Engineering GCSE

Curriculum Resource Pack
Contents

0 Introduction
1 Design and graphical communication
2 Engineered products
3 Application of technology
Introduction

The GCSE in Engineering is a nationally recognised and accredited qualification designed to provide you with a choice of routes into further education or employment. The GCSE in Engineering is a double award equal to two GCSEs. It is therefore twice the size of most GCSEs and represents twice the work that would normally be associated with a single award. The GCSE in Engineering is a 'vocational GCSE'. This means that it is directly relevant to anyone who may be thinking about a career in engineering.

The GCSE in Engineering provides opportunities for students to develop a variety of skills together with the basic knowledge and understanding that underpins the design and manufacture of engineered products. The course also provides students with an opportunity to make informed choices for further study and eventual employment.

This resource pack covers the three units that make up the Engineering GCSE Advanced VCE in Engineering programme. One section is devoted to each of the mandatory units and each section begins with a brief introduction to the unit before going on to explain what students should learn. Detailed information is then given relating to assessment and grading or external examinations (as appropriate). In all cases, however, it is essential for teachers to be aware of current information on assessment and moderation available from the relevant awarding body (i.e. Edexcel or OCR). Many schools and colleges will already have this information to hand but it can also be obtained from the appropriate awarding body’s website, i.e. www.edexcel.org.uk for Edexcel and www.ocr.org.uk for OCR.

Teaching and assessment strategies are discussed and the resources required for delivery of the unit are listed. Opportunities for developing links between units are identified together with a variety of student activities that can be used to generate evidence to support the development of a Key Skills portfolio.

A sample teaching scheme is included for each of the units. However, it is worth noting that many other schemes are possible and tutors should consider their own pattern of teaching before modifying or extending these schemes to their own situation.

A selection of masters for use as the basis for overhead projector transparencies and/or class handouts are provided within each section. Where appropriate, worksheets, examples, activities and investigations are also provided. Once again, tutors should consider the applicability of these materials before incorporating them into their own teaching programmes.
About the Engineering GCSE

Engineering covers a wide range of disciplines including mechanical, electrical, electronic, aeronautical, marine and automotive sectors and the Engineering GCSE enables students to develop a broad knowledge and understanding of the engineering industry, its organisation, products and processes through investigation, research and practical application.

In common with other GCSE qualifications in vocational subjects, the Engineering GCSE is designed to prepare students for employment, including work-based training, progression to level 3 qualifications and provide an insight into engineering for candidates pursuing other career pathways. The qualification will introduce the skills, knowledge and understanding needed in engineering.

The Engineering GCSE builds on students’ previous experience in a number of national curriculum subjects at Key Stages 1, 2 and 3 and satisfies the requirements for programmes of study at Key Stage 4 for Design and Technology in England.

The Engineering GCSE specification must consist of three units, as follows:

- Unit 1: Design and graphical communication
- Unit 2: Engineered products
- Unit 3: Application of technology

The specification requires students to demonstrate an ability to:

- recall and apply their knowledge, skills and understanding specified in the subject content in a range of vocational situations (AO1)
- plan and carry out investigations and tasks, using a range of tools, equipment, material, components and processes, in which they analyse vocational issues and problems; and gather, record and analyse relevant information, data and other forms of evidence (AO2)
- evaluate evidence, make reasoned judgements and present conclusions accurately and appropriately (AO3).

Each unit is separately assessed and the weightings for the Assessment Objectives are as follows:

<table>
<thead>
<tr>
<th>AO1</th>
<th>Unit 1</th>
<th>Unit 2</th>
<th>Unit 3</th>
<th>Whole qualification</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-45%</td>
<td>30-45%</td>
<td>45-70%</td>
<td>35-45%</td>
<td></td>
</tr>
<tr>
<td>30-45%</td>
<td>30-45%</td>
<td>15-30%</td>
<td>25-35%</td>
<td></td>
</tr>
<tr>
<td>30-45%</td>
<td>30-45%</td>
<td>15-30%</td>
<td>25-35%</td>
<td></td>
</tr>
</tbody>
</table>

