MCAST

MQF Level 4

ME4-A5-21

Advanced Diploma in Operations and Maintenance

Course Specification

Course Description

If the student wishes to start a fulfilling career as a technician in the area of operations and maintenance engineering, then this programme provides the necessary knowledge, understanding and skills for the future. The student will have the opportunity to learn basic scientific and mathematical methods to apply in subjects such as thermodynamics and heat engines.

The student will be exposed to the different materials used in common engineering situations and their properties. This qualification not only provides access to more specialist units but it also broadens and deepens the learners' experience in preparation for the real world at work.

Programme Learning Outcomes

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

1. Describe and identify health and environmental risks related to certain processes and what measures are adopted to control these risks

2. Communicate and interpret drawings and manuals in the technical fields concerned

3. Monitor and diagnose faults in engineering systems

4. Analyse mathematically engineering situations to provide scientific solutions.

Entry Requirements

- MCAST Diploma in Mechanical Engineering or
- MCAST Diploma in Engineering (Electronics) or
- MCAST Diploma in Aircraft Maintenance or
- 4 SEC O-levels/SSC&P (Level 3) passes
  Compulsory: One Subject from Mathematics or Physics
  and
  One subject from Engineering Technology, Design and Technology, Chemistry, Mathematics, Physics.

Current Approved Programme Structure

Unit Code	Unit Title	ECVET	Year
ETMEC-406-1510	Pneumatics and Hydraulics	6	2
ETMTS-406-1502	Strength of Materials	6	1
ETMEC-406-1515	Mechanical Principles and Applications	6	1
ETMEC-406-1516	Mechanical Measurement and Inspection Techniques	6	1
ETCDN-406-1501	Computer Aided Design	6	1
ETMEC-406-1511	Thermofluids	6	3
ETMEC-406-1505	Industrial Process Controllers	6	3
ETMTH-406-1617	Mathematics for Engineering	6	2
ETMEC-406-1507	Further Mechanical Principles and Applications	6	3
ETELE-406-1514	Electrical Technology	6	2
ETMEC-406-1517	Application of Mechanical Systems	6	2
ETENG-406-1512	Installing and Commissioning Engineering Equipment	6	3
ETMEC-406-1518	Monitoring and Fault Diagnosis Engineering Systems	6	3
ETMTS-406-1503	Materials Selection	6	1
ETPRJ-406-1513	Engineering Project Design and Implementation	6	3
ETMEC-406-1509	Workshop Practice	6	1
CDKSK-406-2007	Mathematics	6	1
CDKSK-406-2001	English	6	2
CDKSK-404-1915	Employability and Entrepreneurial Skills	4	2
CDKSK-402-2104	Community Social Responsibility	2	2
ETCMP-406-1621	Apprenticeship Unit : Vocational Competences in Operations & Maintenance	6	2
Total ECVET		120	

Unit: ETMEC-406-1510 Pneumatics and Hydraulics

Unit level (MQF): **4**
Credits: **6**

Unit Description

Our lives would be very different today, if early civilisations had not recognised the potential of using air and water to do the work. From the first waterwheels to the sophisticated applications we see today, fluid power has enabled us to do what was considered impossible in many instances. Now with computer interfaces, new materials and imaginative technologies, many things related to pneumatics and hydraulics can be achieved.

This unit is designed to allow the students to gain a Knowledge and Understanding of Pneumatics and Hydraulic Fluid power systems.

Students will also have the opportunity to design a fluid power system and develop an understanding of the Construction, Function and the Components of Fluid power systems.

This unit will complement the capabilities of the future marine engineer, in developing an overall competency in all associated marine engineering areas of work.

Any practical work undertaken, should be carried out in a manner that complies with all necessary health and safety requirements

Learning Outcomes

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

1. *Identify the main components of Pneumatic and Hydraulic and the function and operation of pneumatics and hydraulic components, equipment and plant.*
2. *Design, Construct and test a pneumatic or hydraulic circuit.*
3. *Demonstrate fault finding competence on a fluid power system.*

Unit: ETMTS-406-1502-Strength of Materials

Unit level (MQF): **4**
Credits: **6**

Unit Description

The unit provides necessary underpinning knowledge about the behaviour of materials under the influence of various form of loading to enable learners to apply this knowledge in the design of various engineering components and structural members as well as to decide about their use in engineering applications.

