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Inside the School of Engineering

Students’ project ARION2 breaks British Land speed record
For the second year in a row, our MEng Engineering students’ design and build project ‘The University’s Velocipede (ULV) Team’ has broken both the men’s and women’s British Land Speed Record for a human-powered vehicle with their aerodynamic recumbent bike, ARION2 at the World Human Powered Speed Challenge in the Nevada desert.

The ARION2 is a culmination of two years work by Year 3 and 4 MEng students, who have put their engineering theory and practical experience into this successful project.

The ULV team’s male rider, Ken Buckley set a new speed of 76.59mph to become the fastest British man and Yasmin Tredall is now the second fastest woman in the world, and the fastest British woman, having achieved a speed of 71.05mph.

Read more at www.liverpool.ac.uk/engineering/news/articles/arion2-breaks-british-womens-world-land-speed-record/

Formula Student Team races ahead!
Our Formula Student Team achieved their best ever results at the recent annual international Formula Student competition at Silverstone. Overall they achieved an impressive 3rd place out of 47 UK universities and a total ranking of 15th out of 107 world-wide universities.

The team, consisting of third and fourth year mechanical engineering students, work closely with the University’s VEC (Virtual Engineering Centre) to access the latest virtual engineering tools, programmes and facilities to design and build a virtual prototype before going into production.

Formula Student is an international competition in which top engineering students design, build and race a single seat racing car.

Virtual Engineering Centre hosts NASA student challenge
Students from the University’s School of Engineering participated in the NASA SEE (Simulation Exploration Experience) challenge hosted at the University’s VEC (Virtual Engineering Centre).

SEE is an opportunity for students to take part in a NASA-led simulated lunar mission using distributed network simulation.

The Liverpool team, consisting of staff and students, is one of several university teams from all over the world who work in conjunction with each other, industry partners and NASA to design, develop, test and execute a simulated lunar mission.
Why choose Engineering at Liverpool?

Decide to study engineering and you are choosing a path that will allow you to make a real and lasting impact on the world we live in. At the University of Liverpool’s School of Engineering, our practical, industry-led degrees are creating the engineers of the future.

Choose a degree that prepares you to be a modern engineer for the future

At Liverpool, your learning environment reflects your future working environment. Our emphasis is on active learning, supported by traditional lectures and tutorials. You will benefit from research-led teaching, conducted in collaboration with industry, Government, research laboratories and academics around the world. We have received many accolades from the engineering industry who regard our graduates as among the most employable in the world – the highest validation of our approach.

Benefit from learning in outstanding facilities

We are a Centre of Excellence for engineering research and have a highly respected reputation for world leading experimental facilities. Our £32 million redevelopment includes the award-winning Active Learning Laboratory. This is one of the largest and best-equipped laboratories in Europe and is at the heart of undergraduate learning. The state-of-the-art facilities that you will benefit from include two research-standard full motion flight simulators (one of which is unique within the academic world), manufacturing robotics, wind turbines, a water flume, additive manufacturing machines and many more.
Put your learning into practice through a year in industry
There is nothing like spending a year working in industry as part of your degree for consolidating your knowledge and giving you a head start in the job market after you graduate. A year in industry can be taken in all our programmes.

Shape our flexible programmes around you
Our programmes provide opportunities for specialisation in one discipline or a broad skill base across all engineering disciplines.

Gain professional accreditation
All our BEng/MEng degree programmes are accredited, or preparing for accreditation, by at least one professional institution, providing you with a solid foundation for your career. A MEng degree from Liverpool satisfies the academic requirements for registration as a Chartered Engineer (CEng).

Study abroad
As part of your Engineering degree programme you may have the opportunity to study abroad. Studying abroad has huge personal and academic benefits, as well as giving you a head start in the graduate job market. For more information, visit www.liverpool.ac.uk/goabroad

Year in China
The Year in China is the University of Liverpool’s exciting flagship programme enabling undergraduate students from a huge range of departments, including Engineering, the opportunity to spend one year at our English speaking sister university Xi’an Jiaotong- Liverpool University (XJTLU), following XJTLU’s BA China Studies degree classes. See www.liverpool.ac.uk/yearinchina for more information.

The thing that I enjoy most about my programme is the project work because you can be quite independent when working on it. A lot of it is theory based but then the good thing is that you get to put it into practical use on your project and we actually get to use a lot of the facilities during the whole course starting from first year right the way through to fourth year. At the moment I am designing a prosthetic leg for a client outside the University, so that’s really exciting because it’s something real that we can put to use in the real world.

Grace Clarke
Mechanical Engineering MEng (Hons)

Good to know:

316
Year One undergraduates in 2016

5th
General Engineering is ranked 5th in the UK for 4* and 3* research (REF 2014)

90%
of our graduates are in work/study six months after graduation (Unistats 2016)

Offers study abroad opportunities

Offers a Year in China
How you learn 📚
We are leading the UK’s involvement in the international ‘Conceive-Design-Implement-Operate’ (www.cdio.org) initiative – an innovative educational framework for producing the next generation of engineers – providing students with an education stressing engineering fundamentals set in the context of conceiving, designing, implementing and operating real world systems and products. Students will benefit from this involvement and become ‘industry-ready’ graduates.

We offer an engineering education distinctive in the way students engage actively, through the design and make activities, with their learning process. Our degree programmes encompass the development of a holistic, systems approach to engineering. Technical knowledge and skills are complemented by a sound appreciation of the life-cycle processes involved in engineering and an awareness of the ethical, safety, environmental, economic and social considerations involved in practicing as a professional engineer. The School also houses the Engineering and Materials Education Research Group, which advises all UK teachers about innovations in engineering education.

There are a range of projects available to take part in. My group project involves the design and manufacturing of a Formula Student race car, which is such a great opportunity to apply the knowledge gained from the programme to a real-life project.

India Phillips
Mechanical Engineering MEng (Hons)
Timetable

**Semester One**

**Typical week**

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.00</td>
<td>Solids and structures lecture</td>
<td>Engineering skills</td>
<td>Electrical circuits and digital electronics lecture</td>
<td>Small group tutorial</td>
<td>Work independently on tutorial problems</td>
<td></td>
</tr>
<tr>
<td>10.00</td>
<td>Maths lecture</td>
<td>Solids and structures lecture</td>
<td>Mechanical product dissection</td>
<td>Design</td>
<td>Work independently on tutorial problems</td>
<td></td>
</tr>
<tr>
<td>11.00</td>
<td>Peer-assisted learning (PAL)</td>
<td>Maths lecture</td>
<td>Electrical circuits and digital electronics lecture</td>
<td>Write up lab report</td>
<td>Write up lab report – submit online</td>
<td></td>
</tr>
<tr>
<td>12.00</td>
<td>Work with group on design project</td>
<td>Seminar</td>
<td>Sports</td>
<td>Maths lecture</td>
<td>Write up lab report</td>
<td></td>
</tr>
<tr>
<td>13.00</td>
<td>Work independently on tutorial problems</td>
<td>Laboratories</td>
<td>Mechanical product dissection</td>
<td>Fluids and thermodynamics lecture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.00</td>
<td>Fluids and thermodynamics lecture</td>
<td>Prepare group presentation</td>
<td>Solve maths homework</td>
<td>Electrical circuits and digital electronics lecture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.00</td>
<td>Write up lab report</td>
<td>Peer-assisted learning (PAL)</td>
<td>Maths lecture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.00</td>
<td>Mechanical product dissection</td>
<td>Seminar</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.00</td>
<td>Prepare group presentation</td>
<td>Seminar</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.00</td>
<td>Solve maths homework</td>
<td>Seminar</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.00</td>
<td>Prepare group presentation</td>
<td>Seminar</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Timetabled academic session
- Independent Study Time
- Social
Industry-ready graduates
Our research-led teaching ensures that we incorporate the latest advances in cutting edge engineering research, and with almost 95% of our research deemed world leading or internationally excellent our teaching is highly regarded by engineering industries. As well as achieving a degree qualification, you will graduate as an industry ready engineer who has both practical, hands on experience and highly desirable skills to the Engineering Industry.

Recent employers of our graduates
- ABB Ltd
- Airbus
- Arup
- Atkins
- Balfour Beatty
- Bentley
- BMI
- British Airways
- British Army
- Corus
- Costain
- Government organisations
- Halcrow
- Highways Agency
- Jaguar Land Rover
- Laing O’Rourke
- Metronet Rail
- Mouchel
- National Grid Transco
- National Nuclear Laboratory
- Network Rail
- Pilkington
- QinetiQ
- RAF
- Ramboll
- Rolls Royce
- Royal Haskoning
- Royal Navy
- Siemens
- Tarmac
- United Utilities.

A passion for learning: postgraduate studies
A number of our graduates go on to postgraduate study at MSc or PhD level, either remaining at the University of Liverpool or going to another institution of their choice.
Award winning careers, internship and placement service for students

Our Careers & Employability service was voted one of the best in the UK, by students, for the help they provide to find jobs, placements and internships.

