Aeronautical Engineering BEng/MEng Module Details

Year one

Engineering Mathematics 1 provides a sound knowledge of the elements of classical engineering mathematics which universally underpin the formation of the professional engineer. Topics include fundamental algebraic techniques, function manipulation and single-independent variable calculus.

Engineering Mathematics 2 introduces intermediate engineering mathematical techniques. These include trigonometry, matrices, vectors and complex numbers, study of differential equations and numerical methods. You will also cover statistics and probability methods used in the engineering domain.

Mechanical Principles – Statics provides you with a clear understanding of solid mechanics (statics) concepts and their application to engineering problems. You will study a wide range of topics, including the resolving of forces, moments and couples, direct stress, shear stress and strain, centroids and beam bending.

Mechanical Principles – Dynamics gives you a clear understanding of kinemetics and dynamics, and introduces you to the fundamentals of forces and their impact on motion. You will cover a wide range of topics, including linear and rotational dynamics, Newton's laws, relative motion, oscillations and gyroscopes.

Thermofluids provides you with a solid foundation in, and understanding of, Thermodynamics, heat transfer and fluid mechanics. You will learn to apply thermofluid concepts, equations and experimental techniques to engineering problems.

Aircraft Design Principles introduces you to the main phases of conceptual design of fixed wing aircraft. You will consider user needs and requirements, choice of configuration, aerodynamic design and performance. You will use Matlab for practical exercises.

Computer Aided Engineering and Programming includes two distinct topics, namely an introduction to programming principles using MATLAB and an introduction to the general principles of Computer Aided Engineering (CAE), 3D modelling and Simulation via Creo Parametric and ANSYS software packages.

Mechanics of Flight introduces you to the main principles and methods of flight mechanics, such as the drag polar, aerodynamic efficiency, level trimmed flight, climb and descent flights, power off gliding, horizontal turn. You will use Matlab and Simulink software for practical computational examples.

Year two

Aircraft Structures and Materials covers airframe structures such as fuselage, fuselage frames, wing and wing ribs and materials that are used to manufacture these. The performance of airframe structures under a range of conditions will be assessed using classical engineering techniques.

Fundamentals of Aerodynamics introduces the main concepts and theoretical methods of aerodynamics. Topics include classical aerofoil theory, aerodynamics of a finite aspect ratio wing and

airplane configuration. You will develop your understanding of the theoretical principles of aerodynamics by carrying out wind tunnel experiments. You will use software tools such as Matlab, XFLR-5 and XFoil in practical computational tasks.

Project Management presents some of the background, theory and practice to enable you to embed project management expertise in your academic and professional development. You will focus on the wider role of a project manager, such as scheduling, time/resource management and how future environmental pressures can influence a current project.

Engineering Mathematics 3 is an advanced engineering mathematics module. You will study topics such as functions of several variables, operators: grad, div and curl, multiple integrals and Fourier transforms.

Introduction to Control Engineering introduces the basic principles of control theory and the implementation of control using computers. You will study the analysis and design of single-input single-output continuous and digital feedback control systems. Computer aided design studies support the background theory.

Flight Dynamics and Control introduces you to the principles of aircraft flight dynamics, stability analysis, stability augmentation and control systems using classical feedback control theory. You will use Matlab and Simulink for practical work.

Product Design gives you the opportunity to investigate the design process and apply the principles of product design methodology tools and analysis to solve engineering problems. You will develop your CAD skills and explore more technically advanced modelling and analysis techniques.

Fluid Mechanics presents the principles of science that describe the mechanics of fluids in static and dynamic flow conditions. This module covers both non-compressible and compressible flows. You will study topics such as basic equations of fluid mechanics (mass, momentum and energy), inviscid and viscous flows, boundary layer concept, flow through nozzles, isentropic flow normal and oblique shocks.

Year three

Individual Project gives you the opportunity to engage in a substantial piece of individual research and/or product development work focused on a topic relevant to your specific discipline. This topic may be drawn from a variety of sources including your placement experience, research groups, the company in which you are employed or a subject of personal interest (subject to suitable supervision being available).

