

Unit 1: The Engineered World

Scheme of work

Guided learning hours (GLH): 30

Number of lessons: 20

Duration of lessons: one/two hours (as shown)

This scheme of work is provided to help you make the most of your planning time. Customise this by adding your own activities/lesson ideas to the 'Activities' column.

Lesson	Unit content*	Activities	Links to other units
1		Tutor presentation (approx. 10 minutes) to introduce the unit: outline the nature of the learning aims and of the assessment that learners will be expected to complete.	
Learning aim A: Know about engineering processes used to produce modern engineered products			
1 (1 hour)	Topic A1 Engineering sectors and products Types of products from the following engineering sectors: <ul style="list-style-type: none"> aerospace automotive communications electrical/electronic mechanical biomedical chemical 	<ul style="list-style-type: none"> Tutor presentation, e.g. using PowerPoint or other presentation materials. Introduction to engineering, and how things have changed since the building of the pyramids 4000 years ago. Develop the idea of sectors, each responsible for a certain type of engineering. Group activity: Learners work in small groups to identify sectors associated with services/products. 	
2 (2 hours)	Topic A2 Mechanical and electrical/electronic engineering processes Processes including health and safety issues, characteristics, applications and	<ul style="list-style-type: none"> Tutor presentation, e.g. using PowerPoint or other presentation materials. Tutor presentation introduction to the use of machine tools for shaping materials. Demonstrations/video of drilling, milling and turning. 	Unit 2: Investigating an Engineering Project Unit 3: Health and Safety in Engineering Unit 7: Machining

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	<p>advantages/disadvantages of the following engineering processes:</p> <ul style="list-style-type: none"> • machining – turning, milling, drilling • forming – casting, forging 	<ul style="list-style-type: none"> • Learners record the typical uses of each piece of equipment. • Tutor-led discussion of safety issues associated with machining. • Tutor presentation introduction to forging and casting, using appropriate demonstration or video. 	Techniques
3 (2 hours)	<p>Topic A2 continued:</p> <p>Processes including health and safety issues, characteristics, applications and advantages/disadvantages of the following engineering processes:</p> <ul style="list-style-type: none"> • fabrication – welding, shearing • electrical/electronic – PCB manufacture, surface mount technology 	<ul style="list-style-type: none"> • Tutor presentation e.g. using PowerPoint or other presentation materials. • Tutor-led review of machining and forming • Discuss methods of joining together – welding, brazing and cutting by shearing. • Paired work: Learners produce a short presentation to explain the different types of welding and typical uses. • Activity: Discuss using soldering for making circuits. 	<p>Unit 2: Investigating an Engineering Project</p> <p>Unit 3: Health and Safety in Engineering</p> <p>Unit 7: Machining Techniques</p> <p>Unit 8: Electronic Circuit Design and Construction</p>
4 (2 hours)	<p>Topic A3 Scales of production</p> <p>Characteristics and advantages/disadvantages of the following scales of production used in engineering manufacture:</p> <ul style="list-style-type: none"> • one-off/jobbing production • batch production • mass production • continuous production 	<ul style="list-style-type: none"> • Tutor presentation e.g. using PowerPoint or other presentation materials. • Tutor-led discussion of the key features of the four scales of production. • Individual activity: Learners investigate products that are one-off, batch etc. • Plenary activity: Learners feed back their findings to the group. 	
5 (1 hour)	<p>Topic A4 Modern production methods</p> <p>Applications and advantages/disadvantages of the following modern production methods for production/assembly lines:</p> <ul style="list-style-type: none"> • robots 	<ul style="list-style-type: none"> • Tutor presentation e.g. using PowerPoint or other presentation materials. • Group discussion: What is a robot? Discuss the types of robot that can be used (ROVs, assembly etc). • Individual activity: Learners to select one type of robot and investigate how the use of their robot has impacted engineering. The results should be presented as a report 	Unit 6: Computer-aided Engineering

