



**MCAST**

**MQF Level 4**

**CE4-A6-21**

**Advanced Diploma in Construction Engineering**

**Course Specification**

## **Course Description**

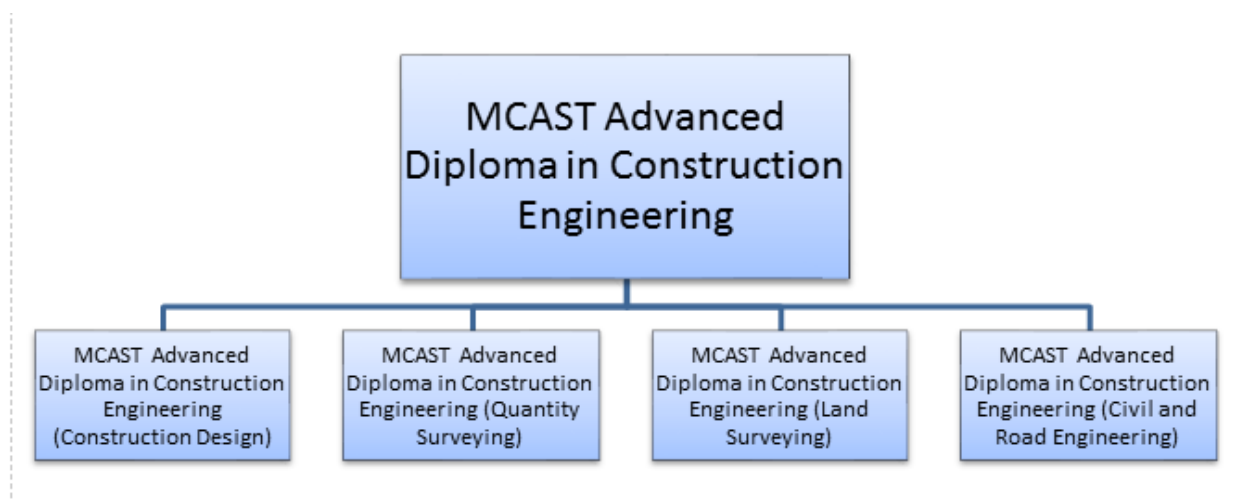
This course is based on both off-the-job and on-the-job training and gives an in-depth knowledge and experience of the general requirements and specialist areas related to the field of building and construction namely, Construction design, Civil and Road Engineering, Land Surveying and Quantity Surveying.

Knowledge gathered throughout the course program will enable the learner to carry out duties, at a professional and technical level, that are continuously required in an architect's office or firms dealing in the building construction and civil engineering projects related to Design, Quantity Surveying, Land Surveying, Geospatial Engineering, Road Engineering, Geographical Information, Infrastructural Projects and Project Management.

After finishing the first-year studies the learners will have the option to choose between Construction Design, Quantity Surveying, Land Surveying and Civil and Road Engineering. Depending on the stream chosen, the learners will be certified as:

- MCAST Advanced Diploma in Construction Engineering (Construction Design)
- MCAST Advanced Diploma in Construction Engineering (Quantity Surveying)
- MCAST Advanced Diploma in Construction Engineering (Land Surveying)
- MCAST Advanced Diploma in Construction Engineering (Civil and Road Engineering)

Each programme has 13 common units and 7 specialized units which will be covered during the three scholastic years.



## **Programme Learning Outcomes**

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

1. *Explain the responsibilities of employers and employees under current health, safety and welfare legislation;*
2. *Identify main equipment, media and techniques used in the production of drawings to detail building/construction techniques and processes;*
3. *Calculate final quantities from dimensions and descriptions of construction and civil engineering works;*
4. *Interpret and evaluate building techniques including surveying and setting out of small engineering projects.*

## **Entry Requirements**

MCAST Diploma in Heating, Ventilation and Air-Conditioning

or

MCAST Diploma in Construction Engineering

or

MCAST Diploma in Joinery and Furniture Making

or

MCAST Diploma in Trowel Trades (Plastering and Tile Laying or Painting and Decorating)

or

MCAST Diploma in Masonry Heritage Skills (Sewwej)

or

MCAST Diploma in Welding and Fabrication

or

MCAST Diploma in Building Services Installations (Plumbing or Plumbing and Electrical)

or

4 SEC/O-Level/SSC&P (Level 3) passes

Compulsory: One subject from Mathematics or Physics and One subject from Engineering Technology, Design and Technology, Chemistry, Mathematics, Physics

## **Current Approved Programme Structure**

### **Core Units**

<b>Unit Code</b>	<b>Unit Title</b>	<b>ECVET</b>	<b>Year</b>
ETH&S-406-1511	Health, Safety and Welfare for Construction and the Built Environment	6	1
ETMTS-406-1505	Science and Materials for Construction and the Built Environment	6	1
ETPMT-406-1501	Project Management in Construction and the Built Environment	6	1
ETCNS-406-1503	Graphical Detailing in Construction and the Built Environment	6	1
ETCNS-406-1506	Building Regulations and Control in Construction	6	1
ETCDN-406-1503	Computer Aided Drafting for Construction	6	1
CDKSK-406-2001	English	6	1
CDKSK-406-2007	Mathematics	6	1
ETCNS-406-1505	Tendering and Estimating in Construction	6	2
ETCNS-406-1508	Surveying in Construction and Civil Engineering	6	2
CDKSK-404-1915	Employability and Entrepreneurial Skills	4	2
CDKSK-402-2104	Community Social Responsibility	2	2
ETMTH-406-1617	Mathematics for Engineering	6	3
ETCMP-406-1601	Vocational Competences in Construction Engineering	6	3
<b>Total ECVET/ECTS</b>		<b>78</b>	<b>/</b>

