MQF Level 4

EE4-A2-21
EE4-A2-21G

Advanced Diploma in Electrical Systems

Course Specification

Course Description

This course is intended for learners who wish to embark on a career as technicians in electrical power systems in both the domestic and the industrial sectors. The course includes the requirements set by the Regulator for Energy and Water Services (REWS) for the Electrical Wireman's Authorisation A and Authorisation B. This ensures a solid technical competence and understanding of the regulations and health and safety requirements governing the electrical installation industry. This course contains modules related to Photovoltaic Systems, Building Services Engineering and Electronic Control Systems that give candidates a solid grounding in the engineering involved in the building services industry. Candidates will also receive exposure to Mechanical Workshop practice.

Programme Learning Outcomes

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

1. *Work safely, communicate effectively in a team and take responsibility of work in an engineering context*
2. *Understand domestic and industrial electrical principles to apply them in real electrical installation situations*
3. *Design, perform and test domestic and electrical installations and machinery according to regulations and requirements*
4. *Troubleshoot, repair and modify existing domestic and industrial electrical installations, motors and switchgear.*

Entry Requirements

Any MCAST MQF Level 3 Diploma delivered by the Institute of Engineering and Transport, the Institute of Applied Sciences and the Institute of Information and Communication Technology

OR

Any MCAST Level 3 Diploma, whilst being in possession of the compulsory subjects as indicated hereunder

OR

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

Compulsory: Mathematics or Physics

AND

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

Other Entry Requirements

All applicants are asked to sit for a Medical Test in view of any Colour Blindness.

Key Information

Awarding Body – MCAST

Accreditation Status – Accredited via MCAST's Self Accreditation Process (MCAST holds Self-Accrediting Status as per 1st schedule of Legal Notice 296/2012)

Type of Programme: Qualification

MQF Level	Examples of Qualifications	'Qualification' Minimum Credits Required	'Award' Credits Required
Level 8	Doctoral Degree Third Cycle Bologna Process	NA	NA
Level 7	Masters Second Cycle Bologna Process	90-120	Less than 30
	Post-Graduate Diploma	60	
	Post-Graduate Certificate	30	
Level 6	Bachelor[23]/Bachelor (Hons.)[24] First Cycle Bologna Process	180-240	Less than 180
Level 5	Short Cycle Qualification	120	Less than 60
	Undergraduate Higher Diploma	90	
	Undergraduate Diploma	60	
	Undergraduate Certificate	30	
	VET Level 5 Programme[25]	60-120	
Level 4	Pre-Tertiary Certificate	30	Less than 120
	VET Level 4 Programme[26]	120	
	MATSEC Certificate	NA	
Level 3	VET Level 3 Programme[27]	60	Less than 60
	General and Subject Certificate	NA	
Level 2	VET Level 2 Programme[28]	60	Less than 60
	General and Subject Certificate	NA	
Level 1	VET Level 1 Programme[29]	40	Less than 40
	General and Subject Certificate	NA	
Introductory Level A	Preparatory Programme	30	Less than 30
Introductory Level B	Pre-entry Basic Skills Course	30	Less than 30

Table 1: Minimum number of credits for 'Qualifications' and parameters for 'Awards'

Fig.1: p56, Ministry for Education and Employment & National Commission for Further and Higher Education Malta (2016). *Referencing Report, 4th Edition*. NCFHE.

Total number of Hours: 3000 hours

Mode of attendance: Fully Face-to-Face Learning

Duration: 3 Years

Target audience for MCAST full-time courses is 16 to 65+

The official language of instruction at MCAST is English. All notes and textbooks are in English (except for language courses, which will be in the respective language being instructed). International candidates will be requested to meet English language certification requirements for access to the course.

This course will be offered at

MCAST has four campuses as follows:

MCAST Main Campus
Triq Kordin, Paola, Malta

All courses except for the Institute for the Creative Arts, Centre of Agriculture, Aquatics and Animal Sciences are offered here.

Institute for the Creative Arts
Mosta Campus
Misraħ Għonoq Tarġa Gap,
Mosta

Institute of Applied Sciences,
Centre of Agriculture, Aquatics and Animal Sciences,
Luqa Road, Qormi

Gozo Campus
J.F. De Chambray Street
MCAST, Għajnsielem
Gozo

Teaching, Learning and Assessment

The programmes offered are vocational in nature and entail both theoretical lectures delivered in classes as well as practical elements that are delivered in laboratories, workshops, salons, simulators as the module requirements dictate.

Each module or unit entails a number of in person and/or online contact learning hours that are delivered by the lecturer or tutor directly (See also section 'Total Learning Hours).

Access to all resources is provided to all registered students. These include study resources in paper or electronic format through the Library and Resource Centre as well as tools, software, equipment and machinery that are provided by the respective institutes depending on the requirements of the course or module.

Students may however be required to provide consumable material for use during practical sessions and projects unless these are explicitly provided by the College.

All Units of study are assessed throughout the academic year through continuous assessment using a variety of assessment tools. Coursework tasks are exclusively based on the Learning Outcomes and Grading Criteria as prescribed in the course specification. The Learning Outcomes and Grading Criteria are communicated to the Student via the coursework documentation.

The method of assessment shall reflect the Level, credit points (ECTS) and the schedule of time-tabled/non-timetabled hours of learning of each study unit. A variety of assessment instruments, not solely Time Constrained Assignments/Exams, are used to gather and interpret evidence of Student competence toward pre-established grading criteria that are aligned to the learning outcomes of each unit of the programme of study.

