MQF Level 6

MS6-01-21

MCAST Bachelor of Science (Honours) in Marine Engineering

Course Specification

Course Description

This course deals with the design, construction, operation and maintenance of engines and machinery in ships and marine installations. You will gain an understanding of developed and emerging technologies while applying theoretical and practical methods in the analysis and solution of marine engineering related problems.

At this level of study you will be expected to develop the qualities needed for employment in situations requiring the exercise of personal responsibility, technical leadership and commercial management in complex and unpredictable circumstances as expected in the Maritime Industry.

Programme Learning Outcomes

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

1. *Design, operate and maintain marine engineering systems*
2. *Decide upon entrepreneurial and managerial activities related to the marine engineering field*
3. *Propose solutions based on mathematical and scientific analysis of situations and issues at hand*
4. *Conduct research and apply accumulated knowledge to a marine engineering situation.*

Entry Requirements

MCAST Advanced Diploma in Marine Engineering

or

MCAST Advanced Diploma in Operations and Maintenance

or

MCAST Advanced Diploma in Manufacturing

or

MCAST Undergraduate Diploma in Foundations of Engineering or

2 A-Level passes and 2 I-Level passes Compulsory A-Levels: Physics, Mathematics (Pure or Applied)

Current Approved Programme Structure

Unit Code	Unit Title	ECVET/ECTS	Year
ETPMS-506-1501	Applications of Pneumatics & Hydraulics	6	1
ETMTS-506-1506	Engineering Materials	6	1
ETENG-506-1514	Engineering Principles	6	1
ETMEC-506-1527	Fluid Mechanics	6	1
ETMEC-506-1529	Heat Transfer and Combustion	6	1
ETMRN-506-1502	Marine Diesel Propulsion & Power Systems (L5)	6	1
ETMRN-506-1503	Marine Electrical Systems 1	6	1
ETMTH-606-1809	Mathematics for Engineers 1	6	1
ETMRN-506-1516	Engineering Thermodynamics (Marine)	6	1
CDKSK-503-1905	Critical Thinking 1	3	1
CDKSK-503-1907	English 1	3	1
ETMTH-606-1811	Mathematics for Engineers 2	6	2
ETENG-506-1515	Instrumentation and Control Systems	6	2
ETMRN-506-1504	Marine Auxiliary Plant(L5)	6	2
ETMRN-506-1506	Naval Architecture	6	2
ETPRJ-512-1525	Project Design and Implementation and Evaluation	12	2
ETMRN-506-1507	Ship Propulsion and Manoeuvrability	6	2
CDKSK-503-1906	Critical Thinking 2	3	2
CDKSK-503-1908	English 2	3	2
CDKSK-602-2105	Community Social Responsibility	2	2
CDKSK-604-1909	Entrepreneurship	4	2
ETMRN-506-2103	Workshop Practice*	6	1-2
ETMRN-606-2102	Maintenance & Fault Diagnosis	6	3
ETMRN-606-1508	Marine Auxiliary Plant (L6)	6	3
ETMRN-606-2101	Marine Electrical Systems 2	6	3
ETMRN-606-1511	Marine Engineering Studies	6	3
ETMRN-606-1512	Marine Engineering Thermodynamics (L6)	6	3
ETMTS-606-1512	Materials in Marine Engineering	6	3
ETMRN-606-1514	Naval architecture with Marine Informatics 1	6	3
ETMRN-606-1515	Naval Architecture with Marine Informatics 2	6	3
ETRSH-600-1502	Research Methods	0	3
ETDIS-612-1501	Dissertation	12	3
Total ECTS		**180**	**/**

**this unit closes in the second year*

ETPMS-506-1501 Applications of Pneumatics & Hydraulics

Unit level (MQF): 5

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 higher level of knowledge and understanding of Pneumatics and Hydraulic Fluid power systems. Where students will have the opportunity to design a fluid power system and develop an understanding of the Construction, Function and the Components of such arrangements. The unit requires comprehension of suitable drawings and details in understanding the capabilities and workings of such 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 fluid power systems*
2. *Describe the construction, function and operation of pneumatics and hydraulic components, equipment and plant.*
3. *Design, assembly and test a pneumatic or hydraulic circuit to a given specification.*
4. *Demonstrate fault-finding competence on a fluid power system.*

ETMTS-506-1506 Engineering Materials

Unit level (MQF): 5

Credits: 6

Unit Description

The unit aims to provide underpinning knowledge about properties of engineering materials, how these properties can be tested and how this knowledge helps engineers to choose materials suitable for given products. Students are also introduced to a wide range of treatments processes aimed at achieved the desired characteristics, form and function which will provide them with tools to select the appropriate processes and to examine the changes in the material properties. Students will also have opportunities to investigate failure mechanisms and to recommend remedial and preventative measures.

The unit is split into three learning outcomes. The first learning outcome deals with a wide range of properties for metals, ceramics, polymers and composites. Students will gain skills to test these properties and then compare the results with the published data. This would help them choose the materials which are suitable for a given design brief and product.

