Tomorrow's Engineers

From idea to career

Explore 12 areas of engineering

Engineering is a diverse, wide-reaching sector and it can be hard to decide which of the many areas to pursue. In this booklet you will find an overview of several different types of engineering, although there are also many other areas. You'll be able to find out which subjects are useful, what you might learn about, what people who work in these areas do and how much you could earn.

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 these areas and one of the best things about engineering is being able to work in teams with other types of engineers. For example, in renewable energy, you could be working with electrical, chemical, mechanical and energy engineers.

Why choose engineering?

- **Engineers are in demand and they earn good money.**
- **Engineers have skills that make them highly employable in lots of different sectors.**
- **Like doctors and lawyers, professionally registered engineers are well respected.**

Did you know?

- **Engineering apprentices earn almost double the national apprentice minimum wage**
- **Starting salaries for engineering and technology graduates are around 20% higher than the average graduate starting salary**

All data is taken from **EngineeringUK 2018: The State of Engineering**

Engineering opens doors...

The great thing about engineering is that no matter which area you choose, you'll gain many skills that will stand you in good stead 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 solutions to problems, whether it's helping remote villages in Africa 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 others is a highly desirable skill from any employer's point of view.

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. Whether you're forecasting profits or designing the next space telescope, getting your numbers right is important.

Computer skills – With engineering, you're likely to use computers for a wide range of applications, such as using computer aided design software when developing or improving products and learning programming skills that will enable you to solve problems. These skills demonstrate your computer literacy and your ability to learn and adapt.

General Engineering

What is general engineering?

'General engineering' is one of the broadest subjects and the most common type of engineering taught in FE colleges. It's 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 branches 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 an ideal entry route if you intend to specialise but want to delay your decision regarding which branch of engineering to take until later in your studies. 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?

The average salary for a general engineering graduate who finds employment within 6 months of graduation is £27,000. This is around 20% higher than the average starting salary for other graduates.

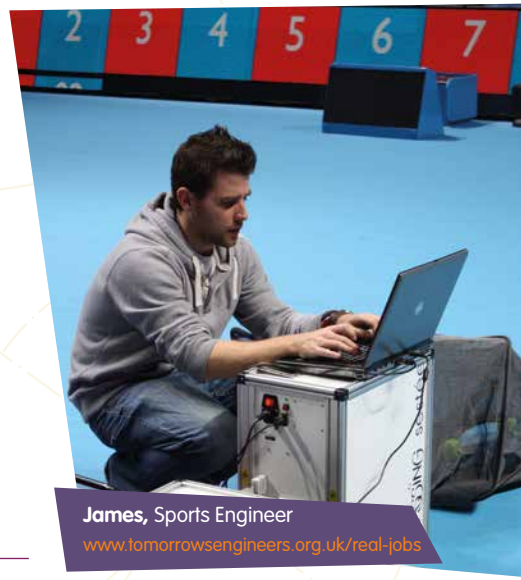
Richard,
Electrical Maintenance Technician
www.tomorrowsengineers.org.uk/real-jobs

Which subjects would help me when studying general engineering?

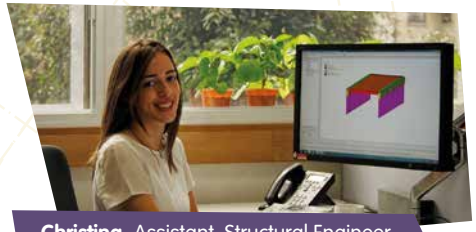
Most university degrees in general engineering or engineering ask for A-levels and/or T-Levels in at least two science subjects or science-related subjects (such as design and technology or computing) and many general engineering degrees ask for maths. The BTEC Extended Diploma and other vocational qualifications are usually considered. Modern foreign languages can be advantageous for all types of engineering.

