Royal Academy of Engineering

Engineering teaching and learning resources guide

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What are these materials and which qualifications do they support?

We're creating nine modules, each containing two to four learning resources, which include practitioner and learner versions, activity sheets, a film and an online interactive tool, to support the delivery of selected components of engineering and manufacturing-related qualifications at levels 2 and 3. The supported qualifications include Level 3 BTEC courses in engineering and manufacturing and the new T Level in engineering and manufacturing.

Why have they been produced?

The Royal Academy of Engineering works in partnership with practitioners and engineers to develop engineering-themed learning and teaching resources that engage and inspire learners about careers in engineering. We understand the pressure on practitioners and have created these resource with that in mind. They provide access to modern industry and links to new innovations and emerging technologies.

What topics do they support?

The complete set of modules will support nine topic areas:

1. Sustainability
2. Innovation and emerging technologies
3. Microcontroller systems
4. Robotics
5. Renewable energy
6. Battery technologies
7. Engineering materials
8. Electrical machines
9. CNC machinery

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What materials are included for each topic area?

The module for each topic area includes:

Practitioner resource slides	Two to four sets of learner-facing slides provide theory, real-world discussion questions, written activities and other stimulus material to help you deliver at least 60 minutes of learning time per resource. Each resource includes a practitioner introduction and detailed practitioner delivery notes under each slide.
Learner resource slides	Learner versions of each set of resource slides, without the practitioner introduction and delivery notes.
Learner activity sheets	Printable activity sheets to support the written activities in each resource.
Film	A two- to three-minute film introduces the topic and provides inspirational real-world examples and ideas for learner reflection.
Online interactive tool	Each module (except Innovation and emerging technologies) includes an online interactive tool that supports a learning activity in one resource. Each tool brings complex concepts to life or provides a realistic mathematical simulation of a system or process.

A full list of the resources available in each module follows.

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Resources list

Module	Film	Interactive	PPT resources	Level	Pre-requisites
Sustainability (Sus)	✓	✓	1. Circular lifecycles and sustainability	2	None
			2. Sustainability and my career	3	Sus 1
Innovation and emerging technologies (Inn)	✓		1. What is innovation?	2	None
			2. Innovation and change	3	Inn 1
Microcontroller systems (Mic)	✓	✓	1. Mechatronic systems and control	2	None
			2. Sensors and signals	3	Mic 1
			3. Understanding control processes	3	Mic 1 and 2
			4. Pulse width modulation	3	Mic 1, 2 and 3
Robotics (Rob)	✓	✓	1. Introducing robotics	2	Mic all
			2. Industrial robotics design principles	3	Mic all and Rob 1
			3. Control and coordinates	3	Mic all, Rob 1 and 2
			4. Planning for safety and performance	3	Mic all, Rob 1, 2 and 3
Renewable energy (Ren)	Coming soon				
Battery technologies (Bat)	Coming soon				
Engineering materials (Eng)	Coming soon				
Electrical machines (Ele)	Coming soon				
CNC machinery (CNC)	Coming soon				

Do the materials provide complete topic coverage?

The materials introduce each module's topic area and stimulate learners to explore and reflect on key concepts. They are designed to complement and enhance practitioners' own lesson materials and schemes of work.

The core activities in each resource provide around 60 minutes of learning time, though additional suggestions, including independent learning, can extend this time significantly. Each module therefore provides two to four hours of learning time, excluding extension activities.

What guidance is there to help me, or to help my learners?

Practitioner introduction and overview

At the start of each set of resource slides you will find a practitioner introduction and overview. This shows you:

- how many resources the topic module includes
- the overarching questions about the topic that the resources together seek to ask and answer
- a brief overview of what the resources explore
- detailed learning outcomes and subject converge for that resource
- how the module links to other module topics in the programme.

Practitioner delivery notes

Each slide in the practitioner version of the resources provides detailed practitioner delivery notes that include step-by-step suggestions for delivering the activity, which activity sheet to use (if relevant), when to use the film and online interactive tool, example answers (where these are not provided on a following slide), assessment suggestions and, on selected slides, ideas for extension activities.

Activity sheet numbering

The activity sheet numbers are referenced on the relevant slides. Where an activity is spread across more than one slide, each part of the activity is referenced, for example activity 1a.