Learning Outcome 2 deals with treatment processes. Heat treatments from basic ones such as quenching to more advanced treatments are covered. Liquid processing is covered in some detail as well as the composites where students will analyse as how combining two different materials result in a material with unique characteristics. Students will investigate these treatments and then apply this knowledge to select a processing method suitable for a given product and its service conditions.

Students will gain an in depth understanding of degradation and failure mechanisms for metals, ceramics, polymers and composites. They will learn that failure could be earlier than expected if the service conditions drastically change or if the product is not maintained correctly. Students will analyse these issues for a given engineering situation/product/service condition and recommend measures to remedy and prevent failure.

Learning Outcomes

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

1. *Examine the properties of engineering materials*
2. *Discuss the processing of engineering materials*
3. *Examine the failure mechanisms of engineering materials*

ETENG-506-1514 Engineering Principles

Unit level (MQF): 5

Credits: 6

Unit Description

Statics is the study of the behavior of structural members under application of external forces. The laws of statics help to calculate and determine the ability of the members to withstand these forces.

Ship structures such as hull frames, cargo tanks and double bottoms are subject to mechanical forces as well as fluid pressures. Learners are to relate shipboard examples with various types of structural loading that could come on frames and structures such as the engine room crane supported at the ends and carrying heavy loads in the middle or towards one end. A ship itself could be considered to be a simply supported beam. Ship's cranes, gantries and davits may be considered as cantilevered loaded structures.

Through proper modeling and the use of analytical techniques, it is possible to calculate the various stresses experienced by these structures. Since the properties and behavior of the materials used in construction are known, the structural strength of the ship and ship-borne structures may be estimated, when acted upon by these stresses.

Eccentric loading occurs when supports are not aligned with the center of gravity of the load. This can cause premature failure of support structures.
Using the understanding of statics, the student should be able to relate the knowledge gained to shipboard examples such as:

- Sizing calculations in order to estimate safe dimensions of structural members such as beams, frames, struts, columns subjected to loading.
- Calculations of safe working loads of equipment such as hooks and slings.
- Stresses on bolts, rivets and other fasteners.

It is expected that, from this Unit, the student will understand the need for ships equipment to be designed, operated and maintained in a safe and efficient manner.

Stress calculations of air reservoirs, gas tanks and gas bottles may be done by assuming them to be thin walled or thick walled pressure vessels. The knowledge assists in understanding the need for safe handling and periodic testing of pressure vessels.

This unit also deals with precision springs and heavy-duty springs which are often used on equipment in machinery and fittings on board, and are subjected to stresses due to application of external forces. For safe design and operation, the strength of the springs to withstand these stresses needs to be determined.

Dynamics is the study of the motion of bodies when forces are applied on them. The laws of dynamics predict the position, velocity and acceleration of these bodies at every instant in time. Dynamics also studies the transfer of energy from one form to another to produce the desired output such as work, fluid pressure, or velocity change.

This unit presents an application oriented approach to understanding the behavior of materials subjected to complex loading systems and their ability to withstand such loading. The teaching should relate to shipboard examples, such as the dynamics of engine flywheels, components of diesel engines, compressors, and other rotating/reciprocating machinery.

The analysis of dynamical systems and calculation of dynamic forces, accelerations and displacements comprise the next part of this unit. On board ships, rotating machinery need to run without noise and vibration under various operating conditions.

The unit then deals with the design, layout and operation of various power transmission equipment commonly used on board ships. This knowledge helps the engineer to select the right transmission equipment and operate them at optimum efficiency.

Recommended prior knowledge and skills:

It would be an advantage if candidates had a knowledge and understanding of physics and mathematics to the desired level.

It is recommended that the Unit on Statics and Dynamics be delivered to the learner prior to delivering this unit. This will enable the learner to fully understand the advanced concepts of mechanical principles contained in this Unit.

Learning Outcomes

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

1. *. Explain and solve problems involving forces and moments concerned with static equilibrium and simple framed structures.*
2. *Explain and solve problems involving the dynamics of motion for linear and angular systems.*
3. *Determine the dynamic parameters of co-planar and non co-planar systems.*
4. *Determine the operating parameters of power transmission elements.*

ETMEC-506-1527 Fluid Mechanics

Unit level (MQF): 5

Credits: 6

Unit Description

This unit provides the learners with the fundamental knowledge and methods of fluid statics, fluid dynamics and turbo machinery. Learners will be able to outline and apply the laws of mass and momentum conservation and familiarize themselves with the basic mechanical quantities describing the state of a static and dynamic fluid. Learners will be able to interpret definitions describing the characteristics of a fluid and determine the relevant assumptions required to assess fluid mechanics problems analytically. In this module the principles behind hydraulic systems and gravity-based pressure measurement instruments will be conveyed together with methods of evaluating the hydrostatic forces on adjacent surfaces.

