MQF/EQF Level 4

AE4-A1-21

Advanced Diploma in Heating, Ventilation and Air Conditioning

Course Description

This programme of study gives participants the knowledge and skills that are required by the Heating, Ventilation and Air Conditioning (HVAC) industry. Learners will be expected to carry out system modifications and customization. The course is based on College-based training as well as work-based learning. Learners will gain an in-depth knowledge and experience which may lead them to supervisory roles in the HVAC sector. During the course learners are given the opportunity to develop personal skills and attributes essential for a successful performance in related careers. Applicants need to be able to work within the industries concerned.

Programme Learning Outcomes

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

1. *Carry out a risk assessment of the surrounding working environment before and after executing an assigned task;*
2. *Carry out installations, repairs and planned maintenance of existing systems within local refrigerant handling legislation;*
3. *Identify materials, refrigerants and equipment that can be used for specific applications;*
4. *Prepare HVAC components for operation and commissioning.*

Entry Requirements

Any MQF Level 3 (minimum 60 ECTS) Diploma

OR

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

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

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

Mode of attendance: Full Time

Duration: 3 Years

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

Target group: Students exiting compulsory education

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/

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
ETHVA-406-1505	Science and Measurement within the HVACR Industry	6	1	YEAR
ETHVA-406-1506	Material, Refrigerant Handling and Pipework (Brazing)	6	1	YEAR
ETELE-406-1501	Electrical Theory and Installation Technology	6	1	YEAR
ETRFG-406-1501	Refrigeration Technology	6	1	YEAR
ETHVD-406-1501	Schematics and Installation Coordinated Drawings	6	1	YEAR
ETHTG-406-1502	Heat Pumps	6	1	YEAR
ETH&S-406-1504	Occupational Safety in the Construction Industry	6	1	YEAR
CDKSK-406-2007	Mathematics	6	1	YEAR
CDKSK-406-2001	English	6	1	YEAR
ETRFG-406-1502	Industrial RAC Technology and Plant	6	2	YEAR
ETPAM-406-1501	Planning and Administration	6	2	YEAR
ETHVA-406-1508	HVAC Electrical and Control Wiring Systems	6	2	YEAR
CDKSK-404-1915	Employability and Entrepreneurial Skills	4	2	YEAR
CDKSK-402-2104	Community Social Responsibility	2	2	YEAR
ETHVA-406-1509	Ventilation and Air Conditioning Technology	6	2	YEAR
ETELX-406-1501	Programmable Logic Controllers and BMS	6	3	YEAR
ETPRJ-412-1507	HVACR Synoptic Project	12	3	YEAR
ETHVA-406-1507	HVACR Commissioning, Alternation and Repair	6	3	YEAR
ETHTG-406-1501	Heating Technology	6	3	YEAR
ETHVA-406-2000	Vocational Competences : Apprenticeship in HVAC	6	1/2/3	YEAR
Total ECTS		120	/	/

ETHVA-406-1505: Science and Measurement within the HVACR Industry

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

Unit Description

This unit provides the student with an introduction to basic scientific principles and instruments used within the HVAC Industry. The SI system of units is primarily used but Imperial units will be discussed and used/converted where necessary e.g. manufacturer data for equipment selection and evaluation etc.

The student will be introduced to the concepts of pressure, temperature and heat. These are the fundamental scientific principles used within HVAC design. The application of these principles to heat transfer, gas compression and expansion processes and other basic processes found within the HVAC Industry will be evaluated.

The student will then apply scientific principles to fluid flow. Basic continuity equations, CIBSE and ASHRAE fresh air requirements, air change rates, air flow and distribution duct work will be investigated and designed. Grilles, registers and diffusers will be sized and selected for both ventilation and air conditioning systems. Basic duct/pipe sizing will be carried out by the student along with investigation into the fan/pump laws. These will be applied to system designs to enable the student to construct fan and system characteristic curves and select fluid moving equipment e.g. fan selection.

