# Aerospace Engineering with Pilot Studies with a Year in Industry MEng

### COURSE DETAILS

- A level requirements: AAA
- UCAS code: H404
- Study mode: Full-time
- Length: 5 years

### KEY DATES

- Apply by: 25 January 2023
- Starts: 25 September 2023

## Course overview

If you are interested in becoming either private or professional pilot, this is the programme for you.

### INTRODUCTION

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 modules.

In addition to studying the core aerospace engineering topics outlined, you will also take the pilot studies modules and develop knowledge, skills and experience of flying. As well as the flight training, pilot studies students also have access to and use of the students pilots lab and can join the Flight Simulation Group (FSG). Study Aerospace Engineering and by the end of your time at Liverpool, you will be able to show that you can now design, build, test and fly an aircraft.

As an aerospace engineering student, you will experience a wide variety of topics and modes of study, whether it be conducting research, analysing reports or designing and building an aircraft. You will have have the opportunity to study a wide range of topics during your time at Liverpool such as aerodynamics, aerostructures, flight dynamics and control, propulsion systems, avionics, aerospace materials and aircraft design.

Aerospace engineers design, analyse, build, test and maintain vehicles, their sub-assemblies and components as well as their associated systems that fly. Flight is not limited to simply within the Earth's atmosphere, and can also be outside of it.

On this **year in industry** programme, you will spend year three of this programme on a year-long placement with an approved company/organisation. During this time, you will develop work-based transferrable skills and professional competences leading to enhanced employability which will make you well placed to take up opportunities in project-based, research

and management roles, both within the aerospace sector as well as other engineering industries and beyond. The year in industry is dependent upon placements being available and is subject to your performance in previous years.

## WHAT YOU'LL LEARN

- Aircraft design and manufacturing
- Flight testing
- Systems engineering
- How to conduct independent research
- Aerodynamics
- Flight dynamics and control
- How to deal with complex problems that may require compromise to meet competing requirements
- Access to and use of pilots lab

---

## ACCREDITATION

All of our BEng/MEng degree programmes are accredited, or preparing for accreditation, by at least one professional engineering institution, providing you with a solid foundation for your career. An MEng degree in aerospace, civil and mechanical engineering from Liverpool, satisfies all of the academic requirements for registration as a Chartered Engineer (CEng). We have excellent links with the professional engineering institutions and benefit from their support.

---

# Course content

Discover what you'll learn, what you'll study, and how you'll be taught and assessed.

## YEAR ONE

You will study the core engineering topics that provide a firm background and understanding of aerospace engineering, in addition you will also study pilot studies modules and develop your knowledge, skills and experience of flying.
The pilot studies module is based on the Private Pilot's License (PPL) ground school syllabus. It is studied alongside either the mandatory 20-hour flight training programme for fixed-wing flying (aeroplanes) or the 20-hour flight and ground training programme for rotary-wing flying (helicopters). For the latter, the 20-hour training programme is divided between 10.5 hours flight training and 9.5 hours of helicopter-relevant ground school.

---

## COMPULSORY MODULES

### ELECTRICAL CIRCUITS FOR ENGINEERS (ELEC121)

**Credits: 7.5 / Semester: semester 1**

To provide students with a basic understanding of electronics from first principles covering analogue and electromechanical systems. Basic circuits and theory will be introduced including the use of semiconductor devices such as diodes and transistors. Electromechanics will be developed to provide the student with a fundamental knowledge of the principles of DC and AC machines, transformers and linear actuators

### ELECTROMECHANICAL SYSTEMS (ENGG121)

**Credits: 7.5 / Semester: semester 2**

To provide students with a basic understanding of modelling and simulation techniques. Mathematical modelling and graph theory will be introduced to develop practical skills in the modelling and designing of different types of systems including electromechanical systems.

### INTRODUCTION TO STATISTICS AND PROGRAMMING FOR ENGINEERS (ENGG185)

**Credits: 7.5 / Semester: semester 1**

This module introduces students to the basic concepts and principles of elementary statistics and programming. It explains the purposes and advantages of analysing data collected specifically to solve problems in engineering, reviews available software tools and programming languages used to formulate and answer basic engineering questions. It draws on examples from applications across the range of School of Engineering program areas.

