Brilliant Inspiration

From idea to career

Explore 12 areas of engineering

Engineering is a diverse, wide-reaching sector with lots of exciting career opportunities. The different types of engineering described in this booklet are only some of the many areas you could have a career in.

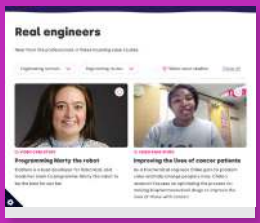
Find out which subjects are useful, what you might learn about, what people who work in these areas do and how you could make a difference.

Areas of engineering:

- General engineering
- Aerospace and aeronautical
- Biomedical
- Chemical
- Civil and structural
- Electrical and electronic
- Energy
- Marine
- Materials
- Mechanical
- Production and manufacturing
- Software engineering and computing

There is a lot of overlap between different types of engineering and **one of the best things about engineering is being able to work in teams with other types of engineers**. For example, in renewable power, you could be working with electrical, chemical, mechanical and civil engineers. Working in engineering is a great career choice for people who enjoy variety - there are plenty of opportunities to gain new skills and work in different industries, both in the UK and globally.

Useful resources:



Take a look at these **enigneer, apprentice and technician profiles** to understand what it's like to be an engineer and find out what people who work in engineering get up to at work.

neonfutures.org.uk/case-study
thisisengineering.org.uk/meet-the-engineers/

Why choose engineering?

1. Make a difference: transform the way we live.

Engineers help create a healthier, safer, greener, happier and more equal society. They develop renewable power, create and distribute vaccinations, improve cyber security, design accessible venues, and much more.

2. Be in demand: enjoy job security.

Engineers and technicians are critical to reducing carbon emissions and achieving net zero, and engineering and technology skills will always be needed to help us adapt and thrive - now and in the future.

3. Be rewarded: have a well paid job that you love.

Engineering is behind everything, from gaming and sports, to the environment and space. It is one of the few career choices that allows you to follow your passion, doing something that you care about, while earning good money.

4. Create and innovate: get paid for having ideas.

Engineers find new and innovative solutions to everyday and complex problems. Their flair for design – combined with their highly practical approach to problem-solving – ensure their workload is varied and their skills are in demand.

5. Choose your path:

Exciting opportunities exist for engineers and technicians at all levels. The engineering sector needs people from diverse backgrounds to join the profession, whether that's via an apprenticeship, a degree, a degree apprenticeship, T Level, A levels, Highers, or your own, unique route.

Google play

Download on the App Store

Take the **Meet the future you quiz** to find out what type of engineer you could be.

mtfy.org.uk

Engineering opens doors...

The great thing about engineering is that no matter which area you choose, you'll gain many transferable skills that will benefit you for the whole of your working life:

Project planning – There are lots of jobs in different industries that require you to know how to run a project effectively. As well as managing your time and planning your work, this means understanding how to prioritise and balance different demands such as cost, quality and speed.

Problem solving and creativity – Engineering is all about finding innovative solutions to problems, whether it's helping remote villages access clean drinking water or improving an athlete's performance through wearable technology. The problems can be large or small, simple or complex; an engineer's job is to meet a challenge head on and come up with creative and practical solutions.

Communication and teamwork – Whichever area of engineering you choose, it is likely to involve working on projects of varying lengths with other people – and not just other engineers. As an engineer, your ability to work well with other professionals is a highly desirable skill from any employer's point of view, and it means that every day is different.

Persistence – When working on engineering projects it can take many attempts to get whatever you're creating to work the way you want it to. This requires patience and perseverance; constantly looking at how to improve what you're working on. This skill is in demand by many industries where giving up is not an option!

Numeracy – There's plenty of maths in engineering, and no matter which industry you end up working in, it's likely to be used to help work out whether ideas are feasible and to ensure that measurements and calculations are precise. Whether you're forecasting profits or designing the next space telescope, getting your numbers right is important.

Technical skills – With engineering, you're likely to use technology in different ways, such as using computer aided design software to develop or improve products and learning programming skills that will enable you to solve problems. These skills demonstrate your ability to learn and adapt.

Where will the jobs be?

Engineers are at the forefront of shaping the world we live in, helping to solve our biggest challenges. From dealing with cyber security, enabling commercial space travel and minimsing the impact of natural disasters to developing sustainable energy, food, housing and products, engineers help pave the way to a better future for everyone.

Advanced Manufacturing: An ever-growing industry, due to the 'computerisation' of production processes, designing for the new 'right to repair' legislation, using renewable materials and techniques like 3D and 4D printing.

Automotive: Electric and autonomous vehicles are a key focus for the future as diesel and petrol cars are phased out, leading to thousands of additional jobs in automotive, design, electrical and mechanical engineering.

Aerospace and space: Over the coming years there is likely to be significant investment into researching and developing greener, quieter, more economical aircraft.

Agricultural technologies: A fast-growing global market driven by population growth. Genetics, nutrition, informatics, satellite remote sensing and precision farming are underpinned by technological advances.

'Big Data': The UK's current digital skills shortage means that opportunities exist in the next decade to gain the skills required to analyse complex data and turn it into useful information and intelligence.

Construction: Significant investment into housing and and the need to retrofit our existing housing stock, along with projects such as Crossrail, Hinkley Point C, Northern Powerhouse Rail and the Dogger Bank wind farm, will generate plenty of opportunities in this sector.

