

**EMMANUEL COLLEGE**  
**THE TECHNOLOGY DEPARTMENT**  
 Cambridge National – Engineering Manufacture



<b>OCR Engineering Manufacture</b>		
<b>Year 10</b>	<b>Autumn, Half-Term 1</b>	<b>Autumn, Half-Term 2</b>
<b>Unit Title</b>	R109: Engineering Materials, Processes, and Production  Learning Outcome One: Know about properties and uses of engineering materials.	R109: Engineering Materials, Processes, and Production  Learning Outcome Two: Understand engineering processes and their application.
<b>Key Question (s)?</b>	How do you categorise the properties and applications of engineering materials?	How can engineering processes be used effectively to create a successful engineered product?
<b>Threshold Concepts</b>	Students will know about, understand and be able to apply knowledge to different types of engineering materials.  Students will apply their knowledge via a practical application of metals and processes theory to produce a functional engineered product. Part of which will include an element of their coursework portfolio.  Students will also become well-versed in exam technique via regular exam technique practice and be able to apply they key engineering terminology via formal and summative assessment.	Students will know about, understand and be able to apply knowledge of the engineering process.  Continuation of regular exam technique practice via tailored methods of feedback.
<b>Link to Prior Learning</b>	This unit builds upon students' previous experience of working with tools and machines in Year 7. They are introduced to machining, Computer Numerical Control (CNC) and scales of manufacturing in Year 8. Finally, they are introduced to Computer Aided Design/Computer Aided Manufacture (CAD/CAM) and the environment/sustainable manufacturing in Year 9. This unit also introduces several new concepts including robotics, automation, and in-depth knowledge of traditional, smart, and modern materials.	This unit builds upon students' previous knowledge of machine and hand tools, mechanisms, including motion, levers, cams, pulleys, and gears in Year 8. Students are also familiar with electronic systems which they are first introduced to in Year 8 and then again in Year 9.  By Year 9, students will have a basic understanding of engineering processes. This unit requires students to build upon their foundation of knowledge and be able to apply it to real-life scenarios.
	<b>Spring, Half-Term 1</b>	<b>Spring, Half-Term 2</b>
<b>Unit Title</b>	R109: Engineering Materials, Processes, and Production	R110: Preparing and Planning for Manufacture

<p><b>Key Question (s)?</b></p>	<p>How can the use of CNC equipment impact the quality of engineering manufacture?</p> <p>How can modern technologies impact the speed/efficiency in which engineered products are manufactured and research is conducted?</p>	<p>How does effective planning of a sequence of events impact the speed in which a prototype is successfully manufactured?</p> <p>Can the selection of engineering skills determine the quality of a prototype?</p> <p>How can a production plan/method be speedily adapted to take a product to mass production?</p>
<p><b>Threshold Concepts</b></p>	<p>Students will know about, understand and be able to apply knowledge of:</p> <p>LO3: Applications of computer-controlled production processes, i.e.:</p> <ul style="list-style-type: none"> <li>• CNC machining processes.</li> <li>• The use of lasers to manufacture/improve quality control.</li> <li>• Additive manufacturing and rapid prototyping processes.</li> </ul> <p>LO4: The impact of modern technologies in engineering production, i.e.:</p> <ul style="list-style-type: none"> <li>• Automation of processes and their impact on output, quality, the workforce, and costs.</li> <li>• The effective use of digital communications in research and development, material supply and control, and global manufacturing.</li> </ul> <p>Continuation of regular exam technique practice via tailored methods of feedback.</p>	<p>Students will know about, understand and be able to apply knowledge of:</p> <p>LO1: Skills required to be able to plan for manufacture, i.e.</p> <ul style="list-style-type: none"> <li>• Interpretation of 2D and 3D engineering drawings.</li> <li>• Standard drawing conventions.</li> <li>• Production plans for the making of a pre-production product.</li> </ul> <p>LO2: Selection of engineering processes to create a successful product, i.e.:</p> <ul style="list-style-type: none"> <li>• Appropriate processes for making a pre-production product.</li> <li>• How to use tools and equipment when making products.</li> <li>• How to follow safe working procedures when using tools and equipment.</li> <li>• How to use Personal Protective Equipment (PPE) appropriately.</li> <li>• Use quality control checks.</li> </ul> <p>LO3: Appropriate scales of manufacture and their impact on production plans, i.e.:</p> <ul style="list-style-type: none"> <li>• Consideration of scales of manufacture.</li> <li>• Impact of quantities of production on production plans.</li> </ul> <p>Continuation of regular exam technique practice via tailored methods of feedback.</p>
<p><b>Link to Prior Learning</b></p>	<p>This unit builds upon students' knowledge gained throughout Years 7, 8 and 9 where they learn about CNC machines and processes, and scales of manufacture. There are many new concepts in this unit which require students to use knowledge gained in Learning Outcomes 1 and 2, particularly in material and processes in order to understand these new concepts.</p>	<p>This unit builds upon students' knowledge gained in Years 7, 8 and 9 via safe use of machines and equipment in the workshops, the use of engineering drawings, methods of quality control and being able to plan for successful manufacture of products.</p>
	<p><b>Summer, Half-Term 1</b></p>	<p><b>Summer, Half-Term 1</b></p>

