



## Level 2 Engineering Manufacture

The course is broken down into FOUR elements all worth 25% of the qualification;

R109  
External Exam

1 hour paper  
External Exam

R110

Students are required to interpret a technical drawing and accurately manufacture the product from it using hand controlled machinery.

R111

Students are required to analyse the accuracy of R110 product and determine how the product could be made in multiple batches with accuracy. Students will use CAD and CNC controlled machinery to make a more accurate product.

R112

Students research and investigate Quality Control and Quality assurance. Students will carry out a range of investigations analysing and testing the range of products manufactured to ensure a quality approach has been taken.



## Example Exam Questions

1 A list of different types of engineering materials is given below.

Alloys  
Composite materials  
Ferrous metals  
Non-ferrous metals  
Smart materials

(a) Choose **three** material types from the list and give **two** examples of each type.

Material type .....

Examples 1 .....

2 ..... [2]

Material type .....

Examples 1 .....

2 ..... [2]

Material type .....

Examples 1 .....

2 ..... [2]

(b) (i) Explain why thermoplastics are used for products more often than thermosetting plastics.

.....

.....

.....

.....








..... [3]

(ii) Give **one** example of a **product** made using thermosetting plastic.

..... [1]

3 (a) Complete the table below by giving the correct name of each of the tools shown.

One has been done for you.

Tool	Name of tool
	Scriber
	
	
	
	
	
	

[6]

(c) Centre lathes are manually operated machines used to produce turned parts.

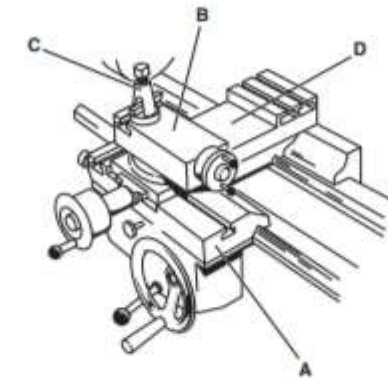


Fig. 1

Fig. 1 shows the parts of a centre lathe that control the cutting tool.

Name the four parts of the centre lathe labelled in Fig. 1.

A .....

B .....

C .....

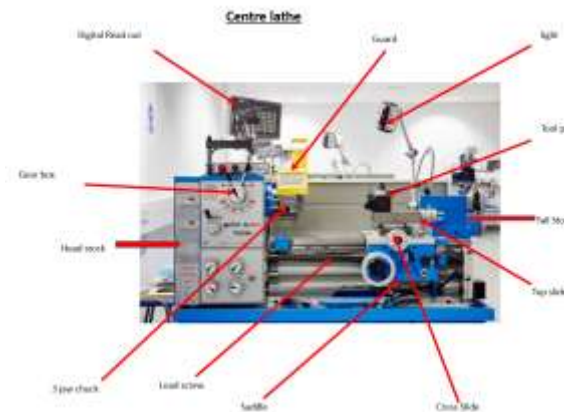
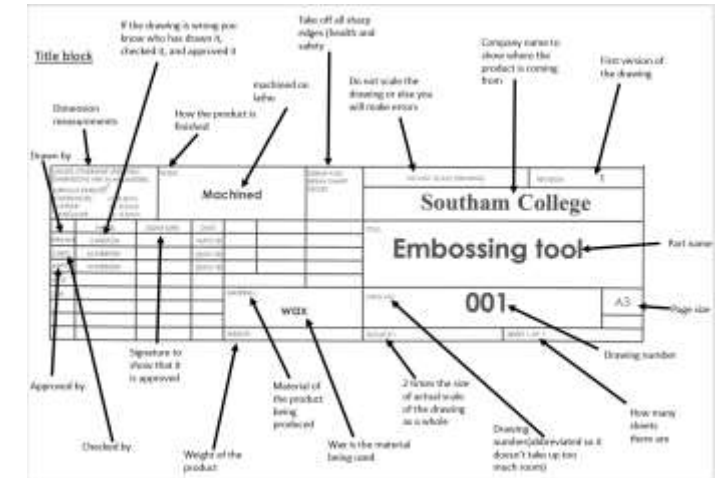
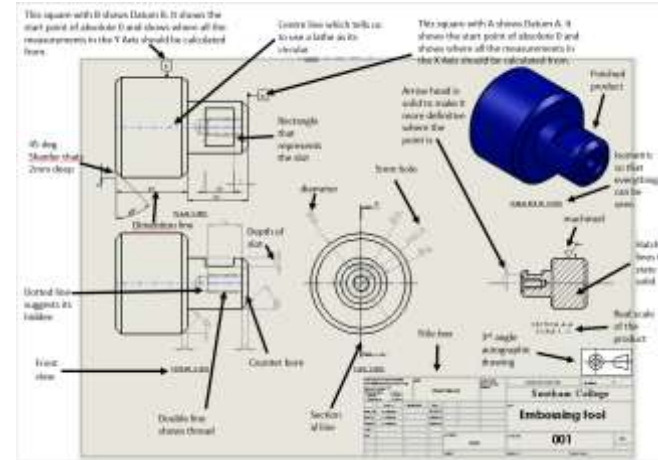
D ..... [4]