Creative digital: The UK is a world leader in areas requiring software and coding skills, such as post-production special effects in films, games design and digital advertising.

Life sciences: The Life Sciences industry employs people in areas such as medical technology and biopharmaceuticals and there has been a rapid expansion in the number of roles for engineers working on vaccine research, development, manufacture and distribution.

Renewable energy: Renewable power now provides around a fifth of the UK's electricity. The UK is a world leader in offshore wind and this is a huge growth sector, along with solar, tidal and hydrogen power, requiring engineers who are skilled in civil, electrical and mechanical engineering

Nuclear energy: Nuclear power is likely to form an important part of a 'balanced mix' of generating technologies over the long term, to provide reliable, low carbon electricity.

Road and rail transport: Significant investment in road and infrastructure projects - including smart motorways and port expansion, as well as the electrification of the rail network - mean there will be plenty of jobs in this sector.

Cyber security

Managing the risk of system failures and cyber-crime. Materials engineers, software engineers and computer scientists will be in high demand.

General engineering

What is general engineering?

'General engineering' is ideal for those who want to see what it's all about before choosing to specialise in a particular area of engineering; you get a basic introduction to specific disciplines (types of engineering) and develop your science, maths and computing skills whilst solving practical problems. Many general engineering degrees at university give students the option to specialise after the first or second year, which could be useful for those torn between, say, civil and electrical engineering.

What are the benefits of studying general engineering?

It's a useful entry route if you intend to specialise but you're not sure what your specialism will be, yet. With general engineering you build a broad and diverse knowledge base and discover how the different areas of engineering overlap. It can also be a springboard into other industries outside of engineering as the skills you'll develop – such as managing projects, solving problems and working in teams – are highly desirable from any employer's point of view.

What would I be doing as a general engineer?

There is no such thing as a 'general engineer'. Engineers are specialists in the particular field in which they work or train. A general engineering course at college or an engineering degree is the start of the journey.

How much could I earn as an engineer?

Engineers have strong earning potential. Average salaries for professional engineers tend to compare favourably against average salaries for other professionals. For specialist roles and experienced Chartered Engineers, average salaries can exceed £75,000. Engineering apprentices can expect to earn considerably more than the national apprentice minimum wage. People who graduate with engineering and technology degrees can expect to earn significantly more over their lifetime than graduates from most other subjects.*

For more information about engineering salaries, visit: checkasalary.co.uk/salaries/engineering

* Graduate outcomes (LEO 2021): www.gov.uk/government/collections/statistics-higher-education-graduate-employment-and-earnings

Mike, Biochemical Engineer

"My work makes a difference, because I work on things like trying to find ways to sustainably feed people, finding ways to power our transport system, and looking for different methods to make new healthcare systems."

neonfutures.org.uk/michael

Which subjects would help me when studying general engineering?

Engineering degrees usually require A level/Higher mathematics. Physics, or sometimes chemistry, depending on the type of engineering, are often required, though it is advisable to check individual entry requirements. Relevant T Levels, advanced apprenticeships and other Level 3 qualifications can also support entry onto an engineering degree.

Some universities offer foundation years for those without the prerequisite subjects to gain the underpinning knowledge needed for the degree.

Check with individual institutions as entry requirements vary. The UCAS website provides information on different post-16 pathways, qualifications needed for specific courses, and subject guides.

ucas.com/explore/subjects/engineering-and-technology

Allanah, Software Engineer

"I chose to do an apprenticeship where I can learn on the job, and earn while working alongside professionals - I've come out with so much experience."

neonfutures.org.uk/allanah

Ainsley, Rollercoaster Engineer

"Engineering involves finding solutions to problems or tasks. When a problem is solved and the results are noticed, it gives me a great sense of achievement."

neonfutures.org.uk/ainsley

Aerospace and aeronautical engineering

What is aerospace and aeronautical engineering?

Aerospace and aeronautical engineering covers the design and engineering of the systems, equipment and components that are part of flying vehicles such as aeroplanes, helicopters, spacecraft and rockets. It involves designing, testing and manufacturing engines, wings, fuselage, electrical systems, landing gear, satellites, remotely piloted vehicles and drones. It is made up of specialist areas of science and engineering such as aerodynamics, avionics (electronics and electrical systems), propulsion and materials.

Relevant subjects:
- Maths
- Physics

Other useful subjects include:
- Computing
- Design & Technology
- Electronics
- T Levels in relevant subject areas **tlevels.gov.uk/students**

Entry requirements vary so check UCAS, where you can also find subject guides

ucas.com/explore/subjects/aerospace-engineering

What would I be doing as an aerospace or aeronautical engineer?

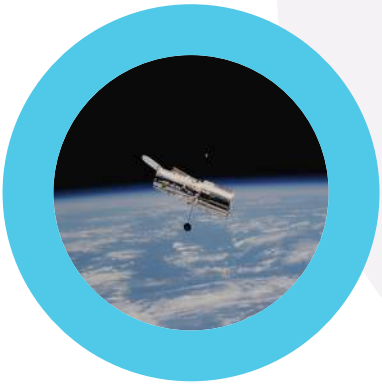
You could work for an engine maker, designing engines to power a commercial airliner, or for an airframer, designing the wings and body of an aircraft. Inspection, non-destructive testing and maintenance are critical aspects of the process. With experience, many aerospace engineers move into management roles, commercial roles or safety and accident investigation.