The Engineering GCSE is particularly appropriate for young people who may wish to enter a career in engineering at a fairly early stage and who wish to progress to further studies at level 3 in an engineering or engineering-related subject. As a consequence, delivery of the qualification is greatly enhanced when a partnership exists between school and Further Education providers. Indeed, many of the successful 14-19 partnerships between schools and colleges are based on supporting and enhancing vocational GCSE awards and most of these schemes include the Engineering GCSE as an option for students at Key Stage 4.
Fact sheet for students

Congratulations on having chosen the GCSE Engineering course! This information fact sheet will give you some idea of what the course is all about and, more importantly, it will help you to set the context of what you are learning. Read through the questions and answers below and then complete the About the GCSE Engineering worksheet (your tutor will explain anything that isn’t clear).

What’s special about the GCSE in Engineering?

Quite a lot really! You already know that the GCSE is a nationally recognised qualification like the others that you are probably studying. However, the GCSE in Engineering is a little different from ordinary GCSEs because it is vocationally related. This basically means that the GCSE in Engineering can provide you with a fast-track route into Engineering as a career. The course is designed to lead you into employment in engineering or further study in engineering in a Further Education College. The GCSE in Engineering is also a Double Award. This means that it is equal to two GCSEs—in other words it’s twice the size of most GCSEs.

What is the GCSE Engineering about?

That’s easy—it’s about all aspects of designing and manufacturing and maintaining a huge variety of products used in industry and in the home. You will get a chance to design and manufacture an engineered product and you will experience all of the stages that this involves!

What does the course involve?

The GCSE Engineering course involves you studying three units and most people do this over two full school or college years. The three units of the course are:

Unit 1 Design and Graphical Communication
This unit is all about the design process and how to develop a design brief. You will learn a great deal about how to present your designs and this might involve quite a lot of sketching and drawing (including drawings that meet the appropriate international standards used in engineering companies).

Unit 2 Engineered Products
This unit will involve you interpreting product specifications, reading and interpreting drawings, selecting materials and creating a production plan. You will also use a variety of engineering tools and machines and you will be introduced to modern computer-aided manufacturing techniques as well as some basic hand skills. All of this will be immensely useful whichever branch of engineering you finally decide to work in.

Unit 3 Application of Technology
In this unit you will investigate the impact of modern technology on the design and manufacture of a variety of engineered products. You will learn about several new technologies and how they have helped to develop new design and manufacturing processes and, how they’ve made it possible to produce products that would previously have been unheard of!
How is the course assessed?

Each unit is individually assessed. The first two units are assessed on the basis of the portfolio evidence that you will provide. The third unit (Application of Technology) is assessed by means of an external examination. Your tutor will provide you with further information about the examination and the type of questions that you will be required to answer.

What do you mean by a portfolio?

A portfolio is simply a collection of documents including drawings, sketches, diagrams, notes and other items that you collect as you study the units. You will start building your portfolio as soon as you start studying Unit 1 (Design and Graphical Communication). As you progress through Unit 1 we would like you to think of this as your own Personal Design Portfolio (or PDP for short). This says a lot about you—it’s your personal property and, since it marks the beginning of your career as an engineer, you should look after it carefully!

How much practical work will I do?

We hope that you will be doing quite a lot! Engineering is about ‘doing’ and there’s a lot of ‘doing’ on this course/Unit 2 (Engineered Products), in particular, will involve you developing some basic hand skills and getting to know some of the tools, equipment and processes that engineers use in their everyday lives.

What can I do when I finish the course?

That’s up to you but there’s quite a wide range of options open to you. To some extent what you do next will depend not only on the grade that you obtain in the Engineering GCSE but also in other GCSE subjects, such as Mathematics and Science. Assuming that you obtain five GCSE passes with reasonably good grades, you could think about taking an Advanced Vocational Certificate of Education (AVCE) or BTEC National Diploma in Engineering. Alternatively, you could look at a more academic programme leading to A-level qualifications (including, for example, Mathematics and Science) before going on to study engineering at University. For this option you will need to be confident in your ability to study Mathematics and Science at a higher level (i.e. at A-level and beyond). Another good option, particularly if you know that you do want to work in engineering, is that of taking an Advanced Modern Apprenticeship (AMA). Your school or college will be able to provide you with further information on this option. If you decide to enter employment after you leave school then you will probably move on to take a National Vocational Qualification (NVQ) which will allow you to progress further in your chosen career. These qualifications are widely recognised in industry where they relate to specific engineering job roles.

