CORE MODULES: BEng (Hons) Integrated Engineering Top-up

You must take modules worth 120 credits at each level of the course. Each module is worth a specified number of credits.

Year one for full-time students (Level 5)

Mathematics for Engineers (15 credits)

- *The module is designed to build on work in the pre-requisite module by introducing techniques that lie behind the solution of engineering problems. The methods tend to be hidden within software and the module will provide an insight into the techniques, their application and their limitations so that students can make informed judgements on reliability of software solutions. Calculus is extended to partial differentiation and its applications and Laplace transforms and matrices are considered in depth. A statistics section is also included applied to the numerous areas of civil engineering which use these techniques It is intended that the module will enable students to undertake appropriate analysis in areas such as hydraulics, geotechnics, structural analysis and design.*

Statistics and Process Quality Assurance (15 credits)

- *The use of statistical tools in industries for process quality assurance is a very vital part for the growth of an organization. Various quality management theories and philosophies have been proposed and implemented over the years to enhance productivity and gain more rewards. This module provides the students with the knowledge and confidence to use sound statistical techniques in industrial applications for process control and problem solving. The history and implementation of quality management alongside quality standards and statistical analysis of experiments using different control charts for analysing the capability of a process are some of the key topics covered in this module. The module will also give an appreciation of the wider aspects of quality management tools and risks associated with their implementation and continuity of such methods that are vital to the survival of all organisations.*

Programmable Logic Controllers (30 credits)

- *This module is concerned with programming a PLC using on-line and off-line techniques. It will cover the Health & safety issues of using PLC's. Students will interface input and output devices to an industrial PLC, generate and test programs for a given application and interpret system specifications. Students will be given a specification and will be required to select, design, program and test a PLC based system to operate to this specification. This module forms the basis of PLC control of machines and is a key development of workplace practice and employment.*

Applied Mechanics (15 credits)

- *This module aims to give the students a broad range of competence in applied mechanics and structural analysis. Emphasis will be on applications of structural analysis of mechanical parts and assemblies. Applied Mechanics is the study of the static and dynamic of particles and rigid bodies under the influence of forces. The module is crucial part of failure analysis of mechanical parts and components and complements students' knowledge on materials and processes as well as stress and strain analysis. In this module worked examples enable the students to become familiar with, and to grasp important concepts and principles in applied mechanics for example pin-jointed and rigid-jointed frames and deflection of the beams with various support systems and variable loading, and concept of three dimensional force balancing of structures. The module includes engineers' bending and torsion equations relating external forces to the internal stresses. Furthermore, force profiles applied by fluid flow in applied mechanics are covered.*

Project Management for Technologists (15 credits)

- *This module is about the planning and control of engineering projects. It covers aspects of planning for engineering projects, operations research techniques, scheduling, quality, people and management skills. The major purpose is to encourage the student thinking about the variety of techniques available that could be used for the control of projects and to give insight to the theoretical underpinning concepts of these techniques. It gives the student the opportunity to take time out to reflect on just what these issues are and what future developments might be envisaged, both in specific work place context and in a general professional development context. The areas this module covers are project life-cycle related to environmental considerations, project constraints, resource utilisation, managing risks, optimum task scheduling, types of contract, and closing a project. Therefore, this module not only supports students' future careers in managing practical projects, it provides them with a view on commercial, management, and organisation of conducting a project in engineering.*

Advanced Engineering Mathematics (15 credits)

- *Applying and building upon the mathematical techniques learnt in Mathematics for Technology 2, this module enables students to use the techniques of mathematical modelling to analyse and improve engineering systems. In analysing technological problems, vector analysis is introduced. Laplace transforms are used to solve first and second order differential equations, whilst systems of differential equations are solved using eigenvalues and eigenvectors. The Fourier series is the mathematical basis for analysing periodical functions as encountered in any area of physics where wave theory is important.*

Plus 15 credits of optional modules dependant on pathway

- ***OPTIONAL MODULE: Applied Software (15 credits)***
  This is an introductory module in software development for real time and non real time applications. The student will learn the basic constructs of a high level language (such as "C" or Visual Basic) and its syntax. Short programs will be demonstrated to enable the student to grasp the concept of "programming" and the student will be asked to write simple programs in order to assimilate the new concepts and demonstrate the ability to write original programs. Techniques to design, develop and test software will be studied and the student will use commercial integrated development environment for software development. Consideration of hardware requirements to run real time and non real time software will be covered at an introductory level. Successful completion of this module will increase students' employability, as they will acquire industry standard skills directly applicable to real world projects.

- ***OPTIONAL MODULE: Introduction to Engineering Materials (15 credits)***
  This module is designed to introduce students to the structure and properties of a range of engineering materials. It includes a review of typical load extension curves and their interpretation and the student will carry out tensile tests on engineering materials to support and extend the classroom teaching. The module also contains an introduction to the atomic structure of metals and non metals as a lead into an understanding of the factors that influence the physical properties of materials. Alloying of metals will be explored via equilibrium diagrams and structure will be determined from given information. This module will develop the students' skill of gathering and interpreting scientific information via a series of laboratory experiments. This will involve the use of metallurgical inspection equipment as well as common testing equipment. The module is supported by a well equipped metallurgical laboratory serviced by technical staff.

