

# CORE MODULES: HNC/HND Civil 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)

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### Individual Project (15 credits)

- *The ability to define, plan and undertake a project is a critical set of skills needed in various roles within the construction industry. Identifying appropriate information and analysing this, to formulate clear results or recommendations, is required to underpin many of the processes that inform construction projects. The aim of this unit is to support students in using and applying the knowledge and skills they have developed through other areas of their studies to complete and present an individual project. In addition, this unit will provide students with key study skills that will support them in further study. Students will be able to identify, define, plan, develop and execute a successful project by working through a clear process. They will develop a project brief; outlining a problem that requires a solution, as well as a project specification, the specific requirements of which the final outcome must meet. They will research the problem, undertaking a feasibility study, and consider a range of potential solutions using critical analysis and evaluation techniques to test, select and contextualise their preferred solution. Students will provide a work and time management plan, keeping a diary of all activities, reflecting on their process and their learning throughout the project.*

### Construction Technology (15 credits)

- *The basic principles of construction technology have not changed for hundreds of years. However, the materials and techniques used to achieve these basic principles are constantly evolving; to enable the construction industry to deliver better quality buildings. Scarcity of resources and the continuing demand of more sophisticated clients, end users and other stakeholder interests, are driving the construction industry to provide buildings which facilitate enhanced environmental and energy performance, and greater flexibility, in response to ever increasing financial, environmental, legal and economic constraints. This unit will introduce the different technological concepts used to enable the construction of building elements; from substructure to completion, by understanding the different functional characteristics and design considerations to be borne in mind when selecting the most suitable technological solution. Topics included in this unit are: substructure, superstructure, finishes, building services and infrastructure components. On successful completion of this unit a student will be able to analyse scenarios and select the most appropriate construction technology solution.*

### Science and Materials (15 credits)

- *Science and material performance are intrinsically linked through the need to create structures and spaces that perform in both mechanical operation and in providing human comfort. This unit aims to support students to make material choices to achieve the desired outcomes of a brief. This is approached from the perspective of materials being fit for purpose; as defined by testing standards and properties, but also by consideration of the environmental impact and sustainability. Awareness of health & safety is considered alongside the need to meet legislative requirements. The topics covered in this unit include: health & safety; storage and use of materials; handling, and problems associated with misuse and unprotected use; environmental and sustainable consideration in material choices; and human comfort performance parameters. Material choice is developed through the understanding of testing procedures to establish conformity to standards and define performance properties. The performance of materials to satisfy regulations and provide appropriate comfort levels is addressed through design and calculations. Upon successful completion of this unit students will be able to make informed decisions regarding material choices; based on understanding the structural behaviour of materials established through recognised testing methods, sustainability, context of build, and health & safety. Students will also be able to perform the calculations necessary to establish anticipated performance of the materials in-use and therefore determine their compliance with regulations and suitability.*

## **Construction Practice and Management (15 credits)**

- *The aim of this unit is to develop and provide students with a holistic understanding of construction practice and management processes. Students will investigate and research the modern construction industry, both from the practical skills embedded within the industry through to its linkage with development on-site and the connection with construction management; including roles within the industry. The unit compares and investigates small, medium and large construction companies within the market place and how construction processes, for development, have evolved. Students will also explore how health & safety has evolved within the industry, including how the major stakeholders, from companies to site operatives, have embedded health & safety into their preferred areas of development and careers. In addition, students will explore Building Information Modelling and how it fits into construction processes/sequences ranging from domestic to large-scale and design and build projects. The knowledge from this unit will provide students with the understanding of modern construction and management; the skills, management of people and projects, and how health & safety have changed the perception of the construction industry.*