**INTRODUCTION TO STRUCTURAL MATERIALS (ENGG108)**

**Credits: 7.5 / Semester: semester 1**

This module introduces students to important mechanical properties of metallic alloys, polymers, ceramics, construction materials and composites used in engineering industry. It also introduces the mechanical testing techniques used to measure such properties, the common mechanisms of materials and component failure in use, and some appreciation of materials processing. The laboratory sessions are designed to familiase students with engineering laboratory methods and procedures, as well as providing an experience of hands-on mechanical testing techniques.

**ENGINEERING MATHEMATICS (MATH198)**

**Credits: 22.5 / Semester: whole session**

MATH198 is a Year 1 mathematics module for students of programmes taught in the School of Engineering, e.g. Aerospace, Civil, Mechanical or Industrial Design Engineering. It is designed to reinforce and build upon A-level mathematics, providing you with the strong background required in your engineering studies and preparing you for the Year 2 mathematics module MATH299 (Mathematics engineering II). In the first semester, the foundations are laid: differential calculus, vector algebra, integration and applications. Semester two covers complex numbers, differential equations, Laplace transformations and functions of two variables

**PILOT STUDIES 1 (AERO131)**

**Credits: 7.5 / Semester: semester 1**

The module is designed to provide students, who are contemplating a career as a commercial pilot, with an insight into the practical and intellectual skills required to become a pilot. Classroom lectures covering PPL ground school material are given together with 20 hours of practical flight training at a local flying school.

**SOLIDS AND STRUCTURES 1 (ENGG110)**

**Credits: 15 / Semester: whole session**

This module aims to introduce students to the fundamental concepts and theory of how engineering structures work to sustain loads. It will also show how stress analysis leads to the design of safer structures. It will also provide students with the means to analyse and design basic structural elements as used in modern engineering structures.

**PROFESSIONAL ENGINEERING: A SKILLS TOOLKIT (ENGG111)**

**Credits: 30 / Semester: whole session**

**ENERGY SCIENCE (ENGG116)**

**Credits: 15 / Semester: whole session**

*Programme details and modules listed are illustrative only and subject to change.*

---

## YEAR TWO

Year two includes a two-day flight test course in the national flying laboratory aircraft. In year two, the pilot studies modules are based on the Air Transport Pilot's Licence (ATPL) ground school syllabus.

Students will continue to study the core engineering topics as well as taking part in a two-day flight test course in the national flying laboratory aircraft.

## COMPULSORY MODULES

**AEROENGINES (AERO213)**

**Credits: 15 / Semester: whole session**

This module covers the main technical aspects of gas turbine engines used on aircraft and other mechanical applications (e.g. power generation, marine). It covers many topics from the basic principles of aeroengines (e.g. production of thrust) through to the design of axial flow turbomachinery (compressors and turbines). An understanding of the principles of compressible flow is also developed. Students do a laboratory using the Virtual Engine Test Bench to explore aeroengine components, thermodynamics and performance. In addition, they use a commercial CFD package to perform a compressible flow simulation.

**AEROSPACE ENGINEERING DESIGN 2 (AERO220)**

**Credits: 15 / Semester: whole session**

Aircraft design is a complex process and requires knowledge and skills in a number of topics, e.g. aerodynamics, structures, materials, flight mechanics and control. The module will look at these topics relating to the components of full aircraft, e.g. mass distribution, aerodynamic surface sizing, fuselage, landing gear, etc. This module explains the different stages of this multi-disciplinary process: Configuration Selection; Conceptual Design; Preliminary Design. The module describes each of these processes and provides analytical engineering tools to allow the students to complete a project to the Preliminary Design.

**AIRCRAFT PERFORMANCE A (AERO212)**

**Credits: 7.5 / Semester: semester 2**

**AVIONICS AND COMMUNICATIONS SYSTEMS (AERO250)**

**Credits: 15 / Semester: semester 2**

Introduction to aerospace communications and avionic systems for Aerospace Engineering and Avionics/Aerospace Electronics students.