Learners will be able to develop clear scientific concepts about the properties of engineering materials. Emphasis will be on forces and their effects and the relationship between applied stress and the resultant strain. The learners will gain sound knowledge of strength-related properties of materials commonly used in engineering applications. They would be able to apply this knowledge in quantifying the relationship between applied loads and resulting changes in materials or what is termed as stress-strain relationship.

Learners will also develop an understanding of various types of loads, their configuration and position/location and their effects. Learners will be able to analyse the given conditions for a simply supported beams to calculate support reactions. Learners will appreciate the effects of slenderness and effective length on the strength characteristics of a column and be able to calculate the maximum stress a column could take. Learners will be able to illustrate stress distribution across simple beam and column sections.

The unit also focuses on mechanism by which materials degrade and fail. Variety of failure and degradation mechanism are included. Learners will carry out a destructive and a non-destructive test to evaluate strength parameters.

Learning Outcomes

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

1. *Determine properties of engineering materials.*
2. *Determine the behavioural characteristics of loaded beams and columns.*
3. *Investigate failure and degradation mechanism of engineering materials.*

Unit: ETMEC-406-1515-Mechanical Principles and Applications

Unit level (MQF): 4
Credits: 6

Unit Description

This is a theory based unit and will allow learners to demonstrate that they have the necessary underpinning knowledge and skills to be able to apply mechanical principles to solve a variety of mechanical engineering problems. It will enable the learner to determine the effects of loading in static engineering systems, as well as the transfer of work, power and energy in dynamic engineering systems. Learners will go on to determine the parameters of fluid systems and the effects of energy transfer in thermodynamic systems.

The Unit is relevant to learners wishing to further develop their knowledge of mechanical principles to determine solutions to common engineering problems. On completion of the Unit learners will understand how to determine the loading effect in static engineering systems using the graphical representation of non-concurrent coplanar force systems in simply supported beams as well as determining the effects on the loaded components.

Learners will apply the relevant formulae using the appropriate kinetic parameters and subsequent kinetic principles and dynamic parameters and subsequent dynamic principles in order to determine transfer of work, energy and power in dynamic engineering systems.

Learners will also determine the thrust on a submerged surface and on immersed bodies as well as the flow characteristics of a gradually tapering pipe in fluid systems.
Learners will understand the effects of heat transfer and use and apply the thermodynamic process equations involved in thermodynamic systems.

Learning Outcomes

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

1. *Determine the effects of loading in static engineering systems.*
2. *Determine work, power and energy transfer in dynamic engineering systems.*
3. *Determine the parameters of fluid systems.*
4. *Determine the effects of energy transfer in thermodynamic systems.*

Unit: ETMEC-406-1516-Mechanical Measurement and Inspection Techniques

Unit level (MQF): 4
Credits: 6

Unit Description

This unit combines both theory and practical elements and should be used to allow learners to apply concepts and content from other units such as mathematics and workshop practice. The ability for engineers to accurately measure processes, product and components is essential for any Engineering business to remain competitive.

As technology and engineering processes have evolved, customer expectations for reliable, consistent products have increased. To meet this demand Engineers have developed measurement and analysis techniques to ensure that product and process variation is within limits. Learners will understand the basis of measurement, tolerances, limits and fits. Learners will also consider the use of gauging techniques, some of which can be applied to production technologies.

Finally learners will be able to use statistical techniques to analyse data, measurement and processes to identify whether manufacturing processes are suitable for their intended use.

Successful completion of this unit will enable learners to understand, utilise and apply appropriate technology in the pursuit of engineering excellence in the workplace. Learners will understand the various types of equipment which can be employed to conduct measurements. Learners will be introduced to, understand and be able to apply key terms such as limits and fits, tolerances and statistical process control. Learners will be able to apply their knowledge to a range of engineering products and processes, becoming confident in the practical applications of these techniques.