The second part of this study unit will deal with fluid dynamics analysis. Learners will obtain knowledge on control volume analysis, the Reynolds transport theorem as applied to the conservation of mass and linear momentum equations and the Bernoulli equation. Learners will be able to apply theoretical knowledge to solve simple one dimensional fluid flow problems. Learners will be able to apply the principles of dimensional analysis and calculate the head loss in pipe systems: define the Reynolds number of fluid flow, identify the pipe friction losses for laminar/turbulent flow and evaluate pipe secondary losses. Learners will also be introduced to definition of drag and lift forces of flows past immersed bodies

In the final part of this module the principles of basic turbomachinery will be analysed in order to assess the differences between different pump and turbine designs. The learner will also be able to evaluate the resulting flow rate in pump/system combination.

Learning Outcomes

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

1. *Interpret and determine the thermodynamic properties of a fluid at rest and in motion*
2. *Define the fundamental principles in the field of fluid statics and carry out basic hydrostatic analysis*
3. *Define the fundamental principles in the field of fluid dynamics and evaluate fluid flow systems and turbo machinery*
4. *Test the fluid mechanics principles and relations covered in the above learning outcomes through experimental methods.*

ETMEC-506-1529 Heat Transfer and Combustion

Unit level (MQF): 5

Credits: 6

Unit Description

The subject of Heat transfer has wide application in the marine industry. For example, marine boilers use the modes of conductive & convective heat transfer to heat feed water and produce steam for marine equipment and utilities.

Refrigeration & air conditioning equipment cool designated spaces by transferring heat out of these spaces to the atmosphere.

Heat exchangers --- both heaters and coolers --- find wide application on board. For example, fuel oil heaters transfer heat from steam to fuel oil to reduce oil viscosity. Lubricating-oil coolers transfer heat from hot lubricating oil to cooling sea water to preserve lub-oil properties.

This unit discusses the expansion and contraction of solids and liquids due to changes in temperature. Ships operate in different temperature zones, and materials and fluids on board expand and contract according to the changes in ambient temperature. Knowledge of heat transfer enables the learner to anticipate and cater for changes in length, area and volume of solids, liquids and gases held on board.

This unit also deals with heat energy produced through combustion of fuels. Marine fuels such as oil and gas are non-renewable sources of energy. One means to conserve fuel for future use is through efficient fuel combustion; hence marine equipment concerned with combustion and heat extraction are designed and operated for maximum fuel efficiency.

Recommended prior knowledge and skills:
It would be an advantage if candidates had a knowledge and understanding of physics, mathematics and basic thermodynamics to the desired level.

Learning Outcomes

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

1. *Explain the effect of, and solve problems on the application of heat energy to solids and liquids; distinguish between the modes of heat transfer and solve problems based on mode of heat transfer.*
2. *Explain the concept of Heat Transfer coefficients; calculate heat transfer parameters during fluid flow through tubes.*
3. *Explain the processes of heat transfer taking place in various heat transfer equipment.*
4. *Calculate the combustion parameters of marine fuels by mass and volume.*

ETMRN-506-1502 Marine Diesel Propulsion & Power Systems (L5)

Unit level (MQF): 5

Credits: 6

Unit Description

This unit, in conjunction with the Marine Auxiliary Systems, is designed to provide a basis for nurturing and developing a holistic but basic understanding on the operation of a shipboard machinery space and deals with various different types of main propulsion schemes. Like other units of the Diploma in Marine Engineering programme, the learning outcomes of Marine Propulsion Systems are in alignment with the *Standards of Training, Certification & Watchkeeping (STCW) Code 2010* as per Table A-III/1.

In this unit, most commonly found main propulsion systems on board the merchant ships are studied. Successful completion and achievement of this unit, naturally, will have prepared the candidate in performing the duties of an Engineering Officer of the Watch (EOOW) efficiently and safely. It is important, however, to note here that this unit is designed to provide a sound base on which further and advanced studies in the subject of Marine Propulsion Systems will be based.

The areas to be addressed include:

- The construction of motor propulsion system.
- The construction of steam propulsion system.
- Marine diesel electric propulsion system.
- Operational and maintenance procedures for marine propulsion systems.

The use of practical demonstrations of plant and equipment is strongly advised in giving a practicality to the subject content, this will be at the discretion of the institution undertaking the delivery of this unit.

Learning Outcomes

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

1. *Describe the construction of motor propulsion systems.*
2. *Describe the construction of steam propulsion system;*
3. *Describe marine diesel electric propulsion system;*
4. *Explain operational and maintenance procedures for marine propulsion systems.*

ETMRN-506-1503 Marine Electrical Systems 1

Unit level (MQF): 5

Credits: 6

Unit Description

Firm understanding and grounding in the basic principles of electrical engineering serve to be an absolute essential for all the Marine Engineer Officers. This assumes even more significance with the increasing trend of diesel-electric propulsion systems found on modern merchant ships. It is from these fundamentals that a sensible, logical, professional and efficient approach is derived for running, operating, maintaining, fault-finding and trouble-shooting a ship's electrical systems. Marine Electrical Systems is divided into two parts – I and II – to take the student through a gradual process of learning. It is expected of the students to have learned Marine Electrical Systems 1 ,before undertaking the study of Marine Electrical Systems 2. It is important to appreciate that both the units are complementary to one another so retention and understanding of key concepts and ideas is a pre-requisite for useful progression.

