



MCAST

Malta College of Arts, Science & Technology

MQF Level 6

**MCAST Bachelor of Science (Honours) in
Construction Engineering**

CE6-A2-20

Course Description

This degree course gives you opportunities to explore management skills and technical knowledge associated with the diverse and challenging tasks that are in continuous change with the introduction of new materials to meet zero energy buildings and various integrated design concepts including precast techniques.

In addition, the programme empowers you with necessary design and evaluation techniques to be able to make professional judgments on technical, social and ethical issues during the planning and execution of construction projects.

This degree course gives you opportunities to explore management skills and technical knowledge associated with the diverse and challenging tasks that are in continuous change with the introduction of new materials to meet zero energy buildings and various integrated design concepts including precast techniques.

In addition, the programme empowers you with necessary design and evaluation techniques to be able to make professional judgments on technical, social and ethical issues during the planning and execution of construction projects.

By the end of the programme, you will be able to work independently, with a significant amount of research and self-directed learning, both within and outside the institute environment.

To enhance this qualification, learners will have the opportunity to carry out apprenticeship experiences in their chosen field in the first 2 years of their programme. Learners will work as apprentices during the summer after they conclude the first year and second year. However, during the scholastic year of their second year they will be going on apprenticeship once a week.

Programme Learning Outcomes

At the end of the programme the learner will be able to:

- 1. Evaluate and design management techniques in the construction and built environment sector;*
- 2. Analyse and evaluate sustainable design options for buildings;*
- 3. Understand and compare construction materials in terms of properties, behaviour and characteristics;*
- 4. Examine and coordinate installation, design and maintenance requirements of building services in domestic, commercial and industrial buildings; of construction and of civil engineering projects.*

Entry Requirements

MCAST-BTEC Extended Diploma in Construction and the Built Environment (Building Services Engineering)

or

MCAST-BTEC Extended Diploma in Construction and the Built Environment (Civil Engineering)

or

MCAST-BTEC Extended Diploma in Construction and the Built Environment

or

2 A-Level passes and 2 I-Level passes

Compulsory A-Levels: Physics and Mathematics (Pure or Applied)

Current Approved Programme Structure

Unit Title	ECTS	Year
Building Control Procedures and Legislation	5	1
Computer Aided Design for Construction	5	1
Construction and Maintenance of Buildings	5	1
Design Principles and Applications for Construction and the Built Environment	5	1
Science and Materials for Construction and the Built Environment	5	1
Structural Behaviour and Detailing	5	1
Applied Mathematics for Construction and the Built Environment	6	1
Technology for Complex Buildings	6	1
Health, Safety and Welfare for Construction and the Built Environment	6	1
Work based Learning - Part 1	6	1
English 1	3	1
English 2	3	1
Applied Mathematics for Complex Engineering Problems	6	2
Building Services Design, Installation and Maintenance in Construction	6	2
Conversion and Adaptation of Buildings	6	2
Environmental Impact of Construction	6	2
Group Project in the Construction Industry	6	2
Management Principles and Application for Construction and Built Environment	6	2
Measuring, Tendering and Estimating for Construction and the Built Environment	6	2
Research Project	6	2
Project Design, Implementation and Evaluation	6	2
Work based Learning - Part 2	6	2
Entrepreneurship	4	2
Intrapersonal and Interpersonal Skills	2	2
Advanced Building Services	6	3
Advanced Construction and Civil Engineering Technology	6	3
Advanced Project Management	6	3
Building Materials	6	3
Mathematical Methods	6	3
Real Estate and Facilities Management	6	3
Research Methods	0	3
Sustainable Buildings	6	3
Project and Dissertation	12	3
Total ECTS	180	

Building Control Procedures and Legislation

Unit level (MQF): 5

Credits: 5

Unit Description

The unit aims to develop an understanding of building control procedures and legislation applicable to residential, industrial and commercial development and associated construction activities.

Students will understand how building control systems have evolved over time and how these have been applied in the construction sector. Students will also learn about the processes involved in primary and secondary legislation. They will gain knowledge about the structure, principles and features of relevant legislation as well as the legal framework with respect to regulations, permits and enforcement. Students will also have opportunities to develop knowledge and skills as how regulations apply to various stages of a project such as design and construction stages.

Students will examine relevant legislation and develop an appreciation of the legal processes. Students will gain skills in applying the regulations to range of projects and processes. They will understand the obligations of various parties such as developers and contractors. Students will also develop an understanding of compliance, various notifications and inspections.