### **Specialised Units for MCAST Advanced Diploma in Construction Engineering (Construction Design)**

<b>Unit Code</b>	<b>Unit Title</b>	<b>ECVET</b>	<b>Year</b>
ETCNS-406-1504	Sustainable Construction	6	2
ETCNS-406-1529	Construction Technology and Design in Construction	6	2
ETCNS-406-1509	Building Surveying in Construction	6	2
ETCNS-406-1513	Mechanical and Electrical Services in Construction	6	2
ETCNS-406-1510	Structural Behaviour and Detailing	6	3
ETCNS-406-1512	Design Procedures in Construction	6	3
ETBTC-406-1501	Building Technology in Construction	6	3
<b>Total ECVET/ECTS</b>		<b>42</b>	<b>/</b>

**Specialised Units for MCAST Advanced Diploma in Construction Engineering (Quantity Surveying)**

<b>Unit Code</b>	<b>Unit Title</b>	<b>ECVET</b>	<b>Year</b>
ETCNS-406-1504	Sustainable Construction	6	2
ETCNS-406-1529	Construction Technology and Design in Construction	6	2
ETCNS-406-1509	Building Surveying in Construction	6	2
ETCNS-406-1513	Mechanical and Electrical Services in Construction	6	2
ETFIN-406-1515	Economics and Finance in Construction	6	3
ETCNS-406-1530	Measurement Techniques	6	3
ETQSS-406-1900	Measuring, Tendering and Estimating in Construction	6	3
<b>Total ECVET/ECTS</b>		<b>42</b>	<b>/</b>

**Specialised Units for MCAST Advanced Diploma in Construction Engineering (Land Surveying)**

<b>Unit Code</b>	<b>Unit Title</b>	<b>ECVET</b>	<b>Year</b>
ETCNS-406-1504	Sustainable Construction	6	2
ETCNS-406-1529	Construction Technology and Design in Construction	6	2
ETCNS-406-1509	Building Surveying in Construction	6	2
ETCNS-406-1511	Spatial Data Techniques in Construction and Civil Engineering	6	2
ETCNS-406-1515	Setting out Processes in Construction and Civil Engineering	6	3
ETCNS-406-1516	Surveying Technology in Construction and Civil Engineering	6	3
ETCNS-406-1514	Topographic Surveying in Construction and Civil Engineering	6	3
<b>Total ECVET/ECTS</b>		<b>42</b>	<b>/</b>

**Specialised Units for MCAST Advanced Diploma in Construction Engineering (Civil and Road Engineering)**

<b>Unit Code</b>	<b>Unit Title</b>	<b>ECVET</b>	<b>Year</b>
ETSTR-406-1501	Structural Mechanics in Construction and Civil Engineering	6	2
ETCNS-406-1518	Highway Construction and Maintenance in Civil Engineering	6	2
ETCNS-406-1517	Construction in Civil Engineering	6	2
ETCVE-406-1900	Road Construction Concepts	6	3
ETCNS-406-1515	Setting out Processes in Construction and Civil Engineering	6	3
ETCNS-406-1516	Surveying Technology in Construction and Civil Engineering	6	3
ETCNS-406-1514	Topographic Surveying in Construction and Civil Engineering	6	3
<b>Total ECVET/ECTS</b>		<b>42</b>	<b>/</b>

## **Unit: ETH&S-406-1511 - Health, Safety and Welfare for Construction and the Built Environment**

**Unit level (MQF):** 4

**Credits :** 6

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### **Unit description**

This unit enables learners to know the responsibilities of employers and employees to take measures against risks and hazards in their work environment. They will learn the legal requirements imposed by the current rules and regulations. Learners will gain knowledge of how to undertake risk assessments, record accidents in the accident book and follow the reporting procedures. High standards of health, safety and welfare should be maintained during all stages of a construction project within the legal framework. The health, safety and welfare should be the prime concerns of employers, employees, visitors and the general public visiting the site.

Learners will explore the importance, techniques and procedures of planning for health and safety at construction sites during handling of materials, tools and machineries. They will investigate dangerous occurrences, common accidents and how to report an accident. They will become familiar with the enforcement of rules, breaches of health and safety and know the prosecution, costs and fines.

They will explore risk assessment methods, control measures in construction and precautions to be taken to avoid accidents. They will identify all sorts of hazards at work place. Risk assessments will be produced in a format that can be understood by everyone so that it can be complied and reviewed. They will become familiar with the legal requirements and safe systems of work. Learners will know the components of health and safety management systems, importance of training, information, instruction and supervision, along with techniques to avoid actual accidents taking place at site and near miss accidents.

This course also provides a base for higher education.

## Learning Outcomes

On completion of this unit learners should be able to:

1. *Describe the responsibilities of employers and employees under current health, safety and welfare legislation;*
2. *Explain risk assessment methods and techniques using appropriate principles and formats;*
3. *Explain how to implement the control measures to reduce risk and how to meet legal requirements;*
4. *Identify the procedures of accident recording and reporting.*



## **Unit: ETMTS-406-1505 - Science and Materials for Construction and the Built Environment**

**Unit level (MQF):** 4

**Credits :** 6

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### **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 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, and testing required to determine the nature and quality of the building materials. They will also gain an understanding of how materials fail.

Buildings provide shelter and create a comfortable space in which to live or work. Thermal comfort, visual comfort and aural comfort within the built environment are important parameters for the occupants of the building. Learners will know the methods to achieve human comfort. The occupants of a building require a comfortable internal environment and the understanding what is acceptable to different end users who undertake a variety of tasks and activities is an essential requirement of good design and performance of the building. Learners will know the mechanism of heat transfer, propagation of sound within the buildings and lighting design for various tasks in the building spaces.

### **Learning Outcomes**

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

- 1. Describe the nature and properties of building materials and coatings;*
- 2. Explain testing methods for index properties of building materials;*
- 3. Demonstrate the importance of standards in materials and construction;*
- 4. Explain the basic factors that affect human comfort in a built environment.*

## **Unit: ETPMT-406-1501 - Project Management in Construction and the Built Environment**

**Unit level (MQF):** 4

**Credits :** 6

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### **Unit description**

The unit focuses on developing project management skills and will enable learners to apply these skills in planning, organising and controlling resources effectively throughout the project in order to achieve a timely and satisfactory outcome for the client and to ensure a financial profit.

