

## **Graduate Certificate in Aeronautical Engineering (68877653)**

### **Pre-requisite**

**BE (Mechanical) or BE(Mechatronics) or BE (Electrical) or**

**BE(Electronics)**

<http://www.digitalbookindex.org/search/search010engineeringaeronauticsa.asp>

### **AERO601: Introduction to Aerospace Engineering**

This unit of study introduces students to the role of professional aerospace engineers, along with the development of fundamental engineering knowledge and skills for aerospace vehicle design, analysis performance and operation. Students will learn through experience, to develop professional skills in research, interpretation, communication, and presentation of information relating to aerospace engineering. Expected learning includes: introduction to lateral thinking concepts; glossary of aerospace vehicle components and terminology; an introduction to the multiple disciplines related to aerospace engineering, such as aerodynamics, aircraft and spacecraft performance, mechanics of flight, aerospace structures, materials and propulsion systems; how the various disciplines are integrated into the design and development of flight platform systems; the operating characteristics of modern flight vehicles, their uses and limitations; modern developments and future trends in aerospace; the limitations of the aerospace environment; teamwork; and resource management. Significantly, professional enhancement is introduced through the development of basic hands-on worksho

### **AERO602: Intro to Aircraft Construction and Design**

The study towards BE(Aeronautical) involves learning about the Design, Analysis, Flight, and Operation of Aircraft and other Flight Platforms. This unit facilitates the training towards becoming professional aeronautical engineers through a globally-unique experiential-learning opportunity to provide a strong background familiarity with aircraft hardware. This unit is designed to educate and facilitate the learning of

aircraft design, basic aircraft construction techniques, the operation of light aircraft and the registration and regulations relating to light aircraft. In addition to hands-on skills on the construction phase, this unit facilitates learning in motivations for unique aircraft design, aircraft aerodynamics, flight mechanics, structural aspects and other design-related issues. Teamwork plays a very important role in this unit; the ability to work with peers and supervising staff is an invaluable skill sought after by employers of engineers. Throughout the semester, students will be actively participating in the construction of a light aircraft, and of aircraft structural components. The aircraft is to be constructed under current Australian Civil Aviation Regulations so that students will gain an insight into all aspects of the process. By being a part of the construction team, students will also experience the organisational requirements necessary to successfully complete a complex engineering project. The aircraft construction workshop component is complemented with lectures, homework, research and assignments to further enhance the learning experience on aircraft. The final outcome will be that students gain a good foundation of: aircraft design and analyses methods; innovative methods of construction; techniques for selecting, sizing and stressing components; regulatory requirements for certification; off-design requirements; construction tolerances; and team-work requirements in undertaking complex engineering projects

## **AERO603: Aircraft Performance and Operations**

This unit aims to develop in students an understanding of the fundamental concepts involved in the operation and performance of aircraft. The students will acquire an ability to make accurate and meaningful measurements of take-off, climb, cruise, turn, descent and landing performance; to perform weight and balance calculations; to understand the use of aerodynamic derivatives and their impact on aircraft performance. Students will be shown methods to optimise performance for specific missions. It will also cover modern issues such as airport congestion, noise restrictions, aviation certification requirements for the use of different aircraft categories and novel methods solving these problems.

## **AERO604: Aerospace Design 1**

This unit aims to introduce students to the theory and practice of aircraft component design. In doing so it will emphasize all the considerations, trade-offs and decisions inherent in this process and thus enable students to gain an understanding of why aircraft structures are designed in the way they are with respect to aircraft operational, certification, manufacturing and cost considerations. At the end of this unit students will be able to understand the design process, especially as it applies to aircraft individual component design; Have a familiarity with some of the standard industry practices for component design; An increasing familiarity with typical aerospace analysis techniques along with the primary failure modes that need to be considered; An understanding of the importance of different failure modes for different components and how these relate to load-conditions; a familiarity with the operating environment that must be considered when designing components; and

understanding of some of the legal and ethical requirements of aircraft design engineers to give a basic understanding of the regulatory framework in which aircraft design is conducted.

## **AERO604: Aerospace Design 2**

This unit aims to develop an understanding of the aerospace industry procedures for design, analysis, and testing of aircraft and aerospace vehicle components. It provides a Design-Build-Test experience by putting into practice, learning outcomes from this and other previously completed UoS, through working on a small structure which is representative of a typical light metal aircraft. Students will be introduced to typical metallic and composite materials and structures for aerospace vehicles. The unit also provides an introduction to fatigue and damage tolerance analysis of metallic aircraft structures. Experiential learning opportunities are provided to acquire skills and knowledge in structural design, analyses, testing methods, procedures, techniques, and equipment. On satisfactory completion of this unit students will have gained practical skills relevant to working on typical modern aircraft and aerospace vehicle components. They will learn from methods, techniques, and experiences from the modern aerospace industry. Experiential learning is enhanced through verifying analyses with actual testing of fabricated component, and the experience of a full design-build-test cycle of a typical aerospace structural component. Subject areas covered will include design methods, internal loads calculations, stress analysis, design for manufacture, joints and fasteners, test procedures, fatigue and damage tolerance, composites, and the art of design.