The student will be introduced to the properties of air and the application of the psychrometric chart. Fundamental air conditioning processes will be evaluated and analysed using both tables and the psychrometric chart. Basic heating and cooling loads will be calculated by the student.

The Mollier diagram and the basic vapour compression refrigeration cycle will be investigated and applied to a range of systems, plant and equipment. The student will plot P-h charts, read from the charts and provide information on system performance in terms of COP, evaporator load etc.

Finally, the student will be introduced to a range of measuring equipment used within the HVAC Industry. Equipment for measuring pressure, temperature and fluid flow will

be analysed in terms of basic operating principles, operating range and limitations and typical applications.

Learning Outcomes

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

1. *Understand fundamental science concepts used within the HVAC Industry;*
2. *Determine ductwork and terminal device designs to satisfy the ventilation and air conditioning needs of non-complex commercial and industrial buildings;*
3. *Analyse and quantify the principles of psychrometry as applied in the HVAC Industry;*
4. *Describe the operating principles of vapour compression refrigeration systems and apply Mollier charts to size plant and equipment;*
5. *Describe the application of instrumentation used within the HVAC Industry.*

ETHVA-406-1506: Material, Refrigerant Handling and Pipework (Brazing)

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

Unit Description

This unit reflects part of the current situation with respect to brazing and refrigerant handling within the Refrigeration & Air-conditioning Industry.

The assessment process will confirm that the candidate has the required practical competence and the underpinning knowledge necessary to carry out the brazing procedure at a quality standard.

The unit provides the student with the working principles of compressed gas brazing processes, as used in the RAC and HP industries, and also the legislative and organisational procedures related to these processes. The student will be able to explain and demonstrate how to complete preparation work for compressed gas brazing activities in relation to current working practices within the RAC and HP industry.

The student will fabricate and connect pipework and install a range of fixtures and fittings by using compressed gas brazing and also mechanical (flared) connections. The brazing process will also involve test pieces fabricated to a given specification and will include a range of materials which will require both brazing and silver soldering techniques. The unit also requires the student to carry out component replacement, pressure testing, evacuation and pre-commissioning checks on refrigeration systems. Current Industry standards will be applied across a range of RAC and HP systems and will involve refrigerants in common use e.g. R134a, R404A, R410A and others as required.

To complete the unit, the student will commission and decommission systems and reclaim refrigerant and oil in line with current RAC and HP Industry requirements and legislation. Ozone depletion, greenhouse gas and global warming details will be evaluated for the various refrigerants in common use. Refrigerant charging, leak checking and refrigerant recovery methods on new and existing refrigeration systems will be undertaken and record keeping documentation completed and filed in line with F gas requirements.

Finally the student will undertake both the theory and practical assessments for F gas certification.

Learning Outcomes

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

1. *Describe the working principles of compressed gas brazing processes, as used in the RAC and HP industries, and state the legislative and organisational procedures related to these processes;*
2. *Explain and demonstrate how to complete preparation work for compressed gas brazing activities;*
3. *Explain how to connect pipework by compressed gas brazing and fabricate refrigeration pipework;*
4. *Complete pressure testing, evacuation and pre-commissioning checks on refrigeration systems;*
5. *Explain and apply refrigerant charging, leak checking, record keeping and refrigerant recovery methods on new and existing refrigeration systems;*
6. *Apply F gas assessment (zeotropic blend).*

ETELE-406-1501: Electrical Theory and Installation Technology

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

Unit Description

This unit has been designed to enable learners to understand the relationship between electrical scientific principles and the competencies required of an operative working within an electrical environment. The aim of the unit is to give the learner an understanding of the electrical principles, installation methods and terminology used within the HVAC industry.