The learners will gain underpinning knowledge about resources of labour, plant, materials and management which must be employed efficiently to ensure a satisfactory conclusion to a project. The areas covered include the logistical organisation of the site, ordering procedures, materials movement and handling, plant selection and usage, construction activities, the management and effective use of site labour, co-ordination of sub-contractors, the allocation of appropriate durations and resources for the construction work and the continuous monitoring of site progress and costs.

Learners will also develop an understanding of the management functions of planning and the techniques that are available both off and on site to effectively plan the deployment of resources needed successfully to complete a project. They will develop an insight into the importance of planning and resource control to the overall construction process.

Learners will be able to identify the human and physical resources needed for a typical low-rise domestic or commercial building, to produce a simple programme and to explain the associated resourcing, monitoring and controls. Learners will also develop an understanding that site planning is to be done in a way which ensures sustainability resulting in least impact upon the natural environment.

## Learning Outcomes

On completion of this unit the student will be able to

1. *Explain the interaction between project management and construction teams;*
2. *Plan the resources required to complete a construction project;*
3. *Organise the production stage of a construction project;*
4. *Produce project documentation to be used by construction teams.*

## **Unit: ETCNS-406-1503 - Graphical Detailing in Construction and the Built Environment**

**Unit level (MQF):** 4

**Credits :** 6

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### **Unit description**

The unit gives learners the opportunity to produce two and three dimensional graphical drawings and details for implementation on building construction sites along with the formulation of schedules and specification documents relating to steel fabrication, reinforced concrete construction and timber detailing. Learners will use the techniques acquired to aptly produce line drawings for layout and fabrication purposes with annexed specifications and schedules where necessary. They need not have any prior experience in the field although a background in technical drawing is preferable.

Drawings form the backbone of any architectural project and are used in numerous ways during different phases of a project. Towards the latter stages of conceptualisation, drawings are required to show methods of construction and final dimensions for fabrication or setting out. Annotations are also used to make reference to workmanship and/or materials with the intention that the drawings may then be used autonomously as a basis for construction.

Learners will learn how to choose appropriate layouts for their drawings, choice of scales and proportions to be used, correct choice of line widths, graphic symbols and annotations.

Learners will also comprehend the importance of checking completed drawings and documents for accuracy in both graphical representation and specification. Drawings annexed to contracts are often legally binding and a poorly detailed or wrongly annotated drawing will usually become apparent in the resulting project.

## Learning Outcomes

On completion of this unit the student will be able to

1. *Demonstrate a good knowledge of equipment and techniques used to produce graphical information documents;*
2. *Evaluate and explain information contained in graphical drawings, details, schedules and specifications;*
3. *Produce graphical drawings, details, schedules and specifications by means of manual drafting techniques;*
4. *Identify and utilise manual techniques used to produce stone masonry elements such as arches and portals.*

## **Unit: ETCNS-406-1506 - Building Regulations and Control in Construction**

**Unit level (MQF):** 4

**Credits :** 6

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### **Unit description**

The unit provides necessary underpinning knowledge about building regulations in terms of how these set the minimum standards required for the construction of most new buildings and many building alterations to ensure that buildings are safe and hygienic, energy efficient and do not waste water.

Learners will develop an understanding that continuous development and updating of building standards and regulations has taken place over many years and that many of these changes result from concerns related to other issues, such as public health. Learners will appreciate that the provisions for building standards are scattered amongst numerous Acts of Parliament and local authority bylaws.

The unit also provides a sound understanding of how building regulations are enforced by building control officers or approved inspectors, and that the enforcement initially involves approval of the proposed design and construction of a building, followed by regular inspections as the work proceeds on site.

The unit also aims to develop the learners' knowledge and understanding of the Building Regulations and their influence on building design, construction and use. It will enable learners to gain an understanding of specific requirements of the regulations and the means by which they are enforced.

Learners will acquire knowledge and understanding of the Building Regulations for various aspects of low-rise domestic and commercial building design, and be able to apply these to typical construction situations. They will also be able to put together the necessary documentation needed for making a submission for Building Regulations approval.

## Learning Outcomes

On completion of this unit the student will be able to

1. *Discuss the origins and purpose of building control;*
2. *Interpret Building Regulations for given situations;*
3. *Discuss the procedures and documentation involved with Building Regulation approval;*
4. *Prepare a submission for Building Regulation approval.*

## **Unit: ETCDN-406-1503 - Computer Aided Drafting for Construction**

**Unit level (MQF):** 4

**Credits :** 6

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### **Unit description**

Nowadays, computer-based technology has facilitated a lot of construction related tasks, ranging from the off-site fabrication of reinforced concrete slabs using dedicated computer numerical controlled machinery to the generation of drawings of buildings. The latter is just one of the capabilities of Computer-Aided Design and Drafting (CADD) technology. This course is intended to anyone who is seeking to acquire skills in basic two-dimensional (2D) and three-dimensional (3D) modelling features of CADD, and who is interested in applying the potential of this technology in the construction industry.

This is a learning-by-doing type of unit and it will provide learners with the opportunity to apply the skills they have learnt to produce accurate detailed drawings, 3D virtual and physical models. The advantages of using CADD technology over manual drawing techniques will be explained at the outset of this unit. Learners will acquire knowledge on the software and hardware requirements needed to run and use effectively a CADD package. One of the most widely used CADD software is Autodesk® AutoCAD®. Although this software will be employed in this unit, by the end of this study unit, learners will be able to acquire knowledge on the underlying principle of and the basic skills to apply 2D and 3D modelling functions found across different CADD software packages. Exemplars of such skills include the generation of simple 2D shapes from basic functions (e.g. line, arc), modifying such shapes, manipulate object properties (e.g. layers), annotating drawings with dimensions, text and hatching patterns, inserting and creating blocks in a drawing, using basic functions (e.g. 3D primitives) and applying other 3D modelling function (e.g. extrude) to produce 3D virtual models. In addition, learners will be able to independently select the appropriate CADD functions for the task at hand. Furthermore learners will be equipped with the necessary skills to independently produce scaled drawings with all required dimensions and other basic information deemed useful by the architect for the completion of a project. Last but not least, learners will gain knowledge on how to obtain a 3D physical scale model on a 3D printer directly from the corresponding 3D virtual model of a building.