They will also investigate the structure and efficiency of the enforcement system and mechanisms and their effectiveness as well as limitations. Students will review the enforcement procedures and for various types of construction work such as demolition works.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Explain the building control systems;*
2. *Examine the relevant legislation;*
3. *Apply building regulations;*
4. *Review the enforcement procedures.*

Computer Aided Design for Construction

Unit level (MQF): 5

Credits: 5

Unit Description

This unit shall provide the learner with the understanding of the basic knowledge, principles, and application for Computer Aided Design (CAD). Through this module the student shall become knowledgeable in the theoretical foundations within the design process which is to include a brief touch-up on the sketching techniques (which are essential pre-requisite prior to using computer aided tools). This module shall also include the understanding and basic knowledge concerning the integration of processes for BIM. With this knowledge the learner shall be able to understand the abilities that such computer aided processes will provide the user. This will also lead to help the learner with an understanding of the financial and organisational factors that are involved.

This unit will provide the learner with abilities to create 2D and 3D drawings using a CAD program which is generally implemented for building, building services and construction designs. The learner shall become accustomed with the different types of CAD modelling; which include Feature Modelling and Parametric Modelling. The student shall be knowledgeable of the different final displaying features as well as proficient in using title blocks, scaling, rendering, and plotting formats. The different options of exporting formats will also be explored.

The learner will be able to implement the principles and knowledge onto provided CAD application software. The learner should be able to show the general basic functions required to produce a drawing as well as have the ability to interpret and modify existing drawings. This will also lead to the learner having capabilities to export respective drawings into different formats which would in turn be suitable for other operations such as; different software operators, client's reviewing, and/or machines software.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Explain the knowledge, application and principles of Computer Aided Design including sketching techniques and the integration of CAD in BIM applications;*
2. *Produce, modify and interpret new and existing 2D and 3D designs using industry related CAD software;*
3. *Produce 2D and 3D construction drawings to industry standards;*
4. *Plot and export designs to different formats.*

Construction and Maintenance of Buildings

Unit level (MQF): 5

Credits: 5

Unit Description

This is mainly a skills unit which allow learners to familiarise themselves with the main civil engineering concepts involved in the construction of buildings. The first part of the unit will delve on the importance of site investigations, the types of sub strata and the design of the sub structure.

The design of the superstructure will be tackled adequately and a brief overview of masonry, concrete and steel buildings will be tackled. The methodology adopted by an office during the construction stage of a project will also be taught in detail and the roles of the office based team and the site based team will be discussed. The main site requirements will also be mentioned. The course will delve into the description of the geological substrata in the Maltese Islands as well site investigations and the common types of foundations used in construction.

An overview of masonry structures, concrete structures and steel structures will be taught and an overview of all the main elements will be discussed.

The last part of the unit will be focussed on the maintenance of buildings. The decay mechanisms affecting buildings will be discussed as will routine cleaning jobs, preventive maintenance and causes of dilapidations in buildings.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Identify the techniques used in site investigations and how their evaluation influences the type of substructure design;*
2. *Identify the types of superstructure design and construction;*
3. *Describe the methodology adopted by an office during the construction stage of a project;*
4. *Identify the causes of decay and the deterioration of buildings.*

Design Principles and Applications for Construction and the Built Environment

Unit level (MQF): 5

Credits: 5

Unit Description

The aim of this unit is to enable learners to gain a broad knowledge of design principles of building construction. The professionals in construction industry require a working knowledge and skills to be part of a design team.

The focus of this unit is on linking design principles with practical applications in construction, civil engineering and building services engineering. Learners will know the nature of building materials and their properties.

Learners will understand the importance of energy and its efficient use. They will know the durability of building materials, importance of buildability and sustainability. They will learn the responsibilities of other members of the design team and participate in the design process of the construction project.

Learners will understand the various phases of design and know the importance of specifications. They will learn how to write specification of materials and work involved in construction. Learners will gain knowledge of the properties of materials and understand the techniques of construction at various stages. They will know the roles and responsibilities of the design team and will know how to communicate with them.

Learners will know the health, safety and welfare regulations and understand the risks involved on construction site. They will understand the Risk Assessment methods.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Explain the planning and design phases of the construction process;*
2. *Use the specification of materials and building services prepared by the design team;*
3. *Explain how environmental factors affect the planning and design phases of the construction process;*
4. *Use the roles and responsibilities of all parties involved in construction projects.*

Science and Materials for Construction and the Built Environment

Unit level (MQF): 5

Credits: 5

Unit Description

The aim of this unit is to enable learners to gain knowledge of the nature and properties of building materials. They will learn the chemical composition of materials and understand the effect of forces applied on building elements, the performance criteria applicable to construction materials, and the techniques used to produce such materials. Learners will be able to know the relationship between stress and strain, deformations produced in the building elements and turning effect due to application of forces. They will also gain an understanding how to prevent and remedy their deterioration.