Grading criteria are assessed through a number of tasks, each task being assigned a number of marks. The number of grading criteria is included in the respective Programme Specification.

The distribution of marks and assessment mode depends on the nature and objectives of the unit in question.

Coursework shall normally be completed during the semester in which the Unit is delivered.

Time-constrained assignments may be held between 8 am and 8 pm during the delivery period of a Unit, or at the end of the semester in which the Unit is completed. The dates are notified and published on the Institute notice boards or through other means of communication.

Certain circumstances (such as but not limited to the Covid 19 pandemic) may lead Institutes and Centres to hold teaching and assessment remotely (online) as per MCAST QA Policy and Standard for Online Teaching, Learning and Assessment (Doc 020) available via link https://www.mcast.edu.mt/college-documents/

The Programme Regulations referenced below apply. (DOC 004 available at: link https://www.mcast.edu.mt/college-documents/)

Total Learning Hours

The total learning hours required for each unit or module are determined as follows:

Credits (ECTS)	Indicative contact hours	Total Student workload (hrs)	Self-Learning and Assessment Hours
1	5 – 10 hrs	25 hrs	20-15 hrs*
2	10 – 20 hrs	50 hrs	40-30 hrs*
3	15 – 30 hrs	75 hrs	60-45 hrs*
4	20 – 40 hrs	100 hrs	80-60 hrs*
6	30 – 60 hrs	150 Hrs	120-90 hrs*
9	45 – 90 hrs	225 hrs	180-135 hrs*
12	60 – 120 hrs	300 hrs	240-180 hrs*

* The 'Self-Learning and Assessment Hours' amount to the difference between the contact hours and total student workload.

Grading system

All MCAST programmes adopt a learner centred approach through the focus on Learning Outcomes. The assessment of MCAST programmes is criterion-referenced and thus assessors are required to assess learners' evidence against a pre-determined set of Learning Outcomes and assessment criteria.

For a student to be deemed to have successfully passed a unit, a minimum of 50% (grade D) must be achieved. In case of part time programmes, the student must achieve a minimum of 45% to successfully pass the unit.

All units are individually graded as follows:
A* (90-100)
A (80-89)
B (70-79)
C (60-69)
D (50-59)
Unsatisfactory work is graded as 'U'.

Work-based learning units are graded on a Pass/Fail basis only.

Detailed information regarding the grading system may be found in the following document: DOC 004 available at: link https://www.mcast.edu.mt/college-documents/

Intake Dates

•MCAST opens calls for application once a year between July and August of each year for prospective applicants residing in MALTA.
•Applications to full-time courses from international students not residing in MALTA are accepted between April and Mid-August.
•For exact dates re calls for applications please follow this link https://www.mcast.edu.mt/online-applications-2/

Course Fees

MCAST course are free for Maltese and EU candidates. International candidates coming from outside the EU need to pay fees for the respective course. Course fees are set on a per-level and course duration basis. For access to course fee structure and payment methods please visit https://www.mcast.edu.mt/fee-payments-for-non-eu-candidates/.

Method of Application

Applications to full-time courses are received online via the College Management Information System. Candidates can log in using Maltese Electronic ID (eID) or European eIDAS (electronic identification and trust services) to access the system directly and create an account as the identity is verified electronically via these secure services.

Non-EU candidates need to request account creation though an online form by providing proof of identification and basic data. Once the identity is verified and the account is created the candidate may proceed with the online application according to the same instructions applicable to all other candidates.

Non-EU candidates require a study visa in order to travel to Malta and joint the course applied for. For further information re study-visa please access https://www.identitymalta.com/unit/central-visa-unit/.

For access to instructions on how to apply online please visit https://www.mcast.edu.mt/online-applications-2/

Academic qualification leading to a Regulated Profession

The course includes the requirements set by the Regulator for Energy and Water Services (REWS) for the Electrical Wireman's Authorisation A and Authorisation B

Contact details for requesting further information about future learning opportunities:

MCAST Career Guidance
Tel: 2398 7135/6
Email: career.guidance@mcast.edu.mt

Current Approved Programme Structure

Unit Code	Unit Title	ECTS	Year	Semester
ETENG-406-1801	Engineering Science	6	1	YEAR
ETELE-406-1804	Authorisation A part 1	6	1	1
ETELE-406-1805	Authorisation A part 2	6	1	2
ETELE-406-1810	Authorisation B part 5	6	1	YEAR
ETMEC-403-1801	Mechanical Workshop	3	1	1
ETH&S-403-1801	Health and Safety	3	1	YEAR
ETELX-406-1801	Analogue Electronics 1	6	1	YEAR
CDKSE-406-1901	Mathematics for Electrical Engineering	6	1	YEAR
CDKSK-406-2001	English	6	1	YEAR
ETELE-406-1806	Authorisation B part 1	6	2	YEAR
ETELE-406-1807	Authorisation B part 2	6	2	YEAR
ETELE-406-1809	Authorisation B part 4	6	2	YEAR
ETMTH-406-1617	Mathematics for Engineering	6	2	YEAR
ETELE-406-1811	Testing of Systems and Documentation	6	2	YEAR
ETELX-406-1511	Power Electronics	6	2	YEAR
ETRES-406-1801	Renewable Energy Systems & PV Installation- Single Phase	6	3	YEAR
ETBSV-406-1801	Building Services Engineering	6	3	YEAR
ETELX-406-1804	Electronic Control Systems	6	3	YEAR
ETELE-406-1808	Authorisation B part 3	6	3	YEAR
CDKSK-404-1915	Employability and Entrepreneurial Skills	4	3	1
CDKSK-402-2104	Community Social Responsibility	2	3	1
ETCMP-406-1605	Vocational Competences in Electrical Systems	6	2/3	YEAR
	Total ECTS	**120**	**/**	**/**

ETENG-406-1801: Engineering Science

Unit Level (MQF/EQF): 4
Credits: 6
Delivery Mode: Face-to-Face Learning
Total Learning Hours: 150

Unit Description

This unit will expose the student to the basic principles of Science necessary to support other engineering units. It will specifically delve into the underlying physics and chemical concepts which would be essential to understand the engineering knowledge concepts.