Flight Simulation Technology familiarises you with flight simulator designs and operational principles. The module brings together mathematics, computer science, flight mechanics and control, electronical systems and provides a background for further skills development in systems engineering. You will study methods of aerodynamic modelling, 6DOF equations of aircraft motion, principles of visualization and motion drive algorithms. You will use the Airfox DISO flight simulator with movable 6DOF cockpit for practical exercises.

Aircraft Propulsion addresses the principles of jet-engine propulsion. You will cover thermo-fluid analysis of different types of engines (Turbo-Jet, Turbo-Prop, Turbo-Fan, etc.) and constituent components, as well as technical and analytical concepts of basic rocket propulsion.

Human Factors and Flight Safety addresses the main aspects and methods in assessing various human factors affecting flight safety. You will study aspects of flight safety connected to human's

operation, Human Risk Informed Design (HURID) principles, upset prevention and recovery pilot training.

Computational Aerodynamics 1 addresses the main concepts and methods of classical computational aerodynamics. You will use software tools based on reduced order aerodynamical methods such as panel methods and Vortex Lattice Methods (VLM) to facilitate computational predictions of aerodynamic characteristics for various airplane configurations.

Structural Dynamics and Aeroelasticity develops your understanding of the main principles involved in a range of aeroelasticity and aerodynamic loading topics that might be encountered in aircraft design. You will be introduced to simplified analytical methods for flexible aircraft and its components for predicting aeroelastic behaviour and aerodynamic loading.

Optional modules

Management Concepts in Aviation Commercial covers modern operations and management concepts used by the aviation industry worldwide. You will consider a range of business and operational approaches, from operating large aircraft such as A380s to small single-seater aircraft which serve remote regions of the planet.

Navigation and Pilot Studies is an introduction to the principles of flight and flying from the point of view of pilots. It provides you with the skills to pre-plan and navigate an effective route for a basic IFR (instrument Flight rules) or VFR (Visual Flight Rules) non-commercial flight, together with mass/balance and performance calculations.

Year four (MEng)

Group Project gives you the opportunity to work on an engineering project as part of a multidisciplinary team, similar to that found in industry. This module has been specifically designed to expose you to the multidisciplinary and team nature of many engineering projects.

Advanced Flight Dynamics provides a comprehensive knowledge of equations governing aircraft dynamics demonstrated by analytical calculations, as well as knowledge of nonlinear aircraft dynamic problems (stall, spin, pilot induced oscillations. etc.) demonstrated by the analysis of flight test data and computer simulations.

Aircraft Handling Qualities and Control familiarises you with the concepts of handling qualities and aircraft control. You will consider methods of analysis, estimation and improvements of aircraft handing qualities, as well as elements of classical feedback control theory for design of command and stability augmentation systems. You will use Matlab and Simulink software for practical work.

Engineering Business Environment enables you to understand and reflect upon the role of business in a rapidly changing and globalised world. You will explore the steps a business can take to respond to the environmental challenges ahead; for example, through supply chain management, logistics, life-cycle analysis, green accounting and carbon trading.

Computational Aerodynamics 2 addresses advanced concepts and methods of CFD simulations for aerodynamics analysis of complicated airframes. You will use commercial and open access CFD software tools to gain practical experience in CFD simulation.

Optional modules

Systems Operations Management enables you to critically understand the role effective operations management has in the success of a company. You will consider different types of decision-making

processes, including product/process design, quality and capacity management, facilities planning, production planning and inventory control.

Introduction to Nonlinear Dynamical Systems addresses the main concepts and methods of nonlinear dynamical systems theory and its applications in engineering analysis and design. You will use software tools from Matlab/Simulink to facilitate practical computational examples.

Unmanned Aero Vehicle Design brings together mathematics, mechanics, electronics, computing science and control theory to build intelligent and efficient flying robots (drones) for various applications. You will study the principles of UAV design and its subsystems: on-board electronics, communication, aerodynamics, propulsion and power systems, principles of modelling and operations.

Composite Materials develops your understanding of the overall topical area of composite materials, including their properties, manufacturing, analysis and design. You will focus on manufacturing methods, the structure-composition-properties relationship, micromechanical modelling and application of composite materials.