Construction includes roads which have an important economic function. Road geomaterials are introduced and their behaviour and testing analysed.

They will also learn the installation and performance of building services in buildings.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Explain the nature and properties of building materials;*
2. *Demonstrate how forces act on materials;*
3. *Identify and describe road materials;*
4. *Describe the properties of ductile and low viscosity materials.*

Structural Behaviour and Detailing

Unit level (MQF): 5

Credits: 5

Unit Description

This is a skills and practice based unit which will allow the learners to be able to analyse, design and detail concrete and steel structures. It is essential that the unit is carried out after one has undertaken the level 5 unit titled *structural analysis and design* as many of the fundamentals covered in that unit will be used in this module. The first part of the course will tackle the design and analysis of singly and doubly reinforced concrete sections. The derivation of the equations in order to determine the moment of resistance and the area of reinforcement required will be carried out in class and examples worked out in order to ensure a good understanding of the subject.

The shear capacity and design of concrete sections will be discussed in detail and both reinforced and un-reinforced sections will be tackled. The equations required in order to determine the area of shear steel required will be described and used to carry out class examples.

The use and design of continuous beams will be described and the learner will relate the design of these elements to the analyses methods covered in the Unit titled *structural analysis and design*.

A large part of this course will be dedicated to the design of simply supported concrete slabs. The use of these slabs in construction will be described in detail and both one way and two way slabs will be mentioned. The design of these slabs will be carried out in class and moment, distribution and shear steel will be tackled.

The behaviour of structural steel will be described with an emphasis on steel beams. The concept of lateral torsional buckling will be taught and calculations performed to practice this subject. The design web bearing capacity checks will also be introduced and calculations carried out.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Analyse the moment of resistance of a singly reinforced and doubly reinforced concrete section;*

2. *Calculate the shear reinforcement needed in beams and analyse continuous concrete beams;*
3. *Design simply supported reinforced concrete slabs;*
4. *Design tension members due to bending, lateral torsional buckling and web bearing capacities.*

Applied Mathematics for Construction and the Built Environment

Unit level (MQF): 5

Credits: 6

Unit Description

This unit has been designed to build upon previous mathematical knowledge covered in Mathematics in Construction and the Built Environment, to be used in a more practical construction context. Therefore, it is assumed that the learner has successfully completed this unit prior to commencing Applied Mathematics for Construction and the Built Environment.

Furthermore, it acts as an essential basis for the successful completion of many of the other units within the qualification. Delivery of the unit should be set within the context of the award to which it contributes.

The first learning outcome will build upon the learners existing algebra skills and includes manipulating and solving equations that contain exponentials and logarithms, solving direct and inverse proportion problems in a construction context, using graphs to solve problems Displacement, velocity, acceleration, momentum, impulse and projectiles are introduced within this outcome and exploring matrices and using them to solve problems.

Learners will develop their trigonometry skills and ability to calculate areas and volumes of irregular shapes in learning outcome 2.

Learning outcome 3 will return to statistics to further develop techniques used to represent and interpret data and applying this technique in a practical context.

Learning outcome 4 will develop the student's knowledge of using vectors to represent and solve problems involving forces, velocity, time and displacement. Students will also be introduced to calculus and using differentiation and integration to solve problems.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Apply algebraic and graphical methods to construction problems;*
2. *Apply trigonometry methods to construction problems;*
3. *Apply statistical methods to construction problems;*
4. *Apply vectors and calculus methods to engineering problems.*

Technology for Complex Buildings

Unit level (MQF): 5

Credits: 6

Unit Description

The unit basically covers the aspects required for the construction and design of complex buildings. The unit will go hand in hand with other unit such as Civil Engineering Technology and Structural behaviour and detailing. The unit will delve into the traditional types of construction such as traditional housing and apartment blocks and will be compared to large span structures such as high rise buildings and large span buildings (such as stadia and warehouses).

Popular building material such as concrete and steel will be explained in detail and lectures will focus on the history of use of these materials, their components and their mechanical properties. The typical building typologies used in large span structures as well as the importance of flexibility in the design and construction will be emphasised.

As most complex buildings in Malta are built using pre-stressed concrete a substantial part of this unit will focus on this topic. The reinforced concrete section will be described and its fundamentals explained. Students will be taught on the important of tension zones and the rebar requirements. The unit will then compare the use and design of pre-stressed structures. Precast concrete will also be described and its uses and production explained.

The last part of the unit will delve onto the subject of domes and trusses (as well as tensile structures). This topic will be described briefly and the overall concepts and construction methodologies will be introduced to the students in order to allow further research on the subject.