This unit will start by outlining the principles of physics underlying the basic electrical AC and DC concepts. It will then go on to explain the fundamental differences between Insulators and Conductors as well as outline the basic circuit theorems.

Another area of relevance to this unit would be the electrostatics and electromagnetic induction on which the student would then be able to build further technical knowledge.

The final part of the unit is aimed to give the student a solid understanding of materials including their chemical properties. This would allow the students to have sufficient knowledge required when selecting the proper material to use for particular applications.

As all the other units in this course this unit is expected to include a strong practical component.

Learning Outcomes

On completion of this unit learners should be able to:

1. *Understand the basic physical principles of electricity and the basic concepts of AC and DC.*
2. *Understand the physical differences between insulators and conductors.*
3. *Perform basic calculations by applying Ohm's Law and other circuit theorems.*
4. *Understand and apply the basic principles of electrostatics and electromagnetic induction.*
5. *Describe different materials and their chemical properties.*

ETELE-406-1804: Authorisation A Part 1

Unit Level (MQF/EQF): 4
Credits: 6
Delivery Mode: Face-to-Face Learning
Total Learning Hours: 150

Unit Description

This unit leads the student to understand the basic concepts of simple single phase standard electrical circuits commonly used in domestic installations. Assessment of load maximum demand and use of diversity factors are important concepts in the design of electrical installation circuits. This unit gives the student the background knowledge to design reliable and safe electrical systems.

To do this the student learns to design systems which sustain the design load currents, prevent fire risks, and ensure that faults are cleared if the case requires. Standard methods of labelling are also thought and also circuit cable design with the inclusion of simple voltage drop calculations.

The unit will also detail how a single phase 40A consumer unit need to be set up with the relevant metering and protection switchgear in place. Standard colour coding will be used throughout all circuits and will also be introduced to the learner in the three phase scenario.

Learning Outcomes

On completion of this unit learners should be able to:

1. *Carry out installations of single phase final circuits commonly used in domestic installations.*
2. *Install all the control / protection required for a single phase domestic installation and calculates the supply Maximum Demand with the use of Diversity.*
3. *Design a domestic electrical supply circuit from protection to load; taking discrimination, circuit cable design and voltage drop into consideration.*
4. *Understand earthing systems and their applications for single phase and three phase installations up to 300A.*

ETELE-406-1805: Authorisation A Part 2

Unit Level (MQF/EQF): 4
Credits: 6
Delivery Mode: Face-to-Face Learning
Total Learning Hours: 150

Unit Description

This unit starts by looking at the fundamental laws of magnetism and then continue on to simple transformers, where one will be led to understand the principles of operation. The student will look into simple construction details of core and shell type transformers. The concepts underpinning the transformer's operations will be essential for the learner to understand the principles of operation of various electrical and electromechanical devices.

Different cable systems will be looked into and practiced to give the student knowledge in industrial installations, such as small garages and workshops. Earthing and bonding will also be practiced during these practical tasks. Earthing will then be discussed in more detail in further units.

The next topic will then be to look into protective gear where the student will look into various types of over-current protection, earth leakage protection and overvoltage protection.

The unit will finally conclude by looking at micro-renewable energies, efficiencies of appliances and buildings.

Learning Outcomes

On completion of this unit learners should be able to:

1. *Use electrical and magnetic principles to understand transformer principles.*
2. *Install different cable systems for garages and small workshops.*
3. *Apply the operating principles of different protective devices in circuits` protection design.*
4. *Understand modern efficient technologies available for use.*

ETELE-406-1810: Authorisation B Part 5

Unit Level (MQF/EQF): 4
Credits: 6
Delivery Mode: Face-to-Face Learning
Total Learning Hours: 150

Unit Description

The days where an electrical installation was all about carrying the task and simply making sure that all systems work are over. In today's engineering world, the electrician needs to be familiar with the requirements of law and regulations that regulate the trade.

This unit is designed to offer the learner the possibility to understand the legal framework and main requirements related to electrical installation work. It gives an overview of the local legislation as well as foreign requirements that bind electrical installations and their applications and implications at work.

This unit also has a practical part. The learner is given the opportunity to understand the purpose, operation and requirements of an earthing system. It delves the setup of the system and other requirements such as methods of earthing, cable sizing and other regulations that surround the earthing system.

The final part of the unit deals with special locations. Such locations require special attention mainly due to their particular environmental conditions which make such places riskier. The study of these special locations is about making the electrical system safer. Such locations include zones with damp conditions and construction sites amongst others.

Learning Outcomes

On completion of this unit learners should be able to:

1. *Recognise the electrical legislation framework.*
2. *Understand the purpose of earthing and assemble and test earthing systems.*
3. *Understand the increased risk of shock and apply the necessary electrical safeguards required to ensure safety.*
4. *Recognise the added dangers and electrical requirements of special locations.*

ETMEC-403-1801: Mechanical Workshop

Unit Level (MQF/EQF): 4
Credits: 3
Delivery Mode: Face-to-Face Learning
Total Learning Hours: 75

Unit Description

This unit is designed exclusively for electrical learners who do not have any experience in engineering workshop practice. It is a skills/theory based unit and will allow learners to demonstrate they have the necessary skills to be able to use machinery and hand tools competently and safely by developing an understanding of the methods used for component manufacture and the use of planning methods and functions for practical and safe business use.

