MQF Level 4

ME4-A8-21

Advanced Diploma in Manufacturing

Course Specification

Course Description

If a learner would like to start an interesting career as a technician in today's highly technological area of manufacturing engineering, then this programme provides the necessary knowledge, understanding and skills.

This qualification provides access to more specialist units and therefore broadens and deepens the experience in preparation for actual work situations.

The learner will learn how to perform basic engineering operations in a safe and efficient manner, whilst safeguarding the environment. The learner will understand basic scientific and mathematical theories and how to apply these to manufacturing engineering processes such as draughting, design, problem solving, and machining.

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 as well as the measures that are adopted to control them.

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

3. Choose appropriate tools and manufacturing processes for the implementation of work projects

4. Apply mathematical and scientific principles to solve engineering related problems.

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/ECTS	Year
ETMTS-406-1502	Strength of Materials	6	2
ETMEC-406-1515	Mechanical Principles and Applications	6	1
ETMEC-406-1503	Metrology	6	1
ETCDN-406-1501	Computer Aided Design	6	1
ETMEC-406-1504	Application of Computer Numerical Control in Engineering	6	2
ETMEC-406-1505	Industrial Process Controllers	6	3
ETMTH-406-1617	Mathematics for Mechanical and Construction Engineering	6	2
ETMEC-406-1506	Engineering Forming Processes	6	1
ETMEC-406-1507	Further Mechanical Principles and Applications	6	3
ETELE-406-1514	Electrical Technology	6	2
ETPMR-406-1501	Polymer and Rubber Science	6	3
ETPMR-406-1502	Processing of Plastics and Rubbers	6	3
ETMEC-406-1508	Mould Making and Maintenance	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-406-1616	Apprenticeship Unit : Vocational Competences in Manufacturing	6	2
Total ECVET/ECTS		**120**	

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 is 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.*

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.*

ETMEC-406-1503 Metrology

Unit level (MQF): 4
Credits: 6

Unit Description

This study unit will provide learners with both theoretical knowledge and practical skills in metrology. This unit will first provide learners with a basic knowledge related to metrology which includes the importance and need of measurements, nomenclature in metrology, geometric dimensioning and tolerancing as well as basic statistics and sampling. Learners will be exposed to a number of linear measurement methods such as different type of Vernier, micrometers and gauges. Different methods and instruments used to measure angle namely the level, angle gauge block, protractor, sine bar or plate and autocollimator will also be delivered in this unit.

In addition, other measurements such as straightness, flatness, roundness, gear and surface measurement will also be introduced to learners. At the end of this unit, learners shall also be knowledgeable about advanced measurement methods which are coordinate measuring machine (CMM) and optical measurement methods such as optical comparator and engineering microscope.

On completion of the unit, learners should be able to explain and use properly different measurement methods or instruments as well as interpret and analyse statistically the measurement results.

The study unit is suitable for learners wishing to gain and/or enhance their knowledge and practical skills in metrology to start their career in any manufacturing industry.

Learning Outcomes

On completion of this unit the learner will be able to

1. *Describe the fundamental knowledge of metrology.*
2. *Use linear measurement instruments.*
3. *Use angle and surface measurement instruments.*
4. *Explain miscellaneous and advanced measurements.*

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.*

ETMEC-406-1504 Application of Computer Numerical Control in Engineering

Unit level (MQF): 4
Credits: 6

Unit Description

Due to global competition there is increasing pressure to design and manufacture products of high quality and competitive prices and to deliver them to market in a short period of time. In addition, customers are expecting more and more functions from a product, making it increasingly complex. In such a manufacturing context, Numerical Control (NC) has found itself as a commonplace technology to directly control the movements of machine components (e.g. worktable) via alphanumeric instructions in the form of a part-program. Computer Numerical Control (CNC) is the use of computer technology to numerically control a machine. Learners should be able to understand the underlying principles associated with CNC. Furthermore, learners will gain knowledge on how CNC is applied across a wide range of manufacturing processes (e.g. milling, spark erosion, water-jet cutting) which are utilised in the local manufacturing industry.