Marine Electrical Systems 1 is designed to enable students to develop knowledge and understanding in Marine Electrotechnology and Marine Electrical Equipment and Practice. This Unit will also provide students with a base from which future advanced work in Marine Engineering may be undertaken. This unit will introduce students to the basics of linear DC circuits, semi-conductors, magnetism, DC transient circuit, and batteries.

It is reminded here that the study in Electrotechnology is not intended to educate the Marine Engineering students to become Electrical Engineers, however, the purpose is to equip them with necessary understanding and knowledge that enables them to sufficiently and efficiently deliver basic task of running, operation and maintenance of

marine electrical systems. Moreover, therefore, this unit is designed in alignment with the *Standards of Training, Certification & Watchkeeping (STCW) Code 2010* as per Table A-III/1 and Table A-III/2.

Learning Outcomes

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

1. *Solve problems relating to linear DC circuits.*
2. *Explain the characteristics of semiconductor devices used in rectification.*
3. *Explain the principles of and solve problems relating to magnetism and electromagnetic induction.*
4. *Solve problems relating to non-linear DC circuits.*
5. *Explain secondary cells and batteries for marine applications.*

ETMTH-606-1809 Mathematics for Engineers 1

Unit level (MQF): 5

Credits: 6

Unit Description

This unit aims to provide underpinning knowledge essential for an engineer to develop skills, not only in solving mathematical and scientific problems but also in applying these skills to analyze, model and predict behaviors of engineering systems.

The unit is split into five learning outcomes, addressing important areas of mathematics, namely: Algebra, graphical techniques, matrices, vectors, calculus, differential equations and statistics. In all the learning outcomes, mathematical skills in order to reach a solution to straightforward problems are first developed. This will be followed by the application of these skills to various, more complex, engineering situations.

The first outcome covers various algebraic methods in solving engineering problems, as well as limits and functions. Graphical techniques including curve sketching, loci, transformations of graphs and their inverses, as well as the polar coordinate system are covered in the second outcome.

The third outcome covers matrices and vectors. 2x2 and 3x3 matrices, including the inverse and transpose of matrices, will be discussed. This will then lead to solving simultaneous equations using matrices. In vectors, the basics of vector addition, subtraction and resolution of forces is first seen to. This will then be followed by more complex problems involving vectors, namely vector geometry. .

In the fourth outcome, students will revise the basics of differentiation and integration in calculus. Various other integration techniques will then be introduced. Students will develop skills to apply this knowledge to analyze and model a variety of engineering situations especially by using differential equations.

The statistics part is covered through learning outcome 5. The emphasis here is on developing higher level skills of synthesis and evaluation and hence the context is production, manufacturing and testing, where students will use correlation and regression techniques as well as appropriate probability models.

It is assumed that students undertaking this unit would have appropriate prior basic knowledge of the above mentioned topics.

Learning Outcomes

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

1. *Use algebraic methods to solve engineering problems.*
2. *Sketch and transform graphs of basic functions.*
3. *Present solution to engineering problems using matrices and vectors.*
4. *Analyze and model engineering situations and solve differential equations and problems using calculus.*
5. *Apply statistical techniques to solve engineering problems.*

ETMRN-506-1516 Engineering Thermodynamics (Marine)

Unit level (MQF): 5

Credits: 6

Unit Description

This unit is designed to present an application-oriented delivery of engineering thermodynamic, and enables students to:

- Develop the knowledge required to apply thermodynamic principles to heat engines
- Understand how these principles are relevant in a Marine engineering environment.
- Comply with the requirements stated in STCW code above.

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

- Understand the parameters used to explain the characteristics of thermodynamic systems.
- Understand the need for efficient operation of marine machinery
- Evaluate the performance of marine machinery

Knowledge of engineering thermodynamics 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, which convert the chemical energy released by fuel combustion into mechanical energy. The efficiency of this energy conversion is based on certain thermodynamic principles.

Equipment such as nozzles, which convert gas pressure into velocity, and compressors which convert work into pressure, also operate based on ideal 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 knowledge of engineering thermodynamics will enable the learner to design and operate the above machinery at optimum efficiency.