The electrical systems learner will need to be able to manufacture metal items at particular points of his career, such as cable trays, racks, enclosures, cleats and other ancillary items. Therefore, the aim of this unit is to provide electrical learners with the opportunity to develop basic knowledge and skills that are important in a mechanical engineering environment.

Learners will also familiarise themselves with key engineering materials and how these are applied in everyday life. They will carry out techniques commonly used in mechanical engineering workshops to learn how to handle tools, equipment and machinery safely and correctly. While learning these skills and techniques, learners will have the opportunity to fabricate a basic mechanically working device that can be integrated with other areas of engineering.

Learners will carry out planning and observation tasks to prepare the machinery for production or sharing with other users.

Finally, learners should have the underpinning knowledge and understanding to check completed PPE is worn or used at all times and understand the benefits it offers.

Learning Outcomes

On completion of this unit learners should be able to:

1. *Know and apply basic metal forming techniques using the correct tools and equipment.*
2. *Understand and apply basic Oxy-Acetylene or plasma cutting and MMA welding to cut and join steel plates.*

ETH&S-403-1801: Health and Safety

Unit Level (MQF/EQF): 4
Credits: 3
Delivery Mode: Face-to-Face Learning
Total Learning Hours: 75

Unit Description

Integrated Workplace Health and Safety legislation can best be defined as the pre-requisite requirement necessary to maintain the well-being and protection of employers, employees and the environment.

Organisations are legally bound to adopt a proactive approach, educating employees on the importance of promoting safe working practices, in order to maintain a safe and healthy working environment.

Taking cognisance of the aforementioned, the aim of the unit is to introduce candidates to key elements relating to fundamental Health, Safety and Environmental legislation. This unit is intended to be delivered as an intensive 3 credit module to all Level 4 Electrical and Electronics students. This will give them the tools required to work safely in their chosen fields.

The unit seeks to highlight the fact that Health and Safety is an issue for everyone, no matter the level at which they are employed. It aims to inform individuals about their responsibilities in the working environment, in the context of say, what constitutes a safe working area and what's required to achieve this in differing scenarios.

The unit is intended to be delivered as practical unit with realistic visits to workshops on MCAST campus in view to conduct assignments such as risk assessments.

Coupled to this a sound grounding in how safety legislation is formulated and controlled, provides a very useful basis, from which the student's understanding of how these requirements are applied in the workplace.

Learning Outcomes

On completion of this unit learners should be able to:

1. *Explain the key features of Local and EU Health and Safety legislation.*
2. *Explain and describe employers' and employees' specific roles and responsibilities in relation to the act.*
3. *Carry out a suitable risk assessment within a workplace environment.*

ETELX-406-1801: Analogue Electronics 1

Unit Level (MQF/EQF): 4
Credits: 6
Delivery Mode: Face-to-Face Learning
Total Learning Hours: 150

Unit Description

Electronics and electronic devices are used in a wide range of manufactured products. From everyday popular items such as mobile telephones and cameras to the robotics used in industry, jet aeroplanes and medical equipment, the use of electronics is continually growing.

The two major uses of electronic devices is in handling signals by amplifying and switching, resulting in applications in information processing, signal processing, and communications. Mixed on a circuit board, electronic devices become part of many household and industrial systems and in contemporary days they are even becoming integral, embedded part of mechatronic systems.

This unit aims to give learners a practical introduction to basic discrete electronic devices and analogue principles. This will build learners' confidence in their ability to simulate and test a variety of electronic circuits.

It will provide knowledge on how diodes and transistors operate as the two most important elements in an electronic circuit. Learners will also be exposed to the application of analogue circuits, their structure, their operation and the way in which they are differentiated from each other.

Besides building and testing electronic circuits on a breadboard and veroboard, learners will also be exposed to computer-based circuit design and simulation software packages that will allow them to understand the first steps of building and testing electronic circuits.

Learning Outcomes

On completion of this unit learners should be able to:

1. *Understand the function and operation of basic electronic components.*
2. *Apply the concepts of basic electronic devices to understand the operation of basic analogue electronic circuits.*
3. *Investigate, describe and demonstrate the operation and applications of identified discrete transistor amplifier circuits.*
4. *Simulate, construct and test simple analogue electronic circuits.*

ETELE-406-1806: Authorisation B Part 1

Unit Level (MQF/EQF): 4
Credits: 6
Delivery Mode: Face-to-Face Learning
Total Learning Hours: 150

Unit Description

Electricity is becoming more important in modern industry. Control systems are becoming more efficient and accurate. Control systems are intended to support larger power systems. Three phase systems form the backbone of electrical power systems.

This unit is intended to introduce the topic of three phase systems to the learner. It provides basic but adequate information for a learner to face everyday issues in industry. The unit gives adequate skills to the learner to understand the performance of a three phase system.

Upon completion of this unit, the learner will become able to assess the system performance, connect three phase loads like motors and heaters, and carry out power factor improving methods for optimum performance of the system. The learner will be also able to discuss the negative impact of low power factor and suggest methods of how and why to improve the power factor.