Reducing environmental impacts

You might work on future concepts for the next generation of aircraft, such as developing biofuels and batteries to reduce carbon emissions, applying new materials to airframes to reduce fuel burn, and finding ways to decrease aircaft-generated sound.

How do I become an aerospace or aeronautical engineer?

You can go to university to study a relevant degree in engineering – this could be aerospace or aeronautical engineering or a specialist area such as space, mechanical, electrical or materials engineering – and then apply to companies after graduation. Alternatively, you could do an apprenticeship with an aerospace employer. There are different entry levels available, including Craft, Advanced, Higher and Degree Apprenticeship routes enabling you to complete your qualifications while working.



Vinita, Space Operations Engineer

Which jobs could I do if I studied aerospace or aeronautical engineering?

Aerospace engineers can work for aerospace component and equipment manufacturers, engineering consultancies, the Ministry of Defence, airlines, aircraft certification specialists and accident and investigation branches. They often specialise in a particular field of aerospace engineering and could be involved in designing and building simulators for aircraft testing or pilot training. Aeronautical engineering knowledge is also sought after in the automotive, Formula 1 and renewable energy sectors as well as fields outside of engineering, such as finance, due to the advanced analytical skills developed. Safety underpins every aspect of aerospace engineering and this understanding can be sought after by sectors including nuclear, rail and medical. Aerospace engineering, like other types of engineering, offers exciting opportunities to work all over the UK and globally.

Further information:

- **aerosociety.com**
- **ife.org.uk**
- **bindt.org**
- **ioa.org.uk**

Stephanie, Space Engineer

"Seeing real life space shuttles was a life changing moment for me. Follow your heart and just go for it!"

neonfutures.org.uk/stephanie

Biomedical engineering

What is biomedical engineering?

Biomedical engineering refers to the innovations that improve our health and healthcare systems, for example 3D organ printing, prosthetic limbs and wearable technology. Engineers in this field combine their problem-solving techniques with knowledge of biological and medical sciences and clinical practice. There are many different areas of work and research within the field.

What would I be doing as a biomedical engineer?

You could be using your knowledge of electronics and computing to develop medical devices such as pacemakers; you could be using mechanical principles to design assistive devices that replace or improve bodily functions; you could be researching materials and living tissue for certain types of implant; you could be applying engineering technology to optimise healthcare delivery in hospitals or you could be improving the quality of life for individuals with physical impairment, by building specialist equipment like wheelchairs.

How do I become a biomedical engineer?

You could do a degree in biomedical engineering or a related subject such as mechanical engineering or materials engineering. It can also be helpful to have an understanding of life sciences. This means the study of living organisms including biology, botany, zoology, microbiology, physiology, biochemistry and related subjects. You may then wish to apply for a job, progress to an advanced qualification (PhD) or to apply for a healthcare science training programme operated by the NHS. It's possible to find an early career role as a technician or trainee technologist without completing a degree. Further qualifications may be necessary for career progression.

Relevant subjects:
- Maths
- Physics
- Chemistry/Biology

Other useful subjects include:
- Computing
- Electronics
- Design & Technology
- T Levels in relevant subject areas **tlevels.gov.uk/students**

Entry requirements vary so check UCAS, where you can also find subject guides

ucas.com

Which jobs could I do if I studied biomedical engineering?

Biomedical engineers are employed in industry, in hospitals, in research facilities of educational and medical institutions, in teaching and in government regulatory agencies. Some biomedical engineers are technical advisors in medical equipment manufacturing companies, and some are in management positions. Healthcare engineering more generally is a vast area which covers the maintenance, calibration, configuration and commissioning of medical devices; engineering maintenance; transport and logistics; waste disposal; sanitation; hygiene; decontamination and sterile services. Biomedical and healthcare engineering, like other types of engineering, offer exciting opportunities to work all over the UK and globally.

Further information: • **ipem.ac.uk** • **iheem.org.uk**

Leo, Clinical Scientist

"I make a difference for people living with some of the most complex disabilities. I get to know them and use technology to improve their life."

neonfutures.org.uk/leo

Chemical engineering

What is chemical engineering?

Chemical engineering is all about the design, management and operation of large-scale processes that turn raw materials into everyday products such as smartphones. The devices we have, the clothes we wear, the food and drink we consume and the power we use all rely on chemical engineering. Chemical engineers work out how to make all these products, while also helping to manage the world's resources and protect the environment.

What would I be doing as a chemical engineer?

As a chemical engineer you could be creating meat alternatives, developing new ways to beat cancer or removing impurities from our drinking water. With experience, you can progress to roles in areas such as project management, risk assessment or consultancy and many chemical engineers become specialists in a particular field, such as safety or environmental regulation.

How do I become a chemical engineer?

Most universities offer a choice of either a bachelor of engineering (BEng) or a master of engineering (MEng) degree in chemical engineering. Some universities offer a foundation course or a Higher National Diploma (HND) and it's possible to enter chemical engineering via an apprenticeship. Another option is to take a college course before applying to a company for a trainee position, such as Level 2 Certificate in Applied Science and Technology.

Reducing environmental impacts

Chemical engineering processes often require large amounts of power. Chemical engineers work out how to make chemical processes more efficient; moving to renewable forms of power, finding uses for waste materials, and installing carbon capture & storage.