**DYNAMIC SYSTEMS (MECH215)**

**Credits: 15 / Semester: whole session**

Dynamic systems are encountered in most engineering disciplines such as mechanical engineering, aerospace engineering, electrical engineering. These systems require specific techniques to be analysed for design or monitoring purpose.

In this module, students will learn the main methods for analysing dynamic systems in time and frequency domains. They will learn how to solve dynamical problems, how to evaluate and control the stability, the accuracy and the rapidity of a dynamical system.

This module will be mainly delivered through class lectures and assessed through a final exam. Additionally, students will be taught some experimental techniques related to second-order dynamical systems through an assessed laboratory work.

**ENGINEERING MATHEMATICS II (MATH299)**

**Credits: 7.5 / Semester: semester 1**

To introduce some advanced Mathematics required by Engineers, Aerospace Engineers, Civil Engineers and Mechanical Engineers. To assist students in acquiring the skills necessary to use the mathematics developed in the module.

**PILOT STUDIES 2 (AERO231)**

**Credits: 7.5 / Semester: semester 1**

This module aims to give students the knowledge and understanding of commercial aviation operations and requirements. It expands on the material presented in Pilot Studies 1 and provides the students with the opportunity to engage with the ATPL ground school material. The module is mixture of lectures, group presentations and simulation and is assessed via a 2 hour MCQ exam.

**PILOT STUDIES 3 (AERO232)**

**Credits: 7.5 / Semester: semester 2**

This module aims to provide students with an appreciation of the principles and systems required to operate commercial aircraft. The module will consist of traditional classroom exercises combined with opportunities to use flight simulators and to interact with commerical pilots. The module will be assessed using an MCQ exam at the end of the semester.

**PROGRAMMING FOR ENGINEERS 1 (ENGG286)**

**Credits: 7.5 / Semester: semester 1**

Students will be introduced to the basic concepts of computer programming in the MATLAB language to solve engineering problems. This will include basic programming constructs, mathematical operations, file input and output, and data visualization.

**PROJECT MANAGEMENT (MNGT202)**

**Credits: 7.5 / Semester: semester 1**

Project Management is a core skill for professional engineers of all types and a sound education in this subject area is required by the professional accrediting bodies. The knowledge and skills developed in this module will equip students for their future UG project work and for their careers ahead.
This module teaches students the theory of fundamental techniques in project management, risk management, and cost management.

In this modules student undertake a group "virtual project" in which they undertake all stages of project management involved n a major construction projects. The five virtual project tasks require students to apply their theoretical learning; and they provide an opportunity to develop key professional skills.

**SOLIDS & STRUCTURES 2 (ENGG209)**

**Credits: 15 / Semester: whole session**

This module aims to introduce students to techniques for load and displacement analysis of simple structures.

*Programme details and modules listed are illustrative only and subject to change.*

---

## YEAR IN INDUSTRY

A life-changing experience highly valued by employers. You will be supported in finding and applying for a placement in an organisation which could range from a local small/medium-sized enterprise to a global blue chip engineering company. As with summer placements, it's up to you.

## WHAT ARE THE BENEFITS OF TAKING A YEAR IN INDUSTRY?

- Develop the key skills and experiences engineering employers are looking for
- Experience first-hand the relationship between academic theory and work-place practice
- Understand and clarify your career options
- Learn about workplace culture, company organisation and management
- Earn money whilst you study.

Year in industry placements must be for a minimum of 40 weeks, and must overlap with the academic year in order that assessments can be managed smoothly. The placement year includes a variety of assessments including a reflective journal based on engineering competencies associated with the Engineering Council's

professional standards and learning outcomes. Overall, the placement year accounts for 10% of the overall degree classification. As year in industry placement students are acting as ambassadors for the University whilst on these paid placements, they must have performed at a high academic level in the year before the placement in order to be considered eligible, otherwise the placement year would have to be taken by suspension of studies and would not contribute towards the degree mark.

Students normally go on their year placement during their third year of study (after successful completion of two years), although for MEng students it can be undertaken after completion of three years of study.

Applicants should note that industrial placements are highly sought after and competition to be accepted into one can be significant. They therefore cannot be guaranteed. Students who fail to secure a suitable placement offer will transfer back to the standard version of the programme without a year in industry.