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	<ul style="list-style-type: none"> CNC machinery 	<p>or presentation.</p> <ul style="list-style-type: none"> Plenary discussion: CNC equipment, and links to CAD CAM. Demonstrate CNC equipment in use and explain why using CNC equipment is beneficial. Paired activity: Learners investigate the advantages and disadvantages of using CNC equipment. 	
Learning aim B: Know about developments in engineering materials and technologies			
6 (1 hour)	<p>Topic B1 Modern and smart materials in engineering</p> <p>Applications, characteristics, properties and advantages/disadvantages of the following modern and smart materials used in engineering:</p> <ul style="list-style-type: none"> Modern composite materials <ul style="list-style-type: none"> GRP carbon fibre Kevlar® 	<ul style="list-style-type: none"> Tutor presentation e.g. using PowerPoint or other presentation materials. Group discussion to consider composites. Uses, features and reasons for use. Discuss use of composites in racing cars, aircraft and as safety materials. Individual activity: Learners to research and record their findings. 	Unit 5: Engineering Materials
7 (1 hour)	<p>Topic B1 continued:</p> <p>Applications, characteristics, properties and advantages/disadvantages of the following modern and smart materials used in engineering:</p> <ul style="list-style-type: none"> Modern high performance materials <ul style="list-style-type: none"> tungsten titanium nickel/cobalt super alloys ceramics 	<ul style="list-style-type: none"> Tutor presentation e.g. using PowerPoint or other presentation materials. Group discussion to review composites. Expand to consider high performance metals. Discuss use of high performance metals in vehicles, sports equipment, turbines. Individual activity: Learners to research and record their findings. 	Unit 5: Engineering Materials

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8 (1 hour)	<p>Topic B1 continued: Applications, characteristics, properties and advantages/disadvantages of the following modern and smart materials used in engineering:</p> <ul style="list-style-type: none"> • Smart materials <ul style="list-style-type: none"> ○ SMAs ○ shape memory polymers ○ electrochromic materials ○ piezoelectric actuators and transducers 	<ul style="list-style-type: none"> • Tutor presentation e.g. using PowerPoint or other presentation materials. • Review learning of composites and high performance materials. Introduce the idea of smart materials – ones that react to changes in the environment. • Use video clips to show smart materials in use. • Group activity: Small groups to produce a presentation about their given smart material. • Plenary activity: Learners feed back their findings to the whole group. 	Unit 5: Engineering Materials
9 (1 hour)	<p>Topic B2 Modern material foams in engineering Applications, characteristics and advantages/disadvantages of metallic foams as used in the automotive, biomedical and aerospace sectors e.g. aluminium, steel.</p>	<ul style="list-style-type: none"> • Tutor presentation e.g. using PowerPoint or other presentation materials.. • Tutor introduction to the concept of metal foams, and principals associated with them. • Individual activity: Learners produce a fact sheet about metal foams and their uses. 	Unit 5: Engineering Materials
10 (1 hour)	<p>Topic B3 Modern material processes in engineering Process, applications, characteristics and advantages/disadvantages of powder metallurgy:</p> <ul style="list-style-type: none"> • powder mixing/blending • pressing/compacting • sintering 	<ul style="list-style-type: none"> • Tutor presentation e.g. using PowerPoint or other presentation materials.. • Show a short video of powder metallurgy, followed by tutor led discussion about powder metallurgy. • Group activity: Learners investigate products that are engineered using powder metallurgy. • Plenary activity: Groups to present their findings. 	Unit 5: Engineering Materials
11 (2 hours)	<p>Topic B4 New technologies in engineering Applications, characteristics and advantages/disadvantages of the</p>	<ul style="list-style-type: none"> • Tutor presentation e.g. using PowerPoint or other presentation materials. • Tutor-led discussion: What do learners consider new technologies to be? 	Unit 5: Engineering Materials

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	following new technologies used in engineering sectors: <ul style="list-style-type: none"> optical fibres in communication hydrogen fuel cells surface nanotechnologies 	<ul style="list-style-type: none"> Video presentation: Use appropriate video clips to demonstrate optical fibres, fuel cells and surface nanotechnologies. Activity: to investigate the benefits of using these technologies over traditional methods. 	
12 (2 hours)	Topic B4 continued: Applications, characteristics, properties and advantages/disadvantages of the following new technologies used in engineering sectors: <ul style="list-style-type: none"> telematics blended wing bodies bionics 	<ul style="list-style-type: none"> Tutor presentation e.g. using PowerPoint or other presentation materials. Review prior understanding of new technologies. Give a brief introduction into telematics, blended wing bodies and bionics. Activity: Learners to investigate the potential uses of the three new technologies. 	Unit 5: Engineering Materials
Learning aim C: Understand how engineering contributes to a sustainable future			
13 (1 hour)	Topic C1 Sustainable engineered products Characteristics, applications and advantages/disadvantages of LCA at the following stages for engineered products: <ul style="list-style-type: none"> raw materials extraction material production 	<ul style="list-style-type: none"> Tutor presentation e.g. using PowerPoint or other presentation materials. Tutor-led discussion introducing Life Cycle Assessment (LCA) and the six stages. Introduce concepts of raw material extraction and material production. Activity: Learners investigate the impacts of material extraction and production and produce a presentation. 	Unit 2: Investigating an Engineering Product Unit 5: Engineering Materials
14 (1 hour)	Topic C1 continued: Applications, characteristics, properties and advantages/disadvantages of LCA at the following stages for engineered products: <ul style="list-style-type: none"> production of parts assembly 	<ul style="list-style-type: none"> Tutor presentation e.g. using PowerPoint or other presentation materials. Tutor-led review of LCA and stages covered so far. Tutor introduction to production of parts and assembly. Activity: Learners to produce presentation covering the two topics of production of parts and assembly. 	Unit 2: Investigating an Engineering Product