The learner will begin with obtaining core knowledge of the mathematical principles required to work in an electrical engineering environment. The learner will be given the opportunity to apply the mathematical principals learned to problem solving situations within electrical engineering. The learner will obtain knowledge of the scientific principles of electrical engineering, this will include the units used in electrical engineering, electron flow theory and the relationship between power, work, force and energy. The learner will gain an understanding of the relationship between magnetism and electricity and from this gain an understanding and core knowledge of electricity production and electrical motors. The learner will examine and gain knowledge of AC theory including the sine wave generation for both single phase and three phase systems, the complexities of inductance, capacitance and impedance. The learner will learn to identify electrical components including but not limited to fuse types, circuit breakers, RCDs and RCBOs. The learner will gain a knowledge and understanding of the wiring systems used within electrical installations and will examine the different types of distribution boards and discrimination between safety devices.

Overall the learner will gain an in-depth knowledge and understanding of the theory needed to work in electrical environments in a HVAC industry. The learner will be given the opportunity to demonstrate the skills and ultimately prove competence in an electrical environment using hands-on tasks built to assess the learner's ability.

Learning Outcomes

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

1. *Apply mathematical principles which are appropriate to electrical installation, maintenance and design work and electrical safety principles;*
2. *Describe and apply standard units of measurement used in electrical installation, maintenance and design work;*
3. *Explain basic mechanics and the relationship between force, work, energy and power;*
4. *Describe the relationship between resistance, resistivity, voltage, current and power and the fundamental principles which underpin the relationship between magnetism and electricity;*
5. *Explain electrical supply, distribution systems and earthing systems;*
6. *Explain how different electrical properties can effect electrical circuits, systems and equipment;*
7. *State the operating principles and applications of DC machines and AC motors;*
8. *Describe the operating principles of different electrical components and circuits;*
9. *Explain the principles and applications of electrical heating, domestic refrigeration wiring and thermo-electric systems;*
10. *Describe the types, applications and limitations of electronic components in electro-technical systems and equipment;*
11. *Commission and test a range of electrical installations.*

ETRFG-406-1501: Refrigeration Technology

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

Unit Description

This unit will introduce the student to the basics of the vapour compression refrigeration cycle. The student will be provided with both theoretical and practical aspects of refrigeration.

The thermodynamic principles behind the vapour compression refrigeration cycle will be examined and the student will be competent in assessing and converting between the various units that are used within the refrigeration and air conditioning industries e.g. mainly SI units but also IP units which are still used in other countries and may be included in textbooks, manufacturers' details etc.

The Mollier diagram (P-h chart) will be evaluated and used as a means of analysing proposed new systems along with existing refrigeration plant during commissioning and as part of the fault finding methods and service and maintenance processes. The basic P-h chart refrigeration cycle will be expanded to include multi-stage compound refrigeration plant along with cascade systems frequently found in very low temperature refrigeration systems.

The student will examine all the classifications, designs, options and performance and fault conditions for the compressors, condensers, expansion devices and evaporators used in vapour compression refrigeration systems. Additional components e.g. pressure switches, oil separators and other accessories used in RAC and HP systems will also be investigated and evaluated in terms of their use, application, performance, control settings and operational problems.

The student will also install plant, equipment or components to provide working systems. These systems will be strength and pressure tested, vacuumed and charged with suitable refrigerant before being fully commissioned by the student. This process should be carried out on a number of occasions on a range of refrigeration systems e.g. cold room, display cases, air conditioners and with different refrigerants e.g. R 134a, R 404A and others currently in use to allow the student to gain experience on a range

of equipment. The student will also undertake fault finding and service and maintenance tasks on a range of plant and equipment.

Learning Outcomes

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

1. *Describe vapour compression refrigeration system fundamentals and apply pressure enthalpy charts for plant sizing and selection;*
2. *Describe the design and application of refrigeration components and systems including defrost requirements;*
3. *Plan and install refrigeration plant and equipment;*
4. *Undertake fault finding, service and maintenance of refrigeration plant and equipment.*

ETHVD-406-1501: Schematics and Installation Co-ordinated Drawings

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

Unit Description

Within this unit the learner will understand how to produce drawings suitable for HVAC installations.

