

The University of Manchester

Electrical, Electronic and Mechatronic Engineering

2020 Undergraduate brochure

Electrical, Electronic and Mechatronic Engineering at Manchester



Studying at university should transform your life. It's important you choose your degree carefully. At Manchester you will encounter the latest technology and share a proud heritage.



Facilities & resources

Our strong, ever-growing links with industry not only help to inform our courses, but also boost our excellent teaching and research facilities, which include:

- National Instruments Undergraduate Teaching Lab, including LabVIEW, LabView Academy and Multisim
- Rolls-Royce University Technology Centre (Electrical Systems for Extreme Environments)
- National Grid High Voltage facility, including the National Grid Power Systems Research Centre
- Oxford Instruments VG Semicon Molecular Beam Epitaxy facility.







Learning support

Peer support scheme

Our peer support scheme is one of the largest in Europe. Peer mentors are higher-year students on the same degree programme as you, who'll help you find your feet when you arrive here and adjust to student life. As they'll have already been a student at Manchester for at least a year, they should be able to help you with anything you might be worried or unsure about.

PASS (Peer Assisted Study Sessions)

Led by volunteer students, PASS sessions will often be based around a specific area of study. You'll have the opportunity to consolidate and build on your existing knowledge through discussion with other students in an informal and supportive environment, where you can compare notes, analyse, ask questions and talk through ideas.

Academic advisers

Study with us and you'll be assigned an academic tutor who is there to give advice about any academic issues throughout the duration of your course. Your tutor will be able to help you with the transition from school or college to university – and can help you get to grips with studying and learning more independently. They'll also be able to help you develop your skills in academic writing or research, or any other skills that are specific to your degree programme.

Disability support

If you have additional needs arising from a medical condition, physical or sensory disability, a specific learning disability such as dyslexia, or a mental health difficulty that affects your study, we can provide support. Contact or visit our Disability Advisory and Support Office before you apply, to discuss your needs and the support available.

www.manchester.ac.uk/dass

Find out more about the personal and academic support available to you throughout your studies: www.manchester.ac.uk/study/experience/student-life/university/student-support



The course is designed for students starting at various levels. I didn't start university with a strong foundation in electrical and electronic principles, or with strong programming skills. However, the structure of the course, combined with tonnes of opportunities to work on practical projects, has helped me sharpen the practical skills required to become an employable engineer.

Huda Ihsanuddin MEng (Hons) Electrical and Electronic Engineering



Apply

How to apply

www.manchester.ac.uk/study/ undergraduate/applications

Please note that the course units listed in this brochure only represent a sample of the full breadth of available units for each course. Units are reviewed on an annual basis and as such may vary slightly to those advertised.

For up-to-date course information, including unit detail and entry requirements in full, visit our course finder: www.manchester.ac.uk/undergraduate

Typical offer

BEng

A-level: AAB including Maths and either Physics, Electronics, Further Maths or Chemistry.

IB: 35 Points including 6 points in Maths and Physics or Chemistry at Higher Level and 5 points in one other Higher Level subject.

MEng

A-level: AAA including Maths and either Physics, Electronics, Further Maths or Chemistry.

IB: 36 Points including 6 Points in Maths and Physics or Chemistry at Higher Level and 6 points in one other Higher Level subject.

For full details of our entry requirements: www.manchester.ac.uk/ugcourses



Our courses

Electrical and Electronic Engineering	BEng	3 years
	MEng	4 years
Electrical and Electronic Engineering	BEng	4 years
	MEng	5 years
Electronic Engineering	BEng	3 years
	MEng	4 years
Electronic Engineering	BEng	4 years
with industrial Experience	MEng	5 years
Mechatronic Engineering	BEng	3 years
	MEng	4 years
Mechatronic Engineering	BEng	4 years
with industrial Experience	MEng	5 years

Which course?

Choosing your course

Our courses cover fundamental and cutting-edge topics in electrical, electronic, and mechatronic engineering. They are practical-based to ensure you leave us with not just the theory but also the skills to put that theory into practice.