The unit progresses from a theoretical approach to the practical aspects of thermodynamics in power plant. Based on the principles taught earlier in the unit, the layout, operation and performance of the following power plant components are discussed:

- Reciprocating compressors
- Steam and gas turbines
- Internal combustion engines

Recommended prior knowledge and skills:

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. *Apply the Gas Laws for non-flow systems and evaluate the work done.*
2. *Explain and solve problems related to the use of single and multi-stage reciprocating air compressors.*
3. *Determine the power and efficiency from steam power plant systems.*
4. *Explain the combustion cycles associated with marine engines and evaluate power and efficiency from test data.*

ETMTH-606-1811 Mathematics for Engineers 2

Unit level (MQF): 5

Credits: 6

Unit Description

The principal aim of this unit is to provide students with mathematical knowledge and skills that are necessary to support their concurrent studies as well as possible subsequent studies. This unit will allow students to create a link between mathematics and real world engineering problems.

In this unit, learners are required to analyse and make use of the necessary analytical skills in order to model and solve practical engineering problems. Being an advanced topic, it is important that students following this unit would have obtained Mathematics for Engineers 1 previously and would have a strong mathematical background, with a particular sound knowledge in calculus and differential equations.

The unit is significant to learners aiming to further extend their knowledge of mathematics as a tool to provide solutions to a wide range of engineering problems, varying from mechanical to electrical fields. On completion of such unit, learners will understand how to solve ordinary differential equations using a variety of power series and Laplace methods, analyse mechanical and electrical systems in terms of stability, analyse complex waves using Fourier series as well as solve partial differential equations and rates of change problems involving stationary values.

Learning Outcomes

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

1. *Apply ordinary differential equations, both series and numerical methods to analyse, model and solve engineering problems.*
2. *Use Laplace transforms to analyse, model and solve engineering problems.*
3. *Use Fourier series to analyse, model and solve engineering problems.*
4. *Apply Partial Differential Equations to analyse, model and solve engineering problems.*

ETENG-506-1515 Instrumentation and Control Systems

Unit level (MQF): 5

Credits: 6

Unit Description

This unit provides a framework for students to have an understanding of the basic principles involved in the design and use of instrumentation and control systems used within modern industrial process systems.

The unit introduces instrumentation systems that are used for making measurements and deals with the basic elements of such systems and the terminology used to describe their performance in use.

The students will also investigate the devices and elements of an instrumentation system, such as the various types of sensors, signal processors and data presentation elements and be introduced to a number of instrumentation case study relating to real world applications.

The unit will also allow students to further explain what is meant by open and closed loop control systems, the differences in performance between such systems and explain the principles involved in some examples of industrial control systems.

The student will further describe the terminology and function of process controllers and the use of proportional, derivative and integral laws and their concepts and applications into the engineering environment.

Finally, the student will be able to describe the correction element or final control elements used in control systems and also describe the forms of commonly used pneumatic, hydraulic and electric correction elements.

Learning Outcomes

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

1. *Interpret and read performance terminology used in the specifications of instrumentation and measurement systems.*
2. *Describe and evaluate instrumentation system elements; sensors, signal processing and display elements used with instrumentation and used in the measurement of position, rotational speed, pressure, flow, liquid level and temperature.*
3. *Explain what is meant by open and closed loop control systems, the differences in performance between such systems and explain the principles involved in some simple examples of such systems.*
4. *Describe the function and terminology of a process controller and the use of proportional, derivative and integral control laws. Explain PID control and how such a controller can be tuned.*
5. *Describe the common forms of correction/regulating elements used in control systems and also describe the forms of commonly used pneumatic, hydraulic and electric correction elements*

ETMRN-506-1504 Marine Auxiliary Plant(L5)

Unit level (MQF): 5

Credits: 6

Unit Description

This unit is designed to be one of the two core units for Diploma in Marine Engineering; other core unit being the Marine Propulsion Systems. Both units, therefore, are complementary. As a certified Engineer Officer of the Watch (EOOW) of a ship's machinery spaces, regulatory bodies such as International Maritime Organisation (IMO) expect an EOOW to be capable of operating the machinery spaces efficiently and safely. This unit will introduce the students to the major and most commonly found auxiliary machinery systems and components; and is aligned with the requirements of the *Standards of Training, Certification & Watchkeeping (STCW) Code 2010* as per Table A-III/1.

Apart from engaging the students in the study of most commonly found auxiliary machinery systems and components, this unit will also introduce the students to major elements of the pollution prevention regulations and shipboard fire-fighting basics and relevant systems. Successful completion and achievement of this unit will provide the student with opportunity of undertaking advanced and further study of Marine Auxiliary Systems with obvious benefits of advantageous career progression at Management Level of a ship's machinery spaces.

Note any practical work undertaken will be in compliance with all relevant Health and Safety legislation.

Learning Outcomes

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

1. *Demonstrate knowledge of the construction and operating principles of the shipboard auxiliary systems and equipment.*
2. *Demonstrate knowledge of preparation, operation, fault-detection, necessary measures taken to prevent damage of the shipboard auxiliary systems and equipment.*
3. *Demonstrate knowledge of Marine pollution prevention regulations and procedures.*
4. *Explain shipboard fire-fighting and fire detection equipment and systems.*

ETMRN-506-1506 Naval Architecture

Unit level (MQF): 5

Credits: 6

Unit Description

For the safety of life at sea and the protection of the marine environment it is essential that seafarers have a level of competence that enables them to carry out their duties safely and effectively.