## **Construction Information (Drawing, Detailing, Specification) (15 credits)**

- *To achieve successful projects in the built environment requires a range of different types of information: to describe the project, quantify the materials, provide clear instructions for assembly and erection, and to allow for accurate costing and management. Throughout the process of design, construction and post-occupancy management, information is critical. Through this unit students will develop their awareness of different types of construction information and their uses in the process. Students will engage in the production, reading and editing of construction information, in order to understand how this information informs different stages of the process. Using industry standard tools and systems, students will consider the ways that information may be shared and, through this, the value of collaboration in the information process. Topics included in this unit are: construction drawing, detailing, Computer Aided Design (CAD), Building Information Modelling (BIM), schedules (door, window, hardware, etc.), specifications, schedules of work, bills of quantities and information distribution and collaboration.*

## **Mathematics for Construction (15 credits)**

- *The aim of this unit is to develop students' skills in the mathematical principles and theories that underpin the civil engineering and building services curriculum. Students will be introduced to mathematical methods and statistical techniques in order to analyse and solve problems within a construction engineering context. Topics included in this unit are: dimensional analysis, arithmetic and geometric progressions wave and vector functions, differential and integral calculus, binomial and normal distribution, sinusoidal waves, and trigonometric and hyperbolic identities, among other topics. 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 construction problems. Therefore, they will also gain crucial employability skills such as critical thinking, problem solving, analysis, reasoning, and data interpretation.*

## **Principles of Structural Design (15 credits)**

- *Buildings, bridges, roads, and many other types of man-made structures are critical to the economic and social well-being of our societies. We rely upon these structures to provide us with suitable spaces and infrastructure to support our daily lives. This unit explores the fundamental principles of structural design, codes of practice and standards required to construct safe, effective static civil engineering structures commonly used in today's infrastructure projects. Topics included in this unit are: methods and techniques used to determine bending moments and shear forces in simply supported steel and reinforced concrete beams; deflection in simply supported steel beams; and axial load carrying capacity of steel and reinforced concrete columns. On successful completion of this unit students will be able to determine and analyse forces within fixed structures and understand the fundamental concepts of structural design.*

## **Civil Engineering Technology (15 credits)**

- *This unit explores the role of professional civil engineers, their essential involvement in the construction and maintenance of infrastructure, and the key technologies they apply. The technologies and processes of civil engineering, in the development of highways, bridges, drainage systems, substructure and superstructure, are crucial to support contemporary societies. Topics included in this unit are: earthwork activities, temporary and permanent dewatering procedures, methods and techniques used to create substructures, highways and superstructures and the common hazards, technical problems and solutions associated with modern civil engineering activities. On successful completion of this unit students will be able to describe, analyse and evaluate modern civil engineering procedures, apply this skill and knowledge to the design of infrastructure and produce solutions to address hazards and problems encountered in civil engineering projects.*

## **Level 5 (HND)**

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### **Group Project (30 credits)**

- *While working in a team is an important skill in construction projects, collaboration goes beyond just teamwork. The success of a project relies not only on the ability of each person in a team to do their work, but on each individual's awareness of how their work relates to the work of others, how to ensure that information is shared effectively and that roles and responsibilities are clear. Through this collaborative project-based unit, students will explore how to define roles within a collaborative team, recognising the skills (and 'skills gaps') of each member of the group. Together students will work to develop a construction project; based on their research and analysis, in response to the Pearson-set 'theme'. Content in this unit will typically include role identification and allocation, collaborative structures, human resources management, project management, procurement, tender documentation, information/data sharing, meetings, health & safety, project costing and Building Information Modelling.*

### **Further Mathematics for Construction (15 credits)**

- *The understanding of more advanced mathematics is important within the civil engineering and building services engineering industries. Students must be introduced to additional topics that will be relevant to them as they progress to the next level of their studies; advancing their knowledge of mathematical theory gained in the Level 4 Unit 8: Mathematics for Construction. The aim of this unit is to teach students to analyse and model civil engineering or building services engineering situations using mathematical techniques. Among the topics included in this unit are: number theory, complex numbers, matrix theory, linear equations, numerical integration, numerical differentiation, and graphical representations of curves for estimation within an engineering context. Finally, students will expand their knowledge of calculus to discover how to model and solve problems using first and second order differential equations. On successful completion of this unit students will be able to use applications of number theory in practical construction situations, solve systems of linear equations relevant to construction applications using matrix methods, approximate solutions of contextualised examples with graphical and numerical methods, and review models of construction systems using ordinary differential equations. As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.*