Our courses are informed by the needs of business, influenced by the latest research and taught by knowledgeable, enthusiastic experts.

Flexibility in the selection

We want to ensure that you obtain the most appropriate degree for your future needs so we offer you flexibility.

All of our courses are available with an industrial placement and as BEng or MEng degrees; it is possible to change between courses up to the end of your first year (grades permitting).

The first year of study is common for all of our courses, giving you strong grounding in fundamental knowledge. The modular structure of final years includes elective course units that can be tailored to your preferred area of specialism.

Industrial experience

All our courses can be combined with an accredited, year- long industrial placement for the award of a 'with Industrial Experience' degree. Students on these extended courses spend a year in industry after their second year. We encourage you to spend time in industry during your course as it develops your business, teamworking and transferable skills, all of which are sought after by graduate employers. It will also increase your awareness of the broad range of careers on offer and guide your choice of optional subjects.

We have strong links with industry and our students find industrial placements with high-profile companies, such as Red Bull Racing, Jaguar Land Rover, National Grid, BP, National Instruments, AstraZeneca, Texas Instruments and many others. During an industrial placement year, you are paid a salary by the company you are working for.

Placements can be accredited by the IET towards the training required for attaining Chartered Engineer status.

www.eee.manchester.ac.uk/study/ undergraduate/industrial-experience

Electrical and Electronic Engineering

The use of electricity is an everyday part of our lives. It has to be generated as efficiently and cleanly as possible, and distributed safely to homes and industry. Our homes require electrical power for lighting, cooking, washing machines, refrigerators and freezers. Electrical power is also needed by computers, tablets, games consoles, smartphones, MP3 players, digital cameras and any other electronic gadget that you can think of.

The domestic mains voltage needs to be converted to a much lower voltage in other household equipment, such as music and video streaming systems, televisions, DVD and hard disk recorders, PCs, and peripherals, all of which contain sophisticated electronic circuitry. Industry needs power at a higher level for use in heavy machinery, which must be controlled and monitored by sophisticated electronic systems. Increasingly in transport, electrical systems are being used in electric vehicles (road and rail), hybrid drives (part electric motor, part internal combustion), engine management electronics, climate control, on-board entertainment and navigation systems.

Course overview

- Combine your maths knowledge with creativity to solve energy challenges
- Develop electronics, sensors and communication systems for homes and industry
- Learn about the design, control and operation of power conversion systems and large-scale power systems
- Develop real-time microcontroller-based embedded systems and robotics.

UCAS code	BEng	3у	H600	Accessing Programme
	MEng	4y	H605	The Institution of Engineering and Technology
With	BEng	4y	H606	Inst
Experience	MEng	5у	H601	MC

Year Sample course units

- 1 The first year of study is common for all of our courses. Units include: > Energy Transport and conversion
 - > Circuit analysis
 - > Electromagnetic field
 - > C Programming
- 2 > Generation and Transport of Electrical Energy
 > Machines, Drives,
 - and Power Electronics
 - > Embedded Systems Project
 - Analogue and Digital
 Communications
- 3 > Individual project

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- > Control Systems II
- > Power system Analysis
- > Electrical Drives Systems
- > Team project
 > Process Control and Model Predictive Control
 > Solar Energy Technologies
 - > Wireless Communication and Mobile Network

Electronic Engineering

In the 21st century, we look to electronics to provide answers for more and more complicated problems. Take the mobile phone: a very sophisticated computer and communications system that links to a worldwide network of antennas to allow it to connect to any other mobile or landline. Or the digital camera, at the heart of which is a sophisticated electronic device containing millions of individual light-level detectors.

Modern electronics requires an understanding of basic analogue and digital circuits to enable the design of simple elements, which can be connected together to make small systems, which can be connected together to make bigger systems. When the systems become complicated, we require techniques to allow us to design and use them, such as digital signal processing – for images and audio signals, concurrent processing – to allow the manipulation of the massive amounts of data, data networking and digital communication systems – for local distribution and across the internet.