Learning Outcomes

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

1. *Explain the purpose, terminology and local and national standards for mechanical measurement and test.*
2. *Select and use of appropriate measurement techniques.*
3. *Select and apply appropriate gauging techniques.*
4. *Collect inspection and process data, applying appropriate statistical techniques.*

Unit: ETCDN-406-1501-Computer Aided Design

Unit level (MQF): 4
Credits: 6

Unit Description

Computer-Aided Design (CAD) technology has nowadays become part and parcel of product development. Although ideas start on paper, at one point during the product development process, they have to be translated into three-dimensional (3D) virtual models, using CAD. There are various reasons for going in this route, in particular the rapidity of obtaining two-dimensional (2D) accurate detailed drawings directly from CAD 3D models. Other benefits are related to the possibility of sharing CAD models with other computer-aided engineering applications (e.g. simulation of plastic melt flow behaviour in an injection mould for a product component modelled in CAD).

This is a learning-by-doing type of unit and it will provide learners with the opportunity to apply the skills they have learnt to produce a wide range of drawing layouts, accurate detailed drawings, 3D virtual and physical models. The advantages of using CAD technology in modern product development will be explained at the outset of this unit. Learners will acquire knowledge on the software and hardware requirements needed to run and use effectively a CADD package. One of the most widely used CAD software used for engineering applications is *Autodesk® Inventor®*. Although this software will be employed in this unit, by the end of this study unit, learners will be able to acquire knowledge on the underlying principle of and the basic skills to apply 2D and 3D modelling functions found across different CAD software packages (e.g. *SolidWorks*).

Exemplars of such skills include the ability to use CAD to create and edit 2D constrained geometric entities as basis for 3D modelling, and the ability to use CAD to generate 3D virtual models of single components or an assembly of components. In addition, learners will be able to independently select the appropriate CAD functions for the task at hand. Furthermore learners will be equipped with the necessary skills to independently generate different types of accurate drawings with all required dimensions and other basic information deemed useful for the realisation of a product during the manufacturing phase. Last but not least, learners will gain knowledge on how to obtain a 3D physical prototype models on a 3D printer directly from the corresponding 3D virtual model.

Learning Outcomes

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

1. *Describe the advantages of using CAD in product development and the basic hardware and software requirements to install and use a CAD software package.*
2. *Use CAD to create and edit 2D geometric entities as basis for 3D virtual modelling.*
3. *Use CAD to generate 3D virtual models of single components or an assembly of components.*
4. *Use CAD to generate different types of drawings and produce physical prototypes directly from 3D virtual models.*

Unit: ETMEC-406-1511 Thermofluids

Unit level (MQF): 4
Credits: 6

Unit Description

Note: This document adheres to the language, format, and content contained in the STCW Code and in the SQA Engineering Framework.

STCW Code Requirements

Excerpts from Standards of Training, Certification and Watch keeping Manual, published by the International Maritime Organisation)
References: Table A-III/1 "Marine engineering at operational level",(page 144,145: STCW including 2010 Manila Amendments- STCW Convention and STCW Code- 2011 Edition

Competence:
Operate main and auxiliary machinery and associated control systems.

Knowledge, understanding and proficiency:

- Basic construction and operating principles of machinery systems.
- Preparation, operation, fault detection and necessary measures to prevent damage to machinery items.

Criteria for evaluating competence

- Construction and operating mechanisms can be understood and explained with drawings/instructions .
- Deviations from the norms as stated in operating manuals are promptly identified.
- The output of plant and engineering systems consistently meets requirements.

Thermo fluids knowledge is essential to understand the operating principles of marine machinery. The energy for conventional ship propulsion and electrical power generation is derived from the use of engines and turbines. These machines convert the chemical energy released by fuel combustion into mechanical energy. The efficiency of energy conversion is based on certain thermodynamic principles.