To this end the International Maritime Organisation (IMO) regulates the maritime industry on an international level. As a signatory to IMO the Maltese Government is responsible for ensuring their compliance. This task is undertaken by Transport Malta

The IMO has set out the competencies required for all seafarers in the Standards of Training, Certification and Watchkeeping Convention (STCW). The latest revision was carried out in 2010. Seafarers are issued a Certificate of competency for the level or rank at which they are employed. The competencies required for a marine engineer officer at a management level is set out in Annex 1, Chapter III, Section A-III/2 (Controlling the operation of the ship and care of persons on board at the management level) of STCW 10.

Having a basic knowledge of ship form, flotation and stability, resistance, structural design and strength calculations, as well as understanding of the impact of these phenomena on power plant designing and operation, is a part of the marine engineer's knowledge. In order to maintain the seaworthiness of the vessel knowledge of the structure and the construction methods is also required for this unit, with the student gaining insights from both design and constructional perspectives.

Learning Outcomes

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

1. *Perform calculations on hydrostatic data*
2. *Calculate small angle stability*
3. *Explain the construction of a ship*
4. *Explain ship construction techniques*
5. *Analyse the construction of various specialised vessels*
6. *Analyse the Loadline Rules with regard to the conditions of assignment*

ETPRJ-512-1525 Project Design and Implementation and Evaluation

Unit level (MQF): 5

Credits: 12

Unit Description

Projects are encountered in every facet of life and students need to be able to conduct and conclude projects whether as part of an overall strategy or as individuals, as part of their job or for personal reasons.

Formalisation of project management tools will give students the ability to break projects down into manageable tasks and create a suitable strategy for delivery of the project requirements.

Students will be given the tools and skills required to devise schedules, present them in meaningful ways and communicate them to those with an interest in their project. Students will be taught the importance of ensuring everyone involved is kept appraised of project progress and, using mind mapping tools students will be taught ways of ensuring that what their project will deliver will encompass the customer's requirements, specifications and expectations.

Objectivity in decision making will be brought in through the use of decision matrices. The use of a contextualized project will give students the chance to carry out a project from initiation to completion and should engage their interest in the subject as well as allow them to gain hands on experience of project management. They should be able to use skills learned in other areas of their qualification to carry out the project giving them a sense of individuality, achievement and purpose. Record keeping in both formal and informal contexts allows students to self-evaluate throughout the life of the project.

With effective reporting throughout the life of the student's project, opportunities for guidance and feedback provide students with reassurance that they are delivering what the customer requires and that they have the chance to increase their professionalism and communication skills in a meaningful way and allows the tutor to guide, encourage and lead students to successful completion.

Learning Outcomes

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

1. *Use a customer's requirements to build a project proposal*
2. *Create a project schedule*
3. *Deliver a product according to agreed criteria*
4. *Analyse project outcomes*
5. *Effectively communicate outcomes and analysis to others*

ETMRN-506-1507 Ship Propulsion and Manoeuvrability

Unit level (MQF): 5

Credits: 6

Unit Description

For the safety of life at sea and the protection of the marine environment it is essential that seafarers have a level of competence that enables them to carry out their duties safely and effectively.

To this end the International Maritime Organisation (IMO) regulates the maritime industry on an international level. As a signatory to IMO the Maltese Government is responsible for ensuring their compliance. This task is undertaken by Transport Malta

The IMO has set out the competencies required for all seafarers in the Standards of Training, Certification and Watchkeeping Convention (STCW). The latest revision was carried out in 2010. Seafarers are issued a Certificate of competency for the level or rank at which they are employed. The competencies required for a marine engineer officer at a management level is set out in Annex 1, Chapter III, Section A-III/2 (Controlling the operation of the ship and care of persons on board at the management level) of STCW 10.

Having a basic knowledge of propellers and rudders, resistance, transmission of propulsive forces, calculations relating to powering and resistance, as well as understanding of the impact of these phenomena on power plant design and operation, is a part of the marine engineer's knowledge. The unit will specifically address areas relevant to ship propulsion and manoeuvrability.

Learning Outcomes

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

1. *Describe the principles and component parts of marine transmission systems.*
2. *Describe propeller types their construction and operation.*
3. *Examine the concepts and applications of ship manoeuvrability.*
4. *Derive formulae and solve problems involving ship's propellers and resistance.*

ETMRN-606-2102 Maintenance & Fault Diagnosis

Unit level (MQF): 6

Credits: 6

Unit Description

Maintenance has grown and developed into a significant major strategy to ensure effective operation of plant and engineering systems whether or not within an automated environment. Today's modern and efficient companies have been required to develop good maintenance strategies to match their investment particularly in the advanced manufacturing technologies. This has resulted in a considerable gap between the required skills and expertise which are essential to maximise the potential benefits from these technologies.