The learner will become familiar with all symbols and abbreviations associated with drawings in the HVAC industry.

The learner will be familiar with the construction process from Tender Stage through to As Installed drawings and the importance of Amendments made to such drawings during the construction process.

The learner will be familiar with the different types of drawing used within the industry, Schematic, Isometric, Orthographic, Plan, Elevation, Sections and such like.

Key components within the HVAC industry will be discussed during this process in order for the student/learner to understand and interpret such drawings in a working environment and understand systems according to the drawings displayed to them through examples.

Systems including, Air Conditioning, Refrigeration, Electrical, Heating, Ventilation and Hot and Cold Water Services will contribute to the student having a knowledge of all services that could be installed into an Industrial or Commercial Premises.

The learner will become familiar with construction drawings of buildings to understand the different formats of construction that can take place. This will aid the learner's knowledge of Fixings, Thermal Transfer of materials (U Values) thus giving a sound basis of most aspects of what the student could face in a working environment.

Learning Outcomes

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

1. *Identify and Apply the Drawing Symbols Used in the HVAC Industry;*
2. *Analyse and Identify Different types of HVAC Systems from Drawings;*
3. *Determine management and administration procedures for contractual drawings;*
4. *Produce Drawings using Manual and/or ACAD systems for Basic HVAC Systems.*

ETHTG-406-1502: Heat Pumps

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

Unit Description
The aim of this unit is to allow students to develop the knowledge and understanding of how heat pump technology is being used throughout Europe to address issues like energy efficiency and indirect global warming. The unit provides the student with a brief overview of what heat pump systems are, their main advantages and limitations compared to conventional heating systems. The types of heat pumps investigated systems include air source, water source and ground source systems. The unit covers the operational principles of a heat pump system, the function of the major components and how to identify these components.

The unit covers fundamental heat pump system design awareness and component selection but does not include detailed system design.

The unit covers connection to collector loops and the fundamental requirements of collector loop design and installation; however, the unit does not cover collector loop design or installation in detail.

The unit covers the requirements for appropriate qualifications as required by The Fluorinated Greenhouse Gases Regulations 2008, in relation to heat pump work but the unit does not cover aspects of heat pump work that involves handling fluorinated greenhouse gases.

Learning Outcomes

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

1. *Describe the health and safety risks and safe systems of work associated with heat pump system installation work (non-refrigerant circuits) and the requirements of relevant regulations/standards relating to practical installation, testing and commissioning activities for heat pump installation work;*
2. *Explain the operational characteristics of heat pump unit and heat pump system components;*
3. *Describe the different types of heat pump units and system arrangements for hydronic emitter circuits;*
4. *Describe the fundamental principles of heat pump selection and system design that are common to both air and ground source heat pumps.*

ETH&S-406-1504: Occupational Safety in the Construction Industry

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

Unit Description

This unit provides learners with the essential Health & Safety knowledge and skills to demonstrate best practice in a construction and engineering environment or sector. The unit provides learners with an awareness of relevant legislation and should underpin all activities learners take part in.

This unit is about maintaining a healthy and safe working environment across the range of installation or maintenance work, this involves being able to use safe procedures when working with others and use safe working practices.

The person carrying out this work must possess the skills and knowledge to ensure that their own actions do not create any health and safety risks, they do not ignore hazards with significant risk in the workplace and that they take sensible action to put things right.

There are many potential hazards within our industry. This unit is designed to ensure that those that work within it are aware of the potential dangers, likely hazards and where to source: safety information, appropriate regulations and apply them to the workplace and the people who operate within it.

This unit is about identifying the hazards and risks that are associated with the job. Typically, these will focus on the working environment, the tools and equipment that are used, materials and substances that are used, working practices that do not follow laid-down procedures, and manual lifting and carrying techniques.