Learning Outcomes

On completion of this unit learners should be able to:

1. *Carry out calculations on Star and Delta connected 3 phase loads including the design of representative phasor diagrams.*
2. *Demonstrate the concepts of inductive loads, capacitances, charge and potential, use of capacitors in three phase a.c. and know how to calculate impedance in relation to the frequency.*
3. *Understand the concepts of Apparent, Reactive and True Power.*
4. *Calculate successful power factor correction methods based on three phase systems.*

ETELE-406-1807: Authorisation B Part 2

Unit Level (MQF/EQF): 4
Credits: 6
Delivery Mode: Face-to-Face Learning
Total Learning Hours: 150

Unit Description

The unit starts by looking at the principle concepts of the Enemalta electricity distribution system whereby the student will understand the operation of the key concepts underpinning the Maltese Electrical Distribution network. The student will then learn about the sequence of control and protection used in the consumer's premises.

The unit will provide competence, understanding and knowledge of common Switchgear and protection methods including prospective short circuit (kA) and prospective earth fault currents, leakage currents, arc faults, surge protection and overvoltage protection that are popular in LV Electrical Installations and in accordance with the IET and local regulations. The importance of balancing three phase loads will also be looked into where monitoring of the neutral current will be discussed.

Proper cable selection is imperative as inappropriate cable selection leads to fire and electric shock. Cables come as either single or multicore. Both have an overall mechanical protection to keep all the associated cables together and to provide at least a minimal degree of protection. Appendix 4 of BS 7671 gives details on the sizes and types of cables available to us. With this unit, from the basic knowledge of cables, students would be required to undertake single phase and three phase cable calculations, correctly using relevant formulae and information extracted from relevant conformance documentation. The student will learn the factors that can influence the size of a cable. They should ensure a safe relationship between the circuit current, the protective device and the size of the cable chosen. Factors such as voltage drop will also be taken into consideration and other factors such as harmonics and thermal constraints will be discussed. Re-calculation may be necessary if any part of their calculations fail to comply with stipulated regulation requirements.

Assessment of loads, maximum demand, diversity factors and diversity will be discussed to evaluate technically and financially the choice between single phase and three phase electricity service requirements. Energy efficiency in buildings and schemes towards this topic will also be discussed.

It is envisaged that the unit will be mainly theoretical in nature, but visual aids, actual cable samples and industrial visits should be utilized to reinforce learning involved with the subject.

Learning Outcomes

On completion of this unit learners should be able to:

1. *Understand the principles of the Enemalta electricity distribution systems, including the sequence of installation of equipment, in single-phase and three-phase installation scenarios up to 300A.*
2. *Understand the terminology associated with, and the different types of consumer protection and switchgear including their application.*
3. *Choose appropriate cables and calculate cable sizes in single-phase and three-phase installations for various different circuits taking into consideration the rating factors and voltage drop for loads up to 300A.*
4. *Calculate maximum demand with the use of diversity factors for three-phase installations.*
5. *Discuss energy efficiency in installations including the possibility of government schemes in the use of electricity.*

ETELE-406-1809: Authorisation B Part 4

Unit Level (MQF/EQF): 4
Credits: 6
Delivery Mode: Face-to-Face Learning
Total Learning Hours: 150

Unit Description

Many processes in industry require some kind of movement. This may be moving objects from one point to another. This may be done using a conveyor or a lifting device. Other processes may need to transfer fluids from a level to another or to increase the pressure of the fluid. There are other processes of different magnitudes that require motion.

In older days, the primary motion used to be a long shaft running through a workshop, driven at one end by a mechanical engine. Machines were connected to the shaft by belts.

Today electric motors are the working horse to provide drive power for many machineries. This is due to their efficiency, cost effectiveness and practicality of the system.

This unit tends to give the learner adequate material to understand the theory behind ac induction motors. It also provides information about different motor starters including any devices used. The unit starts with magnetic theory and is followed by ac motor theory. The unit becomes more hands on when discussing three and single phase induction motors, their respective starters and regulations that effect motor installations. The learners are expected to show their knowledge through practical work by assembling a motor starter.

Finally, learners are also exposed to different transformers like double wound and auto transformers as well as instrument transformers like VTs and CTs and their application with energy meters and maximum demand meters.

Learning Outcomes

On completion of this unit learners should be able to:

1. *Demonstrate the principles of magnetism, magnetic circuits, electromagnetism and electromagnetic induction and the principles of operation of transformers.*
2. *Explain the principle of operation of motors, in particular the operation of three and single phase induction motors.*
3. *Discuss the methods of control of ac induction motors and the relevant regulations.*
4. *Describe the use of instrument transformers with measuring instruments.*

ETMTH-406-1617: Mathematics for Engineering

Unit Level (MQF/EQF): 4
Credits: 6
Delivery Mode: Face-to-Face Learning
Total Learning Hours: 150

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 learners should 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.*

ETELE-406-1811: Testing of Systems and Documentation

Unit Level (MQF/EQF): 4
Credits: 6
Delivery Mode: Face-to-Face Learning
Total Learning Hours: 150

Unit Description

The production of good quality documentation is an essential duty of Electrical Systems professionals. This entails the production of high quality electrical drawings. In today's world, Computer-Aided Design (CAD) technology has become a useful tool for Building Services Engineering. The student will be thought how to read the architect's drawings and how to prepare electrical drawings including specifications and bill of quantities. They will also learn how to provide as fitted drawings on such plans using CAD.

The unit will allow learner to show competence, understanding and knowledge in the verification of Low Voltage Electrical Installations. BS 7671 Part 6 states that every electrical installation shall, either during construction, on completion, or both, be inspected and tested to verify, so far as is reasonably practicable, that the requirements of the Regulations have been met. In carrying out such inspection and test procedures, precautions must be taken to ensure no danger is caused to any person or livestock and to avoid damage to property and installed equipment. It is important that electricians are not just able to construct; they should also be able to recognise faults and take action to help prevent them. As such, using the correct means to test and inspect material is vital. Not all faults will be easily visible however some will be concealed and only take effect over a long period of time. Regular inspection, tests and maintenance will limit such faults and this will form part of what the unit will consider.