## Learning Outcomes

On completion of this unit the student will be able to

1. *describe the advantages of using CADD, compared to manual drawing techniques and the basic hardware and software requirements to install and use a CADD software package;*
2. *use a CADD software to generate accurate detailed drawings related to the construction industry;*
3. *use a CADD software to generate and manipulate virtual 3D models of buildings;*
4. *use a CADD software to plot detailed drawings and obtain a 3D physical scale model directly from the corresponding 3D virtual model of a building.*

## **Unit: ETCNS-406-1505 - Tendering and Estimating in Construction**

**Unit level (MQF):** 4

**Credits :** 6

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### **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 basic estimating and tendering concepts to the construction industry, including basic information required to produce a tender, different types of tender documentation and calculation of unit rates, through to producing a tender for a specific construction trade or element. It is a unit with considerable practical content.

The Unit is relevant to learners wishing to develop their knowledge of estimating and tendering concepts and principles. 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 tendering and estimating process. This Unit will provide the Learner with an understanding of tender documentation and the scrutiny required, the gaining of further information (including site visits), the measurement process, bills of quantities, building up 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 produce a basic tender for a small construction project, making use of available data and possibly software packages, developing the understanding, knowledge and skills required to produce them.

Finally, learners should have the underpinning knowledge and 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. *Describe the basic information required to produce a tender;*
2. *Explain how to use different types of tender documentation;*
3. *Calculate Unit Rates for an element or trade section of a bill of quantities;*
4. *Produce a tender for a specific construction trade or element.*

## Unit: ETCNS-406-1508 - Surveying in Construction and Civil Engineering

Unit level (MQF): 4

Credits : 6

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### Unit description

The setting out of our roads, railways, drainage, harbor structures and other civil engineering structures requires that you develop the initial skills in surveying that will allow you to accurately accomplish these tasks. Measurement using the decimal system for lengths and angles is required to position structures accurately in accordance with designer's drawings and setting out coordinates. You will learn how to take accurate measurements using surveying tape measures and the methods used to record these measurements.

The topography of a civil engineering site has to be measured with regard to vertical levels. These are required for further calculations on excavation volumes and heights of structures relative to existing ground levels. You will understand how to set up and take accurate levelling readings using standard surveying equipment.

The accurate setting out of control stations is required for the coordination of roads, railways and other civil structures in terms of their position relative to other boundaries. You will understand how to set up and use a theodolite to take accurate horizontal and vertical dimensions and the methods used to record these.

Evaluations on accurate measuring and the factors that affect each type of measurement must be explored so you know where these can be compensated for or adjusted to ensure onsite tolerances are maintained.

### Learning Outcomes

On completion of this unit the student will be able to

1. *Carry out linear surveys;*
2. *Produce levelling surveys;*
3. *Measure horizontal and vertical angles and perform setting out of small buildings.*

## **Unit: ETMTH-406-1617 - Mathematics for Engineering**

**Unit level (MQF):** 4

**Credits :** 6

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### **Unit description**

This unit has been designed to build upon previous theoretical mathematical knowledge, to be used in a more practical context. Furthermore, it acts as an essential basis for the successful completion of other units within the program of study. Delivery of the unit should be set within the engineering context.

The learner will be able to understand and apply algebraic techniques to manipulate expressions and solve algebraic equations commonly found in engineering. This includes linear simultaneous equations, logarithmic equations, exponential equations and series. Furthermore, the learner will also learn that algebraic equations can also have complex roots whenever an algebraic expression is found not to have real roots.

This unit was also designed to deal with geometric and trigonometric analysis to give an extra tool to the learner in how to deal with sides, angles, perimeters, areas and volumes. Furthermore, the learner will also know how to find the surface area of irregular shapes by applying numerical integration and by definite integration. All of this will be applied to engineering contexts.

Part of the syllabus will deal directly with graphical techniques in which the learners will further their studies by introducing higher order equations, trigonometric and logarithmic equations. They will also learn how to solve equations graphically and hence how to find the gradient at a point by using differential calculus.

On successful completion of the unit the learner will be equipped with sufficient mathematical skills to be able to deal with mathematical competencies found in the vocational units at level 4 and even further studies at higher levels.

## Learning Outcomes

On completion of this unit the student will be able to

1. *Apply algebraic techniques to manipulate expressions and solve equations;*
2. *Apply techniques to manipulate complex numbers and series;*
3. *Apply trigonometric techniques to solve engineering problems;*
4. *Apply geometric techniques to solve engineering problems;*
5. *Apply graphical techniques to solve equations;*
6. *Apply calculus to solve practical problems.*

## Unit: ETCNS-406-1504 - Sustainable Construction

Unit level (MQF): 4

Credits : 6

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### Unit description

The aim of this unit is to enable learners to understand the impact of building construction activities on natural environment. Learners will find out about how the natural environment can be protected against these activities using the sustainable construction techniques.

The construction industry poses a major potential pollution threat to our environment and this unit will provide a fundamental understanding of how the activities of the construction sector impact on the natural environment. The techniques, processes and procedures used to protect the natural environment are investigated and the advantages of adopting a sustainable approach to construction work are explored in the contexts of energy, materials and waste.

### Learning Outcomes

On completion of this unit the student will be able to

1. *Know the important features of the natural environment that need to be protected;*
2. *Understand how the activities of the construction and built environment sector impact on the natural environment;*
3. *Understand how the natural environment can be protected against the activities of the construction and built environment sector;*
4. *Understand sustainable construction techniques that are fit for purpose.*

## **Unit: ETCNS-406-1529 - Construction Technology and Design in Construction**

**Unit level (MQF):** 4

**Credits :** 6

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### **Unit description**

The aim of this unit is to enable learners to gain broad theoretical and practical knowledge of Construction Technology and Design in Construction and Civil Engineering. It provides facts, basic principles and procedures related to the field of construction technology that influence design, develop skills in communicating ideas between team members and in translating construction details into written and graphical instructions.