Recently several Engineering students completed a three month summer paid internship with Seqirus (formally Novartis), one of the world’s major manufacturers for flu vaccine. They worked in the company’s Engineering and Health & Safety departments.

LivWiSE (Liverpool Women in Science and Engineering)

LivWiSE is a society for men and women to celebrate and promote women in science, technology, engineering, maths and medicine (STEM). They regularly host events and networking opportunities which are open to everyone interested in STEM. Find out more at www.liverpool.ac.uk/livwise, www.facebook.com/liverpoolWISE or @LivUniWiSE.

The approach to active learning helps us engage effectively with engineering concepts and puts together the foundation for life-long learning as a professional engineer. Overall, my degree has given me a unique experience and made me highly versatile. Engineers are not only employed in a technical capacity but also in sales, marketing and managerial roles. Adaptation of these skills makes the University of Liverpool engineer distinctive; hence will be of great demand across a vast range of industries in years to come. At the end of it all, it is certainly reassuring when you pick up your degree on graduation day with pride and being able to do almost anything with your future.

Adeayo Satayo
Winner of the University’s International Student Award and an Engineering graduate
## Degrees

<table>
<thead>
<tr>
<th>Programme Type</th>
<th>UCAS Code</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerospace Engineering BEng (Hons)</td>
<td>H425</td>
<td>3 years</td>
</tr>
<tr>
<td>Aerospace Engineering MEng (Hons)</td>
<td>H421</td>
<td>4 years</td>
</tr>
<tr>
<td>Aerospace Engineering with Pilot Studies BEng (Hons)</td>
<td>H401</td>
<td>3 years</td>
</tr>
<tr>
<td>Aerospace Engineering with Pilot Studies MEng (Hons)</td>
<td>H402</td>
<td>4 years</td>
</tr>
<tr>
<td>Architectural Engineering BEng (Hons)</td>
<td>HK26</td>
<td>3 year</td>
</tr>
<tr>
<td>Architectural Engineering MEng (Hons)</td>
<td>HK28</td>
<td>4 years</td>
</tr>
<tr>
<td>Civil Engineering BEng (Hons)</td>
<td>H200</td>
<td>3 years</td>
</tr>
<tr>
<td>Civil Engineering MEng (Hons)</td>
<td>H202</td>
<td>4 years</td>
</tr>
<tr>
<td>Civil and Structural Engineering MEng (Hons)</td>
<td>H220</td>
<td>4 years</td>
</tr>
<tr>
<td>Engineering BEng (Hons)</td>
<td>H100</td>
<td>3 years</td>
</tr>
<tr>
<td>Engineering MEng (Hons)</td>
<td>H101</td>
<td>4 years</td>
</tr>
<tr>
<td>Industrial Design BEng (Hons)</td>
<td>3D52</td>
<td>3 years</td>
</tr>
<tr>
<td>Industrial Design MEng (Hons)</td>
<td>6G11</td>
<td>4 years</td>
</tr>
<tr>
<td>Mechanical Engineering BEng (Hons)</td>
<td>H300</td>
<td>3 years</td>
</tr>
<tr>
<td>Mechanical Engineering MEng (Hons)</td>
<td>H301</td>
<td>4 years</td>
</tr>
<tr>
<td>Engineering Foundation BEng (Hons)</td>
<td>H109</td>
<td>4 (1+3) years</td>
</tr>
</tbody>
</table>

Degree programmes have flexible entry requirements. Contact degree@carmel.ac.uk for details.

See [www.liverpool.ac.uk/study/undergraduate/courses](http://www.liverpool.ac.uk/study/undergraduate/courses) for current entry requirements.

### Aerospace Engineering BEng (Hons)

**UCAS code:** H425  
**Programme length:** 3 years

The main aerospace engineering topics you'll study include aerodynamics, aero structures, flight dynamics and control, propulsion systems, communications, avionics, and aircraft materials. The programmes include a two day flight test course in a Jetstream aircraft.

Our Aerospace Engineering degree programmes are double accredited (by the Royal Aeronautical Society and the Institute of Mechanical Engineers).

**Programme in detail**

Year One students study core engineering modules such as Structures; Fluid mechanics; Thermodynamics; Materials; Maths; Electronics and management. The module Introduction to aerospace engineering provides a first insight into this exciting discipline.

This, alongside general engineering skills such as technical drawing and communication is reinforced throughout the year via a design-build-test project where students are required to demonstrate their learning by creating an unmanned glider aircraft for use in a humanitarian mission.

Year Two includes a two day flight course on board a Jetstream aircraft. Students take modules in Aeroengines; Avionics; Computer programming; Maths; Dynamics; Structures design; Aircraft performance and project management.

Year Three students undertake an individual project providing the opportunity to conduct research and develop innovative concepts in their preferred technical area of interest. They also take modules in Aerodynamics; Flight dynamics and control; Aerostructures; Avionics; Aircraft design; Composite materials and management. They can also take optional modules in topics such as spaceflight and rotorcraft flight.
Key modules

Year One
Core modules
- Aerospace engineering design IA
- Aerospace engineering design IB
- Electrical circuits for engineers
- Electromechanical systems
- Engineering mathematics
- Fluid mechanics I
- Introduction to aerospace engineering
- Introduction to management and sustainability
- Introduction to structural materials
- Mathematical techniques for engineers
- Solids and structures I
- Thermodynamics I.

Year Two
Core modules
- Aeroengine
- Aerospace engineering design II
- Aircraft performance A
- Avionic and communication systems
- Dynamic systems
- Experimental methods
- Materials processing and selection I
- Mathematics engineering II
- Programming for engineers I
- Project management
- Solids and structures II.

Year Three
Core modules
- Advanced engineering materials
- Advanced modern management
- Aerodynamics
- Aerospace engineering design III
- Aerostructures
- Flight dynamics and control
- Individual project.

Selected optional modules
- Avionic systems design
- Programming for engineers II
- RF engineering and applied electromagnetics
- Risk and uncertainty: numerical applications
- Rotorcraft flight
- Spaceflight.

See pages 20-29 for module descriptions.

Aerospace Engineering MEng (Hons)

UCAS code: H421
Programme length: 4 years
Choose the MEng programme (H421) if you want to follow an extended degree programme that satisfies the academic requirements for registration as a Chartered Engineer (CEng) and a European Engineer (Eur Ing).

Programme in detail
The MEng is designed to offer students a greater depth and breadth of specialist knowledge in the core aerospace subjects with a range of advanced Year Four modules, such as Configurational aerodynamics; Aircraft design; Lightweight materials; Flight handling qualities; Rotorcraft; Advanced guidance systems and management.

Key modules

Year One
Core modules
Same as H425 on page 09.

Year Two
Core modules
Same as H425 on page 09.

Year Three
Core modules
- Advanced engineering materials
- Advanced modern management
- Aerodynamics
- Aerospace engineering design III
- Aerostructures
- Flight dynamics and control
- Individual project.

Selected optional modules
- Avionic systems design
- Programming for engineers II
- RF engineering and applied electromagnetics
- Risk and uncertainty: numerical applications
- Rotorcraft flight
- Spaceflight.
Year Four
Core modules
- Advanced aerodynamics
- Advanced aerostructures
- Aeroelasticity
- Aerospace capstone group design project
- Flight handling qualities.

Selected optional modules
- Advanced 4th year research project
- Advanced fluid mechanics
- Advanced guidance systems
- Advanced mathematical methods
- Enterprise studies
- IC engines
- Structural optimisation
- Risk and uncertainty: probability theory.

See pages 20-29 for module descriptions.

Aerospace Engineering
with Pilot Studies BEng (Hons)
UCAS code: H401
Programme length: 3 years

This programme is very similar to that of the Aerospace Engineering degree programmes (H425 and H421) but also introduces elements of pilot studies for students interested in becoming pilots.

In Year One, the Pilot studies module (based on the PPL ground school syllabus) complements the flight training programme of 20 hours which is mandatory. In Year Two, the Pilot studies module is based on the Air Transport Pilot’s Licence (ATPL) ground school syllabus.

An additional fee of approximately £3,400 is required to cover the costs of the mandatory 20 hours pilot training.

Programme in detail
Year One students study core engineering topics such as structures; fluid mechanics; thermodynamics; materials; maths; electronics and management. Pilot studies provides a first insight into this exciting discipline. This, alongside general engineering skills such as technical drawing and communication is reinforced throughout the year via a design-build-test project where students are required to demonstrate their learning by creating an unmanned glider aircraft for use in a humanitarian mission. The Pilot studies module (based on the PPL ground school syllabus) complements the flight training programme of 20 hours which is mandatory.

In Year Two, you will take modules in Aerodynamics; Avionics; Computer programming; Maths; Dynamics; Structures; Design; Aircraft performance and project management. The pilot studies module is based on the Air Transport Pilot’s Licence (ATPL) ground school syllabus.