Learning Outcomes

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

1. *Identify health and safety legislation;*
2. *Identify how to handle hazardous situations;*
3. *Identify electrical safety requirements when working in the building services Industry;*
4. *Identify the safety requirements for working with gases and heat producing equipment;*
5. *Identify the safety requirements for using access equipment in the building services Industry;*
6. *Apply safe working practice in the building services industry.*

ETRFG-406-1502: Industrial RAC Technology and Plant

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

Unit Description

This unit introduces the student to both Variable Refrigerant Volume and Variable Refrigerant Flow (VRV/VRF) heat recovery systems. Traditional 3 pipe systems and 2 pipe systems architecture will be examined and evaluated.

This unit also introduces the student to traditional cooling systems e.g. Chillers, package AHU and split Air Conditioners.

The student will recap simple air conditioning and heat pump systems and components. Refrigerants in common use will be evaluated and P-h chart analysis will be carried out to establish basic information e.g. COP.

The student will evaluate the energy saving technologies and innovations used in VRV/VRF systems. Inverter driven DC compressors, DC fan motors, fan design, heat exchanger improvements and control strategies will be examined and compared.

Manufacturer recommendations and catalogues/data will be used to produce working designs. Outdoor units, indoor units, control boxes, pipework fittings and accessories necessary to provide a working system will be sized and selected for a range of buildings/applications.

The student will be expected to calculate building heat loads and then select appropriate plant and equipment to satisfy the design. Workshop installation and/or simulation systems will be used to provide system architecture and layout, strength and pressure testing of plant along with vacuum techniques, electrical and control wiring. Refrigerant additional charge will be calculated and the system commissioned for both heating and cooling.

VRV/VRF systems will also have refrigerant reclaim/documentation completed in accordance with current practice and regulations. Systems should be modified to allow

the student use of the facilities of the Pcb at the outdoor unit and also allow extra charge calculations to be completed.

Traditional cooling methods e.g. chiller systems will be investigated for a range of applications and historical systems and current practices will be examined in terms of design, operation, and performance at part load, service and maintenance requirements etc.

The student will compare and contrast existing traditional air conditioning systems and chillers with VRV/VRF systems. Areas of evaluation such as space requirements, performance, ease of installation, costs etc. will be evaluated.

The option of providing heat recovery from a number of different systems will be evaluated. Heat recovery methods, plant and equipment e.g. thermal wheel, run around coil will be investigated by the student to provide guidance on energy saving possibilities.

The student will be introduced to alternative natural refrigerants that are commonly used within the RAC and HP industries e.g. ammonia, hydrocarbons and carbon dioxide.

Learning Outcomes

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

1. *Describe the working principles of VRV/VRF and chiller systems;*
2. *Explain how to evaluate designs of VRV/VRF systems and chillers, including service and maintenance requirements;*
3. *Compare and contrast VRV/VRF systems with traditional HVAC plant and equipment e.g. chiller systems, AHU's etc.;*
4. *Describe heat recovery methods used in air conditioning and HP systems.*

ETPAM-406-1501: Planning and Administration

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

Unit Description

This unit identifies the knowledge and competences needed to contribute to the development and maintenance of positive working relationships with other people, in accordance with organisational and workplace requirements.

This unit covers the different roles and responsibilities within organisations and the workplace. The learner will be able to identify the current and mandatory legislation, regulations and policies which are required to be complied with in an organisation.

The learner will be able to apply and use the correct planning and administration methods to organise and understand work programmes and the requirements of different trades. The learner will be able to demonstrate the use of formal and informal communication with other persons within a workplace and be able to apply a methodical approach to labour and material estimates.

The learner will understand the use of different communication methods throughout regarding the different personnel and their individual requirements within a workplace. The unit will demonstrate the different types of methods used to ensure all persons within a working environment are informed about work plans and activities that affect them.

The unit will demonstrate how persons within a workplace should know how they can develop and maintain positive working relationships with relevant people. The learner should understand the importance of appearance and behaviour, the feelings and expectations of others, and effective communications.