# Coursework 1

This unit is formulated around technical drawings. Students are required to read and understand the information on a technical drawing and use their skills to manufacture the product.

Students will be required to:

- research a range of Technical Drawing tools from the BS8888 standards.
- Identify and label the machinery to be used to manufacture the product.
- To be able to plan the manufacturing process – identifying the key steps and incorporating health and safety precautions along with quality control checks.
- Manufacture the product within tolerance of the technical drawing.



## Coursework 2

This unit is formulated around CNC controlled manufacture.

Students are required to understand how CNC machinery works, how its programmed and how machine codes can be edited and altered.

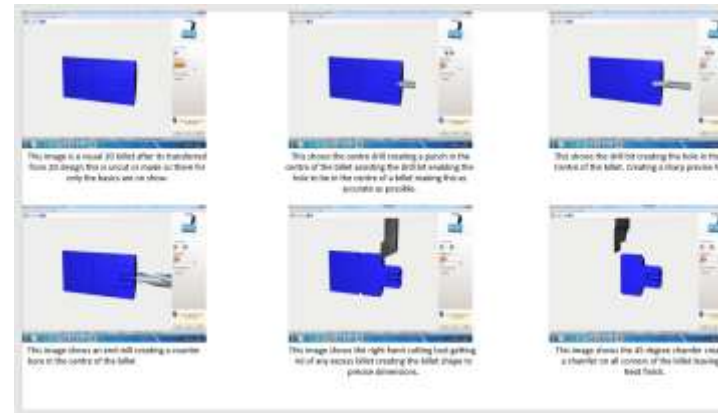
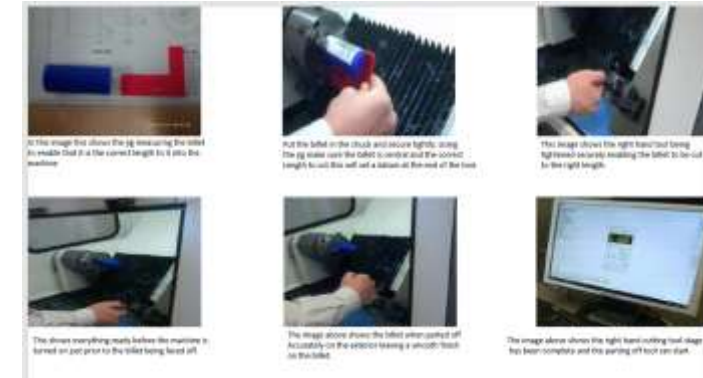
Students will be required to:

- research a range of CNC machinery.
- Identify and explain the programmable machine code, interpreting and explaining the various codes and commands.
- To be able to plan the manufacturing process – identifying the key steps and incorporating health and safety precautions along with quality control checks.
- Manufacture the product using CNC machinery.
- Researching and explaining case studies associated with CNC Industrial production processes.

