

- **Module Descriptors**

#### **ASU\_5\_AMM Advanced Engineering Mathematics and Modelling**

This module covers advanced engineering mathematical techniques used for solving engineering problems, including Computational Techniques in Engineering, Vectors, Differential equations, Selected Numerical and Computational methods, Advanced Matrix computation techniques, and Advanced Computational Optimisation and advanced Statistical techniques, including Permutations and combinations. Binomial, Poisson and normal distributions.

#### **ASU\_5\_CSS Circuits, Signals and Systems**

In practical engineering, it is very common to assume, at least initially, that the system to be analysed or designed is linear and time-invariant. Linear, time-invariant systems provide potentially good approximations of the behaviour of many systems in their normal operating region. The advantage of linear, time-invariant systems is that they can generally be analysed. On the other hand, Nonlinear systems cannot generally be analysed, and one is forced to resort to approximate analysis based on simulation. This module offers an introduction to the analysis of linear, time-invariant systems. Ideally, the analysis of a system involves the determination as mathematical functions of time of all of the signals associated with the system. Accordingly, it is impossible to provide an analysis procedure for systems without a preliminary discussion of signals. Specifically, the module introduces and explains the mathematical ideas, which underpin the very important concept of the frequency content of a signal. The module covers the mathematics required to undertake a study of dynamics, communication theory, signal processing, advanced circuit theory, partial differential equations and control theory, with engineering examples. The module also provides advanced techniques for the solution of linear, constant coefficient, and ordinary differential equations. The module includes a practical component where students perform Matlab/Simulink experiments to apply the theoretical concepts and gain practical skills in the design of linear systems.

#### **ASU\_5\_POC Principles of Control**

The module is an introduction to the theory and practice of continuous-time feedback control systems to enable the design and implementation of control systems for applications, such as robotics, automobiles, aircraft, automatic machinery, and chemical processes. It provides an analytical approach to the modelling of dynamical systems and their analysis by applying engineering mathematics. The module includes a practical component where students perform experiments to apply the theoretical concepts and gain practical skills in control systems.

#### **ASU\_5\_TDP Team Design Project**

This module aims at developing students' skills in engineering design, including identifying and meeting requirements for new products (tangible product, process, or system), such as consideration of regulatory, professional and standards requirements. The module develops students' abilities in working as part of a team, handling information, project planning and management, and report-writing and presentation skills.

#### **ASU\_5\_EPE Electrical Machines and Power Electronics**

The module discusses the design of modern electrical drives, with consideration of the machine, power electronics and control requirements. Comparisons are made between drive types and typical applications considered. Magnetic and electric loadings; thermal design; winding design, choice of pole number, phase number, field and armature location. Permanent magnet machines; induction machines; switched reluctance machines; vector control of ac machines; applications characteristic of ac drives; comparative evaluation of different drives. Use of commercially available software to perform machine analysis and design. The module includes a practical component where students perform experiments to apply theoretical concepts and gain practical skills in electrical machines and power electronics.

#### **ASU\_5\_ADC Analogue and Digital Circuit Design**

This module provides students with the knowledge of analogue, mixed-signal and digital circuits and also experience with both the practical issues of device-level design and system-level performance requirements. A key feature is a balanced approach to both analogue and digital IC design. The module includes a practical component where students perform experiments to apply the theoretical concepts and gain practical skills in analogue and digital circuit design.

#### **ASU\_5\_INT Internship**

This module provides the students with an opportunity to experience the industrial world and be part of a team working on real-world projects. The University assists each student in finding the most suitable industry.

#### **ASU\_6\_DSD Digital Systems Design**

This module covers the design and analysis of modern digital systems utilising finite state machines. Comparison between the use of CPLDs and microcontrollers in typical embedded systems will be made, and appropriate hardware and software methods for a successful design will be considered. Synchronous and asynchronous designs will be covered along with a consideration of the principles of 'design for testability' and JTAG technologies. CAD tools will be used to design and simulate integrated circuits on the silicon workspace. The module also covers further programming methods using HDLs and HLL programming of MCUs. The module includes a practical component where students perform lab experiments to apply the theoretical concepts and gain practical skills in designing and testing digital electronic systems.

#### **ASU\_6\_PRO Project**

The Individual Project is a learning experience that enables students to do independent research and bring together many of the concepts they have learned. The work calls for careful planning, critical judgment, engineering competence, and communication skills. Further details are provided in the Individual Project Guide for Students. This guide may be updated from time to time and include information generally on how to plan the project, milestones, important dates, and deliverables. The module will spread over the first and second semesters of year 4.

#### **ASU\_6\_AAE Advanced Analogue and RF Electronics**

This module covers the design and analysis of radio frequency systems from early design to modern digital systems. Noise measurement, reduction, shielding, grounding and general issues of EMC are covered. RF terminology and wave propagation are

explained, along with a look at modulation/demodulation techniques and the circuits needed to carry them out, such as mixers, oscillators, amplifiers, etc. The module includes a practical component where students perform experiments to apply the theoretical concepts and gain practical skills in analogue and RF electronics.

### **ASU\_6\_IAE Innovation and Enterprise**

The module is intended to be practical, with students developing some appropriate ideas of their own in such a way that they become practical, profitable propositions. Students will practice ways of finding ideas, testing those ideas and developing them, and will write their business strategies, risk assessments and scenario testing so that they demonstrate the commercial viability of their ideas. Topics include project management skills, which help determine the critical path of a proposed business, such as intellectual property, market research, market placement, advertising and finance. Students will be expected to reflect on what they can contribute to a group.

### **ASU\_6\_CEN Control Engineering**

This module builds on the Level 5 module Principles of Control. It introduces a range of Analogue and Digital Control methods to estimate system dynamics and improve system stability, servo tracking and regulation of system outputs against unknown disturbances. Implementation of these methods in a laboratory will closely support the theory. The application-oriented part of the module will use case studies and laboratory work relating specifically to the individual disciplines. The module includes a practical component where students perform experiments to apply the theoretical concepts and gain practical skills in control engineering.