How can I find out more?

Your teacher or tutor will normally be able to provide you with further information about the Engineering GCSE. Alternatively, your school or college Careers Adviser or a visiting Careers Office should be able to tell you more.
Equivalence, links and progression

Although there may be some differences in both teaching and assessment methods, the GCSE Engineering has a significant overlap of content with GCSEs in both Design and Technology and in Manufacturing. Furthermore it is important to be aware that the content of the three units of the GCSE in Engineering (Double Award) is very similar to that of Units 1, 2 and 3 of the six-unit GNVQs in Engineering. Furthermore, although the assessment methods are not designed to provide evidence of occupation competence, learners are introduced to a range of skills that are relevant to a broad range of work placed NVQs. Unit 2 *(Engineered products)* in particular, broadly contributes knowledge, understanding and skills for NVQ work based learning Levels 1, 2 and 3.

When constructing a study programme for individuals or groups of learners it is important to note that there is a significant overlap between the following qualifications:

- GNVQ Engineering (Foundation or Intermediate)
- GNVQ Manufacturing (Foundation or Intermediate)
- GCSE Design and Technology *(Resistant Materials and Industrial Production)*
- GCSE Engineering
- GCSE Manufacturing.

Teaching programmes that involve learners concurrently studying any combination of the above programmes (which all have the same classification code) are likely to be discounted for funding and performance table purposes.

Preparation for further specialist study

The GCSE Engineering is designed to provide the necessary foundation for progression to study a broad range of specialisms within the engineering sector. Students will also gain up-to-date skills, knowledge, and understanding relevant to working in engineering or further study at a higher level. Progression routes include:

- BTEC National Diploma in Engineering
- Six or 12 unit Advanced Vocational Certificate in Education (AVCE) awards in Engineering
- A-levels in Mathematics, Science, Design Technology etc.
- Advanced Modern Apprenticeship (AMA) in Engineering
- Individual National Vocational Qualification (NVQ) units delivered as part of a training programme in the workplace.

Links with industry

The GCSE in Engineering has been developed in consultation with the engineering industry in order to ensure that students are able to progress into employment. It is strongly recommended that schools and colleges form strong links with local engineering industry.

Industry links can take many forms including regular visits, teacher secondment, work experience and work shadowing programmes, industrial mentors, guest speakers, and group visits. In addition, the Neighbourhood Engineers’ scheme is often able to provide local support and contacts with industry. Other initiatives that may add value to the programme include the Young Engineers’ scheme (coordinated by SATROs) and Opening Windows on Engineering provided by the Engineering Council.
Useful contacts

**Edexcel** (Engineering GCSE awarding body)
32 Russell Square
London
WC1B 5DN
Tel: 0870 240 9800
E-mail: enquiries@edexcel.org.uk
Website: www.edexcel.org.uk

**OCR** (Engineering GCSE awarding body)
Westwood Way
Coventry
CV4 8HS
Tel: 01223 553998
E-mail: mawson.sa@ocr.org.uk
Website: www.ocr.org.uk

**SEMTA** (Sector Skills Council for Science, Engineering and Manufacturing Technologies)
EMTA House
14 Upton Road
Watford
WD18 0JT
Tel: 0800 282 167
Fax: 01923 652389
Website: www.semta.org.uk

**NFEC** (National Forum for Engineering in Colleges in the UK)
PO Box 8980
Birmingham
B18 6WA
Tel: 0121 200 3048
Website: www.nfec.org.uk

**OSCE** (Occupational Standards Council for Engineering)
Broadway House
Tothill Street
London
SW1H 9NQ
Website: www.osceng.co.uk