Course overview

- Learn to design analogue and digital circuits to create smart devices
- Develop real-time microcontroller-based embedded systems and robotics
- Learn about nanoelectronics and trends in optical devices
- Design control systems for various industrial processes.

UCAS code	BEng	Зy	H610	Accelled Programme
	MEng	4y	H614	Engineering and Technology
With	BEng	4y	H613	Inst
Experience	MEng	5у	H615	MC/

Year Sample course units

1

2

4

- The first year of study is common for all of our courses. Units include: > Electronic project
 - Electronic materials
 - Electronic Circuit Design
 - > C Programming

> VSLI design
 > Microelectronic components
 > Microcontroller Engineering

- > Control Systems I
- 3 > Individual project
 > Computer Systems Architecture
 > Current Trends in Optical Devices
 - > Digital Signal Processing

> Team project
 > Digital Image Processing

- Machine Learning and Optimization techniques
 Nanoelectronics Devices
- and Nanomaterials



Mechatronic Engineering

Mechatronics is the marriage of mechanical engineering with smart electronics and is vital to industrial automation and robotics

To interact with an object, a system must know where the object is, be able to move the object and be able to place it in the required new position. The electronics therefore require information from sensors that can detect position, orientation and visual or audio signals. The electrical inputs from the sensors have to be interpreted and the appropriate signals sent out to the actuators to perform the required operation. This process relies on sophisticated software and hardware capable of translating low-voltage, low-current signals into power signals of sufficient current to drive the actuators. A good understanding of feedback control is also required in order to make changes in the system from one steady position to another, without oscillations or unpredictable movements.

Course overview

- Develop real-time microcontroller-based embedded systems and robotics
- Learn about design, operation and modelling of actuator systems
- Design control techniques for unmanned intelligent underwater, ground and aerial vehicles
- Develop localization and mapping techniques for robotics applications.

UCAS code	BEng	Зy	HH36	Accessing Programme
	MEng	4y	HHH6	Engineering and Technology
With	BEng	4y	HH63	Inst
Experience	MEng	5у	HHP3	MC/

Year	Sample course units
1	The first year of study is common for all of our courses. Units include: > Electronic project > C Programming > Microcontroller Engineering > Measurements and Analytical Software
2	 > Embedded Systems Project > Applied Mechanics for

3

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Industrial Robotics > Control Systems I

- > Signals and Systems
- > Individual project > Mechatronics Analysis and Design
 - > Mobile Robots and
 - Autonomous systems > Sensors and Instrumentation

> Team project

- > Advanced Robotics and Autonomous systems
- > Digital Control and System Identification
- > Process Control and Model Predictive Control

Example timetable – all courses

	Mon	Tue	Wed	Thu	Fri
09.00	Digital Systems Design	Measurements & Analytical Software	Electronics Project		
10.00	LECTURE Wks: 1–12	Reynold_C2 LECTURE Wks: 1–12	Sackville Street_C34 LABORATORY	Personal Tutorial Sackville Street_B24 TUTORIAL	PASS Session Reynold_D6
11.00	Circuit Analysis Reynold_C2	Maths 1E1 for EEE George Begg_C2 TUTORIAL	Wks: 9 Maths 1E1 for EEE Reynold_C9 LECTURE		Electronics Materials Reynold_C2
12.00	Wks: 1–12				LECTURE Wks: 1–12
13.00					
14.00	Measurements &	Electronic Materials		Electronics Project Reynold C2	
15.00	Analytical Software Barnes Wallis_311 LABORATORY	cal Software Sackville Street_C34 LCCT sWallis_311 LABORATORY Wks: 9 xks: 7–9 Wks: 9 Wks: 9	LECTURE Wks: 1–12	Maths 1E1 for EEE Kilburn TH 1.1	
16.00	Wks: 7–9			AdHocBooking Wks: 9	
17.00					

Project work

Hands-on project work is key to becoming an engineer. Every year you'll participate in either an individual or a team project. You can read about some of our projects below:

Year 1 **Electronics project**

This project introduces the practical issues associated with the design, electronic assembly, mechanical fabrication, and testing of electrical systems. You'll learn how to solder and do electrical and mechanical assembly by building a microcontroller development systems Input/Output board, which is used as a teaching vehicle in other course units. You'll also learn how to conduct electrical testing and fault finding and gain experience using industrial CAD tools such as Altium (circuit design) and SolidWorks (mechanical design).