Relevant subjects:
- Maths
- Chemistry

Other useful subjects include:
- Physics
- Design & Technology
- T Levels in relevant subject areas **tlevels.gov.uk/students**

Entry requirements vary so check UCAS, where you can also find subject guides

ucas.com/explore/subjects/chemical-engineering

Olivia, Chemical Engineer

Which jobs could I do if I studied chemical engineering?

Careers in the energy, water, food & drink and pharmaceutical sectors are all common. The transferable skills taught whilst studying chemical engineering – such as assessing risk, performing complex calculations and considering sustainability – make students highly sought after among employers, even beyond the world of engineering. Chemical engineering, like other types of engineering, offers exciting opportunities to work all over the UK and globally.

Further information: • whynotchemeng.com

Yasmin, Chemical Engineer

"I love being set a problem to solve, discussing it with other people, coming up with a new solution and implementing it. I like how nice and helpful the engineers I work with are and their team working attitude."

neonfutures.org.uk/yasmin

Civil and structural engineering

What is civil/ structural engineering?

Civil engineers and structural engineers - along with engineers and technicians working in construction and building services engineering - help shape the world and improve people's lives by designing, constructing, testing and maintaining the buildings and large structures that we need. They create structures that are used by all of us every day - from houses, theatres, stadiums and hospitals, to bridges, airports and space satellites. They also give us clean water and purify it so we can use it again, they protect us from flooding, earthquakes and extreme weather, and they supply us with power.

Relevant subjects:
- Maths

Other useful subjects include:
- Physics
- Computing
- Design & Technology or Art
- Geography
- T Levels in relevant subject areas **tlevels.gov.uk/students**

Entry requirements vary so check UCAS, where you can also find subject guides

ucas.com/explore/subjects/civil-engineering

What would I be doing as a civil/structural engineer?

You could be planning, designing, and testing the integrity of the buildings, bridges, roads, tunnels, waste systems, power networks and other structures that a town, city or region needs to support the people living there. Civil and structural engineers look at everything from the technical design to the environmental impacts of their project, often using the latest technologies, such as virtual models ('digital twins'). They are also involved in disaster response and humanitarian efforts around the world.

Reducing environmental impacts

Civil and structural engineers are increasingly considering how to reduce the carbon emissions associated with the construction materials (for example steel and concrete) that are used, as well as the power sources used to operate and maintain them. They also look at how to reduce noise from construction sites through careful planning of works.

How do I become a civil/ structural engineer?

There are many different routes you can take to become a civil or structural engineer or technician. You could take relevant A Levels or T Levels or you could apply for an apprenticeship with

Milly, Civil Engineer

a local engineering company. You could go to university to study a bachelor of engineering (BEng) or a master of engineering (MEng) in civil or structural engineering. The industry needs people coming through all these routes so find the one that is best suited to you.

Which jobs could I do if I studied civil/structural engineering?

Civil and structural engineering, like other types of engineering, offer exciting opportunities to work all over the UK and globally. Civil and structural engineers and technicians use their practical and design skills and knowledge of structures to work on projects in a range of areas, including:

- **Architecture and construction** (e.g. dams, buildings, bridges, offshore platforms, rollercoasters)
- **Environment and sustainability** (e.g. flood barriers, water supply, conservation, disaster response and humanitarian engineering)
- **Building services and building information modelling** (e.g. power distribution, ventilation and security systems)
- **Transportation** (e.g. roads, airports, railways and canals)
- **Maritime** (e.g. ports, harbours and sea defences)
- **Ground engineering and tunnelling** (e.g. transport, waste, power and communications tunnels, land reclamation and stabilisation)
- **Highway Engineering** (e.g. transport planning, road safety, traffic management and highway inspection)
- **Geospatial engineering and surveying** (e.g. computer-based mapping, ensuring structures are built to scale in the correct position, and monitoring the future movements of dams, bridges and other structures)

Further information:

- **ice-inspire.co.uk**
- **goconstruct.org**
- **istructe.org**
- **ioa.org.uk**
- **theihe.org**
- **ecitb.org.uk**
- **cices.org**

Noah, Systems Engineer

"Engineers are solving problems, designing things and building things. There's so many routes into engineering - if you can dream it, you can do it!"

neonfutures.org.uk/noah

Electrical and electronics engineering

What is electrical/ electronics engineering?

Electrical engineering covers the generation, distribution, application and control of electricity. Electrical engineers work on a huge range of things – from wind turbines to electric cars; power networks to battery design. As we move to a more sustainable future the intelligent use of electricity is going to be crucially important and electrical engineers will drive many of the energy efficiency improvements. Electronics engineering involves the research, design, development and testing of electronics components, devices and systems for different industries, including aerospace, data communications (e.g. PCs and tablets) and robotics.

Relevant subjects:
- Maths
- Physics/Computing/D&T

Other useful subjects include:
- Electronics
- T Levels in relevant subject areas **tlevels.gov.uk/students**

Entry requirements vary so check UCAS, where you can also find subject guides

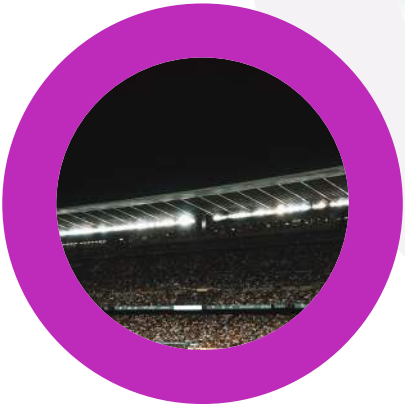
ucas.com/explore/subjects/electrical-and-electronic-engineering

What do electrical/ electronics engineers do?

