

# Aerospace Engineering

 BEng (Hons)

## COURSE DETAILS

- A level requirements: [AAB](#)
- UCAS code: H425
- Study mode: Full-time
- Length: 3 years

## KEY DATES

- Apply by: [25 January 2023](#)
- Starts: 25 September 2023

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## Course overview

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.

## INTRODUCTION

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 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.

Conducting independent research as part of an individual project will provide you with the knowledge to develop innovative concepts in your preferred technical area of interest. All of our Aerospace Engineering degree programmes are accredited, or pending accreditation, by our professional bodies, the Royal Aeronautical Society and the Institute of Mechanical Engineers and are a recognised qualification on the route to Chartered Engineer status.

## 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

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## **ACCREDITATION**

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Institute of Mechanical Engineers and are a recognised qualification on the route to Chartered Engineer status.

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# 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 week 7 of the second semester students take a week long course in Creo, a computer-aided design software.

## 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 AEROSPACE ENGINEERING (AERO110)

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

A short module to introduce students to the language and main concepts of the aerospace engineer to provide a solid basis for the remainder of their degree programme

### 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 familiarise students with engineering laboratory methods and procedures, as well as providing an experience of hands-on mechanical testing techniques.

## **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**

## **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.

## **ENERGY SCIENCE (ENGG116)**

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

## **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

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

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## **YEAR TWO**

You 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. You are required to participate in the Flight Test Course and marks will contribute to AERO212 and AERO215 modules.

Students undertaking Aerospace Engineering programmes will be required to wear safety shoes or boots (both toe cap and midsole protection **must conform** to European safety legislation) for some activities, and these must be provided by the students themselves.

## **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.

**EXPERIMENTAL METHODS (ENGG201)****Credits: 7.5 / Semester: semester 1**

The module focusses on the essentials of data analysis and interpretation, engineering experimentation, measurement techniques and principles of instrumentation.

**MATERIALS PROCESSING AND SELECTION I (MATS214)****Credits: 7.5 / Semester: semester 1**

This module introduces the main materials processing and manufacturing techniques used to shape metals. It also introduces technologies used to modify the surface properties of metal components, and heat-treatment procedures used to change materials' mechanical properties.

**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.*

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## **YEAR THREE**

During your third 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%).

## **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 this 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 principles 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.

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

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## **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.

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# 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.*

## RECENT EMPLOYERS

- ABB Ltd
- Airbus
- Arup
- BAE Systems
- Bentley
- British Airways
- British Army
- Government organisations
- Jaguar Land Rover
- Metronet Rail
- National Nuclear Laboratory
- RAF
- Rolls Royce
- Royal Navy
- United Utilities.

## 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.
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# 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.](#)

<b>UK fees</b> 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

<b>International fees</b>	
Full-time place, per year	£25,750

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

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## 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 may include a laptop, books or stationery. 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.

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## 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.

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# Entry requirements

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

Your qualification	Requirements <a href="#">About our typical entry requirements</a>
A levels	<p>AAB including Mathematics and a second science.</p> <p>Applicants with the Extended Project Qualification (EPQ) are eligible for a reduction in grade requirements. For this course, the offer is <b>ABB</b> with <b>A</b> in the EPQ.</p> <p>You may automatically qualify for reduced entry requirements through our <a href="#">contextual offers scheme</a>.</p> <p>If you don't meet the entry requirements, you may be able to complete a foundation year which would allow you to progress to this course.</p> <p>Available foundation years:</p> <ul style="list-style-type: none"><li>• <a href="#">Engineering Foundation BEng (Hons) (4 year route including a Foundation Year at Carmel College)</a></li></ul>
GCSE	4/C in English and 4/C in Mathematics

<b>Your qualification</b>	<b>Requirements</b> <a href="#">About our typical entry requirements</a>
Subject requirements	<p>Mathematics and a second science.</p> <p>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).</p> <p>Accepted Science subjects are Biology, Chemistry, Computing, Economics, Electronics, Environmental Science, Further Mathematics, Geography, Geology, Human Biology, Physics and Statistics.</p> <p>For applicants from England: For science A levels that include the separately graded practical endorsement, a "Pass" is required.</p>
BTEC Level 3 Subsidiary Diploma	Acceptable at grade Distinction* alongside BB in A Level Mathematics and a second science.
BTEC Level 3 Diploma	Distinction* Distinction* in relevant BTEC considered alongside A Level Mathematics grade B. Accepted BTECs include Aeronautical, Aerospace, Construction, Mechanical, Mechatronics and Engineering.
BTEC Level 3 National Extended Diploma	D*DD in acceptable BTEC, plus B in A level Maths (not accepted without B in A level Maths)
International Baccalaureate	35 overall including 5 in Higher Level Mathematics and 5 in Higher Level Physics.
Irish Leaving Certificate	H1,H1,H2,H2,H2,H3, including H2 in Higher Maths and Higher Second Science. We also require a minimum of H6 in Higher English or O3 in Ordinary English

Your qualification	<b>Requirements</b> <a href="#">About our typical entry requirements</a>
Scottish Higher/Advanced Higher	Pass Scottish Advanced Highers with grades AAB including Mathematics and a second science
Welsh Baccalaureate Advanced	Acceptable at grade B alongside AA in A Level Mathematics and a second science
Cambridge Pre-U Diploma	D3 in Cambridge Pre U Principal Subject is accepted as equivalent to A-Level grade A M2 in Cambridge Pre U Principal Subject is accepted as equivalent to A-Level grade B Global Perspectives and Short Courses are not accepted.
Access	Considered if taking a relevant subject. Check with Department or Admissions team.
International qualifications	<div style="border: 1px solid gray; padding: 5px; text-align: center;">           Select your country or region to view specific entry requirements.         </div> <p>Many countries have a different education system to that of the UK, meaning your qualifications may not meet our entry requirements. Completing your Foundation Certificate, such as that offered by the <a href="#">University of Liverpool International College</a>, means you're guaranteed a place on your chosen course.</p>

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## 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.
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**THE ORIGINAL**  
**REDBRICK**

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