Year 2 **Embedded Systems project**

As part of this year-long problem-based learning project you'll work in teams to design, build and test an autonomous buggy which is capable of using sensors to navigate its way around a track - whilst avoiding a few obstacles on the way! At the end of the year all buggies compete in a series of race heats, with the best making their way to the final, and with that the chance to be crowned as the winning team.

Year 3 – Individual project

The individual project is compulsory and you'll be allocated a project aligned with your preferences from a selection submitted by staff members. The projects are run over two semesters and will give you the opportunity to explore topics outside the curriculum or mastering some of the techniques that you've learnt.

Examples of recent individual projects:

5G communications networks

Agri Internet of Things (IoT) – next generation platform from Sony

Nanopositioning control

Modelling and simulation of thin-film transistors (TFTs) and circuits

Financial time series modelling and prediction using neural networks

Laser powered robots

Design and economics of solar home systems

Design of a flux-switching aerospace generator.

Year 4 – Team project

As part of this project you'll exercise and develop professional engineering skills – both technical and managerial. Emphasis is placed on the development of project management, planning, design and implementation skills. The key theme is of a team working closely together to achieve a common objective and, in theory, the objective may cover the spectrum from being largely of a research nature, evaluating novel techniques or components, through the development stages of a prototype system, up to the production of an actual product.

Examples of recent fourth year projects:

Haptic glove for bilateral teleoperation with virtual/augmented reality tools

An autonomous farm robot crop inspection and care without human intervention

Instrumented training wheelchair for para-athletes

Thickness measurement system that could be fitted to a sledge for use in the Arctic.



The best part of Electrical and Electronic Engineering is that there are countless domains in which you can apply it. From medicine, to phones and computers, all the way to renewable energy systems, it's amazing to see how the same principles apply. Technology is a big part of the present and it'll be an even bigger part of the future, so I have no doubt that this field of study and work will continue to grow in the most unexpected ways.

Flavia Dumitrica MEng (Hons) Electrical and Electronic Engineering



Manchester is a great place to be a student as it's a multicultural city wherever you look. People in Manchester always surprise me. You would never feel alone or lost here because you'll always find someone you can identify with.

Kevin Haro Garces BEng (Hons) Electrical and Electronic Engineering

Career opportunities

Electrical, Electronic and Mechatronic Engineering graduates from The University of Manchester :



Graduate salaries

UK average	£23	5,000
UK EEE	£20	5,146
UoM EEE	£27	7,490

Further study options

PhD - 44% MSc - 35% PhD Electrical and Electronic Engineering

Most popular course title



Most popular qualifications

Most popular institution

What our graduates do:

Where our graduates work:

Design automotive electronics
Design communication systems
Develop robotics
High voltage engineering
Integrate renewable energy sources
Oil and gas exploration
Systems for unmanned vehicles







Graduate profiles



Abdul Gafar

Abdul graduated in 2017 with BEng Mechatronic Engineering and in 2018 with MSc Advanced Control and Systems Engineering.

"I currently work at KPIT in Munich. KPIT is a service provider for Tier 1 and OEMs in the automotive industry. I came across KPIT when the company was looking for graduates that had used MATLAB and Simulink for modelling purposes, which I used for my undergraduate individual project and my master's dissertation.

I enjoyed the programming course units and projects. Programming is needed everywhere, and the projects allowed me to understand more clearly and put into practice the theory I'd learnt."



Raul Funes Tena

Raul graduated in 2018 with MEng Mechatronic Engineering.