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

Check with individual institutions as entry requirements vary:
www.ucas.com



James, Sports Engineer
www.tomorrowsengineers.org.uk/real-jobs



Christina, Assistant, Structural Engineer
www.tomorrowsengineers.org.uk/real-jobs

Asha, Footwear Production Engineer
www.tomorrowsengineers.org.uk/real-jobs

Find out more about different routes into engineering:
– www.tomorrowsengineers.org.uk/university
– www.tomorrowsengineers.org.uk/apprenticeships

Aerospace & Aeronautical

What is aerospace and aeronautical engineering?

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

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

You could work for an engine maker, designing jet engines to power a commercial airliner, or for an airframer, designing the wings and body of an aircraft. You may be asked to improve and adapt existing technologies or work on future concepts for the next generation of military or civil aircraft. Emerging technologies include drones and remotely piloted vehicles, new generation spacecraft and the application of new materials to airframes and equipment to reduce noise and fuel burn, making flying more environmentally friendly. With experience, many aerospace engineers move into management roles, commercial roles or safety and accident investigation.

Important subjects:

- Maths
- Physics

Useful subjects:

- Computing
- Design & Technology
- Electronics
- Languages can also be an advantage

Entry requirements vary so check **www.ucas.com**

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 follow 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.

How much would I earn?

The average starting salary for an aerospace engineer is around £25,000, which is approximately 15% higher than the average starting salary for all graduates. With experience, average salaries can be between £38,000 and £49,000, and for specialist roles and Chartered Engineers, they can be considerably higher. Many engineering employers also pay apprentices well above the statutory rate.

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, oil and gas and renewable energy sectors as well as fields outside of engineering, such as finance, due to the high level analytical skills developed through study. 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 world.

Further information: **www.aerosociety.com**

Abbie

Senior Spacecraft Structures Engineer, Airbus
www.tomorrowsengineers.org.uk/real-jobs

"It really helps to be a creative, 'outside-the-box' thinker. You often have to sketch your ideas or make models to show your colleagues they would work. So if you love design technology – or art – and you're good at solving problems and thinking logically too, then engineering is absolutely for you!"

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?

It helps to have an understanding of life sciences. This means the study of living organisms, including biology, botany, zoology, microbiology, physiology, biochemistry, and related subjects. A biomedical degree will generally require maths and a life science subject like chemistry or biology. You may then wish to apply for a job, progress to an advanced qualification (PhD) or apply for the three-year healthcare science training programme operated by the NHS. It's possible to find a junior job as a technician or technologist without completing a degree, but further qualifications will be necessary if you wish to progress further in your career.

Important subjects:

- Maths
- Physics
- Chemistry/Biology

Entry requirements vary so check **www.ucas.com**

Useful subjects:

- Computing
- Electronics
- Design & Technology
- Languages can also be an advantage

How much would I earn?

The average starting salary for engineering and technology graduates is around £27,000, which is approximately 20% higher than the average starting salary for all graduates. With experience, average salaries for chemical and pharma/medical engineers are between £48,000 and £57,000 and for specialist roles and Chartered Engineers, they can be considerably higher. Many engineering employers also pay apprentices well above the statutory rate.

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 for marketing departments of companies and some are in management positions. Biomedical engineering, like other types of engineering, offers exciting opportunities to work all over the world.

Further information: **www.ipem.ac.uk**

Rishi

Engineering degree student, Kingston University
www.tomorrowsengineers.org.uk/real-jobs

"I'm proud to wear a Blatchford limb. My amputation means that I am now rocking a serious bit of titanium carbon fibre. Prosthetics are fascinating and a really rewarding piece of engineering that can change people's lives."

Chemical Engineering

What is chemical engineering?

Chemical engineering is all about the design, management and operation of large–scale processes that turn raw materials such as oil into everyday products such as smartphones. The devices we have, the clothes we wear, the food and drink we consume and the energy we use all depend upon 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?

Most jobs fall into two groups: the design, manufacture and operation of machinery or the development of new substances and materials. As a chemical engineer you could be solving problems on a chocolate production line, developing new ways to beat cancer or designing how to remove 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.

Important subjects:

- Maths
- Chemistry

Useful subjects:

- Physics
- Design & Technology
- Languages can also be an advantage

Entry requirements vary so check **www.ucas.com**

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 course. Some universities offer a foundation course or a HND and it's possible to enter chemical engineering via a vocational route. 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/Engineering Technology, or Level 2/3 Certificate in Laboratory Technical Skills.