This unit discusses the laws applicable to gases and vapours during the processes of expansion and compression in engines, turbines and compressors. A sound

understanding of thermo fluids will enable the learner to design and operate the above machinery at optimum efficiency.

The unit progresses to the theory and practice of steam power plant operation which is of importance to the engineer as many plants are steam driven. The properties of steam and the energy transfer in the various components of a power plant are dealt with.

Many engineering applications such as hydraulic jets, combustion chambers, mixing tanks, centrifugal pumps etc. involve controlled flow of the working fluid, be it liquid or gas. Continuity and momentum principles governing flow through pipes and vanes are therefore discussed.

This unit also covers the behaviour of hydrostatic pressure and buoyancy. The knowledge of hydrostatic pressure helps the engineer to understand the need to maintain the integrity and sheet-metal thickness on tank bottoms, valve bodies and other equipment under pressure.
It would be an advantage if candidates had a knowledge and understanding of physics, mathematics and marine engineering systems to the desired level.

Learning Outcomes

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

1. *Develop the knowledge required to apply thermodynamic principles to hydrostatics, hydrodynamics and heat engines.*
2. *Understand how these principles are relevant in a Marine engineering environment.*
3. *Comply with the requirements stated in STCW code above.*

The Unit will also provide the candidates with a base from which future advance work in marine engineering may be undertaken.
Knowledge of the subject of thermofluids will enable the learner to:

a) Understand and evaluate the parameters that explain the characteristics of thermodynamic systems.
b) Understand and evaluate the properties of steam with respect to efficient power plant operation.
c) Evaluate the thermodynamic performance of boilers, condensers and other power plant components
d)Understand effect of hydrostatic pressure on submerged and floating bodies

Outcome 1
Apply the Gas Laws to closed and open (non-flow and flow) systems and evaluate the work done.
Outcome 2

i) Determine steam conditions from the use of steam tables and solve related problems

ii) Study energy transfer principles for steam power plant components

Outcome 3

i) Explain the effects of hydrostatic pressure and solve problems related to hydrostatic pressure

ii) Apply energy, continuity and momentum principles to steady flow processes

Unit: ETMEC-406-1505-Industrial Process Controllers

Unit level (MQF): **4**
Credits: **6**

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 three-term controllers and to programming PLCs. The application of three-term controllers and PLCs as industrial process controllers will enable students to gain an understanding of how they are used in industry to control a number of processes such as chemical mixing in a bottling plant.

This unit is relevant to learners who wish to have in depth knowledge of industrial process controllers such as three-term controllers and PLCs and their applications in the industrial world.

On completion of the Unit learners will know about various types of control systems and their utilisation 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 familiarise themselves with various types of programmable logic controllers that are being utilised in the industrial world. Learners will gain a broad understanding regarding the operational characteristics of programmable logic controllers.

Learners will be able to write the PLC programs in ladder logic and identify the errors in the programs that affect the execution of the programs. Learners will also have the capabilities to apply error correction methods to overcome the errors successfully.

Learning Outcomes

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

1. *Describe the control system, types of control system and their utilisation in the industrial world.*
2. *Explain the operational characteristics of three term controllers and briefly describe various types of tuning methods in order to tune the three term controllers to have stable transient response of the system.*
3. *Discuss the various types of programmable logic controllers and describe the operational characteristics of PLC.*
4. *Write the PLC programs, identify the errors in the PLC programs and briefly explain various methods to overcome those errors.*

Unit: ETMTH-406-1617 Mathematics for Engineering

Unit level (MQF): 4
Credits: 6

Unit Description

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

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

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

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

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

Learning Outcomes

On completion of this unit the learner will be able to

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

Unit: ETMEC-406-1507-Further Mechanical Principles and Applications

Unit level (MQF): **4**
Credits: **6**

Unit Description

All machines and mechanisms consist of interconnected parts working together to produce a desired output. Engineers involved in the design, testing and servicing of mechanical systems need to have a firm grasp of the underpinning principles in order to appreciate the choice of components, the forces acting on them and the way that they relate to each other.