In Year Three you will undertake an individual project providing the opportunity to conduct research and develop innovative concepts in their preferred technical area of interest.

You can also take modules in Aerodynamics; Flight dynamics and control; Aerostructures; Aeroengines; Avionics; Aircraft design and management and you can take optional modules in topics such as spaceflight and rotorcraft flight.

Key modules
Year One
Core modules
- Aerospace Engineering design IA
- Aerospace Engineering design IB
- Electrical circuits for engineers
- Electromechanical systems
- Engineering mathematics
- Fluid mechanics I
- Introduction to management and sustainability
- Introduction to structural materials
- Mathematical techniques for engineers
- Pilot studies I
- Solids and structures I
- Thermodynamics I.
Year Two
Core modules
- Aeroengines
- Aerospace engineering design II
- Aircraft performance A
- Avionic and communication systems
- Dynamic systems
- Mathematics engineering II
- Pilot studies II
- Pilot studies III
- Programming for engineers I
- Project management
- Solids and structures II.

Year Three
Core modules
- Advanced engineering materials
- Advanced modern management
- Aerodynamics
- Aerospace engineering design III
- Aerostructures
- Flight dynamics and control
- Individual project.

Selected optional modules
- Avionic systems design
- Programming for engineers II
- RF engineering and applied electromagnetics
- Risk and uncertainty: numerical applications
- Rotorcraft flight
- Spaceflight.

See pages 20-29 for module descriptions.

Programme in detail
The MEng is designed to offer students a greater depth and breadth of specialist knowledge in the core aerospace subjects with a range of advanced Year Four modules, such as Configurational aerodynamics; Aircraft design; Lightweight materials; Flight handling qualities; Rotorcraft; Advanced guidance systems and management.

Year One students study core engineering modules such as Structures; Fluid mechanics; Thermodynamics; Materials; Maths; Electronics and management. Pilot studies provides a first insight into this exciting discipline. This, alongside general engineering skills such as technical drawing and communication is reinforced throughout the year via a ‘design-build-test’ project where students are required to demonstrate their learning by creating an unmanned glider aircraft for use in a humanitarian mission. The pilot studies module (based on the PPL ground school syllabus) complements the flight training programme of 20 hours which is mandatory.

Year Two students take modules in Aeroengines; Avionics; Computer programming; Maths; Dynamics; Structures; Design; Aircraft performance and project management. The pilot studies module is based on the Air Transport Pilot’s Licence (ATPL) ground school syllabus.

Year Three students undertake an individual project providing the opportunity to conduct research and develop innovative concepts in their preferred technical area of interest. They also take modules in Aircraft design; Aerodynamics; Flight dynamics and control; Aerostructures; Avionics; Composite materials and management. They can also take optional modules in topics such as spaceflight.

Aerospace Engineering with Pilot Studies MEng (Hons)
UCAS code: H402
Programme length: 4 years

The programme is very similar to the MEng Aerospace Engineering degree programme (H421), but includes the pilot studies modules in Years One and Two from the BEng Aerospace Engineering with Pilot Studies degree programme (H401).

An additional fee of approximately £3,400 is required to cover the costs of the mandatory 20 hours pilot training.

Continued over...
Key modules

Year One
Core modules
Same as H401 on page 10.

Year Two
Core modules
Same as H401 on page 11.

Year Three
Core modules
Same as H421 on page 09.
Selected optional modules
Same as H421 on page 09.

Year Four
Core modules
Same as H421 on page 10.
Selected optional modules
Same as H421 on page 10.

See pages 20-29 for module descriptions.

Architectural Engineering
BEng (Hons)
UCAS code: HK26
Programme length: 3 years

Architectural Engineering
MEng (Hons)
UCAS code: HK28
Programme length: 4 years

This programme is currently under assessment for accreditation by the Joint Board of Moderators for the Institute of Civil Engineers (ICE), Institution of Structural Engineers, Institute of Highway Engineers and the Chartered Institution of Highways and Transportation. It also satisfies the academic requirements for registration as a Chartered Engineer.

Programme in detail

Working across both disciplines, architectural engineers apply engineering principles to the planning, design and construction of the built environment. Architectural engineers are responsible for the design of different systems within a building or aspect of critical infrastructure with a particular focus on key areas such as:

- creating innovative design strategies to improve our cities and infrastructure
- structural integrity to sustain earthquakes, fires, vibrations, wind loading, explosions and impacts
- modelling and design of heating, ventilation and air conditioning systems to make an environment hospitable for the user
- acoustic performance and lighting design sustainability and energy efficiency.

The BEng/MEng Degree in Architectural Engineering is being assessed for accreditation by the Joint Board of Moderators for the Institution of Civil Engineers (ICE), Institution of Structural Engineers, Institute of Highway Engineers and The Chartered Institution of Highways and Transportation. It also satisfies the academic requirements for registration as a Chartered Engineer.

Architectural Engineering graduates are in great demand. Careers in civil and architectural engineering offer the highest paid jobs for graduates in the UK (source: Telegraph 10 best paid jobs for graduates, Aug 2015).

Year One
Core modules
- Civil engineering design and technology
- Engineering mathematics
- Fluid mechanics
- Geology for civil engineers
- Introduction to civil and architectural engineering
Introduction to environmental design
Introduction to structural materials
Management and sustainability
Solids and structures I
Surveying
Thermodynamics.

**Year Two**
Core modules
- Construction materials
- Environmental design II
- Group design project
- History and theory of architecture
- Reinforced concrete and steelwork
- Soil mechanics
- Solids and structures II
- Structural behaviour and modelling.

Optional modules
- Engineering mathematics II
- Project management.

**Year Three**
Core modules
- Construction management
- Earthquake engineering
- Environmental design III
- History and theory of architecture
- Geotechnical engineering
- Individual project
- Structures III.

Optional modules
- Introduction to finite elements
- Prestressed concrete design.

**Year Four**
Core modules
- Advanced construction management
- Energy and the environment
- Foundation engineering
- Multidisciplinary design project.

Optional modules
- Bridge engineering
- Materials for durable and sustainable construction
- Structural dynamics and applications
- Structural systems
- Town planning and the built environment.

See pages 20-29 for module descriptions.

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**Civil Engineering BEng (Hons)**
UCAS code: H200
Programme length: 3 years

**Civil Engineering MEng (Hons)**
UCAS code: H202
Programme length: 4 years

This broad-based Civil Engineering programme provides sound academic training for the professional engineer. Civil engineering graduates are in great demand. Careers in civil and architectural engineering offer the highest paid jobs for graduates in the UK (source: Telegraph 10 best paid jobs for graduates, Aug 2015).

This MEng programme (H202) is accredited by the Institution of Civil Engineers and satisfies the academic requirements for registration as a chartered engineer. It is possible to transfer to the MEng programme at the end of Year Two; otherwise BEng (H200) students will need to complete additional study as a matching section. This might involve an integrated programme of study, such as a master’s degree, and work with an employer.

The MEng programme shares the same modules as the Civil Engineering BEng (H200) during the first three years. In Year Four you study more specialised fields of Civil Engineering at an advanced level including: bridge engineering, coastal and estuary processes, and materials for sustainable construction.

**Programme in detail**
You will be introduced to the essentials: Structural design and analysis; Fluid mechanics; Land surveying; Soil mechanics; Highway engineering; Hydraulics; and Environmental studies; amongst others. Year One includes a four-day surveying field course and a one-week full-time CDIO project, where teams of students work together to design, build and test a small scale bridge.

You will study mathematics relevant to engineering; structural materials; solids and structures; computer-aided drawing and design, and will be introduced to the principles of management for the construction industry. Site visits are integral to the programme, as are various individual and group design exercises including an opportunity to design your own full-scale bridge.

Continued over...
An exciting part of the second year of our programme is a week of real, hands on construction experience at ‘The Constructionarium’. The Constructionarium takes place at a two hectare site, specifically designed and built to provide a range of challenging teaching and learning conditions for students. (There is an additional cost of up to £300 for the Constructionarium).

The programme gives you the opportunity to undertake an individual research project in your final year and you can choose particular areas of specialisation from a broad range of optional modules including: Town planning; Traffic design and management; Design and construction of roads and airfields; Applied hydrology; Foundation engineering; Structural steelwork; timber and masonry; Coastal and estuarine processes and many more.

On H202, through the wide range of available options, you can retain a broad base to your studies throughout your MEng degree programme. The multidisciplinary group design project brings together students specialising in various aspects of Civil Engineering to work as a team to produce a feasibility study on a project that requires all their skills to be used in a co-ordinated way. A recent study of a ferry terminal scheme, for example, enabled students to explore different aspects of the problem in a project-based learning environment; and field visits to existing quarries were organised to provide an insight into some possible solutions.