**G&M code for milling the slot**

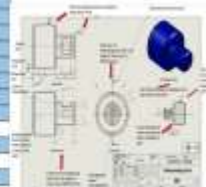
Sequence number	Line	Code	Value	Unit	Comment
1	G00	X0.0			Home X
2	G00	Y0.0			Home Y
3	G00	Z0.0			Home Z
4	G01	Z-0.5			Start cutting
5	G01	X1.0			End of slot
6	G01	Z0.0			Retract
7	G00	X0.0			Home X
8	G00	Y0.0			Home Y
9	G00	Z0.0			Home Z
10	M02				End of program

Each number means a different thing for example, G1 represents positioning at rapid travel, whereas M1 represents optional stop. However When there's a gap it shows the tool is not cutting.



Existing G&M code				New altered G&M code			
Line	Code	Value	Unit	Line	Code	Value	Unit
1	G00	X0.0		1	G00	X0.0	
2	G00	Y0.0		2	G00	Y0.0	
3	G00	Z0.0		3	G00	Z0.0	
4	G01	Z-0.5		4	G01	Z-0.5	
5	G01	X1.0		5	G01	X1.0	
6	G01	Z0.0		6	G01	Z0.0	
7	G00	X0.0		7	G00	X0.0	
8	G00	Y0.0		8	G00	Y0.0	
9	G00	Z0.0		9	G00	Z0.0	
10	M02			10	M02		

Notes: The new altered code enables the company to save time because the 'Y' axis center is no longer cutting, meaning the products are made quicker. The four lines (part 1, 2, 3, 4) means that already more money is being saved. So therefore the more money you make, the more money you save. Another way of saving money would be because although you're saving more money on a bigger order, this will not longer then being several smaller orders.





## Coursework 3

This unit is formulated around quality control and quality assurance.

Students are required to understand how quality control influences the design of a product and why it is essential to manufacturing large batches of similar products.

Students will be required to:

- research quality control and assurance.
- Identify ways in which the manufactured school products can be QC checked.
- To be able to create a method of QC.
- To be able to collate data from a range of products carrying out a wide range of measurements.
- Analyse the data to determine how accurate the manufacturing process has been.
- Comparison between hand machined and CNC machined products.

### Quality Standards Marks

Without having one or more of these a product can not be sold in the UK.



British Standards Institution mark awarded to compliant products mainly used on products where safety is important like crash helmets.



Forest Stewardship Council – used on wood products to show that forests where the wood came from have been well managed.



Conformité Européenne The CE mark shows that an item conforms to European Economic Area health, safety and environmental standards.



International Standards Organisation – Used for industrial and commercial standards world wide



Lion Mark – British Toy and Hobby Association – Used to mark toys as safe and a high quality.



The Assured Food Standards mark. Used for quality reassurance of food products produced in the UK.

### Ultra modern techniques for inspection

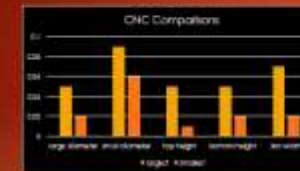
- **Ultrasonic testing:** technique that use high-frequency ultrasonic waves to identify flaws in a material by emitting different frequency waves into the material and using computer monitors to analyse the waves it finds.
- **Visual inspection:** can be used for internal or external surface inspection on a variety of products like bearing parts and other machinery it is also very cheap and not effective but it also has a much lower level of accuracy than other methods of inspection.
- **Dye penetrant:** is a non-destructive inspection technique where the product has a dye applied over the surface of it followed by the application of a developer and then placed under a UV light which causes any flaws within the product.
- **The production testing:** in a shoping area, its purpose is to provide an environment that simulates your actual production environment as closely as possible so you can test your application in conjunction with other operations.
- **Using another technique of inspection:** definition: inspection involves the measurements, tests and gauges needed to obtain characteristics in regard to an object or activity.
- **Sample testing:** when something is finished until it is tested used on products that require alot of time tested to e.g. steering columns, robot test lanes.
- **Remote visual inspection:** when visual aids are used to see objects from a distance or to deliver pictures in the places where the human eye cant see e.g. power chambers, turbine fan, turbine generator.
- **Automated optical inspection:** is a automated inspection of a object based on how the object appears and looks for imperfections before.
- **3D scanning:** you need to define any irregularities within the product by using software that can measure the surface that generate a 3D model of the product.