This unit provides a framework for students to look at the main methods for developing a modern maintenance programme for industrial plants. The Unit will provide students with the knowledge and understanding to be able to develop implement and evaluate maintenance and fault diagnosis routines for new and existing process plant and equipment. In order to achieve this, students will develop knowledge and understanding of general approaches to plant and equipment maintenance and factors associated with maintenance scheduling, condition monitoring and diagnostic testing.

Firstly, the students are introduced to the equipment failures, the reasons for failures occurring and types of failures. The Unit then proceeds to provide a good understanding of types of maintenance strategies: Reactive Maintenance (RM), Planned Preventative Maintenance (PPM), Reliability-Centred Maintenance (RCM), Total Productive Maintenance (TPM) and Condition Based Maintenance (CBM).

The students go on to look at the nature and use of condition monitoring techniques for faulting finding and predictive maintenance.

Finally, the unit introduces the students to computerised maintenance management systems (CMMS) and their role in maintenance in the modern industry.

Learning Outcomes

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

1. *Explain the factors associated with devising a maintenance strategy.*
2. *Analyse the strategies used in systems maintenance.*
3. *Analyse the diagnostic techniques used for fault finding in process systems.*
4. *Demonstrate a broad knowledge of Computer Maintenance Management Systems (CMMS) for a process system*

ETMRN-606-1508 Marine Auxiliary Plant (L6)

Unit level (MQF): 6

Credits: 6

Unit Description

The course covers basic knowledge of the marine auxiliary machines and devices that are integral parts of the ship's systems.

Lecture topics include basic knowledge about: reduction gears, shafting systems and thrust bearings, steering gears, anchoring windlasses, winches, pumps, compressors, blowers, ejectors, condensers, heat exchangers, desalination plant, heating ventilation and air conditioning plant, refrigeration plant and various piping systems.

After each topics derived, lecturer will be approached to designing the simple related plants, in order to stimulate students into thinking and creativity, and to teach them how to solve the underlying problem of independently, what they should confirmed by the solving of their homework.

Learning Outcomes

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

1. *Define and describe the main machinery components involved in the complex plant, such as for example: desalination plant, HVAC plant, refrigeration plant.*
2. *Define and describe the interactions between of a machine (or device) and other components that are integrated in the corresponding system.*
3. *Correctly select the adequate dimensioned machine or device for corresponding plant or system.*
4. *Describe the basic operational parameters of a marine auxiliary machine or device, and understand crucial maintenance procedures.*

ETMRN-606-1511 Marine Engineering Studies

Unit level (MQF): 6

Credits: 6

Unit Description

Marine engineering is the field of engineering that deals with the design and operation of the power plants on various marine structures; marine vessels as well as offshore objects. Although most important plant is the propulsion plant, marine engineering studies must cover much wider range of various equipment, devices and systems, as well.

Therefore, the need to understand new developments covering vast area of marine engineering and the ability to integrate those developments in the marine vessel or structure is at the basis of the marine engineering knowledge. That also includes basic understanding of various regulations, class rules and national as well as international legislation. A firm grounding in marine diesels, ship propulsion and marine systems is therefore a pre-requisite for marine engineering studies as presented in this module.

The course starts with introduction to common rail fuel technology for HFO as well as for lighter blends of diesel fuel, then podded propulsion drives are explained with basic notes covering All Electric Ship concept. Then new technologies in marine power transmissions are explained. The concept of the dual-fuel diesel engine is introduced. The course then investigates marine exhaust emission control, fuel filtration and conditioning including bio-diesel and its application in the marine industry. The concept of the waste water and ballast management is introduced, followed by fresh water generation both using evaporator units and RO plants. Finally, basic marine fire fighting principles are presented, and at the end international regulations and basics of maritime law as a connection between the governments, wider social community, environmental agencies and the real world of marine industry.

Learning Outcomes

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

1. *Define and describe common rail fuel technology for HFO as well as for lighter blends of diesel fuel as well as dual fuel engine operation.*
2. *Describe podded propulsion drives and have basic understanding of the All Electric Ship concept.*
3. *Describe and understand new ways to address exhaust emission control and relate these new technologies to the newest international regulations covering exhaust emission limits.*
4. *Describe the basic operation of the waste and ballast management systems and influence of the MARPOL on the system selection. Describe evaporating and RO water generation systems.*
5. *Understand basic Fire Fighting procedures and systems. Describe basic international regulations for marine engineering field and understand basics of maritime law*

ETMRN-606-1512 Marine Engineering Thermodynamics (L6)

Unit level (MQF): 6

Credits: 6

Unit Description

This unit offers an advanced learning in the field of thermodynamics systems related to the offshore and marine industry. The learners taking this unit will have an extended learning experience to content learned in previous thermodynamics related subjects.