**Key modules**

**Year One**

Core modules
- Civil and architectural design and technology
- Engineering mathematics
- Fluid mechanics
- Geology for civil engineers
- Introduction to civil and architectural engineering
- Introduction to environmental design
- Introduction to structural materials
- Mathematical techniques for engineers
- Management and sustainability
- Solids and structures I
- Surveying
- Thermodynamics.

**Year Two**

Core modules
- Construction materials
- Group design project
- Highway engineering
- Hydraulics
- Mathematics engineering II
- Numerical and statistical analysis for engineering with programming
- Programming for engineers I
- Project management
- Reinforced concrete and steelwork
- Soil mechanics
- Solids and structures II
- Structural behaviour and modelling.

**Year Three**

Core modules
- Construction management
- Earthquake engineering
- Geotechnical engineering
- Individual project
- Introduction to finite elements
- Prestressed concrete design
- Structural dynamics
- Structures III
- Sustainable water engineering
- Transport infrastructure construction materials and design
- Uncertainty, reliability and risk I.

**Year Four (H202 only)**

Core modules
- Advanced construction management
- Foundation engineering
- Materials for durable and sustainable construction
- Multidisciplinary design project
- Structural systems.

Selected optional modules
- Advanced mathematical methods
- Coastal and estuary processes
- Politics of the environment
- Risk and uncertainty: probability theory
- Structural dynamics and applications
- Structural optimisation
- Structural, steelwork, timber and masonry.

See pages 20-29 for module descriptions.
Civil and Structural Engineering MEng (Hons)
UCAS code: H220
Programme length: 4 years

This programme concentrates on a range of analysis and design methods using the principal structural materials of reinforced concrete, steel, timber and masonry. It covers both the theoretical background and the design implications of structural engineering and shares the same modules as the Civil Engineering BEng (H200) during the first three years. There is an emphasis on advanced analysis and design and you will have the opportunity to use state-of-the-art commercial design software.

Programme in detail
In addition to covering core topics in Civil Engineering, you will study various aspects of structural design in greater depth. You will complete an individual research project as well as an industry project, a multidisciplinary group study and a group design project.

Key modules
Year One
Core modules
Same as H202 on page 14.

Year Two
Core modules
Same as H202 on page 14.

Year Three
Core modules
Same as H202 on page 14.

Year Four (H220 only)
Core modules
- Advanced construction management
- Foundation engineering
- Materials for durable and sustainable construction
- Multidisciplinary design project
- Structural systems.

Selected optional modules
- Coastal and estuary processes
- Risk and uncertainty: probability and theory
- Structural dynamics and applications
- Structural, steelwork, timber and masonry.

See pages 20-29 for module descriptions.

Engineering BEng (Hons)
UCAS code: H100
Programme length: 3 years

Engineering MEng (Hons)
UCAS code: H101
Programme length: 4 years

Following a broad first year of study covering all disciplines within the School, students on this programme will be required to transfer their registration onto one of the following engineering programmes, depending on whether they are on the three or four year programme:

- Aerospace Engineering BEng/MEng (H425/H421)
- Architectural Engineering BEng/MEng (HK26/HK28)
- Civil and Structural Engineering MEng (H220)
- Civil Engineering BEng/MEng (H200/H202)
- Industrial Design BEng/MEng (3D52/6G11)
- Mechanical Engineering BEng/MEng (H300/H301)

Key modules
Year One
Core modules
- Electrical circuits for engineers
- Electromechanical systems
- Engineering design A (select mechanical, aerospace or civil and architectural)
- Engineering design B (select mechanical, aerospace or civil and architectural)
- Engineering mathematics
- Fluid mechanics
- Introduction to management and sustainability
- Introduction to structural materials
- Mathematical techniques for engineers
- Solids and structures I
- Thermodynamics
- Plus one discipline-specific module.

Years Two-Four
Follow module selection for chosen programme. See list above.

See pages 20-29 for module descriptions.
Industrial Design BEng (Hons)
UCAS code: 3D52
Programme length: 3 years

Industrial Design MEng (Hons)
UCAS code: 6G11
Programme length: 4 years

This programme brings together product design creativity with the technical knowledge and skills of engineering. Students develop as technically competent industrial designers, benefitting from the very latest in new product development techniques. The result is a modern engineering degree that will equip you with an excellent technical and creative grounding for a successful career in designing and developing new products.

The degree is strongly project-based. You will work on many design projects of increasing complexity. In Year One, you will also study core engineering subjects. It gives you a broad and extended education at an advanced level, combining user-centred product design creativity with key aspects of engineering. You will graduate well-placed to play an important role in new product development, a top management priority in industry today.

Programme in detail
The three-year BEng Industrial Design programme brings together the qualitative decision-making typical of arts-based industrial design with the quantitative and technical acumen of engineering. The result is a truly modern engineering degree that will provide individuals with an excellent technical and creative grounding for a successful career in and around the exciting discipline of designing and developing new products.

During Year One you will study design communication and carry out initial ‘design, build and test’ projects individually and as a team member. Year One introduces core engineering subjects including mechanics of solids; thermodynamics and mechanics of fluids; electrical circuits and systems; and digital electronics.

Unique to this programme, final year individual projects are student conceived and based on the development of a commercially viable product design or innovation. This provides an opportunity to pursue a personal interest.

The MEng programme provides students with additional breadth in modern theory, methodologies and best practices in new product development and visualisation.

It is a four-year MEng programme that gives you a broad and extended education at an advanced level, combining user-centred product design creativity with key aspects of engineering. With a good knowledge of the process and management of design, graduates are well placed to play an important role in new product development, which is a top management priority in industry today.

Years One and Two of study are common with the Industrial Design BEng programme (3D52). Years Three and Four offer an enhanced learning experience with dedicated MEng design, development, visualisation and simulation projects.

Key modules
Year One
Core modules
- Design communication
- Electrical circuits for engineers
- Fluid mechanics
- Introduction to engineering skills
- Introduction to management and sustainability
- Introduction to structural materials
- Mathematical techniques for engineers or Engineering mathematics
- Mechanical engineering design A
- Product development I
- Solids and structures I
- Thermodynamics I.
Year Two
Core modules
- Consumer electronics
- Design II
- Human factors in product design: practice
- Human factors in product design: theory
- Managing product development
- Materials processing and selection I
- Materials processing and selection II
- Product development II
- Product form and materials
- Product visualisation and simulation I
- Project management
- Solids and structures II.

Year Three (3D52)
Core modules
- Advanced modern management
- Individual project
- Management of design
- Manufacturing systems
- Materials design
- Mechatronics
- Product design group project
- Product development III
- Product visualisation and simulation II.

Year Three (6G11)
Core modules
- Advanced modern management
- Group capstone project I
- Individual project
- Management of design
- Manufacturing systems
- Materials design
- Mechatronics
- Product development III
- Product visualisation and simulation II.

Year Four (6G11)
Core modules
- Additive manufacturing
- Biomedical engineering
- Cardiovascular engineering
- Design for environment, manufacture and assembly
- Enterprise studies
- Finite element analysis
- Group capstone project II
- Integrated systems design
- Laser materials processing
- Virtual reality.

See pages 20-29 for module descriptions.

Mechanical Engineering BEng (Hons)
UCAS code: H300
Programme length: 3 years

A degree in Mechanical Engineering is the basis for a professional career in a broad range of industry sectors. Our graduates go on to work in fields such as medicine and healthcare, sustainable power generation, environmental technology, food production, sports science, aerospace, automotive, construction, nuclear, mechatronics & robotics, industrial product design, manufacturing, and project management. Engineering graduates are also in demand in sectors such as accountancy, management consulting, and logistics. More than any other discipline, a degree in Mechanical Engineering is preparation for an enormously wide range of careers.

Our degree programmes offer an exciting blend of learning experiences designed to ensure our students not only master the scientific fundamentals, but also develop the skills, attitudes and experience demanded by 21st century engineering and society. Our ethos is to spend as much time outside the lecture theatre as possible. Our students spend a significant amount of their time working in teams to apply their learning in the solution of practical problems; or in the design, building and testing of new products processes and systems. This means our graduates are very well prepared for their careers ahead, and industry recognises them as highly employable.
All Mechanical Engineering programmes are accredited by our professional body, the Institute of Mechanical Engineers, and are a recognised qualification on the route to Chartered Engineer status.

Programme in detail
Years One and Two of our programmes are designed to provide students with fundamental knowledge of engineering science in subjects such as Thermodynamics; Fluid mechanics; Solid mechanics; Dynamic systems; Materials; Electronics and mathematics. It is this scientific understanding that underpins the practice of all professional engineering. Students also learn about project management, computer programming, and engineering design. Lecture-based learning is complemented by a wide range of laboratory work, practical challenges, team based ‘design-build-test’ projects, site visits and other activities.

In Year Three students move on to study advanced engineering science and undertake a 300-hour individual research project on a topic of their choice. They can also choose their engineering specialism by selecting one of five thematic streams: biomedical engineering, materials engineering, manufacturing, management, or simulation and analytics.