An electrical engineer might design, develop, test, or supervise the manufacturing of electrical equipment, such as electric motors, agricultural machinery, radar and navigation systems. Electronics engineers design, build and test hardware, including the chips and circuit boards, that go into the huge range of electronic systems that are part of our daily lives. This equipment includes communications systems such as mobile phones and global positioning systems (GPS); medical equipment; computers; flight control systems and LED lighting. The Internet of Things is likely to have an enormous impact on our lives in how we sense and optimise the world around us and electronics engineers work at the cutting-edge of this and many other technological developments.

Reducing environmental impacts

Electrical engineers are involved in designing electric vehicle charging systems and redesigning the electricity distribution network to support the connection of renewable power sources (such as wind farms and tidal power), whilst introducing more energy storage (battery) systems.



How do I become an electrical /electronics engineer?

You would normally need to complete a foundation degree, HNC, HND, bachelor of engineering (BEng) or master of engineering (MEng) in electrical or electronics engineering to become an electrical or electronics engineer. Apprenticeships at all levels are also available. For electronics engineering, employers may accept qualifications in related subjects if electronics is covered as part of the course.

Which jobs could I do if I studied electrical/ electronics engineering?

Electrical and electronics engineering, like other types of engineering, offer exciting opportunities to work all over the UK and globally. There are jobs available in many different sectors, including: power, transport, renewable power, architecture, public realm, manufacturing, buildings services, computing, defence, medical instruments, acoustics - including audio engineering, nanotechnology and aerospace.

Further information:

- **www.theiet.org**
- **ioa.org.uk**
- **iagre.org**

Siobhan, Robotics Engineer

"The great thing about my job is that I use a lot of different technologies to make robots work. From one day to the next I could be doing something completely different!"

neonfutures.org.uk/siobhan

Energy engineering

What is energy engineering?

Energy engineering is all about finding innovative ways to meet society's power needs, as well as supporting the journey to net zero carbon emissions. Energy resources are vital to daily life. They keep the world moving and provide access to the things we need in order to survive such as clean water, food and healthcare. As an energy engineer, you are at the forefront of finding solutions; new ways to make sure power is available where it's needed, while taking into account other important factors such as safety and impact on the environment.

What would I be doing as an energy engineer?

You could be researching, designing and testing new ways of generating electricity, as well as improving existing processes. A key part of the work would be working out how to reduce carbon emissions. The role of heating engineers is becoming increasingly important in responding to the energy crisis, through the design and installation of renewable and emerging technologies, including low temperature heating and hot water systems.

Reducing environmental impacts

With future electricity demand set to increase significantly, renewable power sources - including wind, solar, wave, and tidal - as well as nuclear power and alternatives to natural gas (such as hydrogen and biogas) are vital for the UK's ambition to reach net zero by 2050.

How do I become an energy engineer?

There are a variety of paths into the energy sector. Many people start by completing A levels, T Levels or other vocational qualifications before pursuing a relevant degree, for example energy engineering (sometimes with chemical, civil, mechanical or electrical engineering), or environmental engineering. Others undertake apprenticeships or move into company schemes after they have some qualifications. Energy engineers need to be highly skilled and able to deal with complex situations, therefore training in the sector tends to be excellent. It's also quite common for

Relevant subjects:
- Maths
- Physics
- Chemistry – for nuclear

Other useful subjects include:
- Computing
- Design & Technology
- T Levels in relevant subject areas **tlevels.gov.uk/students**

Entry requirements vary so check UCAS, where you can also find subject guides

ucas.com

Milly, Civil Engineer

people to move into energy having built careers in other types of engineering first, such as civil, chemical, electrical and mechanical engineering.

Which jobs could I do if I studied energy engineering?

Energy is a broad sector, and technologies are changing fast. There are increasing opportunities to develop renewables such as wind, wave and solar power. You could be remodelling existing power systems to reduce energy consumption or working to improve the way we store and distribute power so that it reaches businesses, homes and industry. You could also be designing the next generation of reactors, managing the construction of facilities and finding solutions for nuclear waste storage. Alongside this, heating and plumbing engineers play a significant role in safeguarding the health, safety and wellbeing of the public through good plumbing, safe sanitation and efficient heating systems. Energy engineering, like all other types of engineering offers exciting opportunities to work all over the UK and globally.

Further information:

- **energyinst.org**
- **nuclearinst.com**
- **ciphe.org.uk**

Jaz, Energy Manager

"It was important to me to feel like I'm part of something that's working towards the greater good, and I really feel like that in engineering."

neonfutures.org.uk/jaz

Marine engineering

What is marine engineering?

Marine engineers and naval architects design, build, test and repair ships, boats (surface and submarines), underwater craft (remotely operated vehicles – ROVs), offshore platforms (wind farms and oil and gas) and drilling equipment.

What would I be doing as a marine engineer?