The unit will address issues such as the requirements and procedures for testing, to include Visual Inspection, Testing & Completion of Relevant Certificates, Schedules & Reports. Both Initial and Periodic Installations should be considered. Some of the inspection & Test Procedures can be introduced during practical work carried out within the unit. At this level, hands on tests should be carried out on a new Installation as a starting point for the learner to understand. This will enable the student to progress to the more advanced practical Involved in a periodic inspection if required. The unit will also describe and explain specific test requirements including their theoretical and practical application.

Learning Outcomes

On completion of this unit learners should be able to:

1. *Use CAD to produce 'as fitted' Electrical Drawings and Bill of Quantities.*
2. *Explain the requirements and procedures for Initial Verification, Inspection & Testing of an electrical installation, taking into consideration all the safety factors and precautions.*
3. *Perform the Inspection and Testing necessary for Initial Verification on a New Electrical Installation.*
4. *Prepare and complete the relevant Electrical Certificates and Maintenance Schedule for an Electrical Installation.*

ETELX-406-1511: Power Electronics

Unit Level (MQF/EQF): 4
Credits: 6
Delivery Mode: Face-to-Face Learning
Total Learning Hours: 150

Unit Description

This unit aims to give learners an understanding of basic principles of Power Electronic devices and circuits. It is delivered with a high practical content which will build learners' confidence in their ability to simulate and test a variety of power electronic circuits.

The learners are first introduced to the different types of power electronic device which form the building blocks of power electronic circuits. They study the reason why these circuits are used, their structure, their operation, the way in which they are differentiated from each other, their applications and their electrical and thermal protection methods.

Once they have a firm grasp of power electronic devices the learners are introduced to the power electronic circuits that they are used in. They will examine in detail their configuration, operation and applications. Direct Current, Single phase alternating current and three phase alternating current circuits are examined.

The learners then move onto using the basic design calculations that will allow them to predict a circuits operation to meet a given specification.

The circuits are then operated and tested by the learners who will gather results to confirm their theoretical predictions.

Modern design tools involving electronic computer aided design, schematic capture and simulation will be employed by the students at all stages throughout the course.

Learning Outcomes

On completion of this unit learners should be able to:

1. *Describe the purpose, structure, operation, transfer characteristics, applications and protection requirements of identified power semiconductor devices.*
2. *Explain the configuration, operation and application of simple power electronic convertor circuits.*
3. *Calculate the mean operational output voltage and output current of simple power electronic convertor circuits to meet a given specification.*
4. *Verify that the mean operational output voltage and output current of simple power electronic convertor circuits meets a given specification.*

ETRES-406-1801: Renewable Energy Systems and PV Installation - Single Phase

Unit Level (MQF/EQF): 4
Credits: 6
Delivery Mode: Face-to-Face Learning
Total Learning Hours: 150

Unit Description

When mankind was using much less machinery, seldom do we find references or concern about environmental issues. With the developments following the industrial revolution, increasing economic necessities took a forefront role at the cost of environmental issues. In modern days there is a drive to balance the economic needs against environmental requirements.

Renewable sources of energy are often a balanced solution. Such sources of energy are highly dependable on the local ambient conditions. This new method of generating electrical energy has introduced a branch in engineering that requires special attention.

This unit is intended to offer adequate knowledge and skills for technicians working in the sector of renewable energy sources with a major interest in photovoltaic (PV) cells. It introduces different PV technologies available and instruct about the complete installation of the systems. The unit also exposes the learner to the legal framework surrounding PV installations, with particular reference to local regulations and requirements.

At the end of the unit, learners are invited to display their knowledge in practice by building an assembly of a PV system to the required standards.

Learning Outcomes

On completion of this unit learners should be able to:

1. *Review regulations related to connecting renewable electrical sources to the national grid.*
2. *Describe different renewable technologies suitable for the local market.*
3. *Build a functional PV system.*
4. *Test a photovoltaic system.*

ETBSV-406-1801: Building Services Engineering

Unit Level (MQF/EQF): 4
Credits: 6
Delivery Mode: Face-to-Face Learning
Total Learning Hours: 150

Unit Description

Building styles and building requirements have changed over the years. By time new ideas and new systems have been introduced to make new buildings more comfortable for the users. The electrical and water supply were the first commodities that were introduced during this evolution, but other systems such as air conditioning, escalators etc., have been introduced later.

During this module, the learner will learn the symbols used in engineering drawing to be able to understand and interpret installation procedures. The learner will than have some basic information of how different systems work. This will include systems such as electricity, water installation, telecommunication and internet, air conditioning and ventilation systems, fire protection etc.

Finally, the learner will learn about the relationship between the systems involved. The learner will also be given a general understanding of Building Management Systems (BMS) and software to monitor and control.

This unit is intended to give information related to either general or complex systems, as well as smaller or bigger constructions.

Learning Outcomes

On completion of this unit learners should be able to:

1. *Read and interpret engineering drawings of different building services.*
2. *Describe building services systems by illustrating basic block diagrams.*
3. *Distinguish the function of various components in building services.*
4. *Understand the BMS and its functions to control and monitor all the systems installed.*

ETELX-406-1804: Electronic Control Systems

Unit Level (MQF/EQF): 4
Credits: 6
Delivery Mode: Face-to-Face Learning
Total Learning Hours: 150

Unit Description

This is a practice-based unit to develop learners' underpinning knowledge and enable them to demonstrate practical skills which are then applied to program three-term controllers and also to design, operate and test electronic control systems.