Learning Outcomes

On completion of this unit the student will able to:

1. *Explain the main types of complex buildings;*
2. *Define and briefly evaluate the use of the various materials and construction layouts used in multi-storey buildings;*
3. *Identify and explain the flooring systems used in complex buildings;*
4. *Define the main types of large span structural systems.*

Health, Safety and Welfare for Construction and the Built Environment

Unit level (MQF): 5

Credits: 6

Unit Description

The aim of this unit is to enable learners to understand the responsibilities of employers and employees to take measures to reduce risk and to meet legal requirements. Learners will gain knowledge of how to undertake risk assessments, record accidents and follow the reporting procedures.

Learners will explore the importance of planning for health and safety for themselves and others. They will investigate dangerous occurrences, common accidents and how to report an accident. Learners will explore risk assessment methods and control measures in construction. They will identify physical, environmental, psychosocial, chemical and biological hazards at work place. They will know the method of designing a risk assessments format that can be understood by everyone. Learners will know the legal requirements and safe systems of work and become familiar with components of health and safety management systems.

Learners will know the control measures for lifting and manual handling, working at height and working in excavations to avoid risks of accidents and injuries. They will know how to control site traffic and plant and apply general policies on non-smoking, drugs and alcohol at workplace for health and safety of all the construction team at site. They will know the procedures for accident investigation, recording accidents and responsibilities during evidence gathering, interviewing and questioning to prepare report of Injuries, root causes and explanation of contributory factors.

Learning Outcomes

On completion of this unit the student will be able to:

- 1. Explain the responsibilities of employers and employees under current health, safety and welfare legislation applicable to the construction and built environment sector;*
- 2. Design risk assessment methods and techniques using appropriate principles and formats;*
- 3. Implement the control measures used to reduce risk and meet legal requirements;*
- 4. Explain employee role in recording accidents and reporting procedures.*

Applied Mathematics for Complex Engineering Problems

Unit level (MQF): 5

Credits: 6

Unit Description

This unit has been designed to build upon previous theoretical mathematical knowledge to be used in a more practical engineering context. It acts as an essential basis for the successful completion of many of the other units within the qualification. Delivery of the unit should be set within the context of the award to which it contributes.

The first learning outcome will develop the skills necessary for learners to be able to use trigonometry to represent and solve engineering problems. This outcome will include trigonometric graphs, the sum of sine and cosine functions and graphs and using trigonometric identities to simplify and solve equations.

Learners will develop their algebra skills to enable them to solve problems in an engineering context in learning outcome 2. Matrices are introduced and used to solve simultaneous equations; the Gaussian Elimination method, Bisection and Newton Raphson method for solving equations are explored to enable learners to solve more complex equations.

Learning outcome 3 will return to calculus to further develop techniques including partial differentiation, integration by parts, integration by substitution and determining the location and nature of stationary points for functions that contain two variables. Area and volume problems including the volume of a revolution, area between two curves, centroids, second moment of area, radius of gyration are techniques which are also developed. Students will then be shown how to apply these techniques in an engineering context.

Learning Outcome 4 includes first and second order linear differential equations, Euler and Runge-Kutta methods and applying these techniques to solve engineering problems.

Learning outcome 5 will develop the student's knowledge of statistical techniques. This will include sampling methods, linear regression, binomial and Poisson distributions and learners will be able to use these skills to analyse, model and solve engineering problems.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Use trigonometric techniques to solve problems;*
2. *Use algebraic techniques to solve engineering problems;*
3. *Apply calculus to solve engineering problems;*
4. *Use statistical techniques to solve engineering problems.*

Building Services Design, Installation and Maintenance in Construction

Unit level (MQF): 5

Credits: 6

Unit Description

This unit provides learners with the opportunity to develop an understanding of the principles that underpin the design, installation and maintenance of building services in domestic, industrial and commercial buildings.

Learners will develop an understanding of the ventilation requirements in buildings and will know how to install the heating and cooling systems in the building. They will gain an understanding of cold water supply, hot water supply, gas supply and electricity supply and will know the installation of lifts and escalators in large buildings. Issues related to the maintenance of building services, disposal of wastes and fire alarm system will be explored.

They will also learn the foul water disposal system, selection of sanitary appliances, layouts of associated services and requirements of special provisions for people with disabilities. Learners will understand the criteria for the selection and installation of above-ground and below-ground drainage system for domestic, industrial and commercial buildings and know the principles, applications and installation requirements for sewage disposal systems.

Surface water disposal: domestic and small commercial buildings; flat and pitched roofs; criteria for the selection and installation of above-ground and below-ground drainage systems.