A marine engineer or naval architect would normally be responsible for managing a team of engineers, naval architects, technicians and craftspeople. Depending on the industry, your duties could include ship, boat and yacht design, building and repair; designing, building and operating offshore platforms, rigs and equipment; examining ships and offshore installations, looking at their seaworthiness, safety and maintenance needs and making sure structures, engines, instruments and systems work safely and efficiently.

Reducing environmental impacts

You might also research and develop technology that reduces carbon and sulphur emissions both from shipping and ports.

How do I become a marine engineer?

You normally need a BEng/MEng in naval architecture or an HNC/HND or degree in an engineering subject such as marine engineering, marine technology, naval architecture or offshore engineering. It is also possible to study naval architecture, marine engineering and mechanical engineering together. Alternatively, for marine engineering you could train as an engineering officer with the Merchant Navy or Royal Navy. After completing your service, you could move into the commercial marine engineering industry. You may also be able to get into this career as an apprentice marine engineering technician with a manufacturing or engineering company.

Relevant subjects:
- Maths
- Physics

Other useful subjects include:
- Computing
- Design & Technology
- Chemistry
- T Levels in relevant subject areas **tlevels.gov.uk/students**

Entry requirements vary so check UCAS, where you can also find subject guides

ucas.com

Milly, Civil Engineer

Which jobs could I do if I studied marine engineering?

Marine engineering and naval architecture, like other types of engineering, offer exciting opportunities to work all over the UK and globally. Job roles include:

- Naval architect
- Marine engineer
- Marine engineering technician
- Naval engineering officer
- Electrical engineering technician
- Subsea pipeline engineer
- Surveyor

Further information: • **imarest.org** • **bindt.org**

Martin, Marine Engineer

"The marine industry is truly international, with our service bases reaching every corner of the world (where there's water...). In the last year I have worked in nine different offices in the UK, Sweden and Finland, where our product centres are based."

neonfutures.org.uk/martin

Materials engineering

What is materials engineering?

The study of materials is a huge area and you may well find the terms 'materials science' and 'materials engineering' being used interchangeably to mean the same thing. Everything around you is made out of something, from the clothes you are wearing to the phone in your pocket; from the aircraft you fly in to your neighbour's hip replacement. Materials engineers work out how we can get the best out of all the materials available to us in order to keep improving the world around us. It is their job to discover ways of sourcing, using and reusing these materials responsibly.

Relevant subjects:
- Maths

Other useful subjects include:
- Physics/Chemistry
- Design & Technology
- T Levels in relevant subject areas **tlevels.gov.uk/students**

Entry requirements vary so check UCAS, where you can also find subject guides

ucas.com/explore/subjects/materials-science-and-engineering

What would I be doing as a materials engineer?

Some materials engineers work on a very small scale looking at how microscopic and nanoscopic features of materials affect their bulk properties. Others work on a much larger scale looking at how we can process materials industrially. You could be testing materials to see how they cope in extreme conditions; checking certain qualities (such as electrical conductivity); developing prototypes and problem-solving during the manufacturing process.

Reducing environmental impacts

You could help identify alternatives to single use plastics, or explore materials that are less carbon-intensive to produce, that decompose more readily or are more easily recycled and repurposed.

How do I become a materials engineer?

There are a number of routes into materials engineering. Several universities offer degree courses (BEng and MEng) in materials science and engineering or materials with other subjects. Many universities offer general engineering courses that allow you to specialise in materials later on. All engineering degrees will cover materials to some extent. Alternatively, you can apply for an apprenticeship through one of the large employers of materials engineers and study while you work and earn.

Chris, Mechanical Engineer

Which jobs could I do if I studied materials engineering?

Materials engineering, like other types of engineering, offers exciting opportunities to work all over the UK and globally. Materials engineers work in research and development, design and manufacturing in all sectors, including:

- Automotive
- Packaging
- Aerospace
- Communications technology
- Medicine
- Power generation
- Sports equipment

Ellen, Product Engineer

"I help people swim with inclusive design.

The reactions from people is just so rewarding. It makes me really happy to be an engineer."

neonfutures.org.uk/ellen

Further information: • iom3.org

Mechanical engineering

What is mechanical engineering?

Mechanical engineering is all around us. It's about designing, testing and improving mechanical components and systems that make and improve our world and lives. Everything from clean and sustainable power and life-saving vaccines to missions to Mars. Put simply, mechanical engineering is part of everything that moves, including human beings!

What would I be doing as a mechanical engineer?

As a mechanical engineer, your day-to-day tasks could include researching and testing new products and innovations and presenting design plans and data to colleagues. Mechanical engineers use their knowledge to come up with practical solutions to problems, which means they are sometimes based in the office and sometimes out in the field. You could be working in healthcare, designing and testing improvements to prosthetic limbs, or in aerospace designing airline cabin interiors. You could be working on the next generation of spacecraft for missions to Mars, or designing the heating and cooling ventilation systems for multistorey buildings, ensuring noise pollution is minimised. Virtually any machine or process you can think of – from building planes to making crisps – relies on the skills of a mechanical engineer.