This unit is about mechanical principles and their application in solving engineering problems and in detail the mechanical principles that underpin the design of framed structures, simply supported beams and structural components. The aim is to evaluate the integrity and safety of engineering structures and to lay the foundation for structural analysis at a higher level.

Rest of the unit deals with kinematics and dynamics and the associated mechanical principles and their application.

Learning Outcomes

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

1. *Identify the forces acting in pin-jointed framed structures and simply supported beams.*
2. *Identify the stresses in structural members and joints.*
3. *Determine the characteristics of rotating systems.*
4. *Determine the operating characteristics of simple lifting machines.*

Unit: ETELE-406-1514-Electrical Technology

Unit level (MQF): **4**
Credits: **6**

Unit Description

This is a theory based unit to allow learners to demonstrate they have the necessary underpinning knowledge and understanding of how to apply electrical technology to a variety of engineering systems. It will enable learners to link between science and its application, as the underlying technology depends upon a range of concepts such as energy efficiency, materials science issues, design features and environmental concerns. The learner will be exposed to the methods by which electrical energy is produced, the electrical and magnetic properties of materials and their applications, the supply, transmission and distribution of electricity along with its associated equipment, and the use and applications of electrical energy in electrical technology.

The Unit is relevant to learners wishing to gain a fundamental knowledge of electrical energy and its use in various technologies such as transport, manufacturing, healthcare and entertainment.

On completion of the unit learners will understand the ways in which electricity is produced and the environmental effects, the distribution of electricity and its utilisation by the end-user, whether for domestic or industrial use, the electro-magnetic/static properties of materials and their relevant applications, and finally the role of electrical energy to support the electrical technology applications.

Learners will become familiar with the electromagnetic generation of electrical energy and the characteristics and principles of alternating and direct current as well as the featuring a number of types of electric power stations and their various sources of energy.

Learners will gain an understanding of solar panels and how electrical energy can be generated from photoelectric cells as well as the storage of electrical energy in electro-chemical cells such as batteries, both primary and secondary, along with their construction, application and correct means of disposal.

Learners will know about the generation, transmission and distribution of electricity as well as its use in electrical technology.

Learning Outcomes

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

1. *Explain and understand the production methods of electrical energy.*
2. *Demonstrate an understanding of inherent electrical and magnetic properties of insulators, conductors and other magnetised material.*
3. *Apply the physical arrangements of electrical supply, transmission, distribution system's and equipment.*
4. *Explain and understand how electrical energy is used to support electrical technology applications.*

Unit: ETMEC-406-1517-Application of Mechanical Systems

Unit level (MQF): **4**
Credits: **6**

Unit Description

This is a skills/theory based unit and will allow learners to demonstrate they have the necessary skills to be able to use mechanical systems competently by developing a deeper understanding of the design and use of a variety of mechanical systems. Students will examine differences in practical mechanical examples from the workplace and produce a file of mechanical systems that are found at work, power generation, and manufacturing plant.
The design, manufacture and maintenance of such systems is reliant upon engineers who should apply practical and theoretical knowledge for the safe and efficient operation of these systems.

Mechanical parts rely on some form of lubrication and students will study lubricant types and lubrication systems for learning outcome 1.
Pressurised systems rely on seals and gaskets to contain the lubricating agents. Rotating and sliding parts that require bearings and mechanical systems have fastening technology to secure the components in place. A range of bearings, fastening systems and seals are described in the second learning outcome.

A primary use of mechanical systems is to be used for motion and power transmitting. This is achieved in many alternate methods and students will look at many types of powered transmission schemes and there components learning outcome 3.

In the fourth learning outcome students are shown examples of plant equipment and systems. This also involves the study of pneumatic and hydraulic type systems, steam plant, air conditioning and refrigeration plant and mechanical handling devices and equipment.

This unit aim is for students to have sufficient underpinning knowledge and an understanding to enhance the student's overall practical skills of mechanical engineering and its systems, therefore provide a foundation to further study in other related engineering units.