**SETNET** (Science, Technology, Engineering and Mathematics Network)
2nd Floor, 6 Cavendish Square
London
W1G 0PD
Tel: 020 7636 7705
E-mail: info@setnet.org.uk
Website: www.setnet.org.uk
EEF (Engineering Employers’ Federation)
Broadway House
Tothill Street
London
SW1H 9NQ
Tel: 0207 222 7777
E-mail: aballey@eef-fed.org.uk
Website: www.eef-fed.org.uk

QCA (Qualifications and Curriculum Authority)
83 Piccadilly
London
W1J 8QA
Tel: 0207 7509 5555
Website: www.qca.org.uk

CITB (Construction Industry Training Board)
Bircham Newton
Kings Lynn
PE31 6RH
Tel: 01485 577643
Fax: 01485 577497
E-mail: irene.andrews@citb.co.uk
Website: www.citb.co.uk

COGENT (Sector Skills Council for the oil, gas and petroleum industries)
Minerva House
Bruntland Road
Portlethen
Aberdeen
AB12 4QL
Tel: 01224 787800
Website: www.opito.co.uk

ECITB (Engineering Construction Industry Training Board)
Blue Court
Church Lane
King’s Langley
WD4 8IP
Tel: 01923 260000
E-mail: davidedwards@ecitb.org.uk
Website: www.ecitb.org.uk

ETB (Engineering and Technology Board)
10 Maltravers Street
London
WC2R 3ER
Tel: 0207 240 7333
E-mail: smedhat@etechb.co.uk
Website: www.etechb.co.uk
Some useful websites

www.bbc.co.uk/webguide/schools/index.shtml
The BBC’s list of websites to support technology in schools

www.dfes.gov.uk/ebnet/
DfES Education Business Link website

www.e-elp.co.uk
Science, Engineering & Technology learning information portal

www.gcse.innogy.com
Innogy’s website to support the Engineering GCSE

www.key2study.info
Mike Tooley’s website to support the Engineering GCSE textbook

www.vocationallearning.org.uk
Learning Skills Development Agency (LSDA) increased flexibility support program (IFSP)

www.vocationallearning.org.uk/students/engineering.asp
Student area of the LSDA website with careers information

www.wisecampaign.org.uk
Women in Science and Engineering
Worksheet 1

About the Engineering GCSE course

Use the Fact sheet for students to answer the following questions:

1. Name each of the THREE units that make up the Engineering GCSE course:
   Unit 1: __________________________
   Unit 2: __________________________
   Unit 3: __________________________

2. What do the following abbreviations stand for?
   (a) NVQ __________________________
   (b) AMA __________________________
   (c) AVCE __________________________

3. Which unit(s) of the Engineering GCSE are assessed using a portfolio of evidence that you must provide?
   ________________________________

4. Which unit(s) of the Engineering GCSE are assessed by means of an external examination?
   ________________________________

5. How many ordinary GCSEs are equivalent to the GCSE in Engineering?
   ________________________________

6. In which of the Engineering GCSE units will you be introduced to some basic hand skills?
   ________________________________
7. In which unit will you start building your PDP?

8. In which unit will you create a production plan?

9. In which unit will you be introduced to sketching and drawing?

10. In which unit would you expect to be given information on computer-aided manufacturing?

11. In which unit will you be expected to develop a design brief?

12. In which two units will you learn about the use of modern manufacturing technology?

13. Apart from your teacher or tutor, which person within your school or college might be able to provide you with information on the Engineering GCSE and the options that may be open to you in the future?

14. What important collection of documents says a lot about you in terms of your ability to work as an engineer?
Worksheet 2

Using the Engineering GCSE course book

Use the GCSE course book to answer the following questions:

1. What do the following abbreviations stand for?
   (a) **DCV**
   (b) **ELCB**
   (c) **NRV**

2. On what page will you find out how to organise a **brainstorming session**? _____

3. What are the advantages of **polyester capacitors** and where are they widely used?

4. What is the difference between **countersinking** and **counterboring**. Illustrate your answer with a sketch.

5. Explain why **composite materials** are widely used in the aerospace industry.