This unit will enable learners to cope with the requirements of construction-related projects as they pass through various stages from design to construction, including the implications of changes and variations in the design. Learners will develop their ability to produce drawings of construction components, using both manual and CAD techniques, with accurate explanations that specify the exact characteristics of relevant construction details. Learners will be able to use appropriate design and planning procedures to specify for and communicate to other team members involved in a construction project.

### **Learning Outcomes**

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

- 1. Know the factors that influence the design process;*
- 2. Communicate ideas between various members of the design and production teams;*
- 3. Know about construction methods;*
- 4. Translate construction details into written and graphical instructions.*



## Unit: ETCNS-406-1509 - Building Surveying in Construction

Unit level (MQF): 4

Credits : 6

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### Unit description

The unit will provide underpinning knowledge to develop an understanding of the processes and techniques commonly involved in building surveying. The learners will develop an understanding of the role of building surveyors in design, maintenance, repair and any financial negotiations between parties to a contract.

This is a hands-on unit where students will be introduced a variety of equipment used to survey buildings from traditional tape measures to the ones using latest technology to ascertain the condition of a building by identifying defects with more certainty.

It is expected that students are aware of the various construction methods either through studying other units or by means of their industry experience. This will be further reinforced by learning on this unit including building defects. After completing the units, the students will be proficient to carry out some essential tasks such as taking measurements, gathering data using photographs and drawings and using a variety of equipment. The students will be able to produce structured and professionally written survey reports including suggestions for any remedial works and associated schedules for low-rise domestic and commercial buildings.

The survey will not only include the building structure but also building and other services in and around the property being surveyed. Health and Safety is a very important aspect of any surveying work and hence adequate knowledge will be given to students while visiting sites.

### Learning Outcomes

On completion of this unit the student will be able to

1. *Explain the role of the building surveyor;*
2. *Demonstrate how to survey buildings;*
3. *Perform various building surveys;*
4. *Produce documentation related to building surveys.*

## **Unit: ETCNS-406-1513 - Mechanical and Electrical Services in Construction**

**Unit level (MQF):** 4

**Credits :** 6

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### **Unit description**

The aim of this unit is to provide basic knowledge and understanding of building services engineering practices. It is essential to supply buildings with cold water and hot water. There is a growing need of electricity and gas in residential, commercial and industrial buildings in urban areas as well as rural areas. Energy efficiency is of prime importance in the supply, usage and maintenance of building services systems.

Learners will gain knowledge and practical experience in mechanical and electrical services to provide electricity, gas, cold water and hot water in buildings. They will learn the specification, procurement of materials and piping layout in buildings. Learners will understand the drainage system above the ground and below the ground in buildings.

They will understand the basics of electricity and explore the production of single phase electricity and supply system in buildings. They will also learn the gas supply system in buildings and learn the health and safety regulations associated with building services engineering.

High quality building services engineers and technical persons are needed in the construction industry. There is a need for professionals and research and development staff in growing technology. This unit will provide the necessary knowledge and skill to learners at level 4 and prepare them to study at a higher level.

### **Learning Outcomes**

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

- 1. Explain the principles of cold water supply system in buildings and learn the system of providing hot water in buildings;*
- 2. Explain the principles associated with the provision of drainage systems in buildings;*
- 3. Explain the principles and practices of providing single-phase electrical systems in buildings;*
- 4. Explain the principles and practices of supplying gas in buildings.*

## Unit: ETCNS-406-1510 - Structural Behaviour and Detailing

Unit level (MQF): 4

Credits : 6

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### Unit description

This is a skills and practice based unit which will allow the learners to be able to detail concrete and steel structures. It is essential that the unit is carried out after one has undertaken the unit title *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 behaviour of both steel and concrete structural materials as this is a good basis for the actual design and detailing of the individual frame elements.

The stress and strain of concrete as well as the factors governing the (concrete and steel) materials will be tackled followed by the main causes of failure that affect structural elements such as shrinkage and creep. Once these are covered (and understood) the singly reinforced section will be tackled and learners will be taught how to calculate the moment of resistance of a singly reinforced section using the simplified stress block. The equations to calculate the required area of steel will also be carried out and examples will be undertaken in class and tutorial sessions.

The different structural elements based on a detailing perspective will be tackled in detail and all elements will be described. The main types of foundations, columns, wall, beams and slabs will be covered with a main emphasis on slabs as this is arguably the crucial element in concrete design. One way and two way slabs will be mainly described and the advantages of two way systems will be explained in detail. Precast pre stressed slabs (which are also referred to as planki) and continuous beams will be briefly described though their design should only be tackled (in other units) if the learners undertake further studies.

The behaviour of structural steel will be described in detail with an emphasis on the ductility of steel. The concept of fatigue failure will be taught and graphs of steel stresses and strains will be provided. The analysis of steel tension and compression members will be carried out and calculations performed to practice this subject. The type of connections used in frames and beam to beam situations will be covered and both welded and bolted connections will be covered. Learners will be given examples of bolted connections and will be taught how to detail these connections as their design is very often strictly based on a detailing restrictions.

## Learning Outcomes

**On completion of this unit the student will able to**

- 1. Explain concrete properties, types of failure and able to analyse the moment of resistance of a singly reinforced section;*
- 2. Explain the different type of reinforced concrete elements used in construction namely, foundations, columns, walls, beams and slabs;*
- 3. Explain the use of steel in construction and be able to calculate the structural capacities of tension and compression members;*
- 4. Identify the structural steel frame detailing requirements and connection design.*

## Unit: ETCNS-406-1512 - Design Procedures in Construction

Unit level (MQF): 4

Credits : 6

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### Unit description

This unit is a mix of developing an appreciation of the design procedures and actually carrying out a design following the recognised design stages. The unit will provide necessary underpinning knowledge about architectural design as an art form which is combined with 'buildable' construction technology, compliance with building legislation and quality performance standards. Learners will also appreciate that the changing role of a designer requires a sound understanding of each of the stages involved in the creation of a building, from concept to completion, and of the roles of the individuals responsible for these. Importance of communication effectively with other, key, team members, from client to contractors is emphasised.