Learning Outcomes

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

1. *Identify and understand the members of the construction team and their role within the Building Services industry;*
2. *Identify and understand how to apply information sources in the Building Services industry;*
3. *Communicate with other persons within the Building Services industry;*
4. *Apply the correct Planning and Administration methods within a working environment.*

ETHVA-406-1508: HVAC Electrical and Control Wiring Systems

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

Unit Description

This unit provides a framework for learners to develop the knowledge and Describe as well as practical skills to be able to work competently in an HVAC environment.

Learners will examine control theory from basic on/off control to PID control. On gaining this knowledge the learner will be able to identify control strategy required and the controls required for different HVAC applications.

The unit will also focus on the numerous controls found throughout the HVAC industry. Controls on fuelled appliances, heat emitters and air conditioning applications will be examined. The learner will gain a working knowledge and will be able to identify the various controls used in a HVAC environment.

Learners will also examine and investigate the various methods of motor control. The learner will be equipped with a working knowledge of DOL, STAR-DELTA control as well as simple speed control methods. The learner will also examine the role played by multi-tapped motors in the HVAC industry.

The learners will be given the opportunity to investigate the role of variable speed drives within the HVAC industry. The learner will be equipped with the knowledge required to grasp the operating principles of a variable speed drive as well as the applications it is used in.

The learners will finally be introduced to the role building management systems play within the HVAC industry. The learner will also learn how to read electrical schematic and ladder control diagrams common to the HVAC industry. In this learning outcome learners will also investigate and examine the role controls play within a HVAC system and from this gain a working knowledge of how a complete system can function.

Overall the learner will gain an in-depth knowledge and Describe of the role played by controls within many HVAC disciplines. The learner will be given the opportunity to demonstrate the skills required and ultimately prove competence in the area of HVAC controls.

Learning Outcomes

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

1. *Explain the different types of control strategies used in an HVAC environment;*
2. *Explain the working principles of contactors and relays;*
3. *Describe the working principles and requirements for controls used to maintain a space temperature;*
4. *Describe the working principles and requirements for controls used on fuelled appliances;*
5. *Describe the working principles and requirements for controls used in air conditioning applications;*
6. *Describe and investigate the various methods of motor control and motor circuits;*
7. *Explain the operating principles of variable speed drives (Inverter) and the role they play in the HVAC industry;*
8. *Describe the role played by building management systems in the HVAC industry;*
9. *Describe electrical schematic and ladder diagrams and the role of controls in HVAC applications.*

ETHVA-406-1509: Ventilation and Air Conditioning Technology

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

Unit Description

This unit provides the student with the core knowledge and understanding of the different technologies used in ventilation systems and the components necessary to ensure systems operate as designed.

Students will be introduced to the working principles of ventilation systems including reasons for ventilation in buildings, air change requirements for buildings, types of ventilation systems, sources of heat recovery for ventilation systems, effects of wind on ventilation systems and the effects that disrupting ventilation systems could have on a building.

This unit will also describe ductwork systems and components used in ventilation system installation including different types of ductwork, types of ductwork material, ductwork fittings used within systems, the working principles of ductwork components used within systems, preferred location for ductwork components within ventilation systems, the working principles of heat transfer components, insulation requirements for ductwork, bracketing methods required for ductwork, types of fans used ventilation systems. The unit also provides the learner with core knowledge and understanding to be able to install ventilation systems.

The unit will also introduce students to the effects of ventilation equipment on comfort conditions within buildings, the implications of building uses on comfort condition requirements, the effects of changes in system performance on comfort conditions, how heat gains effect the comfort conditions within the building, how test equipment is used to establish comfort conditions, the calculation of air change rates within a room, the suitability of AC and Ventilation equipment for different spaces and the comfort conditions within different spaces.