Year in industry students are expected to achieve a 1st or 2:1 class degree.

## COMPULSORY MODULES

### SCHOOL OF ENGINEERING YEAR IN INDUSTRY (ENGG299)

**Credits: 120 / Semester: whole session**

This module is associated with the placement year of the 'year in industry' programme. On accepting an approved offer, students spend a minimum of 40 weeks employed in a company/organisation. Placements will be approved and arranged at places accessible to the individual student. An academic mentor will be assigned to monitor and assess the student's progress during placement. This will involve at least one site visit and follow-up telephone call as well as checking that the student's placement log is being kept up to date. The placement year should be a mutually beneficial experience for both student and employer. Students will be given opportunities and gain confidence to apply theories and technical skills learned in Years 1 and 2 of their studies in a real-time work environment. Ideally (depending on the placement), these activities will be engineering/industry relevant and project (team) based extending over several months and will therefore provide opportunities to develop the student's transferable skills and professional competence leading to enhanced employability.

*Programme details and modules listed are illustrative only and subject to change.*

---

## YEAR FOUR

During your fourth year you will undertake an individual project. This provides you with the opportunity to conduct independent research and/or develop innovative concepts in your preferred technical area of interest.

## COMPULSORY MODULES

### ADVANCED ENGINEERING MATERIALS (MATS301)

**Credits: 7.5 / Semester: semester 1**

This module aims to understand advanced engineering materials, focusing on non-ferrous alloys and composite materials. It covers the processing, heat treatment, microstructure and properties of Al, Ti and Ni alloys. It introduces constituent materials, manufacturing methods, test methods and mechanical response of composite materials.

**ADVANCED MODERN MANAGEMENT (MNGT352)**

**Credits: 7.5 / Semester: semester 1**

**AERODYNAMICS (AERO316)**

**Credits: 15 / Semester: whole session**

To provide students with an understanding of aerodynamic theories (conservation laws, hierarchy of aerodynamic models, potential flow theory, thin aerofoil theory and the generation of lift, lifting line theory, shock/expansion theory, boundary layer theory).

**AEROSPACE ENGINEERING DESIGN 3 (AERO321)**

**Credits: 15 / Semester: whole session**

Aircraft design is a complex process and requires knowledge and skills in a number of topics, e.g. aerodynamics, structures, materials, flight mechanics and control. Starting with a pre-completed customer brief, students on this course will build upon the methods of Year 2 Design course and proceed with an advanced Conceptual Design of the vehicle. This will include the use of analysis tools and the creation of a simple simulation model of the aircraft. The module will be taught largely in lecture format but is supported by pc-based laboratory support sessions.

**AEROSTRUCTURES (AERO318)**

**Credits: 15 / Semester: whole session**

Aerostructures for aerospace engineering

**FLIGHT DYNAMICS AND CONTROL (AERO317)**

**Credits: 15 / Semester: semester 1**

The module introduces key techniques and concepts used in the analysis of the trim, stability, and dynamic response characteristics of conventional fixed-wing aircraft. It builds on the point-performance theory taught in year two, but whereas in the latter, point mass models suffice, it now becomes necessary formally to treat rigid-body motion in three dimensions; this is done by introducing angular momentum, rotating frames of reference, and the Newton-Euler equations.
Notions of trim and of static and dynamic stability are introduced using various simplified reduced degree-of-freedom models, axis systems, and state and control variables. The standard six degree-of-freedom (6-DOF) equations of motion of a rigid aeroplane are developed; it is shown how these can be solved numerically to enable accurate flight simulation, and how they can be linearized. The relationship between the linearizations and the aircraft's natural modes is studied. Also introduced are a several important feedback control design methods, useful for modifying and improving aircraft stability and control characteristics. These include the Root Locus, Bode and Nyquist based design methods, and gain and phase margins as design goals. Also discussed are linear state-space methods.

#### INDIVIDUAL PROJECT (ENGG341)

**Credits: 30 / Semester: whole session**

The Year 3 individual research project; 300 hours student work over 2 semesters; 3 assessment stages (proposal 5%, interim 20%, final 75%).