The focus of this unit will be placed on a specific manufacturing process, namely vertical milling. In addition, learners will gain knowledge on the basic principles associated with machining (e.g. datum setting, spindle speeds and feed rates) and process planning such as the type and sequence of machining operations. By end of this unit, learners should be able to manually generate the CNC part-program to fabricate simple geometric forms using vertical milling. In this respect, CNC codes (e.g. G-codes for preparatory functions and M-codes for miscellaneous functions) will be covered. Practical examples of CNC part-programs will be provided. Given its relevance to the local manufacturing industry, the use of *computer-aided* part-programming will be also covered. The advantages that CAPP offers, compared to manually-generated CNC part-programming, will be highlighted. A commercial Computer-Aided Manufacturing (CAM) software package such as *MasterCAM*® shall be used in this unit, so that learners get familiar with the steps one needs to take to generate a CNC part-program via CAM.

This is a learning-by-doing type of unit and it will provide learners with the opportunity to apply the knowledge they have learnt to fabricate case-study components using a CNC vertical milling machine.

Learning Outcomes

On completion of this unit the learner will be able to

1. *Describe the underlying principles of CNC and its wide range of applications in engineering.*
2. *Describe the basic principles associated with machining and process planning.*
3. *Generate the CNC part-program required to fabricate a component from the specifications provided in a drawing.*
4. *Generate computer-aided CNC part-program using CAM software.*

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 learners 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.*

ETMTH-406-1617 Mathematics for Mechanical and Construction 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-406-1506-Engineering Forming Processes

Unit level (MQF): 4
Credits: 6

Unit description

The main content of this unit is predominately theory based, however depending on Centre resources and industrial links opportunities exist to conduct some practical activities and industrial visits. Centres should be encouraged to do this where possible.

Initially learners should focus on the development of forming processes and understand the development of these processes from simple blacksmith operations to sophisticated processes involving powered metallurgy, net shape manufacturing and composite materials. Depending on the centre approach to teaching is it's possible that learners will have some underpinning knowledge relating to materials technology.

Materials knowledge will be developed through this unit as learners consider the physical properties of materials and the impact that material properties can have on the ability to successfully manufacture products.

Process design and understanding of the parameters for each process is essential and learners will be able to identify advantages, disadvantages and limitations of each process.

Upon completion of the unit learners should understand the different types of materials and their applications within each process. Learners will also learn about the changes which take place within the materials. Successful completion of this unit will allow learners to be able to select suitable primary forming process for a variety of products and applications. Learners will understand about volume, manufacturability and the parameters of each process.

As with all engineering processes it is essential that learners continue to develop their knowledge of safe working practices, health and safety and the risks associated with engineering products and processes. The final learning outcome of this unit will allow learners to develop this knowledge.

Learning Outcomes

On completion of this unit the learner will be able to

1. Demonstrate the processes, techniques and materials commonly used to manufacture products using deformation processes
2. Demonstrate the processes, techniques, and materials commonly used to manufacture products using moulding processes

3. Demonstrate the processes, techniques and materials commonly used to manufacture products using composite materials
4. Identify the potential risks in carrying out primary forming processes and identify where appropriate legislation needs to be applied

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 student 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: ETPMR-406-1501-Polymer and Rubber Science

Unit level (MQF): 4
Credits : 6

Unit description

This study unit will enable learners to gain a basic knowledge of polymer and rubber materials as well as their classification by structure and performance which also includes common properties of each classification group. In addition, this study unit will provide learners with knowledge of polymer and rubber properties both in solid and melting state as well as modification of their properties.

On completion of the unit, learners should be able to explain polymer terminology, general properties and applications, material sources, structure and synthesis, all groups of polymers such as amorphous and semicrystalline thermoplastics, thermosets and elastomers including their respective structure and properties, and how to modify the properties by means of additive and manipulation of their structure during processing. Learners will also be able to choose material from correct polymer groups by a given design or product specifications and select correct additives to modify particular polymer properties as well as to identify and solve problems during polymer application and processing.

The study unit is suitable for learners wishing to gain and/or enhance their knowledge of polymer and rubber material science to start or develop their career in polymer and rubber manufacturing industry for example as a machine operator, designer or quality control officer.