Reducing environmental impacts

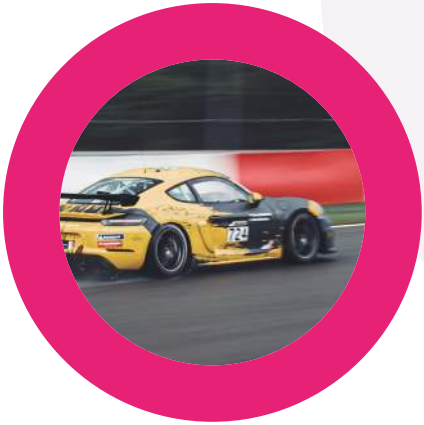
Mechanical engineering has a vital role to play in addressing global challenges. Mechanical engineers design innovative technologies and manufacturing processes to combat environment problems. They optimise efficiency and reduce waste to improve the world around us.

Relevant subjects:
- Maths
- Physics

Other useful subjects include:
- Computing
- Design & Technology
- Electronics
- T Levels in relevant subject areas **tlevels.gov.uk/students**

Entry requirements vary so check UCAS, where you can also find useful subject guides

ucas.com/explore/subjects/mechanical-engineering



Chris, Mechanical Engineer

How do I become a mechanical engineer?

If you enjoy thinking up solutions to everyday challenges and you have an aptitude for maths, science and creative subjects, then you are already on your way. To work as a mechanical engineer, you will normally need a foundation degree, HNC/HND or degree in an engineering subject. You can also start off as an engineering technician apprentice with a manufacturing or engineering company and, after completing your training, you could get a job, progress to higher education or a higher apprenticeship. Individuals take different routes into mechanical engineering, depending on what best suits them.

Which jobs could I do if I studied mechanical engineering?

Mechanical engineers design and work with all types of mechanical systems, meaning careers in this field span many sectors, including power, healthcare, agriculture, transport, aerospace, motorsport, construction and manufacturing (across all industries). You might also be involved in metrology (improving the accuracy of how we measure things). Mechanical engineering, like other types of engineering, offers exciting opportunities to work all over the UK and globally.

Further info: • **imeche.org** • **ife.org.uk** • **iagre.org** • **bindt.org/careers**

Charlotte, Agricultural Engineer

"I'm on a mission to make farming more efficient. I love designing and fixing things - I really enjoy working with tractors."

neonfutures.org.uk/charlotte

Production and manufacturing engineering

What is production/ manufacturing engineering?

Production engineering and manufacturing engineering are linked to the creation of products, such as food and drink, clothing, smartphones and medicines. Typically, a production engineer will focus on the systems used, whilst a manufacturing engineer's focus is on the processes, materials and parts. Together, production and manufacturing engineers design, prototype and produce high quality goods in the most time-efficient, cost-effective way, with the aim of reducing the impact of production on the environment.

Relevant subjects:
- Maths
- Physics
- Chemistry

Other useful subjects include:
- Computing
- Design & Technology
- T Levels in relevant subject areas **tlevels.gov.uk/students**

Entry requirements vary so check UCAS, where you can also find subject guides

ucas.com

What would I be doing as a production/ manufacturing engineer?

From mapping future technology trends with research and development teams to working on the development of new products and their manufacturing processes, production and manufacturing engineers are usually involved in the whole lifecycle of a new product, including checking its safety and integrity. Working in one of these roles requires close team working with colleagues across different disciplines, working in a structured format and maintaining a practical and pragmatic approach. International travel as well as remote working as part of an international team is also a common requirement of the job.

Reducing environmental impacts

You might be involved in helping produce the components of renewable power – perhaps a wind turbine blade or a solar panel. Or you might be working on a better way of manufacturing something to reduce material use or energy consumption. Agri-food is another industry that production and manufacturing engineers might work in, covering the whole journey from farm to fork, with a particular focus on sustainability.

Halvard, Robotics Engineer

How do I become a production/manufacturing engineer?

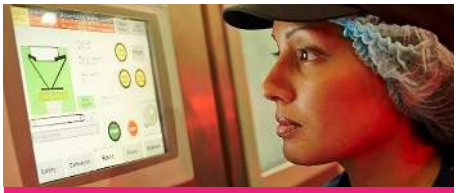
Suitable degree courses for entering the profession include manufacturing systems engineering, electronics, electrical or electronics engineering, mechanical engineering, production or manufacturing engineering.
You may also be able to enter at a trainee level with an engineering HND, foundation degree or higher apprenticeship. With experience and further qualifications, you will then be able to progress to more senior roles.

Which jobs could I do if I studied production/ manufacturing engineering?

Production and manufacturing engineering, like other types of engineering, offer exciting opportunities to work all over the UK and globally. Jobs in this area are largely project based and could include:

- **Developing products and processes** for the UK's world-leading motorsport industry, including Formula 1 teams
- **Solving health related issues** by developing manufacturing methods for new medical products
- **Manufacturing a new food product**, working in a team with others, such as health and safety experts, marketing professionals, lawyers and accountants
- **Meeting future power requirements** by designing hi-tech factories that can manufacture wind turbine blades on an industrial scale
- **Inventing lights made from recycled materials** that use less power and create a better environment for people and wildlife

Further info:
• **theiet.org** • **imeche.org** • **ife.org.uk**



Maria, Production Engineer

"Engineering gives you the freedom to innovate and gives you lots of satisfaction when you're helping processes, products, materials and people."

neonfutures.org.uk/maria

Software engineering and computing

What is software engineering/computing?