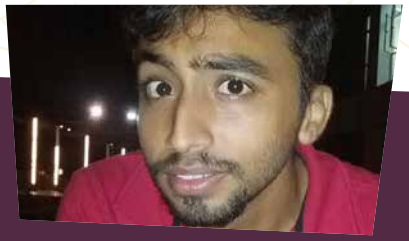
How much would I earn as a chemical engineer?

The average starting salary for chemical, process and energy engineering graduates is around £27,000, which is approximately 20% higher than the average starting salary for all graduates. With experience, average salaries can be between £45,000 and £57,000 and for specialist roles and Chartered Engineers, they can be considerably higher. Many engineering employers also pay apprentices well above the statutory rate.

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 project management – 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 world.

Further information: **www.whynotchemeng.com**



Bhavik

Chemical Engineering student.
University of Nottingham (Malaysia Campus)
www.tomorrowsengineers.org.uk/real-jobs

"I wanted to learn the process of drug production and do my own research on certain diseases that have been studied for decades, but yet there's no sustainable cure. Today's engineers are problem-solvers at the very core. If you end up studying engineering, and not only chemical engineering, you will realise how broad the study of that subject is."

Civil and Structural Engineering

What is civil/structural engineering?

Civil engineers and structural engineers both help shape the world and improve people's lives by designing, creating and maintaining the buildings and large structures that we need. They build all sorts of things so we can get around and live our lives safely – from roads, bridges and tunnels to railways, hospitals and airports. They also give us clean water and purify it so we can use it again, they protect us from flooding and extreme weather and they supply us with energy.

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

You could be planning and designing the networks, facilities and 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. They also work on-site turning designs into real working structures.

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 can take a vocational course at your local college such as a BTEC in civil engineering, or you can apply for an apprenticeship with a local engineering company. You can 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.

How much would I earn as a civil/structural engineer?

The average starting salary for civil engineering graduates is around £26,000, which is almost 20% higher than the average starting salary for all graduates. With experience, average salaries for rail/civil and structural engineers are between £41,000 and £49,000 and for specialist roles and Chartered Engineers they can be considerably higher. Many engineering employers also pay apprentices well above the statutory rate.

Important subjects:

- Maths

Entry requirements vary so check **www.ucas.com**

Useful subjects:

- Physics
- Computing
- Design & Technology or Art
- Geography
- Languages can also be an advantage

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 world. 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)
- Environmental (e.g. waste management, drainage, flood barriers, water supply)
- Building services and building information modelling (e.g. energy 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, oil and gas pipelines, land reclamation and stabilisation)

Further information: **www.ice.org.uk/WICE** **www.istructe.org**

Zavier

Civil Engineering Apprentice (Worked on the Queen Elizabeth Olympic Park stadium transformation project)
www.tomorrowsengineers.org.uk/real-jobs

"The best thing is seeing it built. After all the work that goes in, just seeing it all come together and being used. That's an awesome feeling."

Electrical and Electronic Engineering

What is electrical/electronic engineering?

Electrical engineering covers the generation, distribution, application and control of electrical energy. 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. Electronic engineering involves the research, design, development and testing of electronic components, devices and systems for different industries, including aerospace, data communications (e.g. PCs and tablets) and robotics.

What do electrical/electronics engineers do?

An electrical engineer might design, develop, test, or supervise the manufacturing of electrical equipment, such as electric motors, machines, radar and navigation systems, or be involved in the development of new power generation equipment such as wind turbines and wave power. Electronics engineers design, build and test the 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.

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 electronic engineering to become an electrical or electronics engineer. Apprenticeships at all levels are also available. For electronic engineering, employers may accept qualifications in related subjects if electronics is covered as part of the course.

Important subjects:

- Maths
- Physics/Computing/D&T

Useful subjects:

- Physics/Computing/D&T
- Electronics
- Languages can also be an advantage

Entry requirements vary so check **www.ucas.com**

How much would I earn as an electrical/electronics engineer?

