The Royal Institution Engineering Masterclasses
Speakers and Helpers
The Royal Institution

The Royal Institution (Ri) is an independent charity dedicated to connecting people with the world of science, and has been since it was founded in 1799 to teach science to the public for ‘the common purposes of life’. It is one of the oldest independent scientific bodies in the world.

From the start, the Ri fostered some of the most talented scientists of the time. These scientists produced ground-breaking research and enthralled audiences with lectures and hair-raising demonstrations that explored cutting edge science and made the Ri immensely popular with the public.

The CHRISTMAS LECTURES® at the Royal Institution began in 1825 and are now televised each year, reaching an international audience of several million people. Following Professor Sir Christopher Zeeman's mathematics-themed CHRISTMAS LECTURES in 1978 and the enthusiastic response by young people to the topic, mathematics masterclasses were started in London. These classes were to provide a means for mathematically talented adult volunteers with teaching skills to inspire and share their passion for mathematics with young people. The mathematics masterclass network has since grown to be nation-wide, and celebrated its 30th anniversary in 2011. Since 2009, the Royal Institution has been running a small but growing network of extremely well received engineering masterclasses.

The Engineering Masterclass Programme

Royal Institution Engineering Masterclasses are designed to encourage, inspire and engage young people in the art and practice of engineering. The highly interactive sessions introduce students to a wide range of engineering subjects, both well-founded and cutting edge. The students will encounter science and mathematical theory which is not usually covered in the school curriculum. The aim is to open young people's eyes to the excitement, beauty and real-world value of science, mathematics and engineering.

Masterclasses are organised regionally and take place on Saturday mornings, with students gifted in STEM (Science, Engineering, Technology and Maths) subjects attending from local schools. There are typically six 2½ hour classes in each series, with each class being given by a different speaker who is passionate about sharing their own engineering experiences and enthusiasm for the subject. Speakers come from a variety of industries, academia and teaching, and class topics range from hip joint design to bridge building, rocket science and DNA extraction. The Masterclass team at the Ri offers support to speakers in developing their own class and working with masterclass groups.

Students attend all sessions in a series, allowing them to be introduced to a wide variety of topics covering diverse areas of engineering. Masterclass series can contribute to a positive shift in attitude towards STEM subjects by inspiring and enthusing students, and allowing them to enjoy investigating a range of ideas and applications.
**What makes an Ri Masterclass?**

Typically a masterclass lasts around two and a half hours, including a break – the actual class should be at least two hours to enable to students to explore the topic thoroughly. Masterclasses usually take place on Saturday mornings during term-time. Local masterclass organisers should be able to give exact details on the format and timing of their series.

Topics for classes should contain challenging maths and science, and should be outside the normal curriculum. Classes should not involve simply teaching students material which they will meet later in their school career. They should introduce students to new ideas or different applications of STEM subjects in order to extend and enrich their experience and introduce them to cutting edge engineering.

The majority of the session should be given over to a hands-on activity such as a design/build/test type of project. We recommend at least one hour of the whole session be devoted to this. We strongly encourage speakers to develop a project that involves freedom of design. Students respond well to elements of competition and to elements of realism introduced into the project, such as those often experienced in the real world of engineering. Prior to the activity, the speaker introduces relevant theory that underpins the project work. The most effective teaching style is to alternate the formal teaching sections used to present the theory with the hands-on work, during which students work individually or in small groups to achieve the objective.

**Masterclass attendees**

Currently, masterclass series are for students in Year 9 (England & Wales), S2 (Scotland) or Year 10 (Northern Ireland); i.e. students who will turn 14 before the end of the academic year.

The classes are aimed at those most interested and able in STEM subjects and project work. They will be from a range of backgrounds, and there are not usually more than a few students from each individual school. The size of the class depends on the venue and resources, but most classes are around 30 students.

**Masterclass helpers**

Helpers attend masterclasses in order to assist the students with the problems and activities. They could be teachers, STEM Ambassadors, university science or engineering students or STEM PGCE students. Helpers are able to develop their own teaching skills as well as pick up ideas for topics and activities which they could use in their own teaching or outreach. Many groups organise a rota of teacher helpers from the schools who have nominated students.
In order to assist the students effectively, helpers need to have a good STEM background. They are unlikely to be given the masterclass material in advance, but as all technical aspects should be explained in the class they should be able to learn alongside the students.

Helpers could attend one, several or all sessions in a series. If they are experienced in working with children and young people and can attend the whole series, they may be able to volunteer to be pastoral carers and look after the general organisation of the class on the Saturday morning as well as the health and safety aspects of the class.

Masterclass speakers
The Masterclasses could not run without enthusiastic and interesting speakers. Speakers are typically chosen for their enthusiasm and ability to engage with the students as well as their engineering knowledge. They could be academics or from industry and should have a strong background in any part of engineering.

Each speaker has their own masterclass based on a topic they are interested in. This could be a topic from their research, something they use in their work or simply an area of engineering which has always excited them. The masterclass team at the Ri works with new speakers to help them develop their masterclass, including looking at timing and the suitability of questions and activities.

Speakers typically give at least one masterclass session a year at their local series. If they wish to do more there are masterclass groups across the country; many groups are able to pay expenses and perhaps also offer an honorarium.

Next steps
If you wish to get involved as a helper at a masterclass series or would like to become a speaker, please let us know via masterclasses@ri.ac.uk. We will then be in touch to discuss the options for getting involved in your local area.

If you would like to become a speaker, please have a think about possible topics for masterclasses. We can discuss your development needs and work with you to produce your masterclass. As the classes are very different to a typical lecture or lesson we can help you to design a suitable session, whether you are starting from scratch or have been doing outreach activities for a number of years. We also have a range of support materials available. In many areas of the country, we can arrange for you to take your project into an engineering club in a local school to test it out, and we can arrange for you to visit a masterclass to see what goes on.

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