Key modules

Year One
Core modules
- Electrical circuits for engineers
- Electro mechanical systems
- Fluid mechanics
- Introduction to management and sustainability
- Introduction to structural materials
- Mathematical techniques for engineers
- Mechanical engineering design A
- Mechanical engineering design B
- Mechanical product dissection
- Solids and structures I
- Thermodynamics.

Year Two
Core modules
- Aeroengines
- Design
- Dynamic systems
- Engineering mathematics
- Experimental methods
- Materials processing and selection
- Programming for engineers
- Project management
- Solids and structures II
- Thermodynamics.

Year Three
Core modules
- Advanced modern management
- Engineering fluid mechanics
- Heat transfer
- Individual research project
- Introduction to finite elements
- Solid mechanics
- Vibration and control.

Thematic Stream Options
- Biomedical: Biomedical Engineering; Cardiovascular Bioengineering
- Management: Enterprise Studies; Managing Product Development
- Manufacturing: Additive Manufacturing; Lasers in Engineering
- Materials: Advanced Engineering Materials; Smart Materials
- Simulation & Analytics: Risk and Uncertainty; Programming for Engineers II.

See pages 20-29 for module descriptions.

Mechanical Engineering
MEng (Hons)
UCAS code: H301
Programme length: 4 years

The MEng programme satisfies the academic requirements for registration as a Chartered Engineer (CEng) or European Engineer (EurIng).
The programme follows the Mechanical Engineering BEng (H300) for the first two years.

In Years Three and Four students move on to study advanced engineering science and undertake a 300-hour individual research project on a topic of their choice. They can also choose their engineering specialism by selecting one of five thematic streams: biomedical engineering, materials engineering, manufacturing, management, or simulation and analytics. The most important element of the MEng programme is the two-year Capstone Project: a team project in which students design, build and race a single seat race car, a high speed bicycle or an underwater remotely operated vehicle; or in which students work with our industrial partners, alongside professional engineers, as they develop solutions to real industrial problems.

These projects are designed to transform student engineers into fledgling professionals: they are rewarding for the students, are valued by industry; and have been commended by the Institute of Mechanical Engineers.

Key modules

**Year One**
Core modules
Same as H300 on page 18.

**Year Two**
Core modules
Same as H300 on page 18.

**Year Three**
Core modules
- Advanced modern management
- Engineering fluid mechanics
- Heat transfer
- Individual research project
- Introduction to finite elements
- Mechanical Engineering Capstone Project 1
- Solid mechanics
- Vibration and control.

Thematic Stream Options
- Biomedical: Cardiovascular Bioengineering
- Management: Managing Product Development
- Manufacturing: Additive Manufacturing
- Materials: Advanced Engineering Materials
- Simulation & Analytics: Risk and Uncertainty.

**Year Four**
Core modules
- Advanced fluid mechanics
- Energy and the environment
- Enterprise studies
- IC engines
- Mechanical engineering capstone II
- Structural integrity.

Thematic Stream Options
- Biomedical: Structural Biomaterials; Musculoskeletal Biomechanics
- Manufacturing: Laser Materials Processing; Industrial Robotics and Automated Assembly
- Materials: Smart Materials; Functional Materials
- Research: Advanced Research Project
- Simulation & Analytics: Risk and Uncertainty; Mechatronics; Programming for Engineers II; Advanced Mathematical Methods.

See pages 20-29 for module descriptions.

**Engineering Foundation BEng (Hons) (4-year route including a Foundation Year at Carmel College)**
UCAS code: H109
Programme length: 4 (1+3) years

This modular programme provides a four-year route to any of the BEng degree programmes currently available in the School of Engineering. There is a separate brochure outlining facilities at Carmel College and progression routes.

**Programme in detail**

The first year (Year Zero) is based at Carmel College, St Helens, about nine miles from the main University precinct. The College offers small class sizes and high standards of academic achievement. The programme, which is moderated by University staff, comprises introductory modules in Physics and Mathematics with students choosing a third optional module from Chemistry or Information Technology. In Year Two, Three and Four, students follow their chosen course from a number of available Engineering programmes outlined in this brochure.
## Core and selected optional modules overview

### Year One

<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerospace engineering design IA</td>
<td>1</td>
<td>15</td>
<td>Learn the principles of engineering drawing standards.</td>
</tr>
<tr>
<td>Aerospace engineering design IB</td>
<td>2</td>
<td>15</td>
<td>Builds on Aerospace engineering design IA.</td>
</tr>
<tr>
<td>Civil and architectural design and technology</td>
<td>1</td>
<td>7.5</td>
<td>Develops skills using Building Information Modelling (BIM) tools.</td>
</tr>
<tr>
<td>Design communication</td>
<td>2</td>
<td>7.5</td>
<td>Develops fundamental communication skills for studio-based product design activity.</td>
</tr>
<tr>
<td>Electrical circuits for engineers</td>
<td>1 and 2</td>
<td>15</td>
<td>Provides a fundamental understanding, and analysis of electrical circuits and theory.</td>
</tr>
<tr>
<td>Electromechanical systems</td>
<td>2</td>
<td>7.5</td>
<td>Introduces mathematical modelling terminology and concepts.</td>
</tr>
<tr>
<td>Engineering mathematics</td>
<td>1 and 2</td>
<td>22.5</td>
<td>Covers the key mathematics required in engineering including calculus and extends your knowledge to include an elementary introduction to complex variables and functions of two variables.</td>
</tr>
<tr>
<td>Fluid mechanics I</td>
<td>1 and 2</td>
<td>22.5</td>
<td>Introduces the principles of fluid mechanics and thermodynamics and develops skills in problem-solving and performing simple experiments.</td>
</tr>
<tr>
<td>Geology for civil engineers</td>
<td>1</td>
<td>7.5</td>
<td>Provides a background knowledge of applied geology to enable you to solve problems of site investigation.</td>
</tr>
<tr>
<td>Introduction to aerospace engineering</td>
<td>2</td>
<td>7.5</td>
<td>The module provides an introduction to the key topics from aerodynamics performance, stability and control.</td>
</tr>
<tr>
<td>Introduction to civil and architectural engineering</td>
<td>1</td>
<td>15</td>
<td>Develops students’ understanding of engineering project design.</td>
</tr>
<tr>
<td>Introduction to environmental design</td>
<td>1</td>
<td>7.5</td>
<td>Consolidates the core scientific knowledge and fundamental principles for the natural and built environmental systems commonly encountered in the civil and architectural engineering discipline and design process.</td>
</tr>
<tr>
<td>Introduction to engineering skills</td>
<td>1</td>
<td>7.5</td>
<td>Develops technical report writing and oral presentation skills, research, summary and referencing skills and IT and computational skills for engineering applications.</td>
</tr>
<tr>
<td>Introduction to management and sustainability</td>
<td>1</td>
<td>7.5</td>
<td>Provides an introduction to the principles of industrial management and practices and introduces issues of sustainability in engineering.</td>
</tr>
<tr>
<td>Introduction to structural materials</td>
<td>1</td>
<td>7.5</td>
<td>An introduction to the mechanical properties and deformation of metals, ceramics and polymers, and how the properties are related to microstructure and processing.</td>
</tr>
<tr>
<td>Mathematical techniques for engineers</td>
<td>1 and 2</td>
<td>22.5</td>
<td>Covers the key mathematics required in engineering including calculus and extends your knowledge to include an elementary introduction to complex variables and functions of two variables.</td>
</tr>
<tr>
<td>Mechanical engineering design A</td>
<td>1</td>
<td>15</td>
<td>Provides students with an early understanding of the preliminary design process.</td>
</tr>
<tr>
<td>Mechanical engineering design B</td>
<td>2</td>
<td>15</td>
<td>Builds on mechanical engineering design A.</td>
</tr>
</tbody>
</table>

Please note: modules are provided for information only and may change. Timetabling restrictions may apply.
<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical product dissection</td>
<td>2</td>
<td>7.5</td>
<td>Introduces key topics in mechanical design, materials science and manufacturing processes and provides engineering workshop practice experience.</td>
</tr>
<tr>
<td>Pilot studies I</td>
<td>1</td>
<td>7.5</td>
<td>Provides a basic knowledge of aircraft technical, navigation and radio aids, meteorology, flight performance and planning, radio communications and human performance. Also engages students in a PPL/NPPL flight training programme.</td>
</tr>
<tr>
<td>Product development I</td>
<td>2</td>
<td>7.5</td>
<td>Teaches the basics of industrial design including drawing, graphical, presentation and design communication skills; explores the role the industrial designer plays in the development of new or existing products.</td>
</tr>
<tr>
<td>Solids and structures I</td>
<td>1 and 2</td>
<td>15</td>
<td>Introduces a number of the fundamental principles of dynamics, statics, solid and structural mechanics, and how representative engineering problems can be formulated and solved. Raises awareness of safety and risk issues in engineering.</td>
</tr>
<tr>
<td>Surveying</td>
<td>2</td>
<td>15</td>
<td>This module covers surveying, including practical principles and techniques of land surveying, practical exposure to advanced surveying methods.</td>
</tr>
<tr>
<td>Thermodynamics</td>
<td>1</td>
<td>7.5</td>
<td>Develops an understanding of the laws of thermodynamics and an appreciation of their consequences.</td>
</tr>
</tbody>
</table>

Please note: modules may not be available across all programmes, please check programme specific module lists on pages 08-19.