This unit will reinforce the need to coordinate building services installations within the overall construction process.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Use the principles of design, installation and maintenance of heating, ventilation and air conditioning systems in a building;*
2. *Use the principles of design and installation of water and gas distribution systems in a building;*
3. *Use the principles of design, installation and safety features of electrical systems;*
4. *Use the principles of design, installation and maintenance of building services disposal systems.*

Conversion and Adaptation of Buildings

Unit level (MQF): 5

Credits: 6

Unit Description

This is a skills and practice based unit which will act as a follow up to the unit offered at level 4. In the previous unit, learners were given a very good introduction on the different topics involved and most of the main subjects were covered in basic detail. In this unit many of the same subjects will be revised and expanded on so that learners will be able to participate to a greater extent when working in a design office. This course will be mainly adapted to the re use of buildings in Malta.

The processes involved and the different stages required when adapting and converting buildings will be explained in detail and class exercises carried out to allow one to get a real feel on the subject. The importance of satisfying the client's requirements will be emphasised as will the need for a feasibility study and a conversion must make sense in economic terms and if the works required are unfeasible, learners will learn how to evaluate proposals adequately.

The need for historical and structural surveys has been covered in the previous course and in this unit learners will be taught how condition surveys, historical surveys, ground conditions, structural assessments etc. are carried out and conclusions reached. The methodologies adopted which include crack monitoring, crack mapping and structural analysis will also be discussed and examples of similar documentation provided in class. The importance of testing and site investigations will be discussed in detail. Students will also be taught on the importance of the analysis of the shape and location of the building and how the design of a building relates to its proposed use. The traffic and environmental expectations and the differences in the past and new uses and legislation will be emphasised.

The use of all the research carried out and its relation to the design brief and feasibility study will be covered adequately. The adequacy of the existing building will be analysed and a good study of the 'old' materials and all the available materials will be carried out. Materials that can be used to improve the structural and environmental performance of existing materials will be mentioned.

The preparation of design systems to solve feasible problems will be tackled and the evaluation (systems used) to convert an existing building will be covered in relation to the feasibility study and all the research carried out.

The concepts of restoration and the use of restoration charters will be covered and explained and learners will be briefly taught how evaluation on the retention of elements is carried out. As in the previous unit most of the focus will be on limestone fabric which has been the most common (façade) building material in Malta. The decay factors as well as repair techniques will be discussed. The methodologies adopted when removing masonry walls will be discussed and case studies provided.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Advise and evaluate on the processes and decisions involved in the conversion and adaptation of buildings;*
2. *Participate in the research involved in the adaptation of existing buildings;*
3. *Identify materials and systems to address the unique problems required in such projects;*
4. *Identify the deterioration and conservation mechanisms in the alteration and conversion of masonry buildings.*

Environmental Impact of Construction

Unit level (MQF): 5

Credits: 6

Unit Description

This unit aims to develop an understanding of the impact upon the natural environment as a result of construction projects. It also develops skills to apply legislation and appraise the environmental impact for a given project.

The unit starts by introducing students to the contribution a construction project can have at design, construction and post-construction stages. The approach is generic at this stage where students will appreciate the impact upon local as well as global environment. Students are then introduced to range of approaches and methods used to reduce this impact.

This is where the unit will have more national and European focus. Students will be introduced to Maltese and European legislation as well as global initiatives. Students will have opportunities to apply the legislation to a given project to have clear insights to the legislative principles.

Students will appreciate that if any measures are to be effective, these must start at the design stage. Students will learn and analyse various design practices which are sustainable and could contribute significantly towards achieving the goal of reducing the environmental impact. Students will also develop a clear understanding of sustainable site practices including waste management and use of more environment friendly construction techniques. Students will develop skills in producing a Site Waste Management Plan. The unit also discusses the poor indoor environment, how it could affect the health of building users and what could be done to address this.

The unit provides opportunities for students to examine the current planning approval and approval systems used in Malta to protect the environment. students will learn the difference between Strategic Environmental Assessment (SEA) and Environmental Impact assessment (EIA) and will develop skills to carry out environmental appraisal for a given project by producing an EIA.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Explain the impact of construction projects upon the environment;*

2. *Review various approaches used to reduce the environmental impact of construction projects;*
3. *Examine the impact of construction projects upon the health of users;*
4. *Examine the current environmental assessment systems.*

Group Project in the Construction Industry

Unit level (MQF): 5

Credits: 6

Unit Description

This is a practice based unit which will develop learners' skills in terms of the units covered so far. This unit will enable the application of knowledge, understanding and skills developed in other units and where possible also uses experiences that are developed through work in a design office.