The average starting salary for electronic and electrical engineering graduates is around £26,000, which is almost 20% higher than the average starting salary for all graduates. With experience, average salaries for telecoms and utilities/electronics engineers are between £40,000 and £53,000 and for specialist roles and Chartered Engineers they can be considerably higher. Many engineering employers also pay apprentices well above the statutory rate.

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

Electrical and electronic engineering, like other types of engineering, offer exciting opportunities to work all over the world. There are jobs available in many different sectors, including: power, transport, renewable energy, manufacturing, buildings services, computing, defence, medical instruments, acoustics, nanotechnology and aerospace.

Further information: **www.theiet.org**

Mairead

Design Engineer, Dialog Semiconductor
www.tomorrowsengineers.org.uk/real-jobs

"I studied an MEng in Electronics and Electrical Engineering at the University of Edinburgh. My favourite part of the course was the practical work as you got to put your knowledge from lectures into practice. I now work on audio chips for mobile phones and MP3 players. This is a very large field to work in and every day I continue to learn new things."

Energy Engineering

What is energy engineering?

Energy engineering is all about finding innovative ways to meet society's electricity needs. Energy resources are vital to daily life. They keep the world moving and provides access to the things we need in order to survive, such as clean water, food and healthcare. The modern world is facing increasing challenges including rising population and climate change, placing a huge burden on our planet. 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?

Energy is a very diverse sector that includes oil and gas, nuclear power and renewable energy (such as biofuels, wind, hydro and solar energy). You could be designing and testing machinery, working to improve processes, researching and developing new ways to generate electricity, or looking at how to cut emissions.

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 and/or master's qualification. Others undertake apprenticeships or move into company schemes after they have some qualifications under their belt. 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 people to move into energy having built careers in other types of engineering first.

Important subjects:

- Maths
- Physics
- Chemistry – for oil/gas/nuclear

Entry requirements vary so check **www.ucas.com**

Useful subjects:

- Chemistry
- Computing
- Design & Technology
- Languages can also be an advantage

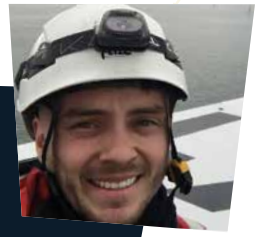
How much could I earn as an energy engineer?

The average starting salary for chemical, process and energy engineering graduates is around £27,000, which is approximately 20% higher than the average starting salary for all graduates. With experience, average salaries for energy/renewable/nuclear engineers are between £49,000 and £57,000 and for specialist roles and Chartered Engineers they can be considerably higher. Many engineering employers also pay apprentices well above the statutory rate.

Which jobs could I do if I studied energy engineering?

Energy is a broad sector, and technologies are changing fast. There are opportunities in established technologies like oil and gas and nuclear energy, and increasing opportunities in renewable energies such as wind, wave and solar energy. Or you could be working to improve the way we store and distribute energy so that it reaches businesses, homes and industry. Energy engineering, like other types of engineering, offers exciting opportunities to work all over the world.

Further information: **www.energyinst.org**



Conor

Wind Turbine Technician, DONG Energy (offshore wind)
www.tomorrowsengineers.org.uk/real-jobs

"It feels good to work in the offshore wind industry as it has a somewhat moral feel to it. To know that the work I do contributes to our country emitting less carbon is quite humbling. The industry is growing rapidly so I feel like I'm part of something big which is moving forward and benefitting society without harming the planet."

Marine Engineering

What is marine engineering?

Marine engineers design, build, test and repair boats, ships, underwater craft (remotely operated vehicles – ROVs), offshore platforms and drilling equipment.

What would I be doing as a marine engineer?

A marine engineer would normally be responsible for managing a team of marine technicians and craftspeople. Depending on the industry, your duties could include shipbuilding, boat-building and repair; designing and repairing leisure boats; designing, building and operating offshore platforms, rigs, pipelines and equipment; examining ships and offshore installations, looking at their seaworthiness, safety and maintenance needs and making sure engines, instruments and systems work safely and efficiently.