Software engineering and computing are about creating systems that automate tasks using computers. This involves developing hardware such as tablets, laptops and control systems and designing and writing the software that make them work. We live in a digital world, from operating systems on a PC and apps on smartphones to big databases in banks that manage your money. Most electronic devices have tiny computers embedded inside that need software to make them work, such as central heating controllers, car engine management systems and smart TVs. Computer engineers create the hardware to make these work and software engineers develop the software to tell the hardware what to do.

What would I be doing as a software/ computing engineer?

Software engineers and computer programmers design, build and test computer programs and apps. This involves defining the needs of the user, designing the technical structure of a system, writing and testing code, fixing bugs and refining existing programs. Computer scientists apply the principles of programming and algorithms to the design of software and systems. Computer science spans many different areas, including artificial intelligence, robotics and information security. Other types of computer engineer (such as systems managers and hardware engineers) design, build and test the hardware, including the components such as chips and boards. They talk to customers to understand their requirements, and help configure, setup, and debug the final system.

Reducing environmental impacts

You might work on a "smart" system to optimise electricity use, e.g. putting a fridge on standby during peak load on the electricity network, or on a control system for electric vehicles.

Relevant subjects:
- Maths
- Physics
- Computing

Other useful subjects include:
- Design & Technology
- Electronics
- T Levels in relevant subject areas **tlevels.gov.uk/students**

Entry requirements vary so check UCAS, where you can also find useful subjects

ucas.com/explore/subjects/software-engineering

Tanda, Software Engineer

How do I become a software/ computing engineer?

Universities offer courses in computer science, software engineering, computer network engineering, software development and business information systems. Computer programming is a very logical process and mathematics is also a good route in. Many universities offer specialist courses for games development.
To develop electronic products there are courses in electronics, many of which include software engineering. Large companies often accept graduates from numerate disciplines and offer graduate training schemes, provided candidates show an interest and aptitude for computers and software. A number of companies offer hardware and software engineering apprenticeships.

Which jobs could I do if I studied software engineering/computing?

Computing is used by all sectors of the economy including industry, education and retail. Typical job titles are: business analyst, cloud engineer, games developer, systems engineer, software engineer, developer, web designer, product manager, technical author, systems manager, IT architect, secondary school teacher or mobile application developer. Some graduates may also go into research.

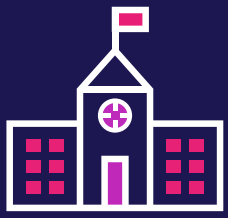
Further information:
- **theiet.org**
- **bcs.org**

Dilani, Drone Engineer

"I love that every day is different. I'm waking up to new challenges and new projects and new work to do every day."

neonfutures.org.uk/dilani

Which route is right for me?



School

Useful subjects include: science (especially physics), maths, D&T, computing

Sixth Form/ Further Education

A levels / T Levels / Highers / IB / TechBacc / HNC /HND / Foundation Degree

University Degree

Bachelors (BEng / BSc)
Masters (MEng)

Apprenticeships

At all levels, including Degree/Graduate Apprenticeship

Earn while you learn

Work

Professional registration (optional)

Find out more and search for apprenticeships at all levels:

- If you live in **England** apprenticeships.gov.uk
- If you live in **Scotland** apprenticeships.scot
- If you live in **Wales** careerswales.com
- If you live in **Northern Ireland** nidirect.gov.uk/apprenticeships

Choosing your options

At 16

If you have 5 GCSEs at grade 9 to 4 (A* to C) or equivalent, including maths, science and English, you can:

- **Take a T Level** in engineering or a related subject. T Levels are roughly equivalent to 3 A levels and take 2 years to complete. They consist of 80% classroom learning and 20% work placement. For a full list of T Levels and to search for T Levels on offer near you, **visit: tlevels.gov.uk/students**
- **Apply for an Advanced (or Modern) Apprenticeship** where you will gain vocational qualifications whilst developing your engineering skills through work. Apprentices receive a wage throughout their apprenticeship.
- **Take a Diploma/A levels/Highers/ International Baccalaureate, or other Level 3 qualification**, in engineering or a related subject if you're thinking of going on to work, study or train in engineering.

At 16, you may choose to attend a FE college, sixth form or University Technical College (UTC).

Professional Registration:

Whichever route you take into engineering, once you have the necessary qualifications and skills developed in the workplace you can apply to become professionally registered with a professional engineering institution. Like doctors and lawyers, professionally registered engineers are well respected.

Registration options include: Engineering Technician (EngTech), Incorporated Engineer (IEng) and Chartered Engineer (CEng). Once registered, you can use these letters after your name so employers and customers all over the world can see that you've achieved a high standard of engineering professionalism.

At 18

Your options include:

- **Applying for a Higher Apprenticeship or a Degree/ Graduate Apprenticeship** , which may incorporate a degree or a master's degree whilst learning on-the-job and being paid.
- **Full-time employment** possibly studying while working.
- **Attending university full time** to study a foundation degree, bachelor's degree (BEng/BSc) or master's degree (MEng/MSc) in engineering or a related subject.

Brilliant Inspiration

Join us at:

NeonFutures @Neon_Futures

www.neonfutures.org.uk

This booklet was designed with input from a community of over 25 professional engineering institutions across the sector.

Image credit: This is Engineering

Institution of Mechanical Engineers

UCL Engineering

EngineeringUK
Inspiring Futures Together

IOP Institute of Physics

IET The Institution of Engineering and Technology

Royal Academy of Engineering

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