This unit is designed to bring together small groups of learners into teams so that they can coordinate their individual skills and abilities. The importance of working as team and of keeping adequate records will be an important skill which will be well practiced throughout. The scheme of work should give individual learners an opportunity to take responsibility for their contribution to the outcome and demonstrate their ability to work as a team.

The project brief will include an agreed timescale with defined working constraints and parameters, with the goals leading towards an acceptable and viable solution to the agreed brief. The importance of the project's evaluation and the skills required to do so will be formulated in this Unit.

The basic skills required to produce a complete project will be tackled in this Unit such as the importance of design briefs, client ideas, surveys, preliminary investigations, sketches and so on. The architectural and structural aspect of the project will be tackled in detail and related to the theoretical units covered in other subjects.

Learning Outcomes

On completion of this unit the student will able to:

1. *Devise a project scope and a scheme of works for the project;*
2. *Begin the implementation of the scheme of work for the project;*
3. *Prepare the group project;*
4. *Present the group project drawings and documentation.*

Management Principles and Application for Construction and Built Environment

Unit level (MQF): 5

Credits: 6

Unit Description

The unit aims to develop an understanding of the principles of management in construction and the built environment sector.

Students will understand how management theories have evolved over time and how these have been applied in the construction sector. Students will also learn about the management functions and techniques required to manage construction organisations.

Organisation within the construction sector have variety of sizes and types. Students will learn about their structures as well as what happens when teams are formed to work on a specific project.

Managers have to produce various types of documentation which students will appreciate and will produce some of these for a given project. Construction sector is subject to change: legislation; standards; working practices; and technology. Project managers have to manage such changes and hence part of the unit deals with this aspect.

Students will learn about various forms of contract and procurement routes. They will be able to understand the contractual relationships among the parties to a contract in terms of obligations and responsibilities. Students will develop skills to make an informed decision on selecting suitable form of contract and procurement route for a given project.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Examine principles of management;*
2. *Analyse construction organisations;*
3. *Apply management principles;*
4. *Review contracting and procurement methods.*

Measuring, Tendering and Estimating for Construction and the Built Environment

Unit level (MQF): 5

Credits: 6

Unit Description

This unit will allow learners to demonstrate their knowledge and understanding of estimating and tendering within the construction industry. It has been devised to help learners to demonstrate an ability to apply established measuring, estimating and tendering concepts to the construction industry, including the format and interpretation of final quantities from dimensions and descriptions in bills of quantities, the basic information required to produce a tender, calculation of unit rates and all-in rates, through to producing a tender and the influence of contractual arrangements for a construction project.

The unit is relevant to learners wishing to develop their previous knowledge of measurement, estimating and tendering concepts and principles: especially units in Level 4. On completion of the Unit learners will understand the principles that underpin construction and civil engineering projects, with knowledge of the personnel, procedures and documentation involved in the measurement, tendering and estimating processes. This unit will provide the Learner with an understanding of selection of contractors, tender documentation and the scrutiny required, the gaining of further information (including site visits), the measurement process, bills of quantities, building up unit rates (including the importance of software) and the conversion of an estimate to a tender. The learner will also be able to apply, analyse and evaluate the effects and implications upon the tendering process of the differing range of project types and tender documentation. The learner will be able to outline the methods and techniques to derive costs, making use of available cost data and possibly software packages, developing the understanding, knowledge and skills required to produce them. The delivery of this unit should make regular and appropriate reference to the public sector procurement regulations - LN296 - 2010.

Finally, learners should have the underpinning knowledge and some understanding of the construction industry, construction technology and of measurement/quantification of building and civil engineering works. In addition, an appreciation of currently-used contract conditions would be beneficial.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Explain the information required to produce a tender;*
2. *Apply the principles and techniques of estimating;*
3. *Formulate an estimate for construction operations;*
4. *Explain the tendering procedures and contractual arrangements.*

Research Project

Unit level (MQF): 5

Credits: 6

Unit Description

The aim of this unit is to enable students to identify and explore areas of personal interest through a sustained research effort which would develop skills to enquire independently using a structured approach. The unit will develop skills which are transferable as well as essential to be successful in any job roles within industry or academia.

The students will develop skills in developing research proposals by applying recognized research techniques. Students will develop themselves in the use of appropriate methodologies and application of statistical techniques and various software available. Students will develop a sound understanding in writing research proposals which are topical and are of relevance to the needs of the stakeholders.

Students will address any health and safety issues as well as ethical considerations arising out of the proposed research activities.

Though it is expected that the student will choose a research area which is in line with their programme of study, the research topic should be the one which draws upon learning across the programme and which is substantial enough to be considered adequate at this level.