Core and selected optional modules overview

**Year Two**

<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aeroengines</td>
<td>1 and 2</td>
<td>15</td>
<td>Provides an overall understanding of how blading turbo machinery works and the ability to conduct a realistic analysis of any simplified axial flow compressor or turbine.</td>
</tr>
<tr>
<td>Aerospace engineering design II</td>
<td>1 and 2</td>
<td>15</td>
<td>Introduces students to important aspects of aircraft design. The module provides material on aircraft configurations, basic aspects of aerodynamics of wing sections and wings, as well as important aspects of aircraft structures, thin-shell alloy structures with ribs, fuselage frames, stiffeners, etc.</td>
</tr>
<tr>
<td>Aircraft performance A</td>
<td>2</td>
<td>7.5</td>
<td>Introduces the fundamentals of the performance of fixed-wing aircraft; develops from the first principles, the theory required to formulate and solve representative performance problems and introduces students to the principles of aircraft stability.</td>
</tr>
<tr>
<td>Avionic and communication systems</td>
<td>2</td>
<td>15</td>
<td>Develops an understanding of basic communication systems, avionics systems, including radar, navigation and aircraft vision systems.</td>
</tr>
<tr>
<td>Construction materials</td>
<td>1</td>
<td>7.5</td>
<td>Introduces the factors which influence the selection of materials for engineering purposes, develops understanding of the properties of these materials, and lays a foundation for subsequent design work.</td>
</tr>
</tbody>
</table>

Please note: modules may not be available across all programmes, please check programme specific module lists on pages 08-19.

Continued over...
## Core and selected optional modules overview

### Year Two (continued)

<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer electronics</td>
<td>2</td>
<td>7.5</td>
<td>Develops understanding of common electrical technologies and their application within consumer electronic products.</td>
</tr>
<tr>
<td>Design II</td>
<td>1 and 2</td>
<td>15</td>
<td>Teaches the fundamentals of the “Total Design” process within a group based engineering design project.</td>
</tr>
<tr>
<td>Dynamic systems</td>
<td>1 and 2</td>
<td>15</td>
<td>Develops an understanding of the essential principles governing the behaviour of first and second order systems in the time and frequency domains and to introduce the concepts of feedback control and dynamic stability. Also you will learn skills in carrying out and reporting upon simple experiments in dynamic systems.</td>
</tr>
<tr>
<td>Experimental methods</td>
<td>1</td>
<td>7.5</td>
<td>Introduces you to the essentials of H data analysis and interpretation, engineering experimentation, measurement techniques and principles of instrumentation.</td>
</tr>
<tr>
<td>Human factors in product design: theory</td>
<td>2</td>
<td>7.5</td>
<td>Builds on Human factors in product design: practice.</td>
</tr>
<tr>
<td>Human factors in product design: practice</td>
<td>1</td>
<td>7.5</td>
<td>Develops understanding of the main concepts of human factors including human capabilities/limitations and how they would be incorporated into designed systems.</td>
</tr>
<tr>
<td>Managing product development</td>
<td>1</td>
<td>7.5</td>
<td>This modules aims to develop knowledge and understanding of the main concepts of the subject and the main models used; to develop analytical skills in applying the concepts and models to real-life examples and to stimulate an appreciation of the special challenges of managing new product development and the importance of this function to organisational success.</td>
</tr>
<tr>
<td>Materials processing and selection I</td>
<td>1</td>
<td>7.5</td>
<td>Provides an understanding of the main techniques and technology associated with the mechanical- and thermal-processing of metallic materials.</td>
</tr>
<tr>
<td>Materials processing and selection II</td>
<td>2</td>
<td>7.5</td>
<td>Identifies the types of fibres and matrices commonly used in the manufacture of composite materials. Investigates the manufacturing techniques commonly used to produce composite structures. Develops an understanding the production methods and performance requirements for non-ferrous metals and materials section charts.</td>
</tr>
<tr>
<td>Mathematics for engineering II</td>
<td>1</td>
<td>7.5</td>
<td>Introduces some advanced mathematics required by engineers, including using matrices to solve systems of linear equations, eigenvalue problems and multi-variable calculus.</td>
</tr>
<tr>
<td>Pilot studies II</td>
<td>1</td>
<td>7.5</td>
<td>Explores navigation, meteorology, aircraft instruments and human factors appropriate to commercial operations.</td>
</tr>
<tr>
<td>Pilot studies III</td>
<td>2</td>
<td>7.5</td>
<td>Explores aircraft performance and principles of flight, radio navigation systems and aircraft general knowledge appropriate to commercial aircraft operations.</td>
</tr>
<tr>
<td>Programming for engineers I</td>
<td>1</td>
<td>7.5</td>
<td>Introduces the concepts of computer programming in the Matlab language, the Matlab language itself, and to selected techniques from the theory of numerical analysis.</td>
</tr>
<tr>
<td>Product development II</td>
<td>1 and 2</td>
<td>15</td>
<td>Builds on Product development I.</td>
</tr>
</tbody>
</table>

Please note: modules are provided for information only and may change. Timetabling restrictions may apply.

Please note: modules may not be available across all programmes, please check programme specific module lists on pages 08-19.
<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product form and materials</td>
<td>2</td>
<td>7.5</td>
<td>Develops understanding of how materials influence the perception, appreciation and experiences people have of, and with, products.</td>
</tr>
<tr>
<td>Product visualisation and simulation I</td>
<td>1 and 2</td>
<td>15</td>
<td>Teaches the principles of virtual reality systems, visualisation techniques and simulation practice to an introductory level.</td>
</tr>
<tr>
<td>Project management</td>
<td>1</td>
<td>7.5</td>
<td>Introduces the tools and constraints associated with managing both small and large projects, and with some simple costing approaches. A virtual project is undertaken by every student. The student is encouraged to adopt a project approach to current and future tasks, and to learn the language adopted by project-oriented employers.</td>
</tr>
<tr>
<td>Solids and structures II</td>
<td>1 and 2</td>
<td>15</td>
<td>Provides awareness and understanding of the principles of solid mechanics applied to engineering structures. In particular, the behaviour and types of failure (instability) of simple elastic systems and structural members used in aerospace, civil and mechanical engineering applications.</td>
</tr>
<tr>
<td>Thermodynamics</td>
<td>1 and 2</td>
<td>15</td>
<td>Provides a grounding in basic power cycles and their thermodynamic analysis (steam, gas turbine and reciprocating IC engine), before moving on to more advanced and modern power plants, as well as refrigeration and heat pump plant.</td>
</tr>
</tbody>
</table>

**Please note:** modules may not be available across all programmes, please check programme specific module lists on pages 08-19.

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**Core and selected optional modules overview**

### Year Three

<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additive manufacturing</td>
<td>1</td>
<td>7.5</td>
<td>Gives an overview on the role of additive manufacturing in new product development.</td>
</tr>
<tr>
<td>Advanced engineering materials</td>
<td>1</td>
<td>7.5</td>
<td>Develops an understanding of the production methods and mechanical properties of non-ferrous metals.</td>
</tr>
<tr>
<td>Advanced modern management</td>
<td>1</td>
<td>7.5</td>
<td>Introduction to various aspects of advanced modern management.</td>
</tr>
<tr>
<td>Aerodynamics</td>
<td>1</td>
<td>15</td>
<td>Develops the ability to understand qualitatively and to predict quantitatively the flow over an aerofoil at all speeds.</td>
</tr>
<tr>
<td>Aerospace engineering design III</td>
<td>1 and 2</td>
<td>15</td>
<td>Develops students’ knowledge and skills in aerospace vehicle design, analysis modelling and simulation and communicating design ideas in a professional manner.</td>
</tr>
<tr>
<td>Aerostructures</td>
<td>1 and 2</td>
<td>15</td>
<td>Introduces advanced aspects of structural analysis, building upon the concepts covered in the structures/solid mechanics courses in the first two years.</td>
</tr>
<tr>
<td>Avionic systems design</td>
<td>2</td>
<td>7.5</td>
<td>Provides you with the experience of solving a design problem within the scope of a typical avionic system. The module aims to provide the opportunity for you to apply your knowledge and creative skills to design and evaluate a practical design solution to meet a given requirement and to further develop your team-working and presentation skills.</td>
</tr>
</tbody>
</table>

**Please note:** modules may not be available across all programmes, please check programme specific module lists on pages 08-19.