#### FLIGHT HANDLING QUALITIES (15CR) (AERO401)

**Credits: 15 / Semester: semester 1**

This module covers the fundamentals of Flight Handling Qualities for both fixed and rotary wing aircraft. Students will work in groups to assess handling qualities of different aircraft. The module adopts a Problem Based Learning approach and contains a number of lectures, desktop modelling and flight simulator sessions. The module is assessed through a group presentation and final report, both of which will contain an element peer assessment for the final mark.

## OPTIONAL MODULES

#### AVIONIC SYSTEMS DESIGN (AERO350)

**Credits: 7.5 / Semester: semester 2**

Avionics includes pretty much all of the electrical sensors and systems that are present on modern aircraft. The aim of tbis module is to provide the opportunity for students to apply their knowledge and creative skills to design and evaluate a practical design solution to meet a given requirement and to further develop their team-working and presentation skills. The module includes 5 weeks lectures to review the fundamentals of avionic systems, and 5 week group project to study/design one of the following 3 avionic systems:i) Instrument Landing System (ILS) ii) Automated Direction Finding (ADF)iii) Distress Frequency Monitoring

#### PROGRAMMING FOR ENGINEERS 2 (ENGG387)

**Credits: 7.5 / Semester: semester 2**

This module extends the coverage of Matlab and introduces Simulink as a tool for creating simulation models of dynamical systems.

### RF ENGINEERING AND APPLIED ELECTROMAGNETICS (ELEC311)

**Credits: 7.5 / Semester: semester 1**

This module will introduce students to the fundamental concepts of high frequency electromagnetics, and circuit design techniques that must be considered in the design of high frequency circuits and systems.

Students will learn in-depth knowledge of transmission lines, the Smith Chart, standing waves and scattering parameters etc.

After this module, students will be able to appreciate the microwave and RF circuit design for contemporary communication systems.

### ROTORCRAFT FLIGHT (AERO314)

**Credits: 7.5 / Semester: semester 2**

The module will introduce the common types of rotorcraft configuration, and will cover the basic theory of helicopter performance and flight dynamics. It will explain how rotorcraft behave in flight, and the roles of some of the main constituent components. The lectures will explain how basic physical and mathematical principles (e.g. fluid mechanics, dynamics, differential equations) can be applied to the analysis of helicopter flight. There is also some discussion of other rotary wing types such as the tilt-rotor and the autogyro.

### SPACEFLIGHT (AERO319)

**Credits: 7.5 / Semester: semester 1**

An introduction to the main concepts of space flight is provided, including princples of space propulsion, space launch vehicles and orbital mechanics of spacecraft.

### UNCERTAINTY, RELIABILITY AND RISK 1 (ENGG304)

**Credits: 7.5 / Semester: semester 1**

This module covers broad aspects of uncertainty quantification methods, reliability analysis and risk assessment in engineering applications. It also provides understanding of statistical analysis of engineering data and computational methods for dealing with uncertainty in engineering problems.

### NUCLEAR TECHNOLOGIES (MECH434)

**Credits: 7.5 / Semester: semester 1**

The module provides an understanding of nuclear engineering, with coverage going from the atomic scale through to the bulk scale. The topics will cover reactor dynamics, design and operation, lifetime behaviour, evolution of technologies and nuclear waste. For example, understanding the implications of the fission/fusion processes themselves on the behaviour of the core.

#### SPACE MISSION DESIGN (AERO419)

**Credits: 15 / Semester: semester 2**

Astrodynamics is an exciting field for students from multiple disciplines, for those interested in space mission design, in planetary science, in applied mathematics, in computer science and mission control. On completion of this module, students will understand the advanced numerical concepts and techniques for space mission design, navigation and operations. Fundamental skills for those who are interested in job roles as Flight Dynamics Engineers, Space System Engineers, Mission Analysts and Researchers

*Programme details and modules listed are illustrative only and subject to change.*

---

## YEAR FIVE

You will study a range of advanced modules that will give you further in-depth knowledge which you will secure by demonstrating your knowledge and understanding in the Capstone Design Project.