Students will develop their projects by starting with a proposal identifying aims, objectives, possible hypothesis or research questions and methodology which will be subject to approval by the supervisor. Students will collect and analyse data and present their findings in an appropriate manner.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Develop a research proposal;*
2. *Carry out the research project;*
3. *Present the research findings.*

Project Design, Implementation and Evaluation

Unit level (MQF): 5

Credits: 6

Unit Description

The aim of this unit is to enable students to identify and explore areas of personal interest through a sustained effort which would develop skills to solve problems by applying knowledge and skills gained across the whole programme.

The students will develop skills in identifying projects which are relevant to their chosen pathway and select the one which is most feasible. Students will develop skills to investigate the given issues using recognized techniques and propose solutions. The variety of techniques could be used depending upon the type of project.

The students will then evaluate and present their findings. They will appreciate how to think in an innovative way while dealing with a variety of problems and then explore areas of improvement and further learning through a thorough evaluation of the outcomes. The students will be supported by an allocated supervisor/mentor who will have regular review meetings in addition to other forms of support such as information handling, research skills and academic support as necessary.

The project could be carried out by each individual student or as a group work in which case close monitoring of the performance of all students is required. The project work should be started when students have gained adequate knowledge and have developed skills to undertake project work which requires application of learning across the whole programme.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Develop a suitable project;*
2. *Design and implement a project plan;*
3. *Present the findings of the project.*

Advanced Building Services

Unit level (MQF): 6

Credits: 6

Unit Description

Building Services Engineering is an area of engineering relating to internal environment and environment impact of a building. It deals with design, installation, operation and monitoring of the mechanical, electrical and public health systems. These systems are required for the safe, comfortable and environmentally friendly operation of modern buildings.

In general, it is said that Building Services Engineering brings the buildings to life. Due to development of advanced technologies building services are developing rapidly over the past years following demanding comfort and regulation requirements.

Building services influence the architecture of a building. It plays a significant role on the sustainability and energy demand of a building.

Within building services engineering, new roles are emerging, for example in the areas of renewable energy, sustainability, low carbon technologies and energy management. With buildings accounting for around 50% of all carbon emissions, building services engineers play a significant role in combating climate change. In this module, the main objective is to present the importance of building services to the students with accent on good indoor air quality and rational use of energy.

The module introduces building services in general and their importance to modern buildings. It explains relation between Building Services and commissioning process of buildings and refers to the utilization phase of buildings. This module will focus on systems and equipment for heating, ventilating and air -conditioning including health and safety.

The main objective of this module is to provide a profound knowledge about importance of building services. The students will understand the different technical installations and the interrelation between building services and the commissioning process of buildings.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Analyse the importance of a good building envelope, its effects on building services and the requirements to meet EU directives;*
2. *Apply scientific principles to provide a safe and comfortable internal building environment;*
3. *Apply electrical principles in the design of building services;*
4. *Recognise building services technical trends.*

Advanced Construction and Civil Engineering Technology

Unit level (MQF): 6

Credits: 6

Unit Description

For the realisation of a successful building solution, it is indispensable that, from the very beginning of the project, formation of the structure system must be developed simultaneously with the architectural design and the shaping that enable specific properties of chosen structure system. In order to find optimal solutions from a multitude of structural possibilities, it is necessary that the engineer knows and respects the geometry and the properties of structural systems of various shapes and their technical and technological characteristics. The development of new structural systems and innovation in classical building constructions provide numerous new and different possibilities, which are characterized not only by varieties of interesting forms, but also excellent technical and technological characteristics and performances which make new systems much more rational comparing to the classical.

The program of the course, include lectures and practical studies (exercises and mini project work). Through lectures general principles of construction and shaping will be introduced to students and illustrated with examples and case studies. The practical studies include exercises and mini project part, which is structured in stages with a tight guidance concerning methods and study subject, but freedom in the choice of project theme. This frame is chosen to reach the aim of the mini project and at the same time let the students free to follow personal and professional interests.

Introducing the new possibilities of constructing and training a student to actively and creatively apply them is the main goal of the course, which studies the evolution of ideas, static-structural, technological, economic and engineering aspects of the different structural systems as well as ways of choices of system under given conditions. Synchronized building design and formation of its structural system assumes an active role of students in the study of literature, exploring new possibilities and combinations, and independent analytical choice of solution which optimally meet the set requirements.