Learners will know the complexity of procedures typical of a design project. Learners will come to know the constitution of the design team and the roles of its members and understand the key stages of the design process. They will become aware of the organisational interactions between members of the design team, client, contractor and other key players involved with a typical construction project, and of the aesthetic, environmental and legislative constraints that affect the design of buildings.

The Royal Institute of British Architects (RIBA) provides check-list detailed guidance on all stages of the design process in the RIBA Plan of work 2013 which provides a framework for the delivery of this unit.

Learners will produce a portfolio of drawings and associated analysis and evaluation of their design.

### Learning Outcomes

On completion of this unit the student will be able to

1. *Select suitable members of design team for a given project;*
2. *Identify the requirements of the client for a given project;*
3. *Develop initial design ideas to meet client requirements for a given project;*
4. *Produce a project portfolio.*

## **Unit: ETBTC-406-1501 - Building Technology in Construction**

**Unit level (MQF):** 4

**Credits :** 6

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### **Unit description**

The aim of this unit is to enable learners to gain a broad theoretical and practical knowledge of low-rise construction, including the design and construction of their foundations, the techniques used in the construction of superstructures and the implications of issues and constraints on building construction.

This course provides a cognitive and practical skills required to carry out multiple complex tasks and communicates theoretical and technical information in a work or learning environment. It generates solutions to specific problems in all building technology activities and enables to perform and supervise qualitative and quantitative tasks.

Learners explore an understanding of building technology by investigating and evaluating how techniques, materials, plant equipment and resources are used to construct buildings. They will have the opportunity to investigate the substructure construction of foundations, piling work and drainage systems; superstructure construction of commercial and industrial buildings; and learn the basic principles of construction management. They will understand that the impact of these technologies on lifecycle costs and the environment are of major importance, and that the choice of construction methods and materials must comply with all relevant legislation and constraints. Consideration is given to specific provisions within the Health and Safety at Work Act and the Construction Design and Management Regulations, where they relate to site safety.

This course also provides a base for higher education.

## Learning Outcomes

On completion of this unit the student will be able to

1. *State common forms of low-rise construction currently used for domestic and Commercial buildings;*
2. *Explain foundation design and construction;*
3. *Explain the techniques used in the construction of superstructures for low-rise Domestic and commercial buildings;*
4. *Explain the implications of issues and constraints on building construction.*

## Unit: ETFIN-406-1515 - Economics and Finance in Construction

Unit level (MQF): 4

Credits : 6

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### Unit description

This unit will allow learners to demonstrate their knowledge and understanding of economics within the construction industry. It has been devised to help learners to demonstrate an ability to apply basic micro and macroeconomic concepts to the construction industry, including how the wider market forces, government policies and general economic activity influence the construction and civil engineering industries.

The Unit is relevant to learners wishing to develop their knowledge of economic concepts and principles, cost control and finance in the industries. On completion of the Unit learners will understand the economic principles that underpin construction and civil engineering projects, with knowledge of the economic resources required. This Unit will provide the Learner with an understanding of cost planning and cost control. The learner will also be able to apply, analyse and evaluate the effects and implications of economic issues upon the construction and civil engineering industries. The learner will be able to produce a basic feasibility study for a small construction project, making use of available data, developing the understanding, knowledge and skills required to produce them.

Finally, learners should have the underpinning knowledge and understanding of the construction industry and of basic economics. In addition, an appreciation of currently-used contract conditions and payment procedures would be beneficial.

### Learning Outcomes

On completion of this unit the student will be able to

1. *Explain the economic principles that underpin the construction industry;*
2. *Identify the economic resources required to complete a typical construction project;*
3. *Demonstrate how to plan and control construction costs;*
4. *Produce a feasibility study for a small construction project.*



## Unit: ETCNS-406-1530 - Measurement Techniques

**Unit level (MQF):** 4

**Credits :** 6

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### Unit description

This unit will allow learners to demonstrate their knowledge and understanding of the quantification and measurement process in relation to works within the construction industry. It has been devised to help learners to demonstrate an ability to apply basic measurement concepts and conventions to the construction industry, including the adherence to a standard method of measurement and to the standard traditional conventions for measuring work and processing the measurement to produce a bill of quantities. It is a unit with some practical content, including mathematical calculation and manual techniques in bill of quantities production.

The Unit is relevant to learners wishing to develop their knowledge of measurement concepts and principles in the construction industry. On completion of the Unit learners will understand the principles that underpin the measurement of work for construction projects, with knowledge of the standard methods of measurement, which apply, their structure and sections, methods and techniques to undertake measurement tasks, and manual techniques for the production of measurements (using traditional dimension paper), abstracts and bills of quantities. This Unit will provide the Learner with an understanding of measurement conventions and documentation, with appropriate mathematical calculation techniques. The learner will also be able to apply, analyse and evaluate the effects and implications upon the measurement process of the current differing range of standard methods of measurement, with emphasis upon the recently adopted RICS New Rules of Measurement (NRM2). The learner will be able to carry out basic measurement tasks, with appropriate presentation and calculations, and continue the process, by converting those measurements to an abstract and finally to a bill of quantities, thus developing the understanding, knowledge and skills required to produce them.

Finally, learners should have the underpinning knowledge and understanding of the construction industry and of simple construction technology. Some prior knowledge of measurement/quantification of building and civil engineering works would be advantageous.