## COMPULSORY MODULES

#### ADVANCED AERODYNAMICS (AERO416)

**Credits: 7.5 / Semester: semester 1**

Advanced Aerodynamics builds upon the body of knowledge acquired in undergraduate years to provide students with a deeper understanding of three-dimensional aerodynamics of lifting surfaces and axisymmetric vehicles in incompressible and compressible flow.

Equal emphasis is placed on theoretical and computational aspects of aerodynamics. Analytical design skills are developed using potential flow theory from the incompressible to the supersonic flow regime. Examples include the derivation of integral coefficients from a given circulation distribution on a wing, as well as the analytical derivation of conical supersonic flow equations and their subsequent solution in Matlab. Numerical skills are acquired through the open source CFD package OpenFOAM, as well as simplified computational prediction tools, such as the panel method and the method of characteristics.

#### FURTHER AEROSTRUCTURAL ANALYSIS (AERO417)

**Credits: 7.5 / Semester: semester 1**

This module is about theory of static and dynamic structural analyses of beams and structures made of rods (trusses) and beams (frames). The structures concerned cover both general structures and aerospace structures.

### AEROELASTICITY (AERO415)

**Credits: 7.5 / Semester: semester 2**

This module is about the theories of structural vibration, steady and unsteady aerodynamics, and static and dynamic aeroelasticity.

### AEROSPACE CAPSTONE GROUP DESIGN PROJECT (AERO420)

**Credits: 30 / Semester: whole session**

This module is the culmination of your Aerospace Engineering degree. It allows you to demonstrate all that you have learned as applied to an aircraft design project. You will work in a small team to satisfy an aircraft design proposal. You will start with a conceptual design exercise and then move into a more detailed design phase of activity. The ultimate demonstration of your aircraft's capabilities comes with a flight test exercise either in the School of Engineering's flight simulation facility or in hardware for small unmanned air system projects. The design exercise is marked using group-based coursework assessments which are moderated by a webPA exercise.

### ENTERPRISE STUDIES (MNGT414)

**Credits: 7.5 / Semester: semester 2**

The module teaches the concepts of Entrepreneurship, Intrapreneurship, Company Infrastructure and Investment Proposals. It is taught using lectures, class questions, case studie sand a comprehensive coursework assignment. Successful students will have acquired knowledge and understanding at mastery level of the process and how itis executed in a modern industrial environment.

### FLIGHT HANDLING QUALITIES (AERO405)

**Credits: 7.5 / Semester: semester 1**

This module covers the fundamentals of Flight Handling Qualities for both fixed and rotary wing aircraft. Students will work in groups to assess handling qualities of different aircraft. The module adopts a Problem Based Learning approach and contains a number of lectures, desktop modelling and flight simulator sessions. The module is assessed through a group presentation and final report, both of which will contain an element peer assessment for the final mark.

## OPTIONAL MODULES

### ADDITIVE MANUFACTURING (MNFG610)

**Credits: 7.5 / Semester: semester 1**

**ADVANCED 4TH YEAR RESEARCH PROJECT (ENGG443)**

**Credits: 15 / Semester: whole session**

This module focuses on a specific project related to a students third year project, with a journal style paper written.

**ADVANCED FLUID MECHANICS (ENGG419)**

**Credits: 15 / Semester: semester 1**

Advanced Fluid Mechanics covers fluid motion in a range of problems of engineering interest. Both laminar and turbulent flows will be considered. Limiting cases of the equations of motion will be solved analytically and with the aid of simple numerical methods programmed in Matlab (R). The full equations of motion will be described and solved numerically using the open-source Computational Fluid Dynamics software package OpenFOAM (R).

The module will be delivered via a series of lectures, computing room exercises and tutorial sessions. It will be assessed through three courseworks (30%) and a final examination (70%).

**ADVANCED GUIDANCE SYSTEMS (AERO430)**

**Credits: 7.5 / Semester: semester 2**

In this module students develop an understanding of the use of advanced guidance laws in autonomous air systems, including the interactions of airframe dynamics, sensors and control surfaces.

**DESIGN FOR ENVIRONMENT, MANUFACTURE AND ASSEMBLY (MNFG413)**

**Credits: 7.5 / Semester: semester 2**

**ENERGY AND THE ENVIRONMENT (MECH433)**

**Credits: 15 / Semester: semester 2**

This modules discusses energy generation and usage, and how they complement each other. The topics are introduced in lectures that then lead onto a case study on a specific topic.