"I work as an Application and Software Engineer for Bosch Rexroth, Bosch's Industrial Division. I was interested in developing embedded software for off-highway vehicles, and in Bosch itself, due to its size and the international opportunities available.

The good thing about joining a company like Bosch is that there are many different routes to moving upwards that I'd never considered prior to starting here, so who knows what the future has in store for me.

Manchester is a great place to be a student because the city region has one of the largest student populations in the UK, not to mention in Europe! There are plenty of young people going through the same experiences as you, which can be really helpful in building a network of friends and support. The city feels quite young, international and vibrant; there are always things to do and places to be."

Scholarships

The Department of Electrical and Electronic Engineering offers a number of scholarship options.

More information can be found on: www.eee.manchester.ac.uk/study/ undergraduate/fees-and-funding

The Beatrice Shilling Scholarship Maria-Irina Oancea

Maria-Irina is a recipient of The Beatrice Shilling Scholarship and is studying for a BEng (Hons) Electrical and Electronic Engineering.

What interests you most about your area of study?

I think that science and technology can make our lives better and I'm preoccupied with the fact that energy demand is increasing in a much computerised and globalised world where everything we do requires power. Representatives of power industries should find a way to produce, store, distribute and utilise energy in a more sustainable and environmentally friendly manner.

What were your first impressions of Manchester as a city?

I really liked Manchester as a city, I love the British architecture involving red brick buildings and the city struck me as a perfect mix of old and new, with plenty of places to explore.

What has been your favourite course unit so far?

The course unit I've enjoyed the most so far is 'Circuit Analysis'. I believe that knowing how current flows in a circuit and how different passive and active components affect it, is an essential skill for any electronics-based engineer.



What are you looking forward to studying in more detail in future years?

I'm really excited about learning how to program microcontrollers and embedded systems.

How do you feel your scholarship will benefit your university experience?

Considering that this scholarship will cover most of my living expenses during my university years, I'll have more time to dedicate to my studies and to enjoy the university experience and multicultural environment offered by Manchester.

What are your experiences and thoughts on being female in an area of study traditionally dominated by men?

I really think there should be equality in the opportunities for males and females studying this field. It may be difficult being surrounded by mostly males, but I'd like to think that cooperation and competence will become a part of the ordinary.

What are your career aspirations?

Firstly I'd like to get a master's degree as I believe it would open my path to more opportunities for further research and a fulfilling job so I can enjoy the contributions of my work.

Women in engineering

Our Department is committed to promoting equality and diversity in our working practices.

Our Equality and Diversity Committee brings together male and female members, and staff at both junior and senior levels. We champion a range of outreach activities, including industrial talks, networking and career guidance. We also recently introduced The Beatrice Shilling Scholarship, open to Home/EU students that have identified as being female when applying to the Department for undergraduate degree level study.

We need to inspire women and make sure they have access to all the amazing opportunities that are emerging in the UK's scientific, technology and engineering fields.

Professor Danielle George Professor of Radio Frequency Engineering

Read about our Women of Wonder: www.se.manchester.ac.uk/people/women-of-wonder

Watch the stories of some of the women in our Faculty: www.mub.eps.manchester.ac.uk/scienceengineering/2017/03/06/women-of-wonder



Dr Alessandra Parisio

Alessandra is a lecturer in the Department of Electrical and Electronic Engineering. Her research interests include the areas of large-scale energy management systems and stochastic constrained control. We are witnessing a huge paradigm shift in the energy sector which requires managing an increasing number of uncertain renewable energy sources, distributed generators, adjustable demand in response to fast-varying grid conditions, and incentives.

Alessandra's research contributes to the development of novel control and decision-support systems that improve the ability to manage the changes required in future electrical power networks in a manner that best meets the targets of affordability, security and sustainability.

Alessandra chairs the Equality, Diversity and Inclusion committee at the Department of Electrical and Electronic Engineering at The University of Manchester, which focuses on promoting equality and diversity in our working practices and developing an inclusive culture that values all staff.