This unit focuses on the laws of thermodynamics, that of perfect gases and steam. Particular focus will be given to their principles and application in a marine environment, such as the thermodynamic processes of the various forms of ship propulsion engine cycles and other onboard industrial equipment which facilitates the processing of fluids and heat transfer. In particular, the governing laws and thermodynamics processes of the gas turbine cycle, the steam / vapor cycle, the diesel engine and alternative fuels, such as the LNG as fuel source in converted marine diesel engines.

The teaching methodology of this unit considers the varying needs of marine learners, recognizing recent changes to the marine propulsion engines and thermodynamics processes. This unit progresses from a theoretical side to a more practical side, thus inferring the learning of a synergy of advanced technologies and thermodynamic process of latest ship power technologies.

Learning Outcomes

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

1. *Understand and apply the fundamentals of thermodynamics.*
2. *Estimate the performances of gas turbine and steam turbine cycles for individual and combined marine process plants.*
3. *Study the fundamental thermodynamics of marine diesel engines and performances of combined heat and power involving refrigeration cycles.*
4. *Analyse problems related to different forms of heat transfer and refrigeration.*

ETMTS-606-1512 Materials in Marine Engineering

Unit level (MQF): 6

Credits: 6

Unit Description

This module should develop and enhance the knowledge and skill of the student in order to select the most suitable materials for marine structures applications. It should also provide students with the latest developments in material technology and applications of new advanced materials. The student must also learn to relate fracture, corrosion and welding behavior to particular material.

This course is designed to give participants a comprehensive overview of material properties, behaviour and performance, including fracture and corrosion phenomena, as well as material behavior during and after welding, focused on materials used for marine engineering components.

The unit covers a broad approach to material science and engineering, including classification, correlation between microstructure and properties, analysis of phase and time-temperature-transformation diagrams, as well as heat treatments. Topics include properties and application of ferrous and non-ferrous materials, used in marine engineering, as well as polymers and composites. Special topics like weldability, fracture mechanics, corrosion and protection, and material inspection are covered in detail .

This course provides the fundamental knowledge of material properties, their behaviour and performance, including fracture, welding and corrosion effects required for an engineering degree in marine engineering.

Learning Outcomes

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

1. *Understand the basic principles of materials science including crystallography and phase diagrams.*
1. *Be knowledgeable on ferrous and non-ferrous alloys, polymers and composites.*
2. *Get a perspective of material technology and behaviour in operation. This includes weldability, fracture mechanics and degradation mechanisms.*
3. *Be able to distinguish and compare different non-destructive testing methods and identification of future trends.*

ETMRN-606-1514 Naval architecture with Marine Informatics 1

Unit level (MQF): 6

Credits: 6

Unit Description

This course covers fundamental knowledge of vessel design and its shape properties which are bases for hydrostatic calculation and behavior for loading or unloading cargo. Students will also learn how to use classification societies' rules to check ships characteristic.

Lecture topics include: principals of ship design, definition of ships main characteristic, basic relations of floating body and liquid, principals of ships stability, basic of ships resistance, learning specific software to use in calculations for testing ships characteristic.

After the completion of every set of topics, lecturer will present and solve related problem, in order to teach and stimulate students to solve similar problems individually, as part of their homework.

Learning Outcomes

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

1. *Create basic hull form using "Rhinocerous"*
2. *Test hull characteristic using Maxsurf*
3. *Calculate preliminary center of gravity*
4. *Test ship characteristic when loading or unloading in Hydromax*
5. *Test ships stability using Hydromax*
6. *Test ship for damage conditions in Hydromax*
7. *Test ships resistance in Hullspeed*

ETMRN-606-1515 Naval Architecture with Marine Informatics 2

Unit level (MQF): 6

Credits: 6

Unit Description

This course covers fundamental knowledge of vessel structure design, which includes calculation of forces acting on vessel hull, definition of vessel's hull structural design and vessel's structure elements strength calculation. Students will also learn how to use classification societies' rules in designing and calculation of structure elements strength.

Lecture topics include: strength principles and strength phenomena definition, stress and strain relation in various structural elements, calculation of loads acting on ship structure, overview and description of typical types of vessel structures, calculation of structure elements' scantlings and practical use of specialized software applications for structure strength calculation.

After the completion of every set of topics, lecturer will present and solve related problem, in order to teach and stimulate students to solve similar problems individually, as part of their homework.

Learning Outcomes

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

1. *Strength theory and strength principles; structural elements' normal stress, shear stress, bending, torsion and buckling analysis.*
2. *Define and calculate typical loads acting on vessel structure. Analyze superposition of global loads acting on vessel as a girder with local loads acting on specified part of structure.*
3. *Describe typical types of vessel structures; define necessary structure elements and calculate minimum required structure elements' scantlings to accomplish vessel structure integrity and strength criteria.*
4. *Overview of typical software applications in the field of structure strength analyses. Practical use of specialized software (Classification societies' online rules and software applications for structure elements' scantlings calculation).*

For further information, please contact us on information@mcast.edu.mt.