

CORE MODULES: HNC Mechanical Engineering

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

Level 4 (HNC)

Engineering Design (15 credits)

- The tremendous possibilities of the techniques and processes developed by engineers can only be realised by great design. Design turns an idea into a useful artefact, the problem into a solution, or something ugly and inefficient into an elegant, desirable and cost effective everyday object. Without a sound understanding of the design process the engineer works in isolation without the links between theory and the needs of the end user. The aim of this unit is to introduce students to the methodical steps that engineers use in creating functional products and processes; from a design brief to the work, and the stages involved in identifying and justifying a solution to a given engineering need. Among the topics included in this unit are: Gantt charts and critical path analysis, stakeholder requirements, market analysis, design process management, modelling and prototyping, manufacturability, reliability life cycle, safety and risk, management, calculations, drawings and concepts and ergonomics. On successful completion of this unit students will be able to prepare an engineering design specification that satisfies stakeholders' requirements, implement best practice when analysing and evaluating possible design solutions, prepare a written technical design report, and present their finalised design to a customer or audience.*

Engineering Maths (15 credits)

- The mathematics that is delivered in this unit is that which is directly applicable to the engineering industry, and it will help to increase students' knowledge of the broad underlying principles within this discipline. The aim of this unit is to develop students' skills in the mathematical principles and theories that underpin the engineering curriculum. Students will be introduced to mathematical methods and statistical techniques in order to analyse and solve problems within an engineering context. On successful completion of this unit students will be able to employ mathematical methods within a variety of contextualised examples, interpret data using statistical techniques, and use analytical and computational methods to evaluate and solve engineering problems.*

Engineering Science (15 credits)

- Engineering is a discipline that uses scientific theory to design, develop or maintain structures, machines, systems, and processes. Engineers are therefore required to have a broad knowledge of the science that is applicable to the industry around them. This unit introduces students to the fundamental laws and applications of the physical sciences within engineering and how to apply this knowledge to find solutions to a variety of engineering problems. Among the topics included in this unit are: international system of units, interpreting data, static and dynamic forces, fluid mechanics and thermodynamics, material properties and failure, and A.C./D.C. circuit theories. On successful completion of this unit students will be able to interpret and present qualitative and quantitative data using computer software, calculate unknown parameters within mechanical systems, explain a variety of material properties and use electromagnetic theory in an applied context.*

Managing a Professional Engineering Project (15 credits)

- *The responsibilities of the engineer go far beyond completing the task in hand. Reflecting on their role in a wider ethical, environmental and sustainability context starts the process of becoming a professional engineer – a vital requirement for career progression. Engineers seldom work in isolation and most tasks they undertake require a range of expertise, designing, developing, manufacturing, constructing, operating and maintaining the physical infrastructure and content of our world. The bringing together of these skills, expertise and experience is often managed through the creation of a project. This unit introduces students to the techniques and best practices required to successfully create and manage an engineering project designed to identify a solution to an engineering need. While carrying out this project students will consider the role and function of engineering in our society, the professional duties and responsibilities expected of engineers together with the behaviours that accompany their actions. Among the topics covered in this unit are: roles, responsibilities and behaviours of a professional engineer, planning a project, project management stages, devising solutions, theories and calculations, management using a Gantt chart, evaluation techniques, communication skills, and the creation and presentation of a project report. On successful completion of this unit students will be able to conceive, plan, develop and execute a successful engineering project, and produce and present a project report outlining and reflecting on the outcomes of each of the project processes and stages. As a result, they will develop skills such as critical thinking, analysis, reasoning, interpretation, decision-making, information literacy, and information and communication technology, and skills in professional and confident self-presentation. This unit is assessed by a Pearson-set assignment. The project brief will be set by the centre, based on a theme provided by Pearson (this will change annually). The theme and chosen project within the theme will enable students to explore and examine a relevant and current topical aspect of professional engineering.*

Mechanical Principles (15 credits)

- *Mechanical principles have been crucial for engineers to convert the energy produced by burning oil and gas into systems to propel, steer and stop our automobiles, aircraft and ships, amongst thousands of other applications. The knowledge and application of these mechanical principles is still the essential underpinning science of all machines in use today or being developed into the latest technology. The aim of this unit is to introduce students to the essential mechanical principles associated with engineering applications. Topics included in this unit are: behavioural characteristics of static, dynamic and oscillating engineering systems including shear forces, bending moments, torsion, linear and angular acceleration, conservation of energy and vibrating systems; and the movement and transfer of energy by considering parameters of mechanical power transmission systems. On successful completion of this unit students will be able to explain the underlying principles, requirements and limitations of mechanical systems.*

Fundamentals of Thermodynamics and Heat Engines (15 credits)

- *Thermodynamics is one of the most common applications of science in our lives, and it is so much a part of our daily life that it is often taken for granted. For example, when driving your car you know that the fuel you put into the tank is converted into energy to propel the vehicle, and the heat produced by burning gas when cooking will produce steam which can lift the lid of the pan. These are examples of thermodynamics, which is the study of the dynamics and behaviour of energy and its manifestations. This unit introduces students to the principles and concepts of thermodynamics and its application in modern engineering. On successful completion of this unit students will be able to investigate fundamental thermodynamic systems and their properties, apply the steady flow energy equation to plant equipment, examine the principles of heat transfer to industrial applications, and determine the performance of internal combustion engines.*

Materials, Properties and Testing (15 credits)

- *The world we live in would be a very different place without the sophisticated engineering materials currently available. Many of the things we take for granted, such as telecommunications, air travel, safe and low-cost energy, or modern homes, rely on advanced materials development for their very existence. Successful engineering application and innovation is dependent upon the appropriate use of these materials, and the understanding of their properties. This unit introduces students to the atomic structure of materials and the way it affects the properties, physical nature and performance characteristics of common manufacturing materials; how these properties are tested, and modified by various processing treatments; and problems that occur which can cause materials to fail in service. On successful completion of this unit students will be able to explain the relationship between the atomic structure and the physical properties of materials, determine the suitability of engineering materials for use in a specified role, explore the testing techniques to determine the physical properties of an engineering material and identify the causes of in-service material failure.*

Computer Aided Design and Manufacture (CAD/CAM) (15 credits)

- *The capacity to quickly produce finished components from a software model is now essential in the competitive world of manufacturing. Businesses now invest heavily in Computer Aided Design (CAD) software, Computer Aided Manufacture (CAM) software and Computer Numerical Control (CNC) machines to facilitate this, thus reducing product lead times. CAD gives design engineers the platform to creatively model components that meet the specific needs of the consumer. When these models are combined with CAM software, manufacturing is made a reality. This unit introduces students to all the stages of the CAD/CAM process and to the process of modelling components using CAD software specifically suitable for transferring to CAM software. Among the topics included in this unit are: programming methods, component set-up, tooling, solid modelling, geometry manipulation, component drawing, importing solid model, manufacturing simulation, data transfer, CNC machine types and inspections. On successful completion of this unit students will be able to illustrate the key principles of manufacturing using a CAD/CAM system; produce 3D solid models of a component suitable for transfer into a CAM system; use CAM software to generate manufacturing simulations of a component; and design a dimensionally accurate component on a CNC machine using a CAD/CAM system.*