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*Continued over...*
## Core and selected optional modules overview

### Year Three (continued)

<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomedical engineering</td>
<td>1</td>
<td>7.5</td>
<td>Develops an understanding of the role of engineering in medicine and biology, with a focus on biomechanics of the cardiovascular system, the eye and hard tissues (bone and teeth).</td>
</tr>
<tr>
<td>Cardiovascular bioengineering</td>
<td>2</td>
<td>7.5</td>
<td>Provides students with a knowledge of basic physiology and anatomy of the components of the circulatory system. How biological tissue structure is related to the physical and mechanical properties of the circulatory system, and how this is related to function. The role of different biofluids in the human body and calculations relating to blood flow in arteries and cardiovascular devices.</td>
</tr>
<tr>
<td>Engineering fluid mechanics</td>
<td>1 and 2</td>
<td>15</td>
<td>Introduction to the role of viscosity in fluid mechanics, including the no-slip condition and the concept of vorticity.</td>
</tr>
<tr>
<td>Flight dynamics and control</td>
<td>1 and 2</td>
<td>15</td>
<td>Gives you a good understanding of flight/flight control systems principles and to equip them to solve related problems.</td>
</tr>
<tr>
<td>Group capstone project I</td>
<td>1 and 2</td>
<td>15</td>
<td>Integrates knowledge from the four-year MEng programme into a single group activity.</td>
</tr>
<tr>
<td>Heat transfer</td>
<td>2</td>
<td>15</td>
<td>Gives you a good understanding of the mechanisms of heat transfer and to equip them to solve significant engineering problems. You will also learn about different designs of heat exchanger and how to carry out performance/design calculations.</td>
</tr>
<tr>
<td>Individual project</td>
<td>1 and 2</td>
<td>30</td>
<td>Provides an opportunity for you to apply engineering knowledge, understanding and skills to plan, carry out and control an open-ended project in a topic of your choice.</td>
</tr>
<tr>
<td>Introduction to finite elements</td>
<td>1</td>
<td>7.5</td>
<td>Provides an appreciation of the capabilities of a modern finite element package in the analysis of a variety engineering problems.</td>
</tr>
<tr>
<td>Lasers in engineering</td>
<td>1</td>
<td>15</td>
<td>Provides an overview of the fundamental principles of laser technology including optical principles, key features and attributes of lasers, laser beam properties and the engineering applications context of lasers.</td>
</tr>
<tr>
<td>Management of design</td>
<td>2</td>
<td>7.5</td>
<td>Develops professional and managerial attitudes towards project management and gives a basis to the management of the group design project in Year Four.</td>
</tr>
<tr>
<td>Manufacturing systems</td>
<td>1</td>
<td>15</td>
<td>Develops an overall understanding of manufacturing systems at a global, company, factory and shop floor level.</td>
</tr>
<tr>
<td>Materials design</td>
<td>2</td>
<td>7.5</td>
<td>Develops an understanding of the important factors in materials and process selection for engineering components and design, and the planning and execution of activities associated with the professional materials design engineer.</td>
</tr>
<tr>
<td>Mechatronics</td>
<td>1</td>
<td>7.5</td>
<td>Develops an appreciation of how microcomputer-based control systems can be used in the design and implementation of electro-mechanical engineering systems.</td>
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Please note: modules are provided for information only and may change. Timetabling restrictions may apply.

Please note: modules may not be available across all programmes, please check programme specific module lists on pages 08-19.
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<th>Module title</th>
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<tbody>
<tr>
<td>Product design group project</td>
<td>1 and 2</td>
<td>15</td>
<td>Integrates knowledge from the three-year Industrial Design programme into a single group activity in which high level engineering science is applied to practical problems.</td>
</tr>
<tr>
<td>Product development III</td>
<td>1 and 2</td>
<td>15</td>
<td>Builds on Product development I and II.</td>
</tr>
<tr>
<td>Product visualisation and simulation II</td>
<td>1 and 2</td>
<td>15</td>
<td>Teaches the principles of virtual reality systems, visualisation techniques and simulation practice to an intermediate level; gives an appreciation of the role that visualisation and simulation plays in the development of new or existing products to an intermediate level.</td>
</tr>
<tr>
<td>Programming for engineers II</td>
<td>2</td>
<td>7.5</td>
<td>Extends students' knowledge and understanding of the MATLAB computer programming language and of some more advanced topics of numerical analysis.</td>
</tr>
<tr>
<td>RF engineering and applied electromagnetics</td>
<td>1</td>
<td>7.5</td>
<td>Introduction to the fundamental concepts of high frequency electromagnetics (including electromagnetics RF and microwave).</td>
</tr>
<tr>
<td>Risk and uncertainty: numerical applications</td>
<td>2</td>
<td>7.5</td>
<td>This module develops understanding and appreciation of uncertainties in engineering on a basic level. It involves the quantification, of uncertainties in the input and modelling, their implementation in engineering analyses and the evaluation of the associated results in view of engineering decision making.</td>
</tr>
<tr>
<td>Rotorcraft flight</td>
<td>1</td>
<td>7.5</td>
<td>The aim of rotorcraft flight is to provide students with a firm grasp and understanding of the principles of rotorcraft aeromechanics, through lectures, tutorials, computer-based simulations and development of computer codes to explore rotorcraft aeromechanics.</td>
</tr>
<tr>
<td>Smart materials</td>
<td>2</td>
<td>7.5</td>
<td>Introduces the concept of smart behaviour through integration of sensors and actuators at various length scales.</td>
</tr>
<tr>
<td>Solid mechanics</td>
<td>1</td>
<td>7.5</td>
<td>Develops an understanding that many design problems involve complex variations of stress and strain within the component which require the derivation of suitable expressions for this variation. You will apply the principles of force equilibrium, compatibility of strain and displacements and the stress-strain relationships of elasticity to some design examples. This module also covers plastic behaviour in engineering components and the role, both advantageous and detrimental, played by residual stresses in engineering components.</td>
</tr>
<tr>
<td>Spaceflight</td>
<td>1</td>
<td>7.5</td>
<td>Develops an understanding of the principles and challenges of space flight and the significance of space-based applications. Development of the ability to analyse the performance of a multi-stage rocket as well as the ability to predict the trajectory of a spacecraft in orbit around the Earth or in an interplanetary orbit.</td>
</tr>
</tbody>
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Please note: modules may not be available across all programmes, please check programme specific module lists on pages 08-19.
## Core and selected optional modules overview