**INTEGRATED SYSTEMS DESIGN (MNFG615)**

**Credits: 15 / Semester: semester 2**

**MUSCULOSKELETAL BIOMECHANICS (ENGG410)**

**Credits: 15 / Semester: semester 2**

This module will give students an understanding of the biomechanics of the musculoskeletal system and will cover techniques used to measure and analyse body movements as mechanical systems.

**RISK AND UNCERTAINTY: PROBABILITY THEORY (ENGG404)**

**Credits: 7.5 / Semester: semester 1**

This module develops understanding and appreciation of basic probability theory. It involves the quantification of uncertainties in the input and modelling, their implementation and the evaluation of the associated results in view of decision making. An introduction to numerical concepts will be provided. The methods shown in the module have a general applicability, which is demonstrated by examples and practical applications.

**STRUCTURAL OPTIMISATION (ENGG414)**

**Credits: 7.5 / Semester: semester 2**

This module is about classical optimisation and modern optimisation and their numerical methods. Structural optimisation and their numerical methods. Students will get an idea of how to optimise simple structure and get optimal solutions by analytical and numerical methods.

*Programme details and modules listed are illustrative only and subject to change.*

---

## HOW YOU'LL LEARN

We are leading the UK's involvement in the international Conceive-Design-Implement-Operate (CDIO) initiative – an innovative educational framework for producing the next generation of engineers.

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.

You will be taught through a combination of face-to-face teaching in group lectures, laboratory sessions, tutorials, and seminars. Our programmes include a substantial practical component, with an increasing emphasis on project work as you progress through to the final year. You will be supported throughout by an individual academic adviser.

## HOW YOU'RE ASSESSED

Assessment takes many forms, each appropriate to the learning outcomes of the particular module studied. The main modes of assessment are coursework and examination. Depending on the modules taken, you may encounter project work, presentations (individual and/or group), and specific tests or tasks focused on solidifying learning outcomes.

## LIVERPOOL HALLMARKS

We have a distinctive approach to education, the Liverpool Curriculum Framework, which focuses on research-connected teaching, active learning, and authentic assessment to ensure our students graduate as digitally fluent and confident global citizens.

# Careers and employability

As a student you will have maximum opportunities for career prospects, graduate opportunities, student summer placements specifically during the annual engineering careers fair with 30 blue chip companies attending (including Jaguar Land Rover, Nestle, Toyota, JCB, British Army, United Utilities, ABB Ltd, Network Rail, BAE Systems and many more).

**4 IN 5** **OF OUR ENGINEERING STUDENTS FIND THEIR MAIN ACTIVITY AFTER GRADUATION MEANINGFUL.**

*Graduate Outcomes, 2018-19.*

Our research-led teaching ensures that we incorporate the latest advances in cutting edge engineering research. As well as achieving a degree qualification, you will graduate as an industry-ready engineer who has both practical experience and highly desirable skills to the engineering industry.

## WORK EXPERIENCE OPPORTUNITIES

Many students undertake placements during the summer or for a full academic year in leading engineering companies.

## POSTGRADUATE OPPORTUNITIES

A number of our graduates go on to postgraduate study at MSc or PhD level, either remaining at Liverpool or going to another institution of their choice.

## QUALIFYING YOU FOR LIFE

Our teaching programmes are highly rated and this is underpinned by an extensive programme of research. All of our programmes are strongly linked with industry, both formally through our industrial advisory boards, and informally through industry contacts and alumni.

## PREPARING YOU FOR FUTURE SUCCESS

At Liverpool, our goal is to support you to build your intellectual, social, and cultural capital so that you graduate as a socially-conscious global citizen who is prepared for future success. We achieve this by:

- Embedding employability within your curriculum, through the modules you take and the opportunities to gain real-world experience offered by many of our courses.
- Providing you with opportunities to gain experience and develop connections with people and organisations, including student and graduate employers as well as our global alumni.