<b>Unit Title</b>	R110: Coursework Portfolio	R111: Computer Aided Manufacturing
<b>Key Question (s)?</b>	Students will be completing their coursework, with limited guidance and questioning occurring in lessons, due to JCQ coursework legislation.	<p>What important factors need to be considered when planning for CNC manufacture?</p> <p>How essential are engineering drawings in creating 3D models?</p> <p>What checks are required to safely operate CNC equipment?</p> <p>What are the modern developments in engineering production?</p>
<b>Threshold Concepts</b>	Students are given a prescribed product to plan for manufacture. This will include students creating working engineering drawings to manufacture the product, applying safe working procedures with tools and equipment, and conducting quality control on the product. Students will demonstrate this in their individual completion of their coursework portfolio.	<p>Students will know about, understand and be able to apply knowledge of:</p> <p>LO1: Factors to consider when producing CNC machining plans, i.e.:</p> <ul style="list-style-type: none"> <li>• Planning for CNC operations.</li> <li>• Scale of manufacture – waste minimisation.</li> <li>• Type of CNC machines.</li> <li>• Types of CNC tooling.</li> <li>• Programming of CNC machines including speed and feed rates.</li> </ul> <p>LO2: Interpret CAD information to safely run CNC machines, i.e.:</p> <ul style="list-style-type: none"> <li>• Use of CAD packages.</li> <li>• Factors to consider when performing CNC machining operations.</li> </ul> <p>LO3: Be able to set-up and use CNC equipment, i.e.:</p> <ul style="list-style-type: none"> <li>• Procedures for setting up CNC equipment.</li> <li>• Procedures to produce products to a given specification.</li> <li>• Methods used to compare manually, and CNC produced products.</li> </ul> <p>LO4: Know about modern methods of computer-controlled processes, i.e.:</p> <ul style="list-style-type: none"> <li>• Applications of computer control.</li> <li>• Rapid prototyping.</li> <li>• Manufacturing processes.</li> <li>• Use of robotics in industry.</li> <li>• Application of CNC processes for different scales of manufacture.</li> </ul>

		Continuation of regular exam technique practice via tailored methods of feedback.
<b>Link to Prior Learning</b>	Students will be required to apply knowledge gained across Year 10 in units R109 and R110 to successfully complete their coursework.	Students will build on their prior knowledge from Year 7, 8 & 9, specifically in manufacturing processes and use of CAD software to create 3D models. Students will apply their foundation of knowledge to get to grips with the new concepts in this unit.
<b>Knowledge and Sequencing Rationale</b>	<p>The structuring of this course allows students to build upon topics they have been introduced to in KS3 and deepen this knowledge whilst being introduced to the more complex concepts in each unit. The sequence of learning is designed to enable students to have acquired the knowledge they need to apply it using the skills they have gained across the 'theory' units.</p> <p>This will then be applied to the completion of students' coursework. Coursework will be completed independently.</p>	