### Year Four

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<th>Module title</th>
<th>Semester</th>
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<tr>
<td>Additive manufacturing</td>
<td>1</td>
<td>7.5</td>
<td>Provides an overview on the role of additive manufacturing in new product development.</td>
</tr>
<tr>
<td>Advanced 4th year research project</td>
<td>1 and 2</td>
<td>15</td>
<td>Provides an opportunity for you to further advance your open-ended project from Year Three.</td>
</tr>
<tr>
<td>Advanced aerodynamics</td>
<td>1</td>
<td>7.5</td>
<td>Students’ develop the ability to analyse and compute the aerodynamic characteristics of an aircraft configuration.</td>
</tr>
<tr>
<td>Advanced composite materials</td>
<td>2</td>
<td>7.5</td>
<td>Investigates techniques for measuring the interlaminar fracture toughness of composites.</td>
</tr>
<tr>
<td>Advanced construction management</td>
<td>2</td>
<td>7.5</td>
<td>Develops your awareness of professional practices in construction management.</td>
</tr>
<tr>
<td>Advanced fluid mechanics</td>
<td>1 and 2</td>
<td>15</td>
<td>Develops an understanding of the effects of viscosity on fluid flow, including the concept of a boundary layer, the differences between laminar and turbulent flow and the concepts of turbulence modelling. You will also gain knowledge and understanding of computational fluid dynamics techniques and their engineering applications.</td>
</tr>
<tr>
<td>Advanced guidance systems</td>
<td>2</td>
<td>7.5</td>
<td>Develops an understanding of the use of advanced guidance laws in autonomous air systems, including the interactions of airframe dynamics, sensors and control surfaces. You will also learn to understand the use of the kalman and extended kalman filters in aerospace systems.</td>
</tr>
<tr>
<td>Advanced mathematical methods</td>
<td>2</td>
<td>7.5</td>
<td>Provides an introduction to the techniques of vector and tensor calculus and to the study and solution of the partial differential equations which arise in engineering.</td>
</tr>
<tr>
<td>Aeroelasticity</td>
<td>1</td>
<td>7.5</td>
<td>Increases knowledge to enable static and dynamic aeroelastic analysis of low-degree-of-freedom systems by analytical and numerical models.</td>
</tr>
<tr>
<td>Aerospace capstone group design project</td>
<td>1 and 2</td>
<td>30</td>
<td>Integrates knowledge from the four-year MEng programme into a single group aircraft design activity.</td>
</tr>
<tr>
<td>Aerostructures</td>
<td>1</td>
<td>7.5</td>
<td>Builds upon the structural analysis methods covered in the previous three years of the course to enable advanced aircraft structural component design through analysis of thin walled plate structures, finite element analysis, and aero elasticity.</td>
</tr>
<tr>
<td>Biomedical engineering</td>
<td>1</td>
<td>7.5</td>
<td>Develops an understanding of the role of engineering in medicine and biology, with a focus on biomechanics of the cardiovascular system, the eye and hard tissues (bone and teeth).</td>
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<tr>
<td>Cardiovascular bioengineering</td>
<td>2</td>
<td>7.5</td>
<td>Provides students with a knowledge of basic physiology and anatomy of the components of the circulatory system. How biological tissue structure is related to the physical and mechanical properties of the circulatory system, and how this is related to function. The role of different biofluids in the human body and calculations relating to blood flow in arteries and cardiovascular devices.</td>
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</tr>
<tr>
<td>Climate change, adaptation and mitigation</td>
<td>1</td>
<td>15</td>
<td>Introduces you to climate change and its impact in building and water related environments; to illustrate the potential impact on sustainable development from such changes, and problems which modern civil engineers must deal with; to provide students with the necessary knowledge and skills based on engineering principles and economic appraisal, in adaptation and mitigation of these effects.</td>
</tr>
<tr>
<td>Coastal and estuary processes</td>
<td>1</td>
<td>15</td>
<td>Introduces you to the work of maritime engineers in the coastal and estuarine environments, sediment transport and morphodynamics, and to provides you with the necessary knowledge, skills and understanding to contribute to the solution of problems in estuaries and coastal waters as well as sediment transport using advanced modelling techniques.</td>
</tr>
<tr>
<td>Design for environment, manufacture and assembly</td>
<td>2</td>
<td>7.5</td>
<td>Provides an introduction to the tools and methods of eco-design, design for manufacture and assembly using real, everyday products as examples.</td>
</tr>
<tr>
<td>Energy and the environment</td>
<td>2</td>
<td>15</td>
<td>Gives you an understanding of the advantages and disadvantages of alternative and conventional energy generation methods.</td>
</tr>
<tr>
<td>Enterprise studies</td>
<td>2</td>
<td>7.5</td>
<td>Introduces various aspects of entrepreneurial activity and enterprise related concepts, legislation and current development tools. Explores the importance of entrepreneurial activity in relation to organisational success.</td>
</tr>
<tr>
<td>Finite element analysis</td>
<td>1</td>
<td>7.5</td>
<td>Provides an appreciation of the capabilities on modern finite element package in the analysis of a variety engineering problems. Develops skills in interpreting and understanding the physical meaning of finite element results.</td>
</tr>
<tr>
<td>Flight handling qualities</td>
<td>1</td>
<td>7.5</td>
<td>Equips you with the skills and knowledge required to understand fundamental aircraft handling qualities and related “whole aircraft” problems in industry.</td>
</tr>
<tr>
<td>Foundation engineering</td>
<td>1</td>
<td>7.5</td>
<td>Includes advanced topics in soil mechanics and deals with reinforced concrete design of foundations and soil/structure interaction including methods of assessing the effects of earthquake forces.</td>
</tr>
<tr>
<td>Functional materials</td>
<td>2</td>
<td>7.5</td>
<td>Develops an understanding of the functional properties of materials.</td>
</tr>
<tr>
<td>Group capstone project 2</td>
<td>1 and 2</td>
<td>30</td>
<td>Develops, implements and operates existing designs conceived and developed in Year Three.</td>
</tr>
<tr>
<td>IC engines</td>
<td>1</td>
<td>7.5</td>
<td>Covers the engineering science behind the operation of internal combustion engines. You will learn how to conduct a thermodynamic analysis of the different processes involved in an IC engine and also understand the principles used to assess the performance of such engines.</td>
</tr>
<tr>
<td>Industrial robotics and automated assembly</td>
<td>2</td>
<td>15</td>
<td>Provides knowledge and skills to design, build and operate industrial robotic systems and to understand the advantages and disadvantages of their deployment.</td>
</tr>
</tbody>
</table>

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## Core and selected optional modules overview

### Year Four (continued)

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<tr>
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<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated systems design</td>
<td>2</td>
<td>15</td>
<td>Provides a practical appreciation of Integrated System Design (ISD) through the design, build and operation of free-standing mobile robots which will perform specific tasks. This module will give you an opportunity to work in teams; gain an understanding of what it means to plan and work through a project; work to deadlines; maximise resources; and cope with uncertainty.</td>
</tr>
<tr>
<td>Laser materials processing</td>
<td>1</td>
<td>15</td>
<td>Provides an overview of the interaction of (high power) lasers with materials and their application in a selected range of established industrial processes, including: key features and properties of high power lasers; laser beam deployment; safety in high power laser use; laser process principles and practice for cutting, welding, marking, drilling and selected surface treatments.</td>
</tr>
<tr>
<td>Materials for durable and sustainable construction</td>
<td>2</td>
<td>15</td>
<td>Enhances knowledge and understanding of the advances made in conventional construction materials and alternative construction materials that are currently being developed for use in construction to achieve more innovative and sustainable structures.</td>
</tr>
<tr>
<td>Mechatronics</td>
<td>1</td>
<td>7.5</td>
<td>Develops understanding and appreciation of how microcomputer-based control systems can be used in the design and implementation of electro-mechanical engineering systems.</td>
</tr>
<tr>
<td>Mechanical engineering capstone II</td>
<td>1 and 2</td>
<td>30</td>
<td>Integrates knowledge from the four-year MEng programme into a single group design activity.</td>
</tr>
<tr>
<td>Multidisciplinary design project</td>
<td>1 and 2</td>
<td>30</td>
<td>Provides you with the opportunity to work in groups to conduct a complete holistic design of a real-life engineering project.</td>
</tr>
<tr>
<td>Musculoskeletal biomechanics</td>
<td>2</td>
<td>15</td>
<td>Introduces biomechanics terminology and concepts.</td>
</tr>
<tr>
<td>Politics of the environment</td>
<td>1</td>
<td>15</td>
<td>Critically evaluates the political responses to the growing impact that environmental issues and the concept of sustainability are having on decision making at all levels of governance (international, national and local).</td>
</tr>
<tr>
<td>Programming for engineers II</td>
<td>2</td>
<td>7.5</td>
<td>Extends students’ knowledge and understanding of the MATLAB computer programming language and of some more advanced topics of numerical analysis.</td>
</tr>
<tr>
<td>Risk and uncertainty: probability theory</td>
<td>1</td>
<td>7.5</td>
<td>This module involves the quantification of uncertainties in the input and modelling, their implementation in engineering analyses and the evaluation of the associated results in view of engineering decision making. Focus is on the assessment of both structural reliability and structural response under uncertainty. Numerical concepts as well as stochastic approximations are considered. The methods have a general applicability, which is demonstrated by examples of practical applications.</td>
</tr>
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<th>Module description</th>
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<tbody>
<tr>
<td>Smart materials</td>
<td>2</td>
<td>7.5</td>
<td>Introduces the concept of smart behaviour through integration of sensors and actuators of various length scales.</td>
</tr>
<tr>
<td>Structural biomaterials</td>
<td>1</td>
<td>15</td>
<td>Develops and advanced understanding of the structure and properties of material used in medical devices.</td>
</tr>
<tr>
<td>Structural dynamics and applications</td>
<td>1</td>
<td>15</td>
<td>Equips you with knowledge in structural dynamics and its applications covering theoretical, computational, and practical aspects.</td>
</tr>
<tr>
<td>Structural integrity</td>
<td>2</td>
<td>15</td>
<td>Provides an understanding of materials failure analysis through case studies drawn from real situations.</td>
</tr>
<tr>
<td>Structural optimisation</td>
<td>2</td>
<td>7.5</td>
<td>This module provides the ability to optimise structures for unconstrained and constrained problems using a range of gradient based and biologically based optimisation techniques.</td>
</tr>
<tr>
<td>Structural, steelwork, timber and masonry</td>
<td>2</td>
<td>15</td>
<td>Introduces you to the behaviour of various forms of steel structures, timber structures and masonry structures.</td>
</tr>
<tr>
<td>Structural systems</td>
<td>1 and 2</td>
<td>15</td>
<td>The module is designed with particular emphasis on design, safety considerations and the environmental impact of structural decisions.</td>
</tr>
<tr>
<td>Virtual reality</td>
<td>1 and 2</td>
<td>15</td>
<td>Builds on Product visualisation and simulation II.</td>
</tr>
</tbody>
</table>

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Student Welfare Advice and Guidance: www.liverpool.ac.uk/studentsupport
Undergraduate enquiries and applications: T: +44 (0)151 794 5927

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