## Learning Outcomes

By the end of this unit, student will be able to:

1. *Explain the methods and techniques to apply the standard method of measurement;*
2. *Explain the elements of the standard method of measurement;*
3. *Explain the methods and techniques to undertake measurement tasks, applying mathematical calculations to the measurement process;*
4. *Explain the manual techniques to produce quality abstracts and bills of quantities pages of measured works.*

## **Unit: ETQSS-406-1900 - Measuring, Tendering and Estimating in Construction**

**Unit level (MQF):** 4

**Credits :** 6

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### **Unit description**

Estimators need to examine the effects of bringing out a contract, often influenced by complex conditions and documents, to appreciate the technical needs of the job. Measuring, Estimating and Tendering for Construction Work explains the position of the estimator/quantity surveyor through every vital stage, from early cost studies to the creation of budgets for successful projects. This reflects recent developments in the field such as new tendering and procurement methods the move from basic estimating to cost planning and the greater emphasis placed on partnering and collaborative working. The calculation is concerned with the practices employed by contractors to make the monetary value to themselves of carrying out construction work.

Tendering is concerned with the commercial aspects of bidding for and getting employment from contracting companies by choosing contractors and taking them to bid and submit a monetary value for the project work. The learner will learn how to prepare the tendering process and how to check an economic value for the client's employment. This is performed by releasing the documents required to get up the estimate, selecting contractors to bid, and assessing the fees received to award the contract. Bids are then evaluated for accuracy and checked numerically to ensure that no errors have been made before formal acceptance and the publication of contract documents to the successful contractor. Students have to obtain detailed quantities from drawings and other documents, estimate the cost of a variety of construction work, convert the estimate into a bid and provide outline cost estimates for proposed construction projects

Measurement, and estimation of the cost of construction work, is essential to provide meaningful cost information for the building firm and the customer. The procedure of bidding for a construction contract, involves typically the contractor measuring the works required accuracies and using the results to calculate the costs and compile the tender. Measurement and the estimation of costs are closely connected to the practical activity of building work.

Nowadays the computer needs a detailed knowledge of the relevant operations and procedures involved in the construction of building elements and will require to be capable to apply this knowledge to do accurate calculations relating to the projected and final costs of materials, plant and labour.

## **Learning Outcomes**

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

- 1. Explain the contractual security under a binding contract.*
- 2. Define payments and subcontractors' obligations and rights.*
- 3. Explain the methods and techniques of estimating cost planning and pre-contract cost control.*
- 4. Carry out the mensuration and quantification for the given project, by using any quantity surveying related software.*

## **Unit: ETCNS-406-1511 - Spatial Data Techniques in Construction and Civil Engineering**

**Unit level (MQF):** 4

**Credits :** 6

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### **Unit description**

The use of spatial data is an essential aspect of any construction development, from the initial feasibility study, through the site survey, design stages (including planning applications), production of the working drawings and the final as-built surveys for the records. The variety of data sources available to those working in construction and the built environment is considered, including their respective data formats. These include remote sensing, satellite and aerial imagery, photogrammetry, laser scans, GPS, socio-economic surveys, statistics and topographic and measured building surveys.

This unit is about developing an understanding of the spatial techniques used to map land-based and spatial information, using both conventional cartography and Geographic Information Systems (GIS). Cartographic design is therefore a fundamental part of the unit.

The techniques and principles are critically compared providing an opportunity to develop understanding by producing a range of maps and design layouts.

### **Learning Outcomes**

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

- 1. Explain the mapping of land using spatial techniques;*
- 2. Collect and process data;*
- 3. Draft effective maps and design layouts.*

## Unit: ETCNS-406-1515 - Setting out Processes in Construction and Civil Engineering

Unit level (MQF): 4

Credits : 6

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### Unit description

The unit will enable learners to obtain knowledge of a variety of processes in construction and civil engineering projects. Learners will know the processes involved when the design and drawings are ready and the construction phase starts. Profiles, pegs and various other marks are set on site so that each part of the building or road works is constructed correctly and at the requisite level.

Mathematical knowledge and skills of a practical nature are necessary for the setting out processes. This process can be completed by traditional methods though the application of current electronic instruments and an understanding of new and upcoming technology will ensure faster work with higher levels of accuracy.

Learners should have a good standard of arithmetic and trigonometry and should have knowledge of Spreadsheets. The use of software can help in decreasing the amount of time spent on calculations, allowing the engineer to save time and focus their skills on other areas.

### Learning Outcomes

On completion of this unit the student will be able to

1. *Establish grids of levels over a site and establish contours to carry out area and volume calculations;*
2. *Set out construction work in a plan with accuracy;*
3. *Control the levels and gradients of construction works;*
4. *Use modern instruments and equipment in setting out processes.*

## **Unit: ETCNS-406-1516 - Surveying Technology in Civil Engineering**

**Unit level (MQF):** 4

**Credits :** 6

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### **Unit description**

The advancements in technology applied to the measurement of distances, angles and heights have over recent years made considerably steps forward. The use of satellites to enable GPS as a surveying measuring tool has now extensively been developed to include the plotting of civil engineering topographical features in real time. Satellite technology links via a base station and now includes hand held or staff mounted data loggers to collect survey measurements and points. Data transfer can therefore be undertaken using paperless technology.

Total stations now contain technologies to upload and plot computer aided designs and communicate via Bluetooth technology to office based applications. Onboard software provided by manufacturers enables data capture via uploading and downloading of surveys.

Laser surveys using a stationary position can produce three dimensional laser surveys that are highly accurate in terms of a few millimetres enabling finer tolerances to be achieved when designing against adjacent structures. This technology produces a three dimensional plot of thousands of points obtained from reflecting a laser off each surface. Lasers can now be utilized extensively for excavations to reduced levels, falls or volumes. Attachments to excavation equipment enable audio and visual signals to be displayed for the operative to guide excavation volumes and grading fill.

### **Learning Outcomes**

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

- 1 Explain how technological principles are applied to surveying;*
- 2 Explain the errors that arise from the use of surveying technology;*
- 3 Use methodologies to reduce survey errors.*

## **Unit: ETCNS-406-1514 - Topographic Surveying in Construction and Civil Engineering**

**Unit level (MQF):** 4

**Credits :** 6

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### **Unit description**

This unit gives learners the opportunity to develop the skills needed to carry out surveys to establish the levels of points, determine coordinates of stations, and survey land and buildings.

Learners will also develop knowledge of emerging technologies in control and topographic surveys.