## Carrying out a quality control process by measuring accurately using Vernier callipers

I used Vernier callipers to get clear and accurate measurements by applying the same amount of force to the product in order to not squash the product. I remembered to keep the product straight to get the most accurate measurements out of it and to also constantly reset the callipers to allow for the most accurate measurements possible.



## Comparison tables – CNC v Manual



The comparison tables above show that in the CNC batch the biggest difference in quality was in the slot width where there was a 0.05mm difference. In the Manual batch the biggest difference was in the length of the smaller boss where there was a 0.1mm difference.

As expected though, there was a much bigger difference across all of the quality control measurements of the whole batch for the manually produced batch as CNC production is much more accurate.

# What will I do in Engineering?

**2 lessons of 4 is coursework  
2 lessons out of 4 is skills**

## Year 9: You will...

- Carry out a range of Mini projects embedding and developing skills and knowledge in the use of Engineering machinery.
- Develop Practical skills in a range of processes including turning on the lathe, milling, drilling, forming and bending.
- Develop your confidence in the use of the Engineering Lathe and Milling machines.
- Along side this you will begin your R110 and prepare for the external examination by learning and revising the key information required.

## Year 10:

You will continue to develop your manufacturing skills through a range of different challenges in metals.

You will also continue the coursework by completing R111.

In addition you will also be preparing for the R109 examination.

## Year 11:

This year will focus on testing and analysing a range of materials – investigating a range of ways in which materials and tolerances can be tested.

Students will complete their R112 and where necessary refine any elements from the previous units.





**SOUTHAM COLLEGE**  
**ENGINEERING**  
 Year 11 Cambridge Nationals

INFORMATION

✓ **Course Outline**  
 Exam Board: OCR Course Code: J842  
 25% Examination, 75% Coursework Assessment

✓ **Key Dates**  
 External Exam: Thursday 9th January 2020

✓ **Focussed Deadlines**  
 R110 End of September 2019—25%  
 R111 End of November 2019—25%  
 R112 February half term 2020—25%

✓ **Class Learning:** OCR Cambridge Nationals in Engineering Manufacture  
 The students will learn to read B.3.8888 drawings and operate the tools and equipment used to make products from the requirements of a design specification, using CAD/CAM, and CNC equipment. The theory element for the examination is delivered throughout the course.  
 Students will be working independently in lessons with the support of their teacher to complete their coursework portfolio. This will be a combination of ICT focussed elements, Prototyping and manufacturing of their final product. All students should be making the most of the time and support available during lesson time especially when writing up their course work as access to ICT is limited.

✓ **Exam Preparation and Revision:** Students will also receive scheduled lessons where the knowledge and content of the course will be delivered and reinforced. Students will be working in their theory books - all information will be used to support and enhance their revision. Remember the exam is worth 25% of your course and a pass grade is required.

✓ **Online Support:**  
 Exam Specification  
<https://www.ocr.org.uk/qualifications/cambridge-nationals/engineering-manufacture-level-1-2-award-certificate-j832-j842/assessment/>  
 Knowledge support  
[www.technologystudent.com](http://www.technologystudent.com)



Southam  
College

*Possible careers that can lead from a qualification in Engineering.*

- Aerospace Engineer
- Tool Maker
- Production Line Supervisor
- Automotive,
- Fabricator
- Manufacture,
- Civil Engineering
- Construction,
- Product Engineer
  
- Plus many more.....

Engineering Careers



Who is this course suitable for?

- A students who is creative and inventive, hardworking and gives of their best in all that they do.
- To have good mathematical and literacy skills.
- To have good drawing and making skills.
- To have a will to change and alter and modify models and products over and over to generate a completed and effective product.
- To be resilient and not give up – to persevere to change and alter designs – It wont work first time.
- To remember that the course is 50% practical and 50% theory, Do not expect to make in every lesson.