<b>OCR Engineering Manufacture</b>		
<b>Year 11</b>	<b>Autumn, Half-Term 1</b>	<b>Autumn, Half-Term 2</b>
<b>Unit Title</b>	Exam revision for January	R111: Coursework Portfolio
<b>Key Question (s)?</b>	What is the question asking you to do?	Students will be completing their coursework, with limited guidance and questioning occurring in lessons, due to JCQ coursework legislation.
<b>Threshold Concepts</b>	Consolidation of unit R109 theory. Exam technique practise. Students will be required to recall concepts in detail and apply their knowledge to set scenarios to successfully complete their one-hour exam.	Students are given a prescribed product to plan for manufacture. This will include students creating working engineering drawings to manufacture the product, applying safe working procedures with tools and equipment, and conducting quality control on the product. Students will demonstrate this in their individual completion of their coursework portfolio.
<b>Link to Prior Learning</b>	Students will revisit concepts covered in units R109 – R111.	Students will be required to apply knowledge gained across Year 10 in units R109 – R111 to successfully complete their coursework for this unit.
	<b>Spring, Half-Term 1</b>	<b>Spring, Half-Term 2</b>
<b>Unit Title</b>	R112: Quality Control of Engineered Products	R112: Coursework Portfolio
<b>Key Question (s)?</b>	<p>How important is quality control in the manufacture of engineered products?</p> <p>How do we inspect quality of engineered products?</p> <p>How can modern technologies be used for quality control?</p> <p>How do we apply principles of lean manufacturing?</p>	Students will be completing their coursework, with limited guidance and questioning occurring in lessons, due to JCQ coursework legislation.

<p><b>Threshold Concepts</b></p>	<p>Students will know about, understand and be able to apply knowledge of:</p> <p>LO1: Understand the importance of quality control:</p> <ul style="list-style-type: none"> <li>• Reasons for implementing quality control and its impact on the quality of products.</li> <li>• Quality control procedures and how to safely apply them.</li> </ul> <p>LO2: Be able to assess product quality via inspection techniques:</p> <ul style="list-style-type: none"> <li>• Quality control techniques used in stages of production.</li> <li>• Application of inspection checks.</li> <li>• Use of specialist inspection equipment.</li> <li>• Techniques in evaluating product quality.</li> </ul> <p>LO3: Know about modern technologies in quality control:</p> <ul style="list-style-type: none"> <li>• Application of modern technologies to ensure a safe and high-quality product is produced.</li> </ul> <p>LO4: Know the principles of lean manufacturing:</p> <ul style="list-style-type: none"> <li>• Causes of waste in manufacturing.</li> <li>• Categories of waste.</li> <li>• Methods of reducing waste.</li> <li>• Sustainable design and its impact on the environment.</li> </ul>	<p>Students will inspect their manually and CNC produced coursework products through investigating, experimenting, and applying a range of quality control techniques. Students will demonstrate this in their individual completion of their coursework portfolio.</p>
<p><b>Link to Prior Learning</b></p>	<p>Students have covered sustainable design in Years 7, 8 and 9. Students will have a solid foundation of knowledge and practical application of quality control via their study of units R109 – R111.</p>	<p>Students will apply their knowledge of quality control techniques covered in units R109 – R111.</p>
	<p><b>Summer, Half-Term 1</b></p>	
<p><b>Unit Title</b></p>	<p>Exam revision for end of year exam</p>	
<p><b>Key Question (s)?</b></p>	<p>What is the question asking you to do?</p>	
<p><b>Threshold Concepts</b></p>	<p>Consolidation of unit R109 theory. Exam technique practise. Students will be required to recall concepts in detail and apply their knowledge to set scenarios to successfully complete their one-hour exam.</p>	

<b>Link to Prior Learning</b>	Students will revisit concepts covered in units R109 – R111.	
<b>Knowledge and Sequencing Rationale</b>	<p>The structuring of this course allows students to build upon topics they have been introduced to in Key Stage 3 and deepen this knowledge whilst being introduced to the more complex concepts in each unit. The sequence of learning is designed to enable students to have acquired the knowledge they need to apply it using the skills they have gained across the 'theory' units.</p> <p>This will then be applied to the completion of students' coursework. Coursework will be completed independently.</p>	