Dr Jessica Louise Boland

Jessica is a lecturer in Functional Materials and Devices and a member of the Photonic Materials and Devices Group in the Photon Science Institute and has strong collaborations with the Henry Royce Institute. She joined the Department in 2018, having previously studied for her undergraduate degree in Physics at The University of Exeter and a Doctor of Philosophy in Condensed Matter Physics at The University of Oxford.

During this time Jessica experienced several different research fields: developing and patenting diffuse cholesteric liquid crystal reflectors for use in reflective liquid-crystal displays (the next colour Kindles!) for Hewlett Packard Labs in Bristol (now Folium Optics); modelling and measuring designer metamaterials for invisibility cloaks in the microwave range; and more recently, utilising terahertz spectroscopy to develop novel terahertz devices based on semiconductor nanowires.

Jessica has been recognised for her work on material characterisation using terahertz spectroscopy and has been awarded the Institute of Physics Jocelyn Bell Burnell medal and prize, the EPSRC Doctoral Prize and an Alexander von Humboldt research fellowship.

Jessica is passionate about the promotion of accessibility in STEM, having recently started the 'SignScience' campaign to promote the use of British Sign Language in STEM subjects.

Make your mark with Stellify

I wanted to try something completely new. Transforming unused and overgrown land into areas where fruit and vegetables can be grown gave my volunteering an environmental focus.

Volunteering is a different experience from study. For me, as a chemical engineering student, it's enabled me to think outside my discipline, which by its nature is very technical.

Here at Manchester, volunteering is embedded in the very heart of the University's culture – there are so many opportunities to try something new, which in turn can have such a positive impact on our communities.



Read Alessia's story at: www.manchester.ac.uk/make-your-mark At Manchester you'll find a whole host of transformational academic and extracurricular activities to help you stand out and make your mark on the world. You could even prove your abilities to potential employers by gaining a prestigious award.

We call this process **Stellify**: to change, or be changed, into a star.

Stellify offers you opportunities to develop and grow at a university leading the way in social responsibility. Here's how.



Learn without boundaries

 Enjoy interdisciplinary, international and entrepreneurial study options outside your course.

Understand the issues that matter

Become ethically, socially and politically informed on some of humanity's most pressing global issues.



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Make a difference

Contribute to and learn from local and global communities through volunteering.



Step up and lead

Gain confidence and experience by assisting and inspiring your peers.

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Create your future

Explore countless opportunities for professional career development.

STELLIFY

www.manchester.ac.uk/stellify

Manchester engineering campus development

A world-leading campus for teaching, learning and research, providing a brand new home for the next generation of engineers and material scientists.

It's a playground for engineers! It's got facilities and spaces - some social, some very technical - to let you work with other people to do some really amazing things.

Its workshops and lab spaces will become amplified centres of creativity, innovation and identity, allowing students to solve problems collaboratively to reflect the way industry works.

Learning will not be confined to the classroom – it will deliver a variety of adaptable and innovative learning spaces, recognising that there is no one right teaching and learning style.

Engineering is about creativity and the first thing you will see when you come into the building is students 'making' and 'doing'.

Our new campus reflects our pride in Manchester's rich academic and civic heritage, while showcasing our ongoing evolution of education and research.



The University of Manchester

Department of Electrical and Electronic Engineering Student Recruitment and Admissions Sackville Street Building Manchester M1 3BB United Kingdom

- t +44 (0)161 306 4700
- e ug-eee@manchester.ac.uk
- w manchester.ac.uk/eee

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This brochure was printed in 2019 for the purposes of the 2020 intake. It has therefore been printed in advance of course starting dates and for this reason, course information may be amended prior to you applying for a place. There are a number of reasons why changes to course information and/or published term dates may need to be made prior to you applying for a place – more details can be found on our website. Prospective students are therefore reminded that they are responsible for ensuring, prior to applying to study, that they review up-to-date course information by searching for the relevant course at:

www.manchester.ac.uk/undergraduate/courses

Further information describing the teaching, examination, assessment and other educational services offered by The University of Manchester is available at:

www.manchester.ac.uk/undergraduate

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