The aim of the lectures is to provide an overview of advanced construction and civil engineering technology in structural design, a field that incorporates many different disciplines and a wide range of expertise. During first week lectures main principles of constructing and form-finding will be introduced to the students. The lectures in the second week will support and provide inspiration to the project work through the presentation of methods, diverse design processes and realized examples.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Apply structural concepts to design civil engineering projects;*
2. *Produce technical drawings of various structural elements;*
3. *Develop geometrical structural concepts to produce technical drawings;*
4. *Deliver a presentation of a mini design project;*
5. *Explain the process of a design proposal through technical drawings.*

Advanced Project Management

Unit level (MQF): 6

Credits: 6

Unit Description

Upon course completion students will be able to understand the activities of the professional project management. They have a good command of frequent services such as:

- Organisation and communication;
- Building project tenders and work flow structures;
- Cost and fee calculations.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Identify and describe the fundamentals of project management and project phasing;*
2. *Analyse the aspects of project organization and time management;*
3. *Explain concepts behind effective cost estimation and cost management;*
4. *Discuss and apply project management tools such as time scheduling, network planning and the calculation of critical paths.*

Building Materials

Unit level (MQF): 6

Credits: 6

Unit Description

This module is designed for MCAST students at the Institute of Building and Construction Engineering following Construction Engineering degree. In this module students will have a general overview of any material which is being used for construction both local and in foreign countries. The building materials are not just a naturally occurring substance but also man-made materials.

Students shall be also knowledgeable on the properties of building materials, the behaviour, the use in structural elements, testing and certifying of building materials.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Knowledge on the physical and mechanical properties of different building materials used in construction;*
2. *Knowledge on testing methods for concrete and concrete mix design;*
3. *Calculate the carbon content in steel and its effect on performance;*
4. *Analyse the testing results for absorption capacity, moisture content and grading design of aggregate used in concrete mix design.*

Mathematical Methods

Unit level (MQF): 6

Credits: 6

Unit Description

The role of civil engineer has changed over the past few decades with the extensive use of new mathematical methods and computers both for design and calculation of structures, as well as for build and construction management. It is therefore necessary to introduce modern mathematical methods to civil engineering students, including numerical analysis of static and dynamic structural behaviour and advanced statistical methods.

This module is designed for those students following a Construction Engineering related degree. Since not every engineering situation related to the construction and built environment can be solved using analytical methods, numerical methods shall be presented so that the student is able to create determinable models of physical engineering problems, such as, structural problems, including but not limited to, bridges, dams, towers and buildings, with the appropriate constructive equations and boundary conditions, and using numerical methods. Such experience will be enriched with the use of computer simulations and software.

Additionally, students shall be also exposed to several statistical techniques, such as elementary probability theory, random variables, discrete and continuous distributions, hypothesis testing and linear regression.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Apply the finite element method to structural problems such as, bridges, dams, towers, and buildings;*
2. *Derive and apply theorems to solve statically and dynamically structural problems and managerial tasks using mathematical methods and software;*
3. *Apply numerical methods to engineering problems;*
4. *Apply harder statistical techniques to engineering problems.*

Real Estate and Facilities Management

Unit level (MQF): 6

Credits: 6

Unit Description

Real Estate, which is defined as “property of land and the buildings on it as well as the natural resources of the land including uncultivated flora and fauna, farmed crops and livestock, water and minerals”, needs to be maintained, especially in its utilization phase. Facility management takes care of the building during such phase together with other Property Management structures.

Facility Management is differentiated depending on its services. Technical Facility Management includes for example operation, maintenance or energy management. Commercial Facility Management includes among others property accounting and cost management. Infrastructural Facility Management is the generic name for floor space management, relocation management, cleaning services etc. The inventory of existing floor spaces concerning structure, composition and occupancy also fall under the responsibility of Facility Management. Key figures concerning the efficient use of spaces and potentials for savings of floor spaces are explained and determined.

No space is properly defined if the user requirements are not considered. The Facility Management connects the building with the user, its process, and the people operating in the building. Basic requirements are the supply of energy, water, heat etc. But there are also special requirements such as flexibility, comfort, operational safety etc. the Facility Management has to deal with.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Understand the importance of real estate and facilities management;*
2. *Understand the connection between user requirements and floor space management;*
3. *Understand the various tasks involved in the building management systems;*
4. *Understand and evaluate operating and life cycle costs;*
5. *Understand key terms for outsourcing and contract management.*

Sustainable Buildings

Unit level (MQF): 6

Credits: 6

Unit Description

Students will be introduced to the key elements of project development and redevelopment phases. They will also develop a critical awareness of factors affecting environmental sustainability and the evaluation of environmental impacts of buildings based on the whole life-cycle.

Learning Outcomes

On completion of this unit the student will be able to:

1. *Implement forms and elements of project development;*
2. *Apply the concept of real estate evaluation;*
3. *Understand the sequential phases of a project lifecycle;*
4. *Analyse property market to predict future development;*
5. *Understand the concept of sustainable development in the built environment;*
6. *Understand the process of green building certification.*