Learning Outcomes

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

1. *Define the reasons and methods of application for lubricants and lubrication systems.*
2. *Describe the engineering uses of the many types of engineering components*
3. *Define how mechanical power transmission systems function.*
4. *Describe how plant equipment and systems operate.*

Unit: ETENG-406-1518-Installing and Commissioning Engineering Equipment

Unit level (MQF): 4
Credits: 6

Unit Description

This unit identifies the basic principles, commonly used processes and elements that are essential to most maintenance, installation and commissioning activities. It takes into account the fact that some industries and organisations employ engineering staff who perform both of these activities, whereas others, particularly specialist contractors for installation and commissioning, may only cover a limited range. The content of this unit can be applicable to both situations as it is considered essential for all candidates to have a wide range of engineering knowledge and experience.

It covers basic maintenance, installation and commissioning requirements including the processes and organisations dealing with them. It also includes components, tools and equipment that are commonly associated with the installation and commissioning of plant and machinery and the ways in which they are used and applied.

The learner is expected to achieve a level of understanding of all maintenance, installation and commissioning strategies that will enable progression to higher level courses, and enable them to become familiar with the events terminology and practices that they will need as part of their normal work.

Finally, learners will be made aware that, as an installation or commissioning engineer, before leaving new equipment with an owner, a suitable handover must take place ensuring that owners are ready to be left with new equipment. The end of this unit will take learners through this process to ensure that they are knowledgeable and fully aware of this handover process.

Learning Outcomes

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

1. *Demonstrate the installation and commission of different mechanical equipment.*
2. *Demonstrate the installation and commission of different electrical and electronic equipment.*
3. *Show ability to install and commission different types of equipment commonly used on an engineered system.*
4. *Describe the handover process of new equipment.*

Unit: ETMEC-406-1518-Monitoring and Fault Diagnosis of Engineering Systems

Unit level (MQF): 4
Credits: 6

Unit Description

Condition monitoring and diagnosing faults are both used to ascertain whether possible failure mechanisms exist in engineering systems. The methods used by engineers encompass automated monitoring systems all the way down to the use of human senses; touch, smell, sight, and hearing. This unit gives students an awareness of the basic principles of monitoring engineering systems and fault diagnosis and introduces students to the practice of condition monitoring.

This unit looks at monitoring engineering systems and diagnosing faults and examines how recent technological and environmental issues have had an impact on the maintenance of today's engineering world. The unit will give students an awareness of how and what is needed to protect them and their colleagues while working and concentrates on the measures of safety required when completing monitoring activities, especially activities for isolation of machinery and services.

Students will become familiar with the use of a wide range of tools used for monitoring activities and will gain the knowledge and skills needed for sourcing and identifying engineering system faults. Students must select the correct monitoring technique and equipment based on the conditions that they are set.

Students will set up the correct equipment to monitor and use it to diagnose condition monitoring on engineering systems. Students will utilise a range of methods and techniques to diagnose faults, and use a range of diagnostic apparatus and tooling. Following successful diagnosis students can then identify the fault and examine the likely cause.

Learning Outcomes

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

1. *Identify relevant requirements under health and safety regulations used in monitoring and fault diagnosis of engineering systems.*
2. *Explain the importance of regularly monitoring systems and their reliability.*
3. *Gain experience using monitoring and test equipment.*
4. *Complete fault diagnosis on engineering systems.*

Unit: ETMTS-406-1503-Materials Selection

Unit level (MQF): 4
Credits: 6

Unit Description

Note: This document adheres to the language, format, and content contained in the STCW Code and in the SQA Engineering Framework.

STCW Code Requirements

Excerpts from Standards of Training, Certification and Watch keeping manual, published by International Maritime Organization)
References: Table A-III/1 "Marine engineering at operational level", (page 144,145: STCW including 2010 Manila Amendments- STCW Convention and STCW Code- 2011 Edition

Competence:

Operate main and auxiliary machinery and associated control systems.
Knowledge, understanding and proficiency:

- Basic construction and operating principles of machinery systems.
- Preparation, operation, fault detection and necessary measures to prevent damage to machinery items.