## **AERO604: Aerospace Design 3**

This unit aims to develop an understanding of the application of design to the modern aerospace industry. Students will gain an overview of how to manage a design team and will also gain skills in carrying out detailed design problems. Course content will include: Design requirements; Sources of information for aircraft design; Configuration design: performance, weight and balance, propulsion; Aerodynamic design: lift, drag and control; Structural design: loads, materials; Philosophies of design and analysis; System design: requirements and specification; System design procedures; systems integration.

## **AERO605: Propulsion**

This unit of study teaches the students the techniques used to propel aircraft. The students will learn to analyse various propulsion systems in use- propellers, gas turbines, etc. The topics covered include: Propulsion unit requirements for subsonic and supersonic flight; thrust components, efficiencies, additive drag of intakes; piston engine components and operation; propeller theory; operation, components and cycle analysis of gas turbine engines; turbojets; turbofans; turboprops; ramjets.

Components: compressor, fan, burner, turbine, nozzle. Efficiency of components: Off-design considerations. Future directions: minimisation of noise and pollution; scram-jets; hybrid engines.

## **AERO606: Aerospace Structures 1**

This unit aims to develop a student's understanding of the theoretical basis of advanced aerospace structural analysis; and introduce students to the solution of real-world aircraft structural problems. This unit of study will develop the following attributes: An understanding of the derivation of the fundamental equations of elasticity and their application in certain analytical problems; An understanding of plate theory and the ability to use this to obtain analytical solutions for plate bending and buckling problems; An understanding of energy-method to develop a deeper appreciation for the complexities of designing solution techniques for structural problems; An understanding of the basic principals behind stressed-skin aircraft construction and the practical analysis of typical aircraft components, including the limitations of such techniques. At the end of this unit students will have an understanding of: 2-D and 3-D elasticity- general equations and solution techniques; Energy methods in structural analysis, including the principles of virtual work and total potential and complimentary energies; Fundamental theory of plates, including in-plane and bending loads as well as buckling and shear instabilities; Solution techniques for plate problems, including Navier solutions for rectangular plates; Combined bending and in-plane loading problems; Energy methods for plate-bending; and Plate buckling for compression and shear loadings; Bending of beams with unsymmetrical cross-sections; Basic principles and theory of stressed-skin structural analysis; Determination of direct stresses and shear flows in arbitrary thin-walled beams under arbitrary loading conditions including: Unsymmetrical sections, Open and closed sections, Single and multi-cell closed sections, Tapered sections, Continuous and idealized sections; The analysis of common aircraft components including fuselages, wings, skin-panels, stringers, ribs, frames and cut-outs; The effects of end constraints and shear-lag on the solutions developed as well as an overall appreciation of the limitations of the solution methods presented.

## **AERO607: Aerodynamics 1**

This unit of study should prepare students to be able to undertake aerodynamic performance calculations for industry design situations. The unit aims to develop a knowledge and appreciation of the complex behaviour of airflow in the case of two dimensional aerofoil sections and three dimensional wings; To encourage hands-on experimentation with wind-tunnel tests to allow an understanding of these concepts and their range of applicability. To understand the limitations of linearised theory and the effects of unsteady flow.

# **AERO608: Flight Mechanics 1**

This unit aims to develop an understanding of aircraft longitudinal equilibrium, static stability, dynamic stability and response. Students will develop an understanding of the importance and significance of flight stability, will gain skills in dynamic system analysis and will learn mathematical tools used for prediction of aircraft flight behaviour. Students will gain skills in problem solving in the area of flight vehicle motion, and learn the fundamentals of flight simulation. At the end of this unit students will be able to understand: aircraft flight conditions and equilibrium; the effects of aerodynamic and propulsive controls on equilibrium conditions; the significance of flight stability and its impact of aircraft operations and pilot workload; the meaning of aerodynamic stability derivatives and their sources; the effects of aerodynamic derivatives on flight stability; the impact of flight stability and trim on all atmospheric flight vehicles. Students will also be able to model aircraft flight characteristics using computational techniques and analyse the aircraft equations of rigid-body motion and to extract stability characteristics. Unit content will include static longitudinal aircraft stability: origin of symmetric forces and moments; static and manoeuvring longitudinal stability, equilibrium and control of rigid aircraft; aerodynamic load effects of wings, stabilisers, fuselages and power plants; trailing edge aerodynamic controls; trimmed equilibrium condition; static margin; effect on static stability of free and reversible controls.