The learners are first introduced to the concept of an electronic system in terms of input, process and output. The learners then move on to study the main components that constitute an electronic control system and the flow of signals through the system including the concept of feedback. The operation and application of a range of analogue and digital sensors transducers and actuators used on the inputs and outputs of electronic control systems are then introduced to the learner.

On completion of the unit learners will know about various types of control systems and their utilization in the industrial world and be familiar with the both open and closed loop systems as well as becoming familiar with different control system types and their applications.

Learners will gain vast knowledge regarding the operational characteristics of the three term controllers and the various tuning methods involved to tune the controllers in order to have the stable and optimum transient response of the system. Learners are encouraged to familiarize themselves with various types of microcontrollers that can be used for electronic control systems.

Finally, the learners will be introduced to the construction and operation of simple control circuits using the sensors, transducers, actuators and control strategies previously studied.

Learning Outcomes

On completion of this unit learners should be able to:

1. *Explain the purpose, structure and operation and also the main components that constitute an electronic control system and the flow of signals through the system.*
2. *Explain the operation, technical characteristics and application of analogue and digital sensors, transducers and actuators.*
3. *Analyse the operation and behaviour of sequential, open loop, closed loop and on/off control systems using simple mathematical modelling.*
4. *Construct and operate simple control closed loop control circuits using sensors, transducers, actuators and control strategies to meet a given specification.*

ETELE-406-1808: Authorisation B Part 3

Unit Level (MQF/EQF): 4
Credits: 6
Delivery Mode: Face-to-Face Learning
Total Learning Hours: 150

Unit Description

Accidents at work may result in deaths and therefore occupational health and safety is not to be taken lightly. It affects everyone in the workplace in all aspects of work and in all environments. We will be looking at the occupational health and safety from the electrical installations aspect as the legal part of health and safety is covered by another unit.

All cable insulation requires mechanical protection and the electrician must be able to carefully select and install the types of wiring systems and methods of containment and support, depending on the many influencing factors. Through this unit, candidates will obtain the competence, understanding and knowledge for the installation and termination of an array of cable systems according to the IET and local regulations.

The unit will also provide competence, understanding and knowledge of common Switchgear and protection methods including prospective short circuit (kA) and prospective earth fault currents, leakage currents, arc faults, surge protection and overvoltage protection that are popular in LV Electrical Installations and in accordance with the IET and local regulations. The importance of balancing three phase loads will also be looked into where harmonics and monitoring of the neutral current will be discussed. Various enclosures and their applications including the index of protection will also be discussed.

The student will understand the meaning of earth fault currents and look into the design, including calculations to ascertain that such faults do not degrade the system and that the protection performs correctly within the scope of the IET and local regulations.

Learning Outcomes

On completion of this unit learners should be able to:

1. *Demonstrate safe working practice and understand the importance of First Aid.*
2. *Choose appropriate wiring systems and installation methods taking into consideration mechanical protection and containment capacities.*
3. *Choose the appropriate type of consumer protection and switchgear.*
4. *Determine fault currents and select suitable protective conductors.*

ETCMP-406-1605: Vocational Competences in Electrical Systems

Unit Level (MQF/EQF): 4
Credits: 6
Delivery Mode: Face-to-Face Learning
Total Learning Hours: 150

Unit Description

Apprentices are to select and prepares materials and components for electrical assembly and also mounts electrical components in enclosures. Also, they are obliged to wire, rewire, install, test, maintain and modify electrical systems and equipment. They are also expected to carry out prevented planned maintenance. Apprentices will be expected to use a variety of tools and test equipment for the above activities together with fault diagnosis methods and techniques, and to utilise a number of diagnostic aids and equipment. From the evidence gained, they will be expected to identify the fault and its probable cause, and to suggest appropriate actions to remedy the problems.

Their responsibilities will require them to comply with organisational policy and procedures for the above-mentioned activities undertaken, and to report any problems with these activities or the tools and equipment used that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. They will be expected to train, learn and carry out activities with minimal supervision.

The apprentices' underpinning knowledge will provide a good understanding of their work, and will provide an informed approach to applying different electrical systems procedures. They will understand the various activities procedures and their application, and will know about the tools and techniques used, in adequate depth to provide a sound basis for carrying out the activities, recognising and correct action and ensuring that the systems undertaken are to the required specification and remains compliant with all standards and regulations.

They will learn the safety precautions required when carrying out such activities, especially those for isolating the equipment and to take the necessary safeguards to protect themselves against direct and indirect electric shock. They will be trained to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning Outcomes

On completion of this unit learners should be able to:

1. *Identify main processes followed/practiced at the place of work.*
2. *Use tools &/material &/equipment &/machinery to carry out safely assigned tasks.*
3. *Communicate effectively in a workplace environment with all stakeholders.*
4. *Review personal and professional experience achieved throughout your work placement*
5. *Follow good work practices at the place of work.*

CDKSE-406-1901: Mathematics for Electrical Engineering

Unit Level (MQF/EQF): 4
Credits: 6
Delivery Mode: Face-to-Face Learning
Total Learning Hours: 150

Unit Description

This unit provides a framework for students to develop mathematical thinking skills further to the level 3 unit specification to solve problems related to real-life situations. Students also develop skills, attributes and knowledge that contribute to their personal growth and effectiveness within their training and work environment and also within the community.