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15 (1 hour)	<p>Topic C1 continued: Applications, characteristics, properties and advantages/disadvantages of LCA at the following stages for engineered products:</p> <ul style="list-style-type: none"> • use • disposal/recycling 	<ul style="list-style-type: none"> • Tutor presentation e.g. using PowerPoint or other presentation materials. • Tutor-led review of LCA and the stages covered so far. • Tutor introduction to product use and disposal/recycling • Activity: Learners to produce their presentation covering the two topics of use and disposal. 	Unit 2: Investigating an Engineering Product
16 (2 hours)	<p>Topic C2 Minimising waste production in engineering Characteristics, applications and advantages/disadvantages of minimising waste production throughout the life cycle of engineered products, using the four Rs:</p> <ul style="list-style-type: none"> • Reduce materials and energy. • Reuse materials and products where applicable. 	<ul style="list-style-type: none"> • Tutor presentation e.g. using PowerPoint or other presentation materials. • Tutor-led activity to discuss the four Rs – why are they important and how do they influence engineering? • Activity: Learners to identify methods to reduce energy use in manufacturing, and methods to reuse materials and products. Their findings to be recorded. 	
17 (2 hours)	<p>Topic C2 continued: Characteristics, applications and advantages/disadvantages of minimising waste production throughout the life cycle of engineered products, using the four Rs:</p> <ul style="list-style-type: none"> • Recover energy from waste • Recycle materials and products or use recycled materials 	<ul style="list-style-type: none"> • Tutor presentation e.g. using PowerPoint or other presentation materials. • Tutor-led discussion reviewing reduce and recover. Introduce concepts of recovery and recycling. • Activity: Learners to identify methods to recover energy from waste, and also the processes used to recycle two different products. Their findings to be recorded. 	
18 (2 hours)	<p>Topic C3 Lean manufacturing Characteristics, applications and advantages/disadvantages of minimising waste at the production stage in</p>	<ul style="list-style-type: none"> • Tutor presentation e.g. using PowerPoint or other presentation materials. • Tutor led discussion – what is lean manufacture? Discuss each of the three methods in turn. 	

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	<p>engineering, using the following lean manufacturing techniques:</p> <ul style="list-style-type: none"> • Just-in-Time • Kaizen • poka-yoke 	<ul style="list-style-type: none"> • Paired activity: Learners describe the similarities and differences between the three. Findings to be recorded. • Individual activity: Learners to look at how one method is used by an engineering company, explaining how efficiency is improved as a result. 	
19 (2 hours)	<p>Topic C4 Renewable sources of energy in engineering</p> <p>Processes, characteristics, applications and advantages/disadvantages of using the following renewable sources of energy in engineering:</p> <ul style="list-style-type: none"> • wind energy using turbines and wind farms • solar energy using photovoltaic cells and solar water heaters 	<ul style="list-style-type: none"> • Tutor presentation e.g. using PowerPoint or other presentation materials. • Tutor-led discussion to find prior knowledge of renewable energy. • Paired activity: One member of the pair to investigate wind energy, the other solar energy. They then teach each other what they have learnt. The joint findings are then recorded. 	
20 (2 hours)	<p>Topic C4 continued:</p> <p>Processes, characteristics, applications and advantages/disadvantages of using the following renewable sources of energy in engineering:</p> <ul style="list-style-type: none"> • hydro energy using dams, barrages and wave power • geothermal energy using heat pumps and exchangers 	<ul style="list-style-type: none"> • Tutor presentation e.g. using PowerPoint or other presentation materials. • Discuss the findings from the previous week; consider the benefits etc, of the two sources considered. • Paired activity: Pairs to consider hydro energy and geothermal energy. Learners to record their research. 	
TOTAL: 30 hours			

*See the specification for full details of unit content.