Final year for full-time students (Level 6)

Research Methods and Individual Project (30 credits)

- *This module enables students to carry out an individual piece of research in the engineering field which will require a literature review of current knowledge in the chosen topic area, the formulation of a research question and the collection of primary data - by analytical methods, numerical modelling, case study, interview, questionnaire or experimentation. Advice will be given by engineering staff on choosing a research topic in a briefing session delivered towards the end of the academic year prior to that in which the student undertakes their dissertation.*

Control Systems (15 credits)

- *Feedback and control systems are at the heart of modern industry, whether in the control of robots assembling your new car or in the process control systems supervising the manufacture of pharmaceuticals. This module introduces the principles and practice of modern control systems. Although a basic grounding in maths is required, the approach of the course will be that certain mathematical skills are essential tools for the analysis and design of control systems, hence the module will emphasise the ability to use the tools effectively rather than treat them with mathematical rigour. Systems with feedback are considered. The associated problems of instability are evaluated with a mixture of case studies and methods for determining the absolute and relative limits of stability in practical systems. The module reflects the modern use of electronics in controller design and the essentially analogue nature of the systems under control. The module will cover the specification of the complete system in terms of performance criteria. It will then consider a variety of design approaches both analytical and heuristic.*

Computer Aided Solid Modelling (15 credits)

- *This module builds on previous CAD experience to create more complex solid part models and consider advanced aspects of CAD. It looks at assemblies made up of a number of parts and sub-assemblies. One of the key elements will be the use of feature-based parametric modelling technique which automates the design and revision procedures by the use of parameters. The module introduces the methods for modelling sculptured surfaces that are seen in plastic mouldings and transition elements. Moving parts in an assembly are checked with animation and their mechanisms are analysed. The assembly, normal or exploded, are produced with parts list and ballooned references in 2D views. The module is assessed by an assignment and time constrained 3D modelling. The assignment includes a design of a product, computer modelling of the component parts in 3D, assembling the product, analysing the product, producing 2D technical drawings with parts list and ballooned references, and compiling a report.*

Signals and Systems (15 credits)

- *It can come as a surprise to students when they discover that the equations describing the suspension system on a car are essentially the same as those describing the oscillations of a quartz crystal clocking a computer. This module emphasises the underlying unity of apparently different physical systems (electrical, thermal, mechanical, fluid, chemical, biological etc.) by developing the concept of the system model and using the method of analogy. The module will focus on simple 'lumped parameter' models with particular reference to instrumentation and control systems. The module contrasts signal types and discusses methods of characterisation. The module concentrates on linear systems, developing the use of the Laplace transform, system block diagrams and the system transfer function as key tools. The difference between static and dynamic system models is explored and practical dynamic models developed. The use of computer tools and packages is integral to the module. Non-linear systems are introduced and methods of dealing with non-linearity outlined. Students will carry out practical studies involving the analysis, test and design of systems, sensors and associated conditioning circuits.*

Embedded Systems (15 credits)

- *The world of engineering covers a very wide range of disciplines and subject specialism. Embedded Systems is one of those areas where the demand has grown and is forecasted to grow exponentially over the next decade. As embedded processors are finding themselves in almost every engineering application from artificial hearts to formula1 racing cars. This module is designed to ensure that future embedded systems engineers have the basic skill set needed to deal with the challenges involved in the creation of embedded system designs of the future. This module starts with an overview of modern microcontroller architecture and software followed by a series of practical experiments illustrating techniques in embedded C programming on a 32bit ARM microcontroller. Students are introduced to both Event Triggered and Time Triggered systems with an emphasis on TT systems for reliable applications.*

Stress and Dynamics (15 credits)

- *The main purpose of this module is to provide the students with a clear and thorough presentation of the theory and applications of engineering mechanics which builds on the material covered in the prerequisite module Applied Mechanics. To achieve this objective, the instructor will deal with the subject of statics first in which the principles are first applied to simple, then to more complicated situations. Most often, each principle is applied first to a particle; in some instances a rigid body application of the coplanar system of forces will be demonstrated. Analysis of forces acting on particles and rigid bodies in static equilibrium; equivalent systems of forces, centroids and moments of inertia; are some of the examples of the static studies that will be covered. The subject of dynamics is presented following statics in which the kinematics of particles is discussed followed by the discussion of particle kinetics (equation of motion). The concept of the particle dynamics are then summarised in a review section and the students are given the chance to solve a verity of problems to complement the tutorials. It should be realised that at the discretion of the instructor, some of the material may be presented in different sequence with no loss of continuity. Analysis of particle and rigid body dynamics in two dimension, concept of dynamic equilibrium and techniques of solution, including energy methods; introduction to vibrations are some of the examples of the dynamic studies that will be covered.*

Power Systems (15 credits)

- *The modern world increasingly relies upon electrical power to supply our industries, commercial centres and homes with a convenient, flexible and reliable source of energy. To meet the customer's expectations, electrical power must be provided at a reasonable cost and transmitted to the customer, at the appropriate voltage and current levels. The customer utilisation of the energy source needs to be appropriate, without undue complexity, to facilitate energy generation and transmission. This module provides an overview of modern electrical power systems together with sources of and applications of renewable energy. The module will provide an introduction to the main components of and electric power systems including power generation, transmission, distribution and conversion as well as the quality and economics of power systems. The module also addresses both traditional and modern renewable energy sources aswell as sutainble technologies such as fuel cells, hybrid vehicles and bio-energy. The module aims to provide a foundation of knowledge for engineers wishing to move into the field of power systems engineering.*