- Providing you with the latest tools and skills to thrive in a competitive world, including access to Handshake, a platform which allows you to create your personalised job shortlist and apply with ease.
- Supporting you through our peer-to-peer led Careers Studio, where our career coaches provide you with tailored advice and support.

# Fees and funding

Your tuition fees, funding your studies, and other costs to consider.

## TUITION FEES

Tuition fees cover the cost of your teaching and assessment, operating facilities such as libraries, IT equipment, and access to academic and personal support. Learn more about tuition fees, funding and student finance.

| **UK fees**<br>**Also applies to Channel Islands, Isle of Man and Republic of Ireland** | |
|---|---|
| Full-time place, per year | £9,250 |
| Year in industry fee | £1,850 |
| Year abroad fee | £1,385 |

| **International fees** | |
|---|---|
| Full-time place, per year | £25,750 |

*Fees stated are for the **2023-24** academic year.*

---

## ADDITIONAL COSTS

We understand that budgeting for your time at university is important, and we want to make sure you understand any course-related costs that are not covered by your tuition fee. This includes the cost of flight training, an aircraft checklist, and a study pack. All safety equipment, other than boots, is provided free of charge by the department.

Find out more about the additional study costs that may apply to this course.

---

## SCHOLARSHIPS AND BURSARIES

We offer a range of scholarships and bursaries to help cover tuition fees and help with living expenses while at university.

Scholarships and bursaries you can apply for from the United Kingdom

Select your country or region for more scholarships and bursaries.

# Entry requirements

The qualifications and exam results you'll need to apply for this course.

| **Your qualification** | **Requirements**<br>About our typical entry requirements |
|---|---|
| A levels | AAA including Mathematics and a second science.<br>Applicants with the Extended Project Qualification (EPQ) are eligible for a reduction in grade requirements. For this course, the offer is **AAB** with **A** in the EPQ.<br>You may automatically qualify for reduced entry requirements through our contextual offers scheme. |
| GCSE | 4/C in English and 4/C in Mathematics |
| Subject requirements | Mathematics and a second science.<br>Applicants following the modular Mathematics A Level must be studying A Level Physics or Further Mathematics as the second science (or must be studying at least one Mechanics module in their Mathematics A Level).<br>Accepted Science subjects are Biology, Chemistry, Computing, Economics, Electronics, Environmental Science, Further Mathematics, Geography, Geology, Human Biology, Physics and Statistics.<br>For applicants from England: For science A levels that include the separately graded practical endorsement, a "Pass" is required. |
| BTEC Level 3 Subsidiary Diploma | Acceptable at grade Distinction alongside AA in A Level Mathematics and a second science. |
| BTEC Level 3 Diploma | D*D in relevant BTEC considered alongside A Level Mathematics grade A. Accepted BTECs include Aeronautical, Aerospace, Mechanical, Mechatronics and Engineering. |

| **Your qualification** | **Requirements**<br>About our typical entry requirements |
|---|---|
| BTEC Level 3 National Extended Diploma | Not accepted without grade A in A Level Mathematics |
| International Baccalaureate | 35 overall, including 5 at Higher Level Mathematics and Physics |
| Irish Leaving Certificate | H1, H1, H2, H2, H2, H2 including H1 in Higher Mathematics and Higher Second Science. |
| Scottish Higher/Advanced Higher | Pass Scottish Advanced Highers with grades AAA including Mathematics and a second science. |
| Welsh Baccalaureate Advanced | Not accepted |
| Cambridge Pre-U Diploma | D3 in Cambridge Pre U Principal Subject is accepted as equivalent to A-Level grade A Global Perspectives and Short Courses are not accepted. |
| Access | Not accepted |
| International qualifications | Select your country or region to view specific entry requirements.<br><br>Many countries have a different education system to that of the UK, meaning your qualifications may not meet our direct entry requirements. Although there is no direct Foundation Certificate route to this course, completing a Foundation Certificate, such as that offered by the University of Liverpool International College, can guarantee you a place on a number of similar courses which may interest you. |

## ALTERNATIVE ENTRY REQUIREMENTS

- If your qualification isn't listed here, or you're taking a combination of qualifications, contact us for advice
- Applications from mature students are welcome.

THE ORIGINAL REDBRICK