Surveyors use a variety of instruments to carry out measurements, which are normally recorded electronically. Measurement data is transferred from the instrument to suitable software for processing and the production of the required drawings. Drawings in digital format can be sent to the client electronically, and are often input directly into their own software for analysis, planning or design of the project.

The professional surveyor must be confident with the underlying mathematics involved in the processing of data, and calculations are therefore an important part of the unit.

Learners should have an understanding of trigonometry and basic mathematical principles before starting this unit. The use of spreadsheets for calculations and software for producing drawings is also an important aspect of this unit.

### **Learning Outcomes**

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

- 1. Carry out control surveys to establish the levels of points;*
- 2. Carry out control surveys to determine coordinates of stations;*
- 3. Carry out surveying of land and buildings;*
- 4. Explain emerging technologies in control and topographic surveys.*



## **Unit: ETSTR-406-1501 - Structural Mechanics in Construction and Civil Engineering**

**Unit level (MQF):** 4

**Credits :** 6

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### **Unit description**

This is a skills based unit and will allow learners to gain the necessary understanding of structural mechanics. Structural mechanics is mainly a theoretical subject so it is important for learners to be given practical examples to be able to demonstrate their understanding of the subject. Through practical examples learners will be able to compare visible building elements to the (simplification) models (used in class) and examples used in this course (especially when carrying out calculations). It is suggested that the initial parts of the course be dedicated to the general revision of statics as covered in secondary school Physics. These topics will concern the concepts of forces and will centre on Newton's Laws of motion which form the general basis of civil engineering concepts. Once the learner can demonstrate the necessary knowledge and understanding, it will be important to gradually introduce the concepts of free body diagrams through which one can truly understand how forces are represented as well as the concepts of stress, strain and their relation to the modulus of elasticity. These latter topics form the basis of all structural mechanics and learners must demonstrate that they have truly understood the subjects through tutorials.

Once these topics are covered it is suggested that a very brief introduction to statically determinate and indeterminate structures be given. Learners will understand what these subjects represent in the construction industry and the best examples centre on the simple beam and a continuous beam. Basic statically determinate structures will be covered in this unit and initial calculations will centre on the simple beam. This structure is a good way of allowing a learner to gain practice at calculating the forces within a structure and to understand the way forces interact within a common structural element. Through worked examples, the concepts of tension and compression can be covered and practiced.

The unit will also focus on the basic theory of bending moment and shear forces which form the basis of all structural analysis and design. These are absolutely fundamental for any learner who wishes to further develop his skills in this subject and the unit will only cover the simple beam on a pinned support. Learners will be asked to work out various examples both in class and through tutorial sessions. The relationship between bending moment and shear forces will be described and diagrams drawn out to further explore this relationship.

The last part of the course will be focused on the simple truss which is a very popular

structure in construction and an easy one to calculate. Students will be asked to calculate the forces within it and also to understand the variation in stresses along the structure.

### **Learning Outcomes**

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

- 1 Describe the basic theory governing structural mechanics concerning forces, stress, strain and material properties;*
- 2 Define the concepts of free body diagrams, tension and compression and the concept of moment;*
- 3 Understand the concepts of bending moment and shear force theory;*
- 4 Determine the forces acting in a determinate framework structure.*

## **Unit: ETCNS-406-1518 - Highway Construction and Maintenance in Civil Engineering**

**Unit level (MQF):** 4

**Credits :** 6

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### **Unit description**

This unit provides learners with knowledge of planning, building and maintenance of roads and highways. They will learn the processes involved in the construction of earthworks for new highways and an understanding of methods used to drain highways and subsoils. They will acquire the skills to specify the materials and highway pavement construction.

The civil engineering industry needs professionals who are flexible, creative, highly skilled and technically competent. These skills are needed for the planning, road building and maintenance of highways in Malta. This unit has been designed specifically to focus on road and highway technology which will enable learners to understand and apply technology and processes in a broader vocational context.

### **Learning Outcomes**

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

- 1. Explain the methods and techniques used in planning the construction of a new highway;*
- 2. Explain the earthwork activities and embankment construction;*
- 3. Explain the methods and techniques of highway drainage system;*
- 4. Explain the methods and techniques used in highway maintenance.*

## **Unit: ETCNS-406-1517 - Construction in Civil Engineering**

**Unit level (MQF):** 4

**Credits :** 6

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### **Unit description**

The aim of this unit is to enable learners to gain a broad theoretical and practical knowledge of the fundamental techniques, processes and materials used in the construction of civil engineering works, and the factors that constrain civil engineering work.

It provides facts, basic principles and procedures related to the field of civil engineering technology including the hazards and risks involved in civil engineering construction activities. This course provides a cognitive and practical skills required to carry out multiple complex tasks and communicates theoretical and technical information in a work or learning environment. It generates solutions to specific problems in all civil engineering activities and enables to perform and supervise qualitative and quantitative tasks.

Learners will gain an understanding of the function of civil engineers and of the economics and lifecycle issues associated with infrastructure projects. It will develop skills in selecting plant, materials and methods for civil engineering projects.

Infrastructure projects such as new roads, railways, airports and water projects all require the skills of the civil engineer. This unit gives learners an opportunity to understand the role of those responsible for these projects, and how projects are developed and achieved.

This course explores how earthworks and excavations are undertaken and looks at the factors influencing construction methods. Learners will have the opportunity to investigate the substructure construction of foundations, piling and drainage systems. The unit introduces superstructure construction of commercial and industrial buildings and deals with the basic principles of construction management. Learners will understand the policies, rules, regulations and legislations applicable in Malta and European Union. They will gain information and understand the documents issued by the Malta Environment & Planning Authority (MEPA) and Occupational Health & Safety Authority (OHSA), Malta.

This course also provides a base for higher education.

## **Learning Outcomes**

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

- 1 Describe methods, techniques, processes and materials used in the construction of civil engineering works;*
- 2 Identify Civil Engineering physical and environmental constraints;*
- 3 Describe methods and techniques to select plant and materials for civil engineering works;*
- 4 Explain philosophy and needs of civil engineering infrastructure projects.*