Slide icons

Icons on each slide signpost when to use activities or materials:

	Learner discussion or activity sheet questions.
	Which activity sheet to use, if relevant.
	Watch the film during or after this activity – see the practitioner delivery notes on the relevant slide.
	Use the online interactive tool with this activity – see the practitioner delivery notes on the relevant slide.

How do I get started?

The resources are ready to use with minimal preparation unless you also wish to deliver some of the extension suggestions. We suggest that you follow these steps.

1. Identify which topics you would like to enhance with these resources.
2. Browse the resources for these topics to review the subject coverage, learning outcomes and activities.
3. Review the delivery notes to plan how you'll deliver and adapt to suit your learners' unique needs.
4. Have the resource slides ready to project and, where appropriate, internet access available for the film and online interactive tool.
5. Print copies of the activity sheets and learner versions of the resource slides, or make these available digitally to your learners.

Is prior learning required?

Generally, no, but where one resource should be done as a prerequisite this is made clear in the practitioner overview slides. For example, learners should complete the Microcontroller systems resources before moving onto the Robotics module.

Many topics are interrelated and we also highlight these opportunities in the practitioner overview slides. However, there is one module – Sustainability – that we recommend your learners complete before any others.

How do the materials support progression?

Each module includes a Level 2 resource that provides a bridge between learners' current knowledge and the Level 3 content. The Level 2 resource helps you to develop a baseline understanding of learners' current knowledge, introduces some key concepts, and begins to develop their understanding.

The remaining resources in each module support Level 3 content. Resources in each topic area should be completed in sequence.

What wider learning outcomes do the materials support?

We think it's important that the activities help learners to develop their wider employability – and raise their awareness of the employment options ahead of them. Where appropriate the activities also embed:

- **Careers** – stimulus slides that introduce engineering and manufacturing careers, and help learners to reflect on their career aspirations and planning.
- **Maths** – real-world examples of using mathematics, with supporting questions, worked examples and complete answers, that help learners to develop the mathematical skills that underpin their engineering knowledge and understanding.
- **Health and safety** – classroom activities and links to workshop practice, industry placements or work experience that help learners to become reflective employees who take steps to work safely and protect themselves and others around them.
- **Sustainability** – how innovations or improved practices in engineering or manufacturing can contribute to greater sustainability.

These links are listed in the detailed subject coverage in the practitioner overview slides at the start of each resource.

What extension activities can I deliver?

Selected slides provide ideas for extension activities including external web links and videos to watch, practical activities, ways to link your classroom learning to industry placements or work experience, or links to information about specific engineering and manufacturing careers.

We suggest that, when planning your delivery, you use the delivery notes and extension suggestions to help you think about how to link your classroom learning to your:

- practical workshop activities
- industry placements or work experience opportunities for learners
- industry partner visits or talks
- broader careers support programme.

Can I modify the slides?

If you wish to modify the slides in any way, you must contact the Academy at FurtherEducation@raeng.org.uk

How do I provide feedback or report a broken external link?

If you have feedback or would like to report a broken external link in the 'Extension' notes under any activity, please email FurtherEducation@raeng.org.uk

About the Royal Academy of Engineering

The Royal Academy of Engineering is harnessing the power of engineering to build a sustainable society and an inclusive economy that works for everyone.

In collaboration with our Fellows and partners, we're growing talent and developing skills for the future, driving innovation and building global partnerships, and influencing policy and engaging the public.

Together we're working to tackle the greatest challenges of our age.

What we do

Talent & Diversity:

We're growing talent by training, supporting, mentoring and funding the most talented and creative researchers, innovators and leaders from across the engineering profession.

We're developing skills for the future by identifying the challenges of an ever-changing world and developing the skills and approaches we need to build a resilient and diverse engineering profession.

Innovation:

We're driving innovation by investing in some of the country's most creative and exciting engineering ideas and businesses.

We're building global partnerships that bring the world's best engineers from industry, entrepreneurship and academia together to collaborate on creative innovations that address the greatest global challenges of our age.

Policy & Engagement:

We're influencing policy through the National Engineering Policy Centre – providing independent expert support to policymakers on issues of importance.

We're engaging the public by opening their eyes to the wonders of engineering and inspiring young people to become the next generation of engineers.