How do I become a marine engineer?

You normally need a 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 marine engineering and mechanical engineering together. Alternatively, 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.

How much could I earn as a marine engineer?

The average starting salary for engineering and technology graduates is around £27,000, which is approximately 20% higher than the average starting salary for all graduates. With experience, average salaries for defence and security/ marine engineers are between £40,000 and £57,000 and for specialist roles and Chartered Engineers they can be considerably higher. Many engineering employers also pay apprentices well above the statutory rate.

Important subjects:

- Maths
- Physics

Useful subjects:

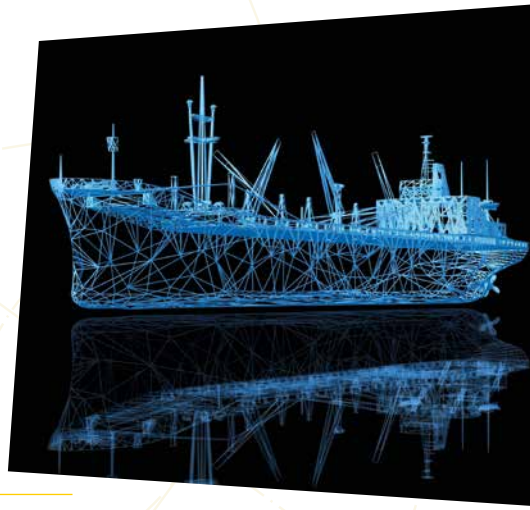
- Computing
- Design & Technology
- Chemistry
- Languages can also be an advantage

Entry requirements vary so check **www.ucas.com**

Which jobs could I do if I studied marine engineering?

Marine engineering, like other types of engineering, offers exciting opportunities to work all over the world. Job roles include:

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



Further information: **www.imarest.org/seayourfuture**

Martin

Marine Engineer, Rolls-Royce Marine
www.tomorrowsengineers.org.uk/real-jobs

"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."

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.

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. You can work anywhere between these two extremes and your work could take you anywhere in the world.

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.

Important subjects:

- Maths

Useful subjects:

- Physics/Chemistry
- Design & Technology
- Languages can also be an advantage

Entry requirements vary so check **www.ucas.com**

How much would I earn as a materials engineer?

The average starting salary for materials technology graduates is around £24,000, which is approximately 10% higher than the average starting salary for all graduates. With experience, average salaries can be between £46,000 and £53,000 for materials engineers and for specialist roles and Chartered Engineers they can be considerably higher. Many engineering employers also pay apprentices well above the statutory rate.

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 world. Materials engineers work in research and development, design and manufacturing in all sectors, including:

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

Further information: **www.iom3.org**

Professor Shu Yan Zhang

Senior Scientist (Principal Scientific Officer), ISIS Neutron and Muon Source, Rutherford Appleton Laboratory
www.tomorrowsengineers.org.uk/real-jobs

"I work at the world's leading neutron research centre. People come to conduct experiments to study the materials used in components, for example the wing of an Airbus A380 or welded parts in nuclear reactors. They need to work out how these parts respond to stress and movement and make sure they're safe to run."

Mechanical Engineering

What is mechanical engineering?

Mechanical engineering is about designing, developing and improving mechanical components and systems that make our world and lives function; everything from nuclear fusion and artificial hearts to driverless cars. Put simply, mechanical engineering deals with anything 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 hotels. Virtually any machine or process you can think of – from building planes to making crisps – relies on the skills of a 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 progress to higher education or a higher apprenticeship, such as the Level 4 Advanced Manufacturing Engineering Higher Apprenticeship. Individuals take different routes into mechanical engineering, depending on what best suits them.

