also be realised that working within Electrical Engineering you would have to have various knowledge of components and systems. This ranges from a basic resistor, to a complex Integrated IC microchip. On HV systems you would require knowledge on heavy duty components such as Transformers, Relays and Motors

When first starting to study Electrical Engineering, a good starting point is to become familiar with components and their symbols. Please observe and study the components list given below:

Electronic circuit diagram components (symbols)

Symbol	Component	Symbol	Component	Symbol	Component
	Joined conductors		Crossing conductors -no connection		Single-Pole-Single-Throw switch (SPST) (normally open)
	Fixed resistor		Diode		Single-Pole-Single-Throw switch (SPST) (normally closed)
	Potentiometer		Light-Emitting Diode (LED)		Single-Pole-Double-Throw switch (SPDT)
	Preset potentiometer		NPN transistor		Double-Pole-Double-Throw switch (DPDT)
	Thermistor		Amplifier		Push-To-Make switch (PTM)
	Light-dependent resistor		Fuse		Push-To-Break switch (PTB)
	Polarised capacitor		Resonator		Dry-reed switch
	Non polarised capacitor				Opto switch
	Power supply		Primary or secondary cell		Relay (with double-throw contacts - contact symbol varies with type used)
			Battery (of cells)		

Note: Relay Symbol - The symbol consists of a relay coil and contacts. Contacts are usually drawn separate from the coil at convenient points on the circuit diagram and are always shown in the unoperated position.

Now observe this video that will introduce a DC and AC circuit theory to you without the complication of components

Difference between AC and DC Current Explained | AddOhms #5
https://youtu.be/vN9aR2wKv0U

I hope you enjoyed and understood it. I chose this example because of the simplified cartoon type nature of the explanation, which was not too rigid and scary to students who are new to Electrical Engineering.

Now observe this second video that introduces DC with basic components

Basic Electricity - Resistance and Ohm's law
https://youtu.be/NfcgA1axPLo

Again, I hope you enjoyed and understood the video. This example video was chosen because it gave so much information about instruments, formulas and the principles of physics. It was explained well with lots of graphical items.

Task 3 – Electrical & Electronic Engineering

Let us look at some basic DC calculations which related to the last video. You can use the video along with some Internet research to answer the given questions

1) What is the main distinguishing factor that differentiates between resistors of varying wattage?

2) Would a ceramic body resistor be used as a low tolerance resistor?

3) Would a ceramic body resistor be used as a high temperature resistor?

4) What is meant by the term ‘a plus and minus tolerance’?

5) The following resistors have a +/- 5% tolerance. Give their lowest possible values.

   a) 56kΩ

   b) 18Ω

   c) 150Ω

   d) 100kΩ

   e) 82Ω

6) For a 4-colour band resistor what would be the colour codes for the following values of resistor. Give the colour codes from left to right.
   a) 1Ω +/- 2% tol.
   b) 20Ω +/-10% tol.
   c) 1000Ω +/- 5% tol.
   d) 96Ω +/- 2% tol.
   e) 10MΩ +/- 20% tol.
   f) 100MΩ +/- 5% tol.

7) Carbon film resistors are common place on PCB circuitry. What is the usual wattage of a carbon film resistor?

8) You are trying to read a 10Ω resistor with your multimeter set on the 200KΩ range. Why is this not good practice?

10)Your multimeter is set to the 1MΩ range. The reading for a resistor shows 0.20. What is the value of the resistor?

11)Define the term ‘resistance’ when associated with an electronic circuit.

12) You are checking a resistor’s value out of circuit with your multimeter. The reading on your meter shows 0.001. What is probably wrong with the resistor?

Recommended Websites

Whilst the internet if full of useful Engineering information, we do not advise a random search as many of these sites are not specifically designed for the level of qualification you are studying, this applies to Wikipedia, as the content regularly goes far beyond the BTEC specification and covers many interesting areas that are not relevant to the course.

The most useful websites are:

BTEC (RQF)
https://qualifications.pearson.com/en/qualifications/btec-nationals/engineering-2016.html

BTEC (QCF)
https://qualifications.pearson.com/en/qualifications/btec-nationals/engineering-2010.html

EAL
https://eal.org.uk/index.php/sectors/engineering-and-manufacturing

YouTube

https://www.youtube.com/

You tube demonstrates many practical experiments that are essential to the course, as well as many that show the diversity and fun aspects of Engineering.

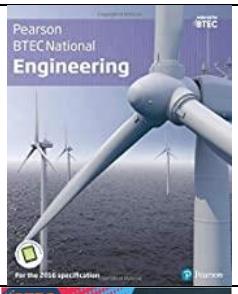
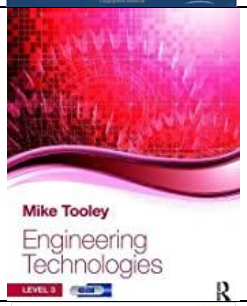
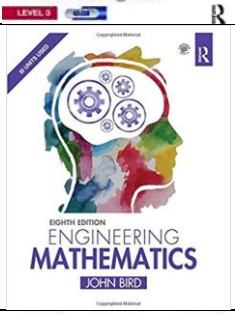
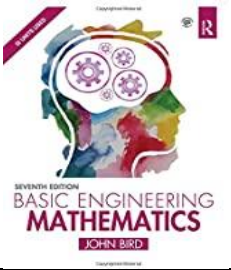
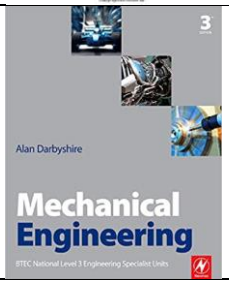
Recommended Apps to download

Bury College Canvas App

Kahoot

Socrative

Engineering Text Books (available to loan from the college LRC)

BTEC National Engineering	
BTEC Level 3 National Engineering Student Book	
Engineering Technologies Level 3	
Engineering Mathematics John Bird	
Basic Engineering Maths John Bird	
Mechanical Engineering Alan Derbyshire	

What I wish I'd known about Engineering

We asked some of our current learners if they were to give advice about doing Engineering what they would say. Here are some of the comments:

"Try to remember not only Engineering formulae and definitions but also to apply the basic principles of Engineering to questions."

"Revise class notes, ask if you don't understand and be comfortable with maths."

"Be prepared for the hard work. If you don't understand something, ask your tutor."

"Think before choosing Engineering it isn't all practical activities in the Engineering workshop. If you have a genuine interest in Engineering and also like the theory behind it then this course will be perfect for you."

"If you do not put in your maximum effort you will not achieve your full potential."

"Find a good work experience placement and it can lead to an apprenticeship"