Criteria for evaluating competence:

- Construction and operating mechanisms can be understood and explained with drawings/instructions .
- Deviations from the norms as stated in operating manuals are promptly identified.
- The output of plant and engineering systems consistently meets requirements.

Designing and producing an engineering component involves several activities: selection of material, specifying dimensions, color and surface finish, choosing a manufacturing process to achieve prescribed accuracy, and meeting special customer requirements.

Engineering raw material --- ores and minerals --- are finite resources and are being consumed at ever-increasing rates. It is the engineer's responsibility to select the most appropriate materials and use them efficiently in minimum quantities and with minimum impact on the environment during extraction, refining and production.

Selection of the right material at the appropriate price is important as it leads to lower manufacturing cost, reduced in-service failures, safety while handing etc., all resulting in lower product cost and customer acceptability. Furthermore, there are other

considerations such as aesthetics, recycle-ability etc. which influence selection. To satisfy all the above parameters, engineers have to deal with and understand the use of a large number of materials.

It is expected that, from this Unit, the learner will understand the need for mechanical components to be designed, manufactured and maintained in a safe and efficient manner. It would be an advantage if candidates had the core skills of critical thinking, reviewing and evaluation, as well as an understanding of physics and chemistry to the desired level.

Learning Outcomes

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

1. *Have an understanding of material properties and testing.*
2. *Apply material science concepts to assess suitability for a range of components.*
3. *Investigate materials and components with the aim of establishing their basic properties.*

Unit: ETPRJ-406-1513-Engineering Project Design and Implementation

Unit level (MQF): 4
Credits: 6

Unit Description

The aim of this unit is to enable students to develop an engineering project through design and implementation while on an internship.

Activities in a workplace if planned and managed correctly could contribute significantly towards developing skills in problem solving, communication and managing engineering projects. Students will be supported by mentors and supervisors during their course of studies throughout the whole project life cycle. The institute administration will help in identifying a suitable project or engineering problem substantial enough to generate the assessment evidence for this unit as well as to ensure that it is relevant to students' chosen area of interest.

Students will work on solving the given engineering problem in a structured manner following the recognised procedures in building up a project portfolio. Students will have tutorial support throughout this unit to facilitate and to ensure that any issues arising are addressed early.

Students will present their final project solution along with an evaluation of the outcome.

It is expected that this unit will be delivered later on in the programme when the students have already gained adequate underpinning knowledge and skills required to solve engineering problems requiring students to draw upon learning in other units.

Learning Outcomes

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

1. *Negotiate a suitable project.*
2. *Produce and implement a project plan.*
3. *Evaluate the proposed solutions.*
4. *Present the project outcomes.*

Unit: ETMEC-406-1509-Workshop Practice

Unit level (MQF): **4**
Credits: **6**

Unit Description

This 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. Learners will use the lathe, milling machine and drilling machine to produce component outputs and check their output against a set of British Standard machine tolerances, and as a consequence learners will be able to operate effectively at more than a basic level of competence after completing this Unit.

The Unit is relevant to learners wishing to further develop their knowledge of component manufacture as a tool to help provide solutions to common design and manufacture problems. On completion of the Unit learners will understand how to produce component parts that may be technically complex in content, as well as developing the understanding, knowledge and skills required to plan and inspect them. This Unit will provide the Learner with the ability to safely use a variety of manufacturing and assembly tools, and plan, inspect and interpret data and information using logical, statistical thinking. The learner will also be able to use available information to gain significant safety awareness.

Learners will carry out planning and observation tasks to prepare the machinery for production or sharing with other users. This will therefore require learners to be confident in carrying out more advanced setting, tooling and finishing.

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 the learner will be able to:

1. *Plan a production schedule to maximise efficiency and minimise waste of materials and time.*
2. *Use a range of machine functions to interpret and validate data and manufacture component parts.*
3. *Demonstrate the safety implications surrounding the use of workshop tools and equipment.*
4. *Explain the importance and relevance of the use of personal protective equipment.*