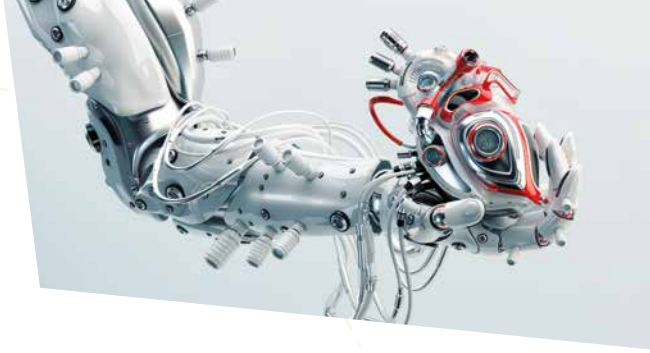
Important subjects:

- Maths
- Physics

Useful subjects:

- Computing
- Design & Technology
- Electronics
- Languages can also be an advantage

Entry requirements vary so check **www.ucas.com**



What is the starting salary of a mechanical engineer?

The average starting salary for mechanical engineering graduates is around £26,000, which is almost 20% higher than the average starting salary for all graduates. With experience, average salaries can be between £42,000 and £51,000 for automotive engineers and for specialist roles and Chartered Engineers they can be considerably higher. Many engineering employers also pay apprentices well above the statutory rate.

Which jobs could I do if I studied mechanical engineering?

Because mechanical engineers design and work with all types of mechanical systems, careers in this field span many sectors, including healthcare, transport, aerospace, motorsport, construction and manufacturing (across all industries). Mechanical engineering, like other types of engineering, offers exciting opportunities to work all over the world.

Further info: **www.imeche.org**

Angela

Mechanical Engineer, Arup
www.tomorrowsengineers.org.uk/real-jobs

"I enjoyed the 'mechanics' side of maths because it can be used in a real-life environment. I chose mechanical engineering as I didn't know what to do as a career and it would keep my options open for when I finished my degree."

Production and Manufacturing

What is production/manufacturing engineering?

Production engineering and manufacturing engineering are linked to the creation of products. Typically, a production engineer will focus on the systems used, whilst a manufacturing engineer's focus is on the processes that allow the systems to work. Together, process 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.

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 required from the outset and are usually involved in the whole lifecycle of a new product, to ensure business objectives are met. Working in one of these roles requires close team working with internal and external colleagues, 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.

How do I become a production/manufacturing engineer?

Suitable degree qualifications for entering the profession include manufacturing systems engineering, electrical or electronic 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.

Important subjects:

- Maths
- Physics
- Chemistry – for some courses

Useful subjects:

- Computing
- Design & Technology
- Languages can also be an advantage

Entry requirements vary so check **www.ucas.com**

Further info: www.theiet.org / www.imeche.org

How much would I earn as a production/manufacturing engineer?

The average starting salary for production and manufacturing engineering graduates is around £24,000, which is approximately 10% higher than the average starting salary for all graduates. With experience, average salaries can be between £46,000 and £49,000 for food and drink/consumer goods engineers and for specialist roles and Chartered Engineers they can be considerably higher. Many engineering employers also pay apprentices well above the statutory rate.

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 world. 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
- Working with accountants, human resources personnel and health and safety officers on the manufacture of a new food product
- Meeting future energy requirements by designing hi-tech factories that can manufacture wind turbine blades on an industrial scale
- Developing semiconductors for the latest smartphone or high power transmitters for 5G aerial masts

Lorena

Product Engineer,
Cummins Turbo Technologies
tomorrowsengineers.org.uk/real-jobs

"I am able to contribute a great deal to improving the level of emissions in the commercial vehicle market, making our environment cleaner. It is all about innovating and making a difference and by choosing an engineering career you have the chance to do that. No two days are ever the same, which makes the job really enjoyable."

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. There are many different job titles in software engineering and computing. The different engineers work in teams - often virtually, working in different parts of the country or the world.

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, providing candidates show an interest and aptitude for computers and software. A number of companies offer hardware and software engineering apprenticeships.

Important subjects:

- Maths
- Physics

Useful subjects:

- Computing
- Design & Technology
- Electronics
- Languages can also be an advantage

Entry requirements vary so check **www.ucas.com**

How much could I earn as a software/computing engineer?