Learning Outcomes

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

1. *Identify, describe and select ventilation and air conditioning requirements for buildings, recommend strategies, select design conditions and estimate cooling loads;*
2. *Describe the operational features and characteristics of ventilation and air conditioning, equipment, plant and materials and how these features contribute to their application and usage;*
3. *Design ventilation and simple single zone air conditioning installations for specific applications;*
4. *Size, select, specify, install and commission ventilation and air conditioning systems, ductwork, plant and equipment.*

ETELX-406-1501: Programmable Logic Controllers and BMS

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

Unit Description

This unit has been designed to enable learners to develop the skills and competencies required to work in the HVAC industry. In this unit the learners will be introduced to Semi-conductor materials and the science associated with the electronics industry. Learners will then examine electronic components used in small scale circuits to larger components used in power electronics. Learners will be equipped with the knowledge and skills that will enable them to design and build their own electronic circuits.

The unit will also focus on Logic, a fundamental requirement before working with programmable logic controllers. In studying logic learners will cover number bases from binary to hexadecimal. Furthermore, the learner will be introduced to logic gates, logic ladder diagrams and Boolean algebra.

Using the knowledge gained from the logic learning outcome the unit will now focus on transducer and sensors used within the industry. The learner will be introduced to the huge variety of transducers used to measure temperature to fluid flow amongst others. The learner will also be reacquainted with system feedback and analogue and digital systems. Lastly in this part the learner will be tasked with developing electrical and electronic circuits containing transducers.

Learners will now examine the role played by programmable logic controllers in industry. Programmable controller construction will be examined and the main parts will be studied more closely. Learners will be introduced to the working principles of programmable logic controllers and the differing programming techniques commonly used.

Finally, the learner will examine building management systems and the role they play within the HVAC industry. The learner will be shown the common layout of BMS systems and common controls, components and techniques used for building control. Lastly, the learner will be given the opportunity to have an in-depth look at BMS control circuits and ladder diagrams.

Learning Outcomes

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

1. *Demonstrate an understanding of electronic principles and semi-conductor materials;*
2. *Demonstrate an understanding of electronic components and power electronics;*
3. *Demonstrate an understanding of logic;*
4. *Demonstrate an understanding of process control and transducers;*
5. *Demonstrate a working knowledge of programmable logic controllers;*
6. *Demonstrate a working knowledge of HVAC controls and BMS.*

ETPRJ-412-1507: HVACR Synoptic Project

Unit Level (MQF/EQF): 4
Credits: 12
Delivery Mode: Fully Face-to-Face Learning
Total Learning Hours: 300

Unit Description

This project has been designed to give learners a platform to demonstrate the practical skills required in an HVACR environment and thus prove competence.

The learner will have to provide evidence, that will demonstrate the knowledge and understanding required as well as the practical skills needed that will satisfy the practical performance objectives for each of the relevant units.

The learner should compile a dossier of documentation that will be used as evidence to satisfy the practical performance objectives of the units listed below.

Evidence may come in the form of; projects, workshop log-books, site based reports etc. Example workshop/workplace tasks should be produced by the Institution that satisfy a selection of the practical performance criteria of the appropriate units.

Within this project practical and theoretical elements of the following units will be covered.

- Refrigeration technology and brazing;
- Domestic & industrial electrical installations, circuits, DBs and isolators;
- Refrigeration, classification and handling of refrigerants;
- Advanced knowledge and skills;
- HVAC electrical control and wiring systems;
- Latest HVAC technology;
- Programmable logic controllers and BMS;
- Science and measuring instrument;
- Schematics and installation coordinated drawings;
- Health and safety on construction sites.

Learning Outcomes

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

1. *Carry out practical work relating to refrigeration and brazing;*
2. *Carry out practical work relating to industrial and domestic electrical installations;*
3. *Carry out practical work relating to refrigeration, classification and handling of refrigerants;*
4. *Carry out practical work relating to advanced knowledge and skills;*
5. *Carry out practical work relating to HVAC electrical controls wiring;*
6. *Carry out practical work relating to the latest HVAC technology;*
7. *Carry out practical work relating to programmable logic controllers and BMS.*

ETHVA-406-1507: HVACR Commissioning, Alteration and Repair

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

Unit Description

Within this unit the student shall become familiar with the Knowledge, Theory and Skills regarding complex Refrigeration Systems. The unit consists of 3 learning outcomes.