### **Geotechnics and Soil Mechanics (15 credits)**

- *This unit explores the essential relationship between civil engineering and the Earth's crust, in the support of built structures and highways. The ability to understand, evaluate and develop solutions; related to soil and rock, is a key aspect of civil and structural engineering. Topics included in this unit are: rock types, soil description and classification, methods and techniques used when undertaking site investigations and laboratory testing, determination of soil properties and the importance of these geotechnical procedures and resultant findings to civil engineers. On successful completion of this unit students will be able to analyse and evaluate modern geotechnical methods and apply these skills and knowledge to the initial design of infrastructure.*

### **Advanced Structural Design (15 credits)**

- *With the development of new materials and processes, along with technologies that allow us to design and model more complex structures, the demands on structural design become more complex. The ability to conceive of and accurately model complex buildings, bridges, roads and other types of structure, pushes both the aesthetic and technical envelope. In managing the design and construction of modern structures, the civil or structural engineer must be able to carry out more complex calculations; dealing with dynamic conditions, while maintaining an awareness of the overall design intention. Extending areas of study, from Unit 20: Principles of Structural Design, this unit will support students to extend their ability to design, test and quantify more complex structural conditions.*

### **Transport Systems in Buildings (15 credits)**

- *The success of today's modern high-rise buildings is the ability to transport its occupants vertically and horizontally in a safe and efficient manner. This unit will examine such systems in detail and their integration into the overall structural elements of the building that supports them. The overall aim of this unit is to give project managers, in building services, a working knowledge of lifts, escalators and other forms of access arrangements with a building. The principle person responsible for this is often the building services engineer and it is their responsibility to ensure that such systems operate efficiently and safely for all stakeholders. On successful completion of this unit students will be in a position to understand the requirements for the installation of a transport system within a building that would be installed by a specialist sub-contractor. In addition, students will have the fundamental knowledge and skills to progress on to a higher level of study in services engineering.*

### **Highway Engineering (15 credits)**

- *The quick and flexible means of transport, afforded to us by motor vehicles, has transformed modern life. This ease of mobility is afforded by the construction and maintenance of our road system. With increased volume of traffic and the need to have an efficient road network; to transport resources, requires us to become more proactive in developing innovative highway solutions. In recent years, we have seen the introduction of 'smart motorways' and 'guided bus-ways'; however, we will require more creative and resourceful solutions for the future. This unit explores the planning, design, construction and maintenance of our road infrastructure; including the supporting structures such as tunnels, bridges and full pavement construction. On successful completion of this unit students will be able describe a new route process for a highway as well as explaining civil engineering aspects, including pavement types. They will also be able appraise improvements to the existing road infrastructure.*

### **Hydraulics (15 credits)**

- *The action, management and distribution of fluids, in relation to built structures, is critical. In civil engineering, it is necessary to ensure that we are able to manage the pressures that water may put on structures, either through its flow or the forces exerted and how to resist these. In building services, the balance between necessary pressures to ensure flow and distribution of fluids (through heating/cooling systems or domestic water supplies), and the sizing of pipes to support this flow, will determine efficiency and effectiveness of a system. However, fluids are dynamic; their behaviour changes based on a range of factors. Thus, the ability to estimate and manage their forces, rates of flow and suitable systems for control requires specialised calculations, equipment and maintenance. Through this unit students will explore principles of hydrostatic and hydrodynamic fluids, calculate a range of factors and use these calculations to arrive at practical hydraulic solutions.*