The unit is designed to adapt for the needs of a particular field of study (business & finance or engineering & transport and others).

To reach this goal the unit was divided into four learning outcomes which are related to statistics, graphical representation, geometry, trigonometry, algebra and finance. Through these different areas students will be able to develop the effective skills for information processing, reasoning, evaluation creative thinking and enquiry, all fundamental skills for the problem solving process. This will prepare students in applying and evaluating a range of strategies to solve real-life problems. Through this unit the learner will also learn to present and communicate results and conclusions effectively.

On successful completion of the unit the learner will be equipped with mathematical thinking skills which make them aware of and understand their thought process, to reassess and identify areas for development. Students learn to evaluate, reflect about their strategies, understand and verify results to solve problems. These skills will equip students with managerial skills, to further their studies and for work employability.

Learning Outcomes

On completion of this unit the student will be able to

1. *Demonstrate visual and logical techniques in evaluating graphical representations and communication skills in presenting the results effectively.*
2. *Apply information processing skills to solve problems in a relevant statistical context.*
3. *Demonstrate evaluation and communication skills in solving and presenting problems applied to costing methods and techniques.*
4. *Apply thinking skills in geometric, trigonometric and algebraic areas related to electrical engineering contexts.*

CDKSK-406-2001: English

Unit Level (MQF/EQF): 4
Credits: 6
Delivery Mode: Face-to-Face Learning
Total Learning Hours: 150

Unit Description

The main objective of this unit is to prepare students to use the English language to understand, analyse, organise and communicate specific technical knowledge by inferring meaning from, and using, embedded information, being able to evaluate information critically and communicate through different types of texts, as required by various but often specific technical contexts within the selected field of study.

The emphasis is on the processes needed to transition from use of the English language in General Education to that required for access to Higher Education.

In particular, L4 Key Skills English is targeted at learners who have completed Foundation College programmes (Levels 1 to 3) and seek to further their studies at Technical or Degree level.

In this respect, this unit recognises the necessity to meet two linguistic demands at this threshold level; strengthening students' linguistic competences to be able to communicate more specifically within their vocational area and stream and to prepare them for more rigorous academic thinking, research and writing as necessitated by degree courses.

Being introduced at this level are core and elective unit outcomes. Reading and writing outcomes are core components in this syllabus while listening and speaking are elective components. Every L4 programme must deliver the two core outcomes and any one of the two elective learning outcomes. The elective criteria to be assessed cannot be selected from and across both outcomes.

Learning Outcomes

On completion of this unit the student will be able to

1. *Read technical texts effectively to improve knowledge of the subject area.*
2. *Understand information presented orally in the form of recordings, or talks, discussions, seminars, interviews or presentations.*
3. *Demonstrate own understanding of the subject matter via oral presentation, mock interviews or similar oral delivery.*
4. *Write a research paper or technical report demonstrating cohesion, structure and appropriate style.*

CDKSK-404-1915: Employability and Entrepreneurial Skills

Unit Level (MQF/EQF): 4
Credits: 4
Delivery Mode: Face-to-Face Learning
Total Learning Hours: 100

Unit Description

This unit complements the vocational and key skill units at Level 4 and provides an opportunity for learners to enhance their employability and entrepreneurial skills.

Quite often, learners tend to focus most on technical skills and competences required in a certain trade which enable them to access employment. On the other hand, employers expect employees to be appropriately skilled to follow instructions, take initiative, work effectively in a team, take a lead when necessary and more. In view of this the unit starts with an introduction to the 4th industrial revolution and proceeds to the transversal skills necessary to find employment, retain employment and advance at the place of work. Learners will be able to highlight their strengths and identify the areas that require improvement.

The rest of the unit focuses on entrepreneurial skills, a skill which is one of the most important transversal skills identified by UNESCO. Learners are introduced to methods which can be used to generate new and innovative business ideas and methods which help them evaluate ideas and choose the most feasible. Furthermore, learners will cover the various stages of product and/or service development, including market analysis, processes, pricing strategy, promotion and resources required.

Learners will work in a small team and by the end of the unit they will have the opportunity to develop a business idea which is commercially viable. Furthermore, they will present the idea to prospective investors/stakeholders.

Learning Outcomes

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

1. *Understand the employability skills required for Industry 4.0.*
2. *Use idea generation techniques to come up with ideas and evaluate chosen ideas.*
3. *Understand the various stages of product and/or service development.*
4. *Work in a team to develop a business idea which is commercially viable.*

CDKSK-402-2104: Community Social Responsibility

Unit Level (MQF/EQF): 4
Credits: 2
Delivery Mode: Face-to-Face Learning
Total Learning Hours: 50

Unit Description

This unit focuses on Community Social Responsibility and provides an opportunity for learners to better understand themselves and the others and to establish goals in life. Community social responsibility enables learners to understand their strengths and areas for improvement and prepares them for life, employment and to become active citizens in society.

Moving away from traditional delivery of other units, learners will be empowered to take ownership of their learning process. Hence, community social responsibility will be delivered through a combination of workshops, small-group sessions with mentors and various opportunities to reflect.

The set of sessions will tackle community social responsibility skills and will mostly focus on the self, the ability to work independently and important values in life. The second set of sessions will address interpersonal skills and will focus on working with others, dealing with diversity and conflicts. Furthermore, at the end of the sessions, the learners will be introduced to the importance of active citizenship in life.

Learning Outcomes

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

1. *Identify personal goals through self-reflection.*
2. *Evaluate how collaboration with others can be more effective.*
3. *Explain the importance of giving and receiving feedback.*
4. *Contribute actively to make a difference in society.*