The learner will have foundation level of knowledge of HVACR Science and Measurement, Handling Refrigerants and Refrigeration Technology before attempting to complete this Unit.

The design consists of an understanding of the working principals and layouts of complex refrigeration Systems including the operating principals of controls used on these systems. Supermarket systems including stand alone, multi-compressor, distributed system architecture along with display case designs and layouts are explained. Oil return and pipe work design and layout, oil return and oil management systems are also investigated.

The student will undertake heat load calculations for cold rooms. These calculations will include applications involving both product load and heat of respiration load. The heat loads will be evaluated in a number of ways such as using standard design methods, computer solutions and rule of thumb solutions/spreadsheets etc. The student will then construct P-h charts from the heat load data and calculate evaporator loads, compressor duties and condenser total heat rejection capacities. Using this information, the student will then consult manufacturer catalogue data/CD data to select compressor/condensing sets, evaporator and expansion devices to provide a working solution. Defrost arrangements, oil return allowance and capacity control will be evaluated and factored in to the design.

Low temperature compound and cascade systems are also investigated by the student along with plant and equipment. Reciprocating compressors, screw compressors, intercoolers and refrigeration problems are investigated and evaluated and the P-h chart is used to calculate cooling load, compressor power and system COP by the student.

Primary and Secondary refrigerants and systems are investigated by the student to provide reasons for their use and applications where this type of system may be preferred. The desirable properties of a secondary refrigerant fluid are evaluated along with the actual properties of fluids used within the industry. Plant design and layout are also evaluated by the student. Ice storage systems and ice slurry systems will also be investigated as alternatives to traditional systems.

Learning Outcomes

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

1. *Calculate and select refrigeration plant and equipment for a range of applications;*
2. *Describe the design, operation and application of components used in complex refrigeration systems;*
3. *Calculate and select refrigeration plant and equipment for a range of low temperature applications.*

ETHTG-406-1501: Heating Technology

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

Unit Description

The purpose of this unit is to provide the learner with the core knowledge and understanding of low and medium heating systems within industrial and commercial applications. Learners will be introduced to differing heating system types, pipework systems, component parts and heat emitters. They will also learn to demonstrate installation of heat emitters and associated components and fittings to industry standards.

They will provide an understanding and be able to demonstrate how to fill a heating system to the required specifications. Learners will identify and demonstrate commissioning and decommissioning procedures applied to heating systems. They will carry out soundness tests using the correct procedures and test mediums to the required industry standards.

The Learner will apply procedures to rectify operational mechanical faults within components of a heating system. The Learner will demonstrate an understanding of how various components relate to each other within the systems being installed. They should provide an understanding of heating design drawings and apply this knowledge to installation of system designs. Learners will be assessed in both theory knowledge and understanding along with practical application in workshop/work based environment.

In unison with the above information, all work will be undertaken in a safe and efficient manner compliant with industry standards and specifications.

Learning Outcomes

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

1. *Identify and understand the pipework and components of heating systems;*
2. *Identify and understand the operation of heat emitters for heating systems;*
3. *Identify and understand warm air systems used in heating systems;*
4. *Demonstrate the installation of heat emitters, heating installation pipework and components to required specifications.*

CDKSK-406-2001: English

Unit Level (MQF/EQF): 4
Credits: 6
Delivery Mode: Fully 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 learner 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: Fully 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: Fully 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.*

CDKSK-406-2007: Mathematics

Unit Level (MQF/EQF): 4
Credits: 6
Delivery Mode: Fully 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, game theory 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 creative thinking skills and demonstrate evaluation skills to solve problems in a relevant (game theory) context.*