Learning Outcomes

On completion of this unit the learner will be able to

1. Explain basic knowledge of polymer and rubber materials
2. Describe polymer classifications and their common properties
3. Describe polymer properties in solid and melting state
4. Explain how to modify polymer properties

Unit: ETPMR-406-1501-Processing of Plastics and Rubbers

Unit level (MQF): 4
Credits: 6

Unit description

This study unit will enable learners to gain a basic knowledge of plastic and rubber processing. The processing of plastic materials will be divided in two parts namely processing of plastic materials with and without fibre reinforcement. This study unit introduces learners to plastic and rubber materials and leads them to plastic and rubber processing.

On completion of the unit, learners will be able to explain plastic and rubber terminology, classification of plastic materials according to their structure and processing-related properties of plastic and rubber materials. Learners will also gain knowledge on a number of processing techniques for plastic and rubber materials such as extrusion, thermoforming, blow moulding, rotational moulding and injection moulding. The following topics will be discussed for most of the processing techniques: typical materials to be processed, typical products, processing principles, processing machinery including the peripheral equipment and important machine components, setting processing parameters and problem solving. In addition, learners will also gain knowledge on fibre reinforced plastics (composites) and their specialised processing techniques.

The study unit is suitable for learners wishing to gain and/or enhance their knowledge of plastic and rubber processing to start or develop their career in the plastic, rubber and composites manufacturing industry e.g. as machine operator, designer or quality control officer.

Learning Outcomes

On completion of this unit the learner will be able to

1. Describe processing-related properties of plastics and rubbers
2. Discuss basic knowledge of plastic processing techniques
3. Discuss basic knowledge of rubber processing techniques
4. Discuss basic knowledge of processing of fibre reinforced plastics

Unit: ETMEC-406-1508-Mould Making and Maintenance

Unit level (MQF): 4
Credits: 6

Unit description

Many of the products that we use in everyday life have a polymer part; this can range from a rubber button to a plastic housing in a TV remote control. Moulding has proved to be as one of the most effective manufacturing process for medium to large production volumes. Moulding is used to shape objects from different materials, such as metal, ceramics and polymers. Given the local manufacturing context, this unit focuses on polymer moulding processes. Polymer Moulding has a number of variants including injection, blow, compression and transfer moulding. All of these moulding variants are used in the local manufacturing industry. At the outset of this unit, learners will first comprehend the basic principles on such moulding variants and in which sectors they are applied in the local industry. Irrespective of the moulding variant, the core of this widely used manufacturing process is the actual mould tool. In view of this, learners should be able to understand the basic principles related to mould construction and fabrication. Focus will be placed on injection moulding as this is utilised with a vast range of polymers, including rubbers.

Aspects such as basic mould terminology, different type of moulds (e.g. underfeed, hot runner), different manufacturing processes, standard mould parts and typical bench fitting procedures employed in mould making, will be covered. Furthermore, learners will be introduced with general design principles (e.g. draft angles, mould balancing, shrinkage factor etc.) which are imperative for tool making. Learners will also gain knowledge on design principles specific to three main mould sub-systems, namely feeding, cooling and ejection. Practical examples of polymer components will be illustrated throughout the course, so that the learner can appreciate, how a mould is made.

Typically, a mould tool is worth thousands of Euro. Therefore, it is imperative that a company carries out maintenance procedures to ensure that mould tools are well preserved. In view of this, this unit will equip learners with the knowledge required on different types of mould maintenance procedures and guidelines on when, by whom and how such procedures must be conducted. Tool shop requirements to carry out activities related to mould maintenance procedures are also covered in this unit.

This is a ‘learning-by-doing type’ of unit and it will provide learners with the opportunity to apply the knowledge they have learnt to outline a basic mould layout for a particular thermoplastic component. Also students will be exposed to typical

manufacturing processes and bench fitting procedures related to mould making during workshop sessions.

Learning Outcomes

On completion of this unit the learner will be able to

1. Describe the underlying principle of the different variants of moulding processes and their applications in industry
2. Outline the basic principles related to mould construction and fabrication
3. Apply the basic principles related to mould design
4. Describe typical mould maintenance procedures, related guidelines and tool shop requirements

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

Negotiate a suitable project.
Produce and implement a project plan
Evaluate the proposed solutions
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