The average starting salary for computer science graduates is around £30,000, which is approximately 40% higher than the average starting salary for all graduates. With experience, average salaries can be between £34,000 and £49,000 for IT and telecommunications professionals and for specialist roles and Chartered Engineers they can be considerably higher. Many engineering employers also pay apprentices well above the statutory rate.

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, administrator, 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.

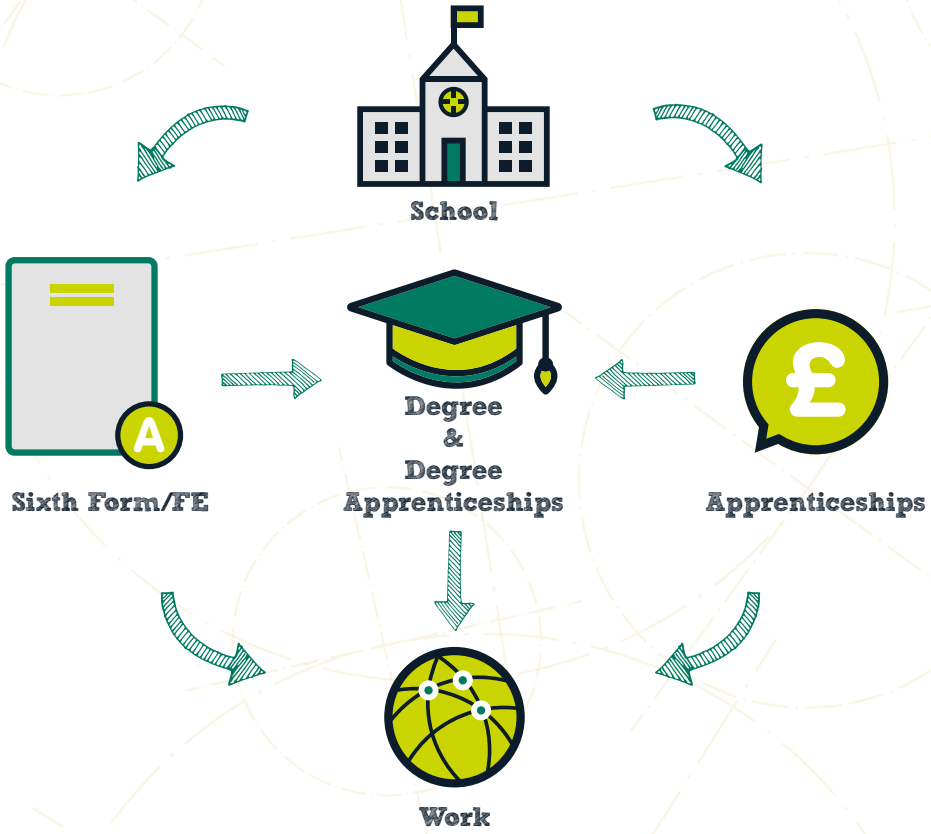
Further information: **www.theiet.org**

Elizabeth

MSc in Computer Games Software Development at Sheffield Hallam University with work placement as a Net Developer at G2G3 Digital
www.tomorrowsengineers.org.uk/real-jobs

"Computer games are art and the stories they tell and worlds they depict can be compared to that of a fantastic novel or detailed painting. For me, it's an exciting concept to be able to use elements of STEM to create emotive and enjoyable experiences."

Which route is right for me?



Find out more about different qualifications and routes into engineering:
www.tomorrowsengineers.org.uk

Professional Registration: Engineers can gain professional registration, which is recognised around the world. The letters after your name (EngTech, IEng or CEng) demonstrate academic ability, expertise, competence and commitment to your chosen career.
You can find out more at:
www.engc.org.uk

Choosing your options

At 14

If you want to keep your options open for engineering, including engineering apprenticeships, then at 14 make sure you focus on maths and science – particularly physics – at GCSE. Engineers also need to be creative problem solvers with good technical skills, so subjects like design & technology and computing can also be useful. Foreign languages can also put you at an advantage.

At 14 you may choose to attend a University Technical College (UTC)

More information can be found at:
- **www.utcolleges.org.**

At 16

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

- Take a Tech Level (T-level) in engineering or a related subject. These can be combined with A-levels/Highers or equivalent.
- Apply for an Advanced Apprenticeship where you are likely to study for a Tech Level whilst developing your engineering skills through work.
- Take a Diploma/A-levels/Highers/IB/SB, in maths, physics or engineering if you're thinking of going on to study a degree in engineering.
- With slightly lower grades, you could apply for a traineeship, a Level 2 qualification or an Intermediate Apprenticeship.

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

At 18

Your options include:

- Applying for a Higher Apprenticeship (typically Level 4 and 5) or a Degree Apprenticeship (Level 6 and 7), which may incorporate a degree or a master's degree whilst learning on-the-job.
- Full-time employment and 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.

To search for apprenticeships, go to: **www.getingofar.gov.uk**

Where will the jobs be?

Engineers are at the forefront of shaping the world we live in and developing new inventions; helping to improve our lives and solve our biggest challenges. One of the most exciting things about engineering is that many of the future jobs don't exist yet.

Some fields where you might work in 10 years' time if you choose engineering include:

Aerospace

Developing commercial space travel, working on the next generation of space exploration and designing cutting edge defence technology.

Built environment

Using building information modelling and smart technology to create 'intelligent' structures that plan for and monitor their own maintenance for their entire lifecyle. These structures will be cheaper, more energy efficient and have less environmental impact than ever before.

Cyber security

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

Food and drink

Ensuring the safety and efficiency of food production, using agricultural technologies (agri-tech), satellite imagery, big data and meteorology.

Healthcare

Transforming and saving lives by developing equipment and drugs for use by healthcare professionals – for example, robotic surgical instruments, artificial limbs and cancer-fighting treatments.

High-tech manufacturing

Developing the systems and equipment to make the products we couldn't live without, whilst improving efficiency, reliability and cost. For example, 3D and 4D printing.

Renewable energy technologies/ nuclear energy

Finding new ways to generate sustainable energy and evolving energy efficient devices to reduce demand for power.

Robotics

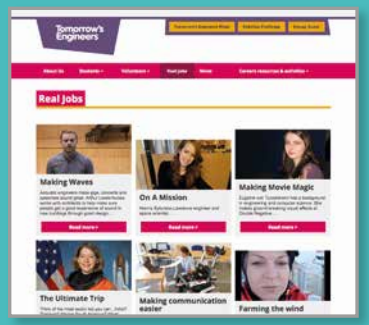
Designing new breeds of robotics machines that can help us address many of the problems we face in the modern word. Robots will be used in nuclear energy, offshore energy generation, unmanned aircraft (or drones), medical and social care, manufacturing, agriculture and intelligent vehicles.

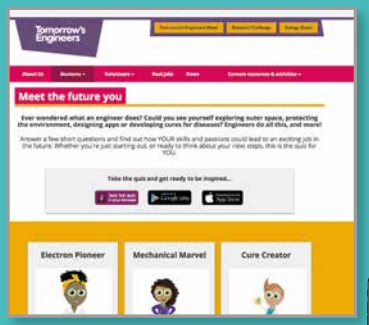
Water and flood risk

Dealing with climate change, the provision of clean water, disposal of waste water and sewage and helping protect us against floods and extreme weather conditions.

Tomorrow's Engineers

- Use our career finder to find out which engineering-based job role matches your interests.
- Investigate our 'real jobs' to understand what it's like to be an engineer and find out what engineers get up to at work.
- Take the 'Meet the future you' quiz to find out what type of engineer you could be.





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IOP Institute of Physics

'From idea to career' was produced by EngineeringUK, The Institution of Civil Engineers, The Institution of Engineering and Technology and The Institution of Mechanical Engineers, with advice from the Institute of Physics. These organisations work in collaboration (with support from the Royal Academy of Engineering), to develop engineering careers materials for the Tomorrow's Engineers programme, which exists to inspire young people to consider engineering careers.

To order more copies of this booklet or for further information, please visit the Tomorrow's